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Adams, Steven H. *Identification of Factors Impeding Implementation of Nontraditional Math Courses in Northwest Wisconsin*

Abstract

The purpose of this study was to understand the factors that have prevented the 34 school districts in Northwest Wisconsin from offering nontraditional math courses. Such courses, for the purpose of this study, are courses that count as math credit, based on the Wisconsin Department of Public Instruction procedures, but that are not the traditional math courses of Algebra, Geometry, Algebra II, Advanced Math, or Calculus. This included determining if there were barriers preventing school districts from including these courses and understanding the perceptions surrounding the offering of career and technical education (CTE) or computer science courses as math credits.

An online survey of key curriculum decision makers was conducted. The survey results indicated that representatives of school districts were generally aware of the 2013 Wisconsin Act 63 legislative changes, generally believed that their current math offerings met the needs of their students, and that granting math credits for computer science and CTE courses would help improve students' math knowledge. The final finding was that teacher availability was the greatest barrier for creating new math, computer science or CTE courses.

Creating opportunities to leverage computer science and CTE instruction would enhance academic learning in Wisconsin school districts.

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Chapter I: Introduction

Starting around World War II math instruction changed. Before the war, math was practical and geared toward calculations that students would use in their particular career (Vigdor, 2013). After the war, math focused on mastering fundamental concepts and increasing rigor (Vigdor, 2013), resulting in additional expectations for students to graduate. As a matter of fact, expectations rose in all subjects. In 1946, the average required number of credits to graduate from high school was 16.73 (Lillard & DeCicca, 2001). By 1983, that number had increased to an average of 17.78 credits, and in 1996, the average credits required to graduate from high school were 20.20 (Lillard & DeCicca, 2001). The 1983 National Commission on Excellence in Education report, *A Nation at Risk*, was a significant source for the higher expectations laid on students. One focus of the report was a decline in standardized test scores in the United States and the fact that students were falling behind in math and science proficiency when compared to other nations (National Commission on Excellence in Education, 1983). This national concern caused states to focus on increasing the expectations regarding math and science education for high school students. From 1980 to 1993, schools increased the average credits required to graduate by approximately 1.6 credits; math and science courses comprised two-thirds of this change (Schiller & Muller, 2003). One topic in *A Nation at Risk* was the understanding that too little was expected and students would achieve more if more was expected of them (Daun-Barnett & St. John, 2012).

The No Child Left Behind legislation of 2001 also had a significant impact on primary and secondary education in the United States (Dee & Jacob, 2010). Among the impacts of the legislation was the requirement that schools annually test most students in reading and mathematics to verify students were making appropriate progress each year. As a result of

greater accountability, schools increased the amount of time allocated to math and reading instruction (Dee & Jacob, 2010). Based on information from a compilation prepared by the Education Commission of the States, 31 of the 45 states where information was available required three or more math credits to graduate (Education Commission of the States, 2007). The compilation also indicated the remaining 14 states currently required two math credits.

In 2013, the Wisconsin Legislature passed Legislative Act 63 increasing the graduation requirements for Wisconsin public schools (High School Graduation Standards, Wis. Stat. §118.33, 2017). The act stated that starting in 2017, students needed to complete at least three credits of math to graduate; the previous requirement had been two credits. The legislation also granted additional opportunities to earn math credits by way of computer science courses, based on criteria to be established by the Wisconsin Department of Public Instruction (WDPI), as well as career and technical education (CTE) courses as determined by local school boards (High School Graduation Standards, Wis. Stat. §118.33, 2017). The legislation allows schools to offer up to one math credit for qualifying computer science courses and one math credit for qualifying CTE courses. Therefore, a student in Wisconsin could earn two of the three required math credits from these nontraditional math courses (Wisconsin Department of Public Instruction [WDPI], n.d.-d).

To provide opportunities for students to earn nontraditional math credits, the following states allow computer science courses to qualify for math credit: Arizona, Florida, Idaho, Illinois, Maryland, Ohio, Oklahoma, South Carolina, Texas, Virginia, Washington, and Wisconsin (Zinth, 2015). California allows districts that require three or more math credits to use a computer science course to meet the third math requirement. According to Zinth (2015), Michigan is the only state, besides Wisconsin, that allows CTE coursework to be treated as a

math credit. In Michigan, the CTE course replaces Algebra II, and students still need to successfully complete an Algebra II equivalency assessment (Zinth, 2015).

According to the master list of Wisconsin schools offering business and technology education courses for equivalent credit, 18 school districts and 23 schools offered math equivalent courses through the 2015–2016 school year (WDPI, n.d.-b). For technology-related courses, in all but one school, digital electronics was the listed course offered. In most cases, this was labeled as a “Project Lead the Way” (PLTW) course. In the Oregon (Wisconsin) School District, electronics was the listed course (WDPI, n.d.-f). In reviewing the Oregon School District curriculum guide, it was unclear whether this course was part of a PLTW program (Oregon (WI) High School, n.d.). Through the 2015–2016 school year, only the Oakfield School District offered a nontraditional course for math credit (Construction Math) that was neither digital electronics nor electronics (WDPI, n.d.-b). None of the schools currently offering nontraditional math courses are located in Northwest Wisconsin (WDPI, n.d.-f).

Statement of the Problem

Recent mandates have required students in Wisconsin schools to take additional math courses as a prerequisite to graduating. Although Wisconsin Legislative Act 63 passed in 2013, allowing certain CTE and computer sciences courses to count as math credits, implementation of the act’s provisions has been limited. Out of 510 school districts in Wisconsin, only one CTE course and 23 computer science courses were offered (WDPI, 2016). The WDPI information shows that none of these school districts are located in Northwest Wisconsin.

Purpose of the Study

The purpose of this study was to understand the factors that prevent school districts in Northwest Wisconsin from offering nontraditional math courses. Such courses, for the purpose

of this study, are courses that count as math credit, based on the WDPI procedures but are not among the traditional math courses of Algebra, Geometry, Algebra II, Advanced Math, or Calculus. This study focused on identifying any barriers that prevent school districts from creating and implementing these courses, along with understanding the perceptions surrounding the offering of nontraditional math courses based on the 2013 legislative changes that allow offering CTE or computer science courses as math credits.

Research Objectives/Questions

The questions this research addressed included:

1. What level of knowledge do the solicited representatives in the school districts have regarding the additional math credit opportunities provided in the 2013 Wisconsin Act 63 legislation?
2. What factors have school administrators considered in determining whether to offer math credit for nontraditional math courses?
3. What are the barriers preventing or delaying implementation of nontraditional math courses?

Significance of Study

One impact of the No Child Left Behind legislation was an increased expectation for schools to improve math instruction. This has led many states to increase the mathematics credit requirements for graduation, which in turn increases the number of math credits students must take in high school. Math education is critical to long-term success (Chaplin, 1998), and mathematical concepts are included in most CTE coursework (Stone, Alfeld, & Pearson, 2008). Wisconsin has provided an opportunity for school districts to increase math instruction through the use of CTE courses. The belief that CTE instruction increases relevancy when coursework

can be treated as math credits has influenced the National Research Center for Career and Technical Education to include improving student achievement—particularly through math instruction and the integration of advanced math concepts into CTE—as an important topic for further research (Lewis, 2008).

This study is important as Wisconsin has increased math expectations for graduation from two to three math credits. Concurrently, the legislature has provided an alternative method for schools to deliver that third required math credit. Findings from this study may provide opportunities to educate and inform district administrators of the value provided by CTE and computer science courses as math credit options. Additionally, the findings may inform key education decision makers in Wisconsin of the barriers districts may face when attempting to implement courses in accordance with the 2013 Wisconsin Act 63 legislation.

Definition of Terms

The following terms will be used throughout this paper and are listed here to provide clarity.

Carnegie units. The amount of time to earn one high school credit in a course. One unit is measured as a minimum of 120 hours of class time estimated as a class meeting 4 times per week for 40–60 minutes each time. Typically this calculation meets the expectation of 1 hour of coursework per day for 24 weeks (Carnegie Foundation for the Advancement of Teaching, n.d.).

Computer science course. A course meeting the established Wisconsin Department of Public Instruction (WDPI) criteria for computer courses that will qualify as a math course to satisfy graduation requirements.

CTE completers. Students who successfully complete two or more sequential career and technical education (CTE) courses in a program of study (Blowe & Price, 2012).

Curriculum director. The individual in a school district responsible for evaluating the current curriculum and planning for curriculum improvement (Doll, Shafer, Christie, & Salsbury, 1958).

Dual credit enrollment. Taking courses in high school that qualify for both high school and technical college credit.

Northwest Wisconsin. The eight-county area comprised of Barron, Bayfield, Burnett, Douglas, Polk, Rusk, Sawyer and Washburn counties.

Limitations of the Study

The limitations that may have impacted the results of the study included the following:

1. Wisconsin has 510 school districts. This study was limited to the school districts located in Northwest Wisconsin: eight counties containing 34 school districts. The results of the research may not be generalizable to other parts of Wisconsin.
2. Most of the school districts surveyed are small and each principal and administrator contacted has multiple responsibilities and may not have paid sufficient attention to the survey questions when responding.
3. Some school districts have one person acting as principal and superintendent and no curriculum director limiting the potential responses from a school district to just one.
4. The literature regarding research on nontraditional math courses is dated, yet math graduation requirements and alternative options remain fluid as federal and state government regulations change.

Methodology

The study was conducted as nonexperimental quantitative research. The author completed the research through a survey of key decision makers in the 34 school districts that

serve Northwest Wisconsin. This internet-based survey focused on the relationship between the subject's familiarity with the 2013 Wisconsin Act 63 legislation, allowing the creation of nontraditional math courses, and the ability and desirability to implement nontraditional math courses. The study was cross-sectional and included all school districts in Northwest Wisconsin.

Chapter II: Literature Review

Math instruction and expectations have changed dramatically since World War II. Several publications have served to focus legislative interest on reforming math achievement in school. Most significantly, President Reagan's National Commission on Excellence in Education released *A Nation at Risk* in 1983 (National Commission on Excellence in Education, 1983). This report stated that schools needed to increase academic rigor and establish standards both for the courses taught and for the instructors teaching those courses (National Commission on Excellence in Education, 1983). After this report was published, federal legislation focused on helping all students improve academically (Stone, 2004). As a result, states have been increasing math requirements to meet graduation expectations. In 1983, the Wisconsin Legislature passed Act 411 creating state-level graduation requirement expectations for all Wisconsin school districts (High School Graduation Standards, Wis. Stat. §118.33, 2011). Before this change, school districts were responsible for setting their own graduation requirements. This law established two credits of math as a requirement for graduation, starting in 1988 (High School Graduation Standards, Wis. Stat. §118.33, 2011). In 2013, Wisconsin Act 63 increased the requirement from two to three math credits for high school graduation (High School Graduation Standards, Wis. Stat. §118.33, 2017). In addition, the legislation increased the possibility for other coursework to qualify for math credits, including career and technical education (CTE) and computer science courses (High School Graduation Standards, Wis. Stat. §118.33, 2017).

The new opportunities to earn high school math credits through CTE and computer science courses have not resulted in many changes in Wisconsin. Department of Public Instruction records indicate only limited implementation in the state, and none of the districts in Northwest Wisconsin have created a relevant course (Wisconsin Department of Public

Instruction, n.d.-f). The objective of this study was to understand the factors preventing school districts in Northwest Wisconsin from offering nontraditional math courses. This understanding includes school district representatives' level of knowledge regarding the 2013 legislation as well as the barriers preventing schools from implementing new courses or adjusting existing courses to meet state criteria.

This chapter includes a review of the literature related to benefits and detriments of increased math credit requirements for high school graduation. Also included are the potential contributions of CTE and computer science coursework in terms of math success and math credit completion.

Benefits of Math Education

Significant literature has explored the impacts related to the choices of math courses, the impacts of increased graduation requirements (more Carnegie units of math, in particular), and the general benefits of taking math classes. The benefits include higher college graduation rates (Choy, 2001; Gaertner, Kim, DesJardins, & McClarty, 2014; Trusty & Niles, 2003), higher compensation over time (Rose & Betts, 2004; Vigdor, 2013), and higher standardized test scores (Daun-Barnett & St. John, 2012). There are also disadvantages found with the increased math expectations such as less time for students to take elective coursework (Daun-Barnett & St. John, 2012) and lower graduation rates (Lillard & DeCicca, 2001; Plunk, Tate, Bierut, & Grucza, 2014). The disadvantages are often mitigated by students taking CTE courses (Bishop & Mane, 2004; Blowe & Price, 2012; Wu & Greenan, 2003). Studies have also noted similarities between math skills and processes and the skills and processes used in studying CTE coursework and computer science (Bruce, Drysdale, Kelemen, & Tucker, 2003; Henderson, 2003; Knuth, 1974).

Four-year college completion. One of the most frequently cited benefits of taking more math courses in high school is increased college enrollment and completion. Choy (2001), through the National Center for Education Statistics, studied the impact of math courses on students whose parents did not go to college. Of these students, 27% enrolled in college within two years of graduating high school. When the same classification of students took at least one math class beyond Algebra II, the rate of college enrollment increased to 64% (Choy, 2001). Despite the limited sample of students, the results indicated that taking more math courses is related to increased college enrollment.

High school math course completion not only appeared to influence enrollment in college but also was a significant factor in students obtaining a bachelor's degree. Trusty and Niles (2003) study on a sample of 5,257 students who enrolled in college indicated that the students' high school math course choices had the greatest impact on future degree completion (within eight years of completing high school). In the study, students who completed Algebra II, Trigonometry, Pre-calculus, or Calculus were more than twice as likely to earn a bachelor's degree as students who did not complete at least one of these courses. Gender, eighth-grade reading or math ability and racial/ethnic group makeup were not factors in the results (Trusty & Niles, 2003). A different study indicated that the college graduation rates of students who finished Algebra II in high school were 29.4% higher than those of students who did not complete the course (Gaertner et al., 2014). Out of all high school courses, the highest level of math coursework completed had the strongest influence on students finishing a college degree (Choy, 2001).

Taking dual credit courses in high school through tech-prep programs (a part of CTE programs) also had positive effects on math college readiness as well as increased likelihood of

graduating from high school and attending 2-year colleges. A study that measured the college readiness of students who participated in dual credit programs found a significant positive relationship between participation in the programs and college readiness in math (Kim, 2014). This study also found that tech-prep participants tended to stay in college longer. Cellini (2006) found that tech-prep participants taking dual credit courses were more likely to graduate from high school and attend a 2-year college. However, this study also found that these students were less likely to attend a 4-year college.

Compensation. Studies have generally shown that completing a bachelor's degree leads to higher compensation over time. Abel and Deitz (2014) indicated that individuals who complete a bachelor's degree earn an average of "well over \$1 million more than high school graduates during their working lives, while those with an associate's degree earn about \$325,000 more" (p. 4).

Completing advanced math courses and presumably graduating from college may also be associated with increased compensation. However, studies examining compensation found mixed results. The American Community Survey of 2009 and 2010 found that math skills often determine compensation (Vigdor, 2013). This survey found that students who received bachelor's degrees in math, engineering and physical science fields earned 19% more than other students upon graduation. In a review of the impact specific math courses had on future earnings, Rose and Bets (2004) found that different levels of math completion impacted earnings. Students who completed Algebra and Geometry earned more than students who did not, and the same held true for advanced math courses. The study found that the higher the math courses completed, the higher a student's earnings were 10 years later. Completing Algebra and Geometry positively impacted earnings between 3% and 6% and completing Calculus increased earnings by between

5% and 20% (Rose & Betts, 2004). Rose and Betts (2004) further noted that students who only completed vocational math courses saw earnings decline by approximately 3%.

Two additional studies reached different conclusions related to compensation. In 1998, Chaplin attempted to calculate the benefits of advanced high school math coursework on earnings. The author found it difficult to directly connect math courses with earnings. Indirectly, he found that math skills positively impacted earnings and that math courses were the most likely means of obtaining math skills (Chaplin, 1998). A study specifically on the impact of Algebra II completion in high school found that any differences in career advancement between students who completed Algebra II and those students who did not was statistically insignificant (Gaertner et al., 2014).

Several studies highlighted in this review showed that advanced math coursework increases student success through college and beyond. The same is true for students who complete significant CTE coursework. A study of data compiled over 12 years suggested that students who spend one sixth of their high school career taking CTE coursework earned approximately 12% more than other students one year after graduating from high school (Bishop & Mane, 2004). These students earned 8% more seven years later. These results held true whether or not the students pursued any post-secondary education (Bishop & Mane, 2004). Moreover, high school CTE courses may serve to entice students to pursue CTE fields in college. A 1997 review of 1992–1993 college graduates found that those students who earned degrees in applied fields in college such as business, engineering, computer science, or nursing earned higher-than-average wages and experienced greater job stability (Horn & Zahn, 2001).

Standardized test scores. The increased expectation in math credits for graduation has positively impacted test scores. Daun-Barnett and St. John (2012) concluded that for every extra

year of college preparatory math courses students took, student scores on the National Assessment of Educational Progress increased by 18 points. The study used data collected from various public sources between 1990 and 2008 from all 50 states (Daun-Barnett & St. John, 2012). Other researchers found that in addition to higher test scores for students taking more advanced math coursework, states with higher math graduation requirements tended to have students who entered high school taking more advanced math courses than was the case in states that required fewer math credits (Schiller & Muller, 2003).

Research has also shown that material improvements in math test scores have occurred through additional math content integration in CTE courses. Stone et al. (2008) matched CTE instructors with math instructors and, using tools the researchers created, developed techniques to teach math-enhanced CTE lessons relevant to the content of the specific CTE course (Stone et al., 2008). One objective of the experiment was to increase math relevance through courses the students were already taking and engaged in. Measurement in the form of TerraNova and ACCUPLACER math tests showed that the math scores of students who received the intervention were materially improved compared to the scores of the control group. The differences in math scores were not huge; however, the amount of time dedicated to math instruction within the CTE coursework was also limited (Stone et al., 2008).

One benefit of CTE coursework in general is highlighted in Stone (2004) where the researcher used data from previous studies to understand the impact that CTE had on math course taking. In this study, Stone reached the conclusions that CTE students took more and harder math classes than educationally similar students and that CTE reforms are improving math attainment.

Negative Impacts of Increased Math Requirements

Not all impacts related to increasing math credit requirements have been positive. Some research raises concerns for student success when more math coursework is required.

A number of negative issues have resulted from schools increasing their math credit requirements. One practical result was that as graduation requirements increased, particularly in math, less time was available for elective coursework as well as less time for remediation for those students who struggled with math (Daun-Barnett & St. John, 2012). A second negative outcome that a number of studies observed was that increases in state credit requirements for graduation led students to drop out of school. Lillard and DeCicca (2001) suggested that increasing credit requirements by approximately 2.5 credits to graduate from high school would increase the number of students who drop out of school nationally by 26,000 to 65,000. Studies demonstrated that increasing graduation expectations made individuals more likely to drop out of school. It was also less likely for Black women and Hispanic women and men to begin college as a result of increased graduation expectations (Plunk et al., 2014). One positive finding in the study was that if these same groups of people started college, they were more likely to graduate.

Mixed with the negative impact of lower high school graduation rates is one study that indicated increased rigor has helped lead more students to continue on to college (Daun-Barnett & St. John, 2012). The authors of the study believed that the decline in graduation rates was temporary as schools and teachers became better prepared for the increased rigor of the additional math courses (Daun-Barnett & St. John, 2012).

Impact of Contextualized Math Courses on Student Achievement

Contextualization of math curriculum can bridge the abstract nature of mathematics and help make the knowledge pertinent to students. Wang, Sun, and Wishersam (2017) studied the

benefit of contextualized learning—connecting required information or skills to practical examples—for students in remedial math courses at the community college level. One approach involves complementary courses where the focus of one course is on the basic skills, while the second course focuses on application (Wang et al., 2017). Another method the authors mentioned was to teach the knowledge or skills and then immediately apply these to real-world examples. A benefit of this technique included the lack of intimidation caused by formula memorization that was replaced by confidence as students could see how the math directly related to their real-world experiences making learning math interesting and valuable. Demonstrating the connection between math and the future career of the student contributed to student success and motivation (Wang et al., 2017). Contextualization of content is one of the primary advantages to including CTE coursework for math credit.

CTE benefits as math credits. According to the literature described in this section, studies have demonstrated that career and technical education coursework helps students stay in school and graduate. Such coursework has also increased their general math success.

Lower dropout rates. While an increase in math expectations has increased dropout rates, a number of studies have demonstrated the positive impact of CTE coursework on student retention and graduation. Blowe and Price (2012), reviewing the Virginia state-mandated testing of 11th grade English and math scores for the years 2008–2010, showed that graduation rates for CTE completers were 95% for the 3 years of the study and the average graduation rate for non-completers was “in the mid-80% range” (p. 6). The students in the study, who took more CTE courses by enrolling in Program of Study (POS)–themed high schools, had an 11% higher probability of graduating from high school. Programs of study are a series of three to four related courses of increasing difficulty related to a CTE career field (Castellano, Richardson, Sundell, &

Stone, 2017). For each additional credit of CTE coursework earned, the probability of graduating from high school increased by an additional 4% (Blowe & Price, 2012). In a John Hopkins University study of high school students, researchers found that taking a moderate mix of CTE coursework decreased the chances that students would drop out of high school for students aged 14 or younger when entering high school (Plank, DeLuca, & Estacion, 2008). CTE coursework may help students stay in school.

Math success. Blowe and Price (2012) conducted a study in Virginia that compared the English and math success of students who were CTE completers (students who met the Virginia requirements for a CTE concentration) with the success of non-completers. Completion consisted of taking two successive CTE courses in a specific program area (such as business or agriculture) and obtaining at least an 80% proficiency in the course competencies. The objective of the study was to compare the math and English skills as measured by the Virginia Standards of Learning (SOL) tests. In the second two years of the study (2009 and 2010), CTE completers outperformed non-completers by 7% and 10% respectively. In first year of the study, 2008, non-completers outperformed completers by 7% (Blowe & Price, 2012).

Wu and Greenan (2003) conducted a study with 10th, 11th, and 12th grade students in Indiana who were enrolled in secondary CTE programs. Students in the experimental group received 15 minutes of generalizable math instruction during their CTE course, covering 22 lessons over 6 weeks. The control groups received the normal CTE instruction. The students in the experimental group exhibited higher math skills achievement on the post-test than students who did not receive the intervention. The study concluded that if CTE teachers focused a small portion of their time on generalizable math skills, students' math scores would improve. The

implication of the study was that practical application mixed with instruction was materially beneficial to students (Wu & Greenan, 2003).

Another study on the effectiveness of math instruction found that students do better when engaged in real-world applications of mathematical concepts, and the researcher recommended that mathematics instructors find ways to incorporate real-life problem-solving into the classroom instruction (Pippenger, 2003), a key feature in CTE coursework. College math readiness was also demonstrated to be improved through the use of dual credit enrollment. Kim (2014) studying dual credit enrollment, in which students were taking high school courses for both high school and technical college credit, found a positive relationship between taking CTE dual credit courses and college readiness in math. A study of mathematics and agricultural education found that “student achievement in math is dependent on the interaction of contextually rich curriculum . . . [and the] use of problem-based experiences as methods by which concepts and principles can be learned and applied” (Shinn et al., 2003, p. 21).

In contrast to many of the other studies, Bozick and Dalton (2013) concluded that math achievement is driven by the instruction provided in math courses and not by adding CTE courses or replacing math courses with CTE coursework. Most studies reviewed, excluding Bozick and Dalton (2013), demonstrated that CTE coursework increases the number of math courses taken and improves math competencies. By including CTE options as math credits, it is possible that even more students will receive the math benefits of CTE.

Computer science as math credits. Researchers have shown that computer science skills and mathematics are significantly related. Knuth (1974) explored this relationship, focusing on comparing algorithms in mathematics and the process for creating computer code. According to Knuth (1974) “an algorithm is a precisely-defined sequence of rules telling how to

produce specified output information from given input information in a finite number of steps” (p. 323). These same processes are often used when solving math problems. Henderson (2003) noted that mathematics also plays a role in the field of software engineering (development of computer software programs). Software engineers use mathematical reasoning when creating software systems. They need to develop algorithms and logically test assumptions, similar to solving math problems. Henderson considered the following key mathematical skills essential in software engineering included: functions, relations, and sets; basic logic; direct and indirect proofs; discrete probability; and algorithm analysis (Henderson, 2003). According to Bruce et al. (2003), mathematics is used throughout the process of developing computer programs, including the design, specification, coding, and verification stages. Bruce et al. further noted that algorithms are important in programming, and mathematical skills are necessary to write and prove that the algorithms are correct. Devlin (2003) stated that computer programming is “about constructing, manipulating, and reasoning about abstractions” (p. 38), which is what mathematics instruction provides. Computer science and math are closely related, and one skill enhances the other.

Not much research has been done on the impacts of including computer science in high school coursework, and no studies were found on treating computer science coursework as math credits. This topic should generate significant interest moving forward. On January 30, 2016, President Obama allocated \$4 billion for computer science education (The White House, 2016). Guzdial (2016) noted that many states are looking to increase their computer science offerings, including creating standards for courses and treating computer science as math, science or foreign language graduation credits. He estimated that within five years, 50% of schools in the 11 leading states will offer computer science education (Guzdial, 2016). These states are part of

an initiative to develop plans to increase computer science education through better-prepared teachers, increased participation in computing, and growing computer science (Guzdial, 2016).

Summary

The literature indicated that requiring additional math credits for graduation has a number of positive effects. Students who take more and harder math courses in high school are more likely to have higher standardized test scores, graduate from college, and earn more over their careers. Some negatives were indicated through the literature, as well. Studies showed that increasing math expectations limited the number of elective courses students could take and resulted in lower high school graduation rates. Including CTE instruction increased math fluency and had positive impacts on graduation rates. Computer science instruction also complements math instruction, and the systems used to learn computer science are very similar to those used in mathematics.

Chapter III: Methodology

The State of Wisconsin increased math graduation requirements; making the changes effective for 2017 graduates (2013 Wisconsin Act 63, 2013). Given that this is recent legislation and has only started to impact high school graduation, limited research has explored school districts' implementation of nontraditional math courses. The purpose of this study was to understand the factors preventing school districts in Northwest Wisconsin from offering nontraditional math courses. The research questions addressed in the study were:

1. What level of knowledge do the solicited representatives in the school districts have regarding the additional math credit opportunities provided in the 2013 Wisconsin Act 63 legislation?
2. What factors have school administrators considered in determining whether to offer math credit for nontraditional math courses?
3. What are the barriers preventing or delaying implementation of nontraditional math courses?

This chapter explains the methods used to conduct the study including the school districts solicited and how they were approached. Descriptions of the data analysis and study limitations are also included.

Research Design

The study was conducted as nonexperimental quantitative research. Quantitative research is numerically based, and the results are easy to compare and analyze, which was appropriate for this study as the research emphasized the facts and causes of the issue (Wiersma & Jurs, 2009). The research involved a survey of key decision makers in the 34 school districts that serve Northwest Wisconsin. The survey focused on the subject's familiarity with the 2013 Wisconsin

Act 63 legislation allowing the creation of nontraditional math courses and the ability and desirability to implement nontraditional math courses. The study was cross-sectional, and all school districts in Northwest Wisconsin were included. The study used an internet-based survey as the tool for soliciting the information.

Subject Selection and Description

Subjects were selected to represent one region in Wisconsin. The area consists of eight counties in Wisconsin, from Barron County up to Lake Superior and west to the Minnesota border. To locate schools within these counties, the researcher used the Wisconsin Department of Public Instruction (WDPI) public search function, and the search included all “regular” and “public schools” in the eight counties (Wisconsin Department of Public Instruction, n.d.-e). Private schools, charter schools and vocational schools were excluded from the search as they may operate under different rules from those of traditional public schools. This list included primary and secondary schools. The list of schools was then sorted, and schools that did not include students in grades 9, 10, 11, or 12 were eliminated. Table 1 shows the school districts and schools included in the survey. None of the school districts in Northwest Wisconsin have more than one traditional high school in their district (WDPI, n.d.-e).

Table 1

School Districts and Schools Included in Survey

School District	School Name	School District	School Name
Amery	Amery High School	Maple	Northwestern High School
Barron Area	Barron High School	Northwood	Northwood High/Mid School
Bayfield	Bayfield High School	Osceola	Osceola High School
Birchwood	Birchwood High School	Prairie Farm Public	Prairie Farm High School
Bruce	Bruce High School	Rice Lake Area	Rice Lake High School
Cameron	Cameron High School	Saint Croix Falls	Saint Croix Falls High School
Chetek-Weyerhaeuser Area	Chetek-Weyerhaeuser High School	Shell Lake	Shell Lake Jr/Sr High School
Clayton	Clayton High School	Siren	Siren High School
Clear Lake	Clear Lake High School	Solon Springs	Solon Springs School
Cumberland	Cumberland High School	South Shore	South Shore Jr/Sr High School
Drummond Area	Drummond High School	Spooner Area	Spooner High School
Flambeau	Flambeau High School	Superior	Superior High School
Frederic	Frederic 6-12 School	Turtle Lake	Turtle Lake High School
Grantsburg	Grantsburg High School	Unity	Unity High School
Hayward Community	Hayward High School	Washburn	Washburn High School
Ladysmith	Ladysmith High School	Webster	Webster High School
Luck	Luck High School	Winter	Winter High School

Note. The data source is WDPI (n.d.-e) public school search.

After sorting out the traditional high schools, a number of alternative high schools remained from the same districts as the traditional schools. These schools, including charter and virtual schools, were eliminated from consideration as most had the same principal as the traditional high school and including these schools could create confusion when soliciting survey

responses. Table 2 lists the schools that were eliminated to prevent duplication of solicitation. All schools on this list have a traditional high school in the district that received surveys (WDPI, n.d.-e).

Table 2

Schools Excluded From Survey to Prevent Duplication

School District	School Name
Barron Area	Advanced Learning Academy of WI
Birchwood	Bobcat Virtual Academy
Chetek-Weyerhaeuser Area	Link2Learn Virtual Charter School
Cumberland	Island City Academy
Cumberland	Island City Virtual Academy
Grantsburg	iForward
Hayward Community	HACIL
Hayward Community	Northern Waters Environmental
Northwood	Northwood Virtual Charter School
Rice Lake Area	Northern Lakes Regional (NLRA)
Turtle Lake	Laker Online

Note. The source of the information is WDPI (n.d.-e) public school search.

Within each school district, the surveys were sent to the individuals most likely to be the district curriculum decision makers. The positions included: high school principal, district administrator or superintendent, and director of instruction. The WDPI public school search used to select districts also included the names of the principals of each school (WDPI, n.d.-e). To locate the additional professional positions (district administrator/superintendent and director of

instruction) within each district the *WDPI 2015-2016 SEDA - Staff Ethnicity and Gender Report by District - Administrative ('A' Position Grouping) Summary Report* was used. The purpose of the report is to list administrative (non-teaching) positions in each school district by gender and ethnicity. This report helped determine the key administrative positions within the school districts included in the survey. With three exceptions, each school district in Table 1 has a principal and a district administrator/superintendent, assuring at least two surveys were sent to each district. Bayfield, Chetek-Weyerhaeuser and South Shore each have a combined district administrator and principal; therefore, only one survey was sent to each of these districts. The following districts also had director of instruction positions: Bruce, Cameron, Osceola, Rice Lake, Siren, and Superior. Therefore, these districts received a third survey. Turtle Lake also received three surveys as the district has a superintendent and a district administrator in addition to the high school principal. Table 3 lists the number of surveys sent per district. To determine the names, addresses, and email addresses for each of these individuals, searches on their school websites and the WDPI School Directory were conducted (WDPI, n.d.-a).

Table 3

Surveys Sent to Each District

School District	Number of Surveys	School District	Number of Surveys
Amery	2	Maple	2
Barron Area	2	Northwood	2
Bayfield	1	Osceola	3
Birchwood	2	Prairie Farm Public	2
Bruce	3	Rice Lake Area	3
Cameron	3	Saint Croix Falls	2
Chetek-Weyerhaeuser	1	Shell Lake	2
Clayton	2	Siren	3
Clear Lake	2	Solon Springs	2
Cumberland	2	South Shore	1
Drummond Area	2	Spooner Area	2
Flambeau	2	Superior	3
Frederic	2	Turtle Lake	3
Grantsburg	2	Unity	2
Hayward Community	2	Washburn	2
Ladysmith	2	Webster	2
Luck	2	Winter	2

Note. The source is the WDPI (n.d.-a) public school search.

Instrumentation

Two instruments were important to the data collection. The first was the letter explaining the survey, the purpose of the survey and how the results would be used, is included in Appendix A. The letter introduced the idea of the survey to the recipients and aimed to create a sense of responsibility to complete the survey. Included with the letter was a second document with the UW Stout Implied Consent statement.

The second instrument was the survey itself, which was created using Qualtrics and was sent out via email to the recipients. The first three survey questions used a Likert scale, which allowed for the use of ordinal numbers to represent the strength of familiarity with the 2013 Wisconsin Act 63 legislation and agreement regarding sufficiency of current math offerings and desirability to grant math credits for career and technical education (CTE) and computer science coursework (Questions 1–3). Questions 4–9 were multiple choice to allow respondents to select from an established list, making the response easier and more efficient. Blanks were provided with each of these responses if the options were not adequate to reflect the desired responses of the person taking the survey. Questions 10–14 were multiple choice designed to obtain general demographic information on the participants. The survey questions are included in Appendix B.

The email transmitting the survey included a reference to the letter sent previously, a brief discussion of the purpose of the survey, and the link to take the survey. At the completion of the survey a thank-you screen acknowledging the time and attention the respondent put into the survey appeared on the screen.

Relevant variables. The key variables in this study included familiarity with the 2013 Wisconsin Act 63 legislation, particularly the alternative math credit provisions. Understanding how familiar individuals were with the legislation helped define the ability of the respondents to

answer the remaining questions in a manner useful for the intended results. If the respondents were unfamiliar with the legislative act, their ability to act would be limited.

The second key variable was the adequacy of the current math offerings in the district as measured in the second survey question. The third variable, recorded from survey Question 3, measured the desirability of expanding math offerings to potentially include computer science and CTE courses as math credits.

Data Collection Procedures

Since the tool used was an online form, the survey responses were deposited directly into an online database. The database was checked each day to ensure responses were still coming in. At the 7- and 14-day marks follow-up emails were sent to encourage those who had not already responded to complete the survey.

To maximize the response rate, letters were mailed to the survey recipients in advance of the survey explaining the purpose of the survey—to support graduate research—and let them know that a survey would be sent to them via email within the next week in case the email was caught in SPAM filters. The letter also conveyed the implied consent document as an attachment. Appendix A contains a copy of the letter. The letter was sent on premium quality paper, individualized for each recipient, used personalized addresses, and included the author's home address as the return address. The intention was to distinguish this mailing from traditional bulk mailings and increase the likelihood that the letter would be opened. No letters were returned due to incorrect addresses or forwarding order expirations. Two individuals responded to the letter asking to not be a part of the survey; therefore, they did not receive email requests. Instead, a response email was sent, to acknowledge their request and affirm that they would not be contacted further. These two names were immediately removed, and no additional emails were

sent to either party. Five business days later, the survey was sent to the 70 remaining members on the list (Appendix D). Each email was sent with the author listed as the main recipient and all individual participant email addresses in the “BCC” section to assure anonymity.

In order to ensure that implied consent was obtained, each email with a link to the survey had a reference to the UW Stout Implied Consent Statement information that had been included in the initial letter. The complete UW Stout Implied Consent Statement comprised the first page of the survey.

Several emails were rejected due to incorrect addresses. The researcher completed additional research the same day to find correct emails and sent the initial email survey to those individuals on the same date that all other initial emails were sent. In order to obtain the attention of the recipients when they first started work, the emails were sent between 5:00 – 6:00 a.m. each week, for three weeks. One email was rejected due to a personnel change in the school district. Research to find the correct email revealed that one principal had recently left the district and a new principal had been hired. It was assumed that the new principal did not receive the initial mailing; a new physical letter was prepared and sent, followed by an email with the survey. Thereafter, this individual’s email was included with the bulk email.

Follow-up responses. Since not everyone responded immediately to the survey, the author implemented follow-up procedures. The first reminder was a short email with another link to the survey sent 5 business days after the original email (Appendix E). The email explained the importance of responding to this survey and instructed the participant to ignore the emails if he or she had already responded. The email also requested a reply if a participant was unwilling to complete the survey. The second reminder was sent 5 business days after the first reminder and included a similar email to the first (Appendix F). If the individual was unresponsive after the

second request, it was assumed that he or she was not going to answer the survey and no further contact was made.

Data Analysis

Descriptive statistics were used to evaluate the results of the survey. Specifically the process used measures of central tendency and measures of frequency. These provided simple and clear means of evaluating the results of the survey. The reliability of the survey has not been tested in a prior study as the survey was created for this study by a novice researcher. However, to gauge the reliability of the survey results, the response scores for the first question regarding familiarity with the 2013 Wisconsin Act 63 legislation were used. Since 71% of respondents indicated that they were “Very familiar” or “Somewhat familiar” with the legislation and only 3% stated that they were “Unfamiliar,” the survey results can be considered reliable.

To measure the internal validity of the survey, answers from Question 3 were compared to the responses from Question 4. Individuals who selected either “Strongly Disagree” or “Disagree” to Question 3 asking if granting math credit for computer science or CTE courses would improve student math knowledge should have selected that they had not considered making a change by adding computer science and CTE courses for math credit or that they had considered but not acted on that change in Question 4. Since 100% of respondents who selected “Strongly Disagree” or “Disagree” to Question 3 answered Question 4 by stating that they had not started to make a change in course offerings, the survey is internally valid.

Limitations

The limitations related to the methods used for the study include the following:

1. The survey was conducted in spring towards the end of the school year when administrators have even more to do than usual and so this survey may not have received adequate attention.
2. The letter and survey emails were all sent around many school districts' spring break and Easter. Administrators may have had other priorities, both personal and professional, instead of completing this survey.
3. The results of the survey are limited to the information provided by the respondents. Not all individuals solicited returned the survey.
4. Since the time frame for responses was limited to approximately three weeks, individuals who were on vacation or otherwise unable to check email were unable to respond.

Chapter IV: Results

The State of Wisconsin increased math graduation requirements, which became effective for 2017 graduates (2013 Wisconsin Act 63, 2013). Given that this is recent legislation and has only begun to impact high school graduation, limited research has been done to explore school districts' implementation of nontraditional math courses. The purpose of this study was to understand what has prevented school districts in Northwest Wisconsin from offering nontraditional math courses. The research addressed the following three questions:

1. What level of knowledge do the solicited representatives in the school districts have regarding the additional math credit opportunities provided in the 2013 Wisconsin Act 63 legislation?
2. What factors have school administrators considered in determining whether to offer math credit for nontraditional math courses?
3. What are the barriers preventing or delaying implementation of nontraditional math courses?

Out of 510 districts in the state of Wisconsin, 34 were surveyed. The results can be expanded to most rural districts in Wisconsin. Since few districts have implemented any nontraditional math courses, most districts can be assumed to have similar constraints as the districts in Northwest Wisconsin.

Demographic Data

Out of 72 requests, 37 participants responded to the survey. Two responses did not contain any information and were discarded. This meant that 35 out of 72 surveys were complete, for an average response rate of 49%. The average time respondents took to complete the survey was 5.5 minutes.

The titles of the respondents to the survey are listed in Table 4. Two respondents listed Curriculum Director and District Administrator as their titles, and two listed District Administrator and Superintendent. In order to prevent duplication and overweighting the responses of these four individuals, their responses were reported under Curriculum Director for the Curriculum Director/District Administrators and under District Administrators for the District Administrators/Superintendents. One individual who listed Assistant Principal was reclassified as a Principal for comparison purposes. Two did not answer this question. The responses represent all levels of administration as solicited. Forty-six percent of the respondents listed their title as Principal or Assistant Principal while 28% listed the titles of District Administrators and/or Superintendents.

Twenty-five percent of the respondents listed their gender as female, while 63% identified as male. The majority of curriculum directors identified themselves as female, while the majority of principals and district administrators identified themselves as male.

Table 4

Respondents by Title (n = 35)

Title	Number of Respondents	Percent of Total	Gender	
			Female	Male
Principal	16	46%	2	12
District Administrator	10	28%	2	8
Curriculum Director	7	20%	5	2
No Response	2	6%		

Note. Two individuals did not answer the question on gender, and two selected “Prefer not to say.”

A majority of the respondents have been in their current positions for short periods of time. Thirty-four percent of respondents have been in their position for less than three years and 62% have been in their position less than seven years. Table 5 lists the number of years each respondent has been in their current position.

Table 5

Respondents by Years in Position (n = 35)

Years in Position	Number of Respondents	Percent of Total
3 years or less.	12	34%
More than 3 years, but less than 7 years.	10	28%
7 or more years, but less than 10 years.	3	9%
10 or more years.	7	20%
No Response	3	9%

Approximately 46% of the respondents were age 50 or above, with 12% age 60 or older. Of the four respondents age 60 or older, two were district administrators and were two curriculum directors. No respondent age 60 or older was a principal. Three of the four age 60 or older respondents had been in their position for 10 or more years. The other respondents were represented relatively evenly among all of the positions and years in the position.

Schools of all sizes found in Northwest Wisconsin are represented in the survey results. Respondents were balanced across very small schools (less than 50 graduates), medium-sized schools (50 – 100 graduates), and what are considered large schools for the region (over 100 graduates). Table 6 lists the size of the average graduating class from the high school in the respondent's school district.

Table 6

Respondents Based on Average Graduating Class Size (n = 35)

Graduating Class Size	Number of Respondents	Percent of Total
Less than 50 students	12	34%
50 - 100 students	10	28%
101 -150 students	6	17%
More than 150 students	5	14%
No Response	2	6%

Research Questions

This section analyzes the data collected to answer each research question.

Question 1. What level of knowledge do the solicited representatives in the school districts have regarding the additional math credit opportunities provided in the 2013 Wisconsin Act 63 legislation? The first research question was intended to determine the school leaders' familiarity with the 2013 Wisconsin Act 63 legislation. It was also the first question asked in the survey, and responses are listed in Table 7. A list of CTE courses was included in this question to enhance the reliability of responses to the question. The initial letter mailed to respondents included a brief overview of the legislation and provided participants with a limited base of knowledge. Of the 35 people who responded to the survey, 71% indicated that they were "Very familiar" (23%), or "Somewhat familiar" (48%) with the legislation. Twenty-nine percent indicated that they were "Not very familiar" or "Unfamiliar" with the 2013 Wisconsin Act 63 legislation.

Table 7

Familiarity With Wisconsin Legislation that Changed Math Graduation Standards (n = 35)

Response Choices	Frequency	Percentage
Very familiar	8	23%
Somewhat familiar	17	48%
Not very familiar	9	26%
Unfamiliar	1	3%

Table 8 highlights familiarity with the 2013 Wisconsin Act 63 legislation by demographic identification. Respondents who were newest in their positions (less than three years) or in the smallest school districts (graduating classes of less than 50 students) were the least familiar with the legislation. Individuals 50–59 years old or who were female were also less familiar with the legislation than other groups.

Table 8

Familiarity With Legislation by Demographic Identification

Demographic Identification	Number of Respondents	Familiar	Not Familiar
Title			
Curriculum Director	7	71%	29%
District Administrator	10	80%	20%
Principal	16	69%	31%
Years in Position			
3 years or less	12	50%	50%
More than 3 and less than 7 years	10	100%	0%
7 or more and less than 10 years	3	67%	33%
10 years or more	7	71%	29%
Average Graduating Class			
Less than 50 students	12	50%	50%
50 - 100 students	10	80%	20%
101 - 150 students	6	83%	17%
More than 150 students	5	100%	0%
Age			
Under 30 years old	1	100%	0%
30-39 years old	5	100%	0%
40-49 years old	11	73%	27%
50-59 years old	12	58%	42%
60 years and older	4	75%	25%
Gender			
Female	9	56%	44%
Male	22	77%	23%
Prefer not to say	2	100%	0%

Question 2. What factors have school administrators considered in determining whether to offer math credit for nontraditional math courses? For administrators in school districts to consider adding nontraditional math courses, a perceived need is required. One method to establish this need would be by recognizing the inadequacy of existing math courses to meet their students' needs. Related to the inadequacy of current math curriculum would be the perception that additional math-related courses, such as computer science or CTE could enhance students' math knowledge in high school.

The second survey question asked if the respondents believed that their current course offerings were not meeting the needs of their students, given the third math credit requirement. Table 9 lists a summary of the responses to this question. Seventy-nine percent of respondents indicated that their school's math offerings were meeting the needs of students by selecting "Strongly Disagree" or "Disagree" to the question. Only one respondent selected "Strongly Agree" that their school's math course offerings were inadequate, while seven others stated that they "Agree" with the statement that current math courses are not meeting the needs of students. Two out of the five large-school responses agreed that math course offerings were not currently meeting their students' needs.

Table 9

Responses Whether Current Math Courses do Not Meet Student's Needs (n = 35)

Response Choices	Frequency	Percentage
Strongly Disagree/Disagree	27	77%
Strongly Agree/Agree	8	23%

Most respondents believed that the current math offerings in the district were meeting the needs of their students. The third survey question was asked to understand if these individuals

believed that granting math credit for computer science or CTE courses would improve their students' math knowledge. Table 10 summarizes responses to Question 3 in the survey. Sixty-six percent of respondents selected "Agree" or "Strongly Agree" that adding computer science or CTE courses as math credits would improve math knowledge. The results become interesting when looking specifically at principals as shown in Table 11. Principals were split, with 44% disagreeing and 56% agreeing that computer science and CTE would improve math knowledge. Approximately 70% of each category District Administrators and Curriculum Directors agreed that math knowledge would improve, while those in the Principals category were evenly divided.

Table 10

Responses Whether Granting Math Credits for Computer Science or Career and Technical Education Courses Would Improve Math Knowledge (n = 33)

Response Choices	Frequency	Percentage
Strongly Disagree/Disagree	12	34%
Strongly Agree/Agree	21	66%

Table 11

Responses by Title Whether Granting Math Credits for Computer Science or Career and Technical Education Courses Would Improve Math Knowledge (n = 33)

Title	Number of Respondents	Strongly Disagree or Disagree	Strongly Agree or Agree
Curriculum Director	7	29%	71%
District Administrator	10	30%	70%
Principal	16	44%	56%

Question 3. What are the barriers preventing or delaying implementation of nontraditional math courses? This question was broken into three parts. The first asked a

survey question to develop an understanding if there were barriers that delayed or prevented the addition of new math courses. Any barriers for traditional math courses, were likely to be compounded when considering nontraditional math courses. The second step was to understand if respondents had considered adding nontraditional math courses. Following this question were detailed questions that sought to better understand the types of courses considered and what challenges were anticipated when considering implementing new computer science or CTE courses.

The final question of the survey attempted to gather data about challenges that existed when creating new math courses in their district. Table 12 highlights the concerns respondents indicated as existing in their school district when implementing new math courses; respondents could choose more than one response. Teacher training, licensing, and additional costs were all equally highlighted concerns. The majority of respondents (74%) indicated that “Teacher Availability” was a challenge to creating new math courses. Two of the “Other” responses indicated that costs to hire additional teachers were the challenge for their district. These responses related directly to “Teacher Availability” as the district did not have the resources to add more math courses without additional teachers. Only three individuals indicated that there were no barriers to creating new math courses in their districts.

Table 12

Challenges to Create New Math Courses (n = 35)

Response Choices	Frequency of Challenge	Percentage of Challenge
Teacher Availability	25	43%
Additional costs such as text books and other resources	9	15%
Teacher Licensing	8	14%
Teacher Training	8	14%
No barriers exist in our district	3	5%
Other: Please specify ^a	3	5%
Lack of School Board Support	2	4%

^a Responses included: costs of hiring additional teachers (2) and meeting college and career readiness standards

In addition to understanding if school district administrators have considered additional math courses, developing an understanding whether computer science or CTE courses have been considered for math credits is important. The fourth survey question asked if schools had given any consideration to offering math credit for CTE or computer science courses. Twenty-eight percent of respondents had not considered adding courses, 54% had considered making a change but had not moved forward, while 9% were in the development stages for computer science and CTE courses as Table 13 shows; respondents could choose more than one response. Course development is occurring in schools with average graduation class sizes between 50 and 150 students. Neither the smallest schools nor the largest schools in the region having respondents to the survey were working on implementing courses.

Table 13

Level of Consideration Given to Offering Math Credit for Computer Science or Career and Technical Education Courses (n = 35)

Response Choices	Frequency	Percentage
We have considered making changes in courses offered for math credit, but have not moved forward with it.	19	54%
We have not considered making any changes in courses offered to meet math credits	10	28%
We are in the development stages of determining CTE courses to offer as math credit.	3	9%
We are in the development stages of determining computer science courses to offer as math credit.	3	9%

Additional survey questions were asked based on the response to survey Question 4. These additional survey questions were asked to clarify the interest in adding computer science or CTE courses, the types of courses considered, and what barriers were anticipated that could impact implementation of the courses. Survey Questions 5 and 6 were asked only if the respondent did not select “We have not considered making any changes in courses offered to meet math credits” in survey Question 4. If the respondent was not going to consider adding courses, his or her opinion on what courses to add was deemed not to be relevant. Survey Question 5, summarized in Table 14, solicited whether respondents were considering adding computer science courses and which courses were being considered; they could choose more than one response. Twelve of the 24 respondents (50%) indicated that they were not considering adding computer science courses as math credits. Of those schools considering adding courses, “Computer Programming,” “Other Computer Science,” and “AP Computer Science A” each

received multiple selections. The next question, summarized in Table 15, asked about the barriers schools would face should they try to implement computer science courses; participants could choose more than one response. Survey Question 5 was asked only if the respondent did not select “We have not considered making any changes in courses offered to meet math credits” in survey Question 4. No one responded that they thought implementation would occur. Concerns were divided between a lack of qualified candidates to teach the courses and a lack of students interested in taking the courses.

Table 14

Computer Science Courses to be Considered as Math Credits (n = 24)

Response Choices	Frequency	Percentage
We have considered making changes in courses offered for math credit, but have not moved forward with it.	19	54%
We have not considered making any changes in courses offered to meet math credits	10	28%
We are in the development stages of determining CTE courses to offer as math credit.	3	9%
We are in the development stages of determining computer science courses to offer as math credit.	3	9%

Table 15

Barriers Anticipated if Adding New Computer Science Courses (n = 12)

Response Choices	Frequency	Percentage
Not enough qualified teaching candidates.	9	38%
Enrollments would be too low to justify course offerings.	8	33%
Current teacher licenses do not match DPI requirements.	5	21%
Other costs would be too high (computers, textbooks, materials) to justify offering the course.	1	4%
Other: ^a	1	4%
We expect the implementations to occur.	0	0%

^a Responses included: Teacher already overloaded

Similar to survey Questions 5 and 5a regarding computer science curriculum implementation, survey Questions 6 and 6a were asked about CTE implementation. Survey Question 6 asked what CTE courses were being considered for math credit; participants could choose more than one response. As Table 16 shows, 30% indicated that they were not considering adding CTE courses, while “Accounting” and “Personal Finance” generated the majority of the interest at 28% and 30% of the responses, respectively. Ten out of 24 respondents (42%) indicated that they were not considering adding a CTE course for math credit. Similar to the computer science questions, if the respondent indicated that he or she was not considering adding courses, the follow-up question was not asked. Table 17 lists the responses for the follow-up to Question 6 regarding barriers to implementation; participants could choose more than one response. Teacher licensing (32%), lack of qualified teaching candidates (23%), and too low of enrollment (32%) each received multiple responses. Unlike computer science, two respondents indicated that they expect implementation to occur.

Table 16

Career and Technical Education Courses to be Considered as Math Credits (n = 24)

Response Choices	Frequency	Percentage
We are not considering adding CTE courses as math graduation credits.	10	30%
Personal Finance	10	30%
Accounting	9	28%
Other Existing Course ^a	4	12%
We will be creating a new course to meet these needs.	0	0%

^a Responses include: WITC Dual Enrollment, Vocational Math, Computer Science/Programming

Table 17

Barriers Anticipated if Adding New Career and Technical Education Courses (n = 14)

Response Choices	Frequency	Percentage
Current teacher licenses do not match DPI requirements.	7	32%
Enrollments would be too low to justify course offerings.	7	32%
Not enough qualified teaching candidates.	5	23%
We expect the implementations to occur.	2	9%
Other: ^a	1	4%
Other costs would be too high (computers, textbooks, materials) to justify offering the course.	0	0%

^a No detail provided

Chapter V: Discussion, Conclusion and Recommendation

Math instruction and expectations have changed dramatically since World War II. Several publications have served to focus legislative interest in reforming math achievement in school. Most significantly, *A Nation at Risk* stated that schools needed to increase academic rigor and establish standards both for the courses taught and for the instructors teaching those courses (National Commission on Excellence in Education, 1983). After this report was published, federal legislation focused on helping all students improve academically (Stone, 2004). As a result, states have been increasing the math expectations to meet graduation requirements. In 1983, the Wisconsin Legislature passed Act 411, creating state-level graduation requirement expectations for all Wisconsin school districts (High School Graduation Standards, Wis. Stat. §118.33, 2011). Previous to this change, school districts were responsible for setting their own graduation requirements. This law established two credits of math requirement for graduation starting in 1988 (High School Graduation Standards, Wis. Stat. §118.33, 2011). In 2013, the 2013 Wisconsin Act 63 legislation increased the requirement from two to three math credits for high school graduation (High School Graduation Standards, Wis. Stat. §118.33, 2017). In addition to increasing this expectation, Wisconsin also made it possible for other coursework to qualify for math credits, including career and technical education (CTE) and computer Science courses (High School Graduation Standards, Wis. Stat. §118.33, 2017).

The new opportunities to earn high school math credits through CTE and computer science courses have resulted in little change in Wisconsin. Department of Public Instruction records indicate only limited implementation in the state, and none of the districts in Northwest Wisconsin have created a relevant course (Wisconsin Department of Public Instruction [WDPI], n.d.-f). The objective of this study was to understand what has prevented school districts in

Northwest Wisconsin from offering nontraditional math courses. The researcher made several assumptions before the research was completed. The first was that administrators were simply too busy with all the other tasks in their positions to do more than understand the expectations of the third math credit created under the law. The second was that school district administrators believed that the need or value added through the inclusion of nontraditional math courses is limited. The third explanation considered was that despite significant interest in adding nontraditional math courses, barriers also exist that prevent the implementation. The study sought to answer three research questions:

1. What level of knowledge do the solicited representatives in the school districts have regarding the additional math credit opportunities provided in the 2013 Wisconsin Act 63 legislation?
2. What factors have school administrators considered in determining whether to offer math credit for nontraditional math courses?
3. What are the barriers preventing or delaying implementation of nontraditional math courses?

This chapter discusses how the survey findings addressed the research questions. The conclusions reached and recommendations from the study are also included.

Discussion

The first research question attempted to gain an understanding regarding how familiar administrative professionals in school districts are with the 2013 Wisconsin Act 63 legislation. This legislation added a third credit of math to graduation requirements and included the opportunity for school districts to add nontraditional math courses to their course offerings for math credit (High School Graduation Standards, Wis. Stat. §118.33, 2017). Since

implementation of nontraditional math courses has been limited in Wisconsin and no courses have been implemented in Northwest Wisconsin, understanding what level of knowledge school administrators possessed was important (WDPI, n.d.-f). Seventy-one percent of respondents indicated that they were familiar with the act. Only one individual, who completed the survey, indicated being “Unfamiliar” with the act. Focusing on those individuals who indicated that they were “Not very familiar” or “Unfamiliar”, 60% had been in their current position for less than three years, and the majority of those individuals were with small school districts. The generally high level of understanding of the 2013 Wisconsin Act 63 legislation indicates the presence of other reasons why new courses are not being implemented, and it is not due to the lack of understanding the opportunity.

The second research question attempted to elicit whether administrators had considered offering nontraditional math courses. For administrators in school districts to consider adding nontraditional math courses, a perceived need is required. One method to establish this need would be by recognizing the inadequacy of existing math courses to meet their students’ needs. Based on the results of the survey, 77% of respondents believed that their current math courses were meeting the needs of students even with the addition of a third required math credit. Of those individuals who felt that their school district was not meeting the math needs of their students, one individual (3%) selected “Strongly Agree” that math needs were not being met, while seven individuals (20%) selected “Agree” that needs were not met. Of those who agreed that the math needs of their students were not being met, age was the only distinguishing factor. Three of the individuals were between 40–49 years old, two were between 50–59 years old and one was over the age of 60. The other two individuals did not disclose their ages.

Another method of establishing need is via the demonstration of additional benefits that can be provided through CTE and computer science courses. Numerous studies suggest math benefits can be obtained through CTE course completion, from outperforming other students on math skills tests (Blowe & Price, 2012) to being better prepared for college math if they take CTE dual credit courses (Kim, 2014). These successes may be related to a key benefit of CTE instruction, which is the practical application of concepts mixed with instruction (Pippenger, 2003; Wu & Greenan, 2003). Devlin (2003) stated that the skills of computer programming and mathematics enhance each other as computer programming “is all about constructing, manipulating and reasoning about abstractions” (p. 38). Mathematics instruction provides the same skills (Devlin, 2003).

The factors that school administrators have considered in determining whether to offer math credit for nontraditional math courses, related to the second research question, should have been influenced by the evidence of math benefits through CTE and computer science courses. This led to a survey question that attempted to determine if administrative professionals believed that math knowledge could be enhanced through computer science or CTE coursework. The purpose of the question was not to ask about the adequacy of existing math curriculum, but to attempt to understand if the administrators valued computer science or CTE as nontraditional math courses. Sixty-six percent of respondents indicated that they believed computer science or CTE coursework could improve math knowledge. Therefore, one third of the respondents did not believe that nontraditional math courses would improve students’ math knowledge. Approximately 70% of the curriculum directors and district administrators who responded to the survey believed that giving math credit for computer science and CTE courses would increase students’ math knowledge. Principals were almost evenly split; 44% disagreed and 56% agreed

that these courses would increase math knowledge. School districts where principals are making the curriculum decisions appeared less likely to consider nontraditional math courses. The perception that current math courses are adequate for students' math needs, combined with the nearly even split among principals regarding math benefits, may be material factors in the lack of implementation of nontraditional math courses.

While administrators indicated on the survey a level of familiarity with the 2013 Wisconsin Act 63 legislation and generally indicated that computer science and CTE coursework enhanced students' math knowledge, they have not offered nontraditional math courses. Therefore barriers may exist that are preventing or delaying the implementation of nontraditional math courses. The third research question aimed to identify what barriers have prevented or delayed the implementation of nontraditional math courses. To better understand the barriers to computer science and CTE courses, it was necessary to establish a level of understanding of the challenges districts face when implementing new math courses. The difficulties in creating math courses are likely to be compounded when considering the implementation of non-core courses like computer science or CTE.

The next two survey questions aimed to distinguish if there was interest in creating nontraditional math courses in the areas of computer science or CTE, and if there was interest, what the perceived barriers that prevent implementation might be. When asked about the challenges districts faced when creating new math courses, 25 of the 34 individuals (74%) who answered this survey question selected "Teacher Availability." Respondents who selected the "Other" category and articulated what they perceived as challenges listed the costs of hiring new teachers. Other challenges included "Teacher Training," "Teacher Licensing," and the additional costs associated with a new course. It seems reasonable to speculate that if administrators

considered “Teacher Availability” to be a challenge for a core program such as math, additional challenges would arise when deciding to create elective courses such as computer science and CTE.

The researcher anticipated the possibility of several barriers to creating new computer science or CTE courses. Respondents were asked the questions about barriers unless they stated that they were not considering adding computer science or CTE courses for math graduation credits. Barriers anticipated for the implementation of new computer science courses predominantly related to lack of available qualified teaching candidates (38%) and enrollment that would be too low to justify creating the course (33%). Related to these was the concern that the licenses held by current teachers do not match Wisconsin’s licensing requirements (21%). The barriers anticipated when attempting to create new CTE courses were very similar to those for computer science. Current teacher licensing (32%), lack of available qualified candidates (23%), and enrollment that would be too low to justify creating the course (32%) made up the majority of the barriers. Participants’ responses indicated that important concerns regarding the ability to find qualified teachers (math, computer science, and CTE) and the concerns that enrollments would be low create barriers for implementation of nontraditional math courses. If administrators in high schools are struggling to create new math courses it seems reasonable that even more challenge would be involved in finding teachers in specialty areas such as CTE and computer science. This challenge would be more pronounced in smaller schools where full-time specialty positions are not available due to limited enrollment.

Conclusions

Few school districts in Wisconsin have implemented nontraditional math courses as created through the 2013 Wisconsin Act 63 legislation. No school district in Northwest

Wisconsin has implemented a nontraditional math course. The purpose of this research was to develop a better understanding as to why school districts have not introduced additional courses as allowed under this legislation. Several reasons are possible to explain why implementation has not occurred, and the survey solicited responses from the individuals responsible for curriculum decisions.

The first conclusion reached was that across the school districts surveyed, regardless of the size of the school or the age or experience of the respondent, school district administrators were knowledgeable about the law allowing for nontraditional math credits. This level of familiarity hopefully allows them to make informed decisions related to the introduction of additional courses for math credit such as computer science or CTE courses.

The second conclusion reached was that administrators who completed the survey generally believed that the existing math courses being taught at their schools were sufficient to meet the graduation requirement of three math credits. As a result, they may have perceived no need to consider nontraditional math courses as an option. This does not imply disinterest in tools that would improve students' math knowledge. In general, they agreed that adding computer science or CTE for math credit would increase students' math knowledge. The administrators noted that they perceived adding the nontraditional math courses could help improve their students' math knowledge, implying that another reason for the lack of implementation is likely.

The final conclusion reached was that the barriers for implementing nontraditional math courses seemed to be focused on limited resources at the local level. The survey asked participants questions about their local school district providing the courses. Opportunities may

exist for districts to collaborate to offer nontraditional math courses. That option was not provided as a response choice.

Recommendations from the Research

The results clearly state that school administrators are interested in pursuing the nontraditional math opportunities, at least for a subset of their students. The challenge is in finding properly trained professionals and coordinating a large enough student body to justify implementing the courses. Collaborative efforts to offer nontraditional math courses may provide opportunities for districts to increase course offerings while minimizing additional costs.

Possibilities include:

1. Coordinate the computer science courses at the Cooperative Educational Service Agency (CESA) level. School districts could subscribe to a course taught by an instructor through CESA, and the instructor could offer the course virtually or over the televised education system. The instructor can alternate locations when teaching or hold study sessions on local campuses on a rotating basis. A number of internet based education companies specialize in supporting teachers by providing necessary lessons, grading materials, and structure to support online computer science education. The element these sites are missing is an instructor on site to answer student questions when there are challenges in the programs.
2. Engage vendor support. Wisconsin Department of Public Instruction (WDPI) has created an initiative regarding college and career readiness. To support schools in meeting these goals, WDPI is providing software and tools to schools (WDPI, n.d.-c). A similar approach could be accomplished with respect to computer science. A vendor, supported by WDPI, could be engaged to support Wisconsin students

- learning computer science. WDPI could create additional resources to increase the number of licensed computer science instructors or alternative licensing methods could be employed to make it easier to teach computer science.
3. Partner with technical colleges. To better implement the CTE-based math courses, high school administrators could look to partner with local technical college administrators to increase expertise and offer nontraditional math courses. This is often done with CTE courses and could be extended to math or other courses, as well. Technical colleges offer many courses in the form of dual enrollment, allowing the student to earn both high school and college credit for completing the math course. The technical college system has developed the math courses, and the high school instructors would then implement the college course. While the cost of the instructor and textbooks remains, much of the planning time has been eliminated.

Recommendations for Additional Research

The following are research recommendations based on this study.

1. One third of the respondents to this survey indicated that they do not believe that granting math credit for computer science or CTE courses would improve students' math knowledge. Conducting a study to understand the reasons for these beliefs could be beneficial, as possibly leading to the development of computer science or CTE courses that address the concerns articulated in the results.
2. The survey included only 34 of the 510 school districts in Wisconsin, all in some of the most rural parts of the state. A second study completed in urban school districts in Wisconsin could be accomplished to understand if urban schools are experiencing the same development and implementation challenges as rural schools.

3. Respondents to the survey indicate significant challenges in finding licensed and trained teachers for math, computer science and CTE. Barriers or challenges to obtaining licenses to teach math, computer science or CTE in Wisconsin may be in place. Understanding these barriers could help provide a greater supply of educators.
4. The survey results indicated that older respondents were less likely to believe that existing math courses were meeting the needs of their students. Understanding the differences that led older educators to believe existing math courses have not met the needs of students, while all respondents under the age of 40 believed that current math courses were meeting the needs of their students, could provide opportunities to understand potential generational differences in math expectations.

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Appendix A: Initial Letter

School District Administrator

Dear Administrator:

My name is Steve Adams and I am finishing my master's thesis in Career and Technical Education at UW-Stout by completing a study related to the interest and ability of school districts in Northwestern Wisconsin to teach non-traditional math courses. Non-traditional math courses in Career and Technical Education (CTE) and Computer Science were authorized in the 2013 Wisconsin Act 63 legislation. School districts were provided the opportunity to teach certain computer science courses or CTE courses and issue math credits for the completion of these courses. This is the same legislation that increased the graduation requirements in mathematics from two to three credits starting with the 2017 graduating class.

In the next week I will be sending you a brief survey, via email, asking you questions regarding the 2013 Wisconsin Act 63 legislation and how your district has responded to the additional math course opportunities created in the legislation. The survey should take less than 10 minutes to complete. I am only surveying schools in Northwest Wisconsin and your response is important to me in obtaining usable results from the survey.

If you do not wish to participate, please let me know and I will not send you any further correspondence. If I do not hear from you, I will assume that you are interested in participating.

Attached to this letter is the one page consent to participate in the survey.

Please review the consent form and feel free to contact me at 715-651-8883 or email me at adamss5068@my.uwstout.edu with any questions or concerns.

Thank you in advance for participating in this survey.

Sincerely,

Steven H. Adams

Enclosure: Consent to Participate

Appendix B: Survey Questions

By completing the survey you agree to participate in the project entitled, *Identification of Factors Influencing the Lack of Non-traditional High School Math Courses in Northwest Wisconsin*. A copy of the consent language is included in the introduction to the survey.

Consent to Participate In UW-Stout Approved Research

The purpose of this study is to better understand the factors that are impeding the pursuit of non-traditional high school math credit options that were created through the 2013 Wisconsin Act 63 legislation that increased the graduation requirements from two to three credits of math. The survey is being sent to the key curriculum decision makers in the eight county area comprised of Barron, Bayfield, Burnett, Douglas, Polk, Rusk, Sawyer and Washburn counties. The benefits to be obtained from completing this survey are that better information is available to help school districts understand what challenges are faced regarding the implementation (if desirable) of non-traditional math courses.

The survey should take less than 10 minutes to complete. Your responses will be anonymous. No identifying information will be gathered and your name will not be included on any documents related to this research.

Your participation in this study is entirely voluntary. You may choose not to participate without any adverse consequences to you. You have the right to stop the survey at any time. However, should you choose to participate and later wish to withdraw from the study, there is no way to identify your anonymous document after it has been submitted. If you do not want to participate in this survey, please let me via email and I will not follow up with you again.

This study has been reviewed and approved by The University of Wisconsin-Stout's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by federal law and University policies. If you have questions or concerns regarding this study, please contact the Investigator or Advisor. If you have any questions, concerns, or reports regarding your rights as a research subject, please contact the IRB Administrator.

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By completing the survey you agree to participate in the project entitled, *Identification of Factors Impeding Implementation of Non-traditional Math Courses in Northwest Wisconsin*.

Question 1: How familiar are you with the option created in the 2013 Wisconsin Act 63 legislation that allows school districts to create non-traditional math courses using computer science or Career and Technical Education (CTE) curricula? For the purposes of this survey CTE includes agriculture, business, education and training, health science, information technology, law and public safety, manufacturing and engineering, media and communication, and personal care services career related courses.

- 1) Very Familiar
- 2) Somewhat familiar
- 3) Not very familiar
- 4) Unfamiliar

Question 2: How much do you agree with this statement: Current course offerings do NOT meet the math needs of our school's students given that an additional math credit is now required.

- 1) Strongly Disagree
- 2) Disagree
- 3) Agree
- 4) Strongly Agree

Question 3: How much do you agree with this statement: Granting math credits for computer science or CTE courses would help improve our students' math knowledge.

- 1) Strongly Disagree
- 2) Disagree
- 3) Agree
- 4) Strongly Agree

Question 4: What level of consideration have you given to offering math credit for CTE or computer science courses? (can choose more than one response)

- 1) We have not considered making any changes in courses offered to meet math credits.
- 2) We have considered making changes in courses offered for math credit, but have not moved forward with it.
- 3) We are in the development stages of determining CTE courses to offer as math credit.
- 4) We are in the development stages of determining computer science courses to offer as math credit.

If the answer to question 4 is "1", questions 5 – 8 will not be asked.

Question 5: If you are considering adding computer science courses (or reclassifying current courses) to meet the math credit graduation requirement, what courses are you considering? Please select all that apply.

- A) Computer Programming
- B) Visual Basic (VB) Programming
- C) C++ Programming
- D) Java Programming

- E) Other Computer Language
- F) AP Computer Science A
- G) Other Computer Science: _____
- H) We are not considering adding computer science courses as math graduation credits.

Question 5a will only be asked if the response to Question 5 is not “H”.

Question 5a: What barriers do you anticipate will occur if you attempt to add new computer science courses? Please select all that apply.

- A) Current teacher licenses do not match DPI requirements.
- B) Not enough qualified teaching candidates.
- C) Enrollments would be too low to justify course offerings.
- D) Other costs would be too high (computers, textbooks, materials) to justify offering the course.
- E) Other: _____
- F) We expect the implementations to occur.

Question 6a: If you are considering adding Career and Technical Education courses (or reclassifying current courses) to meet the math credit graduation requirement, what courses are you considering? Please select all that apply.

- A) Accounting
- B) Personal Finance
- C) Other existing course: _____,
- D) We will be creating a new course to meet these needs.
- E) We are not considering adding CTE courses as math graduation credits.

Question 6b will only be asked in the response to Question 6a is not “E”.

Question 6b: What barriers do you anticipate will occur if you attempt to add new CTE courses? Please select all that apply.

- A) Current teacher licenses do not match DPI requirements.
- B) Not enough qualified teaching candidates.
- C) Enrollments would be too low to justify course offerings.
- D) Other costs would be too high (computers, textbooks, materials) to justify offering the course.
- E) Other: _____
- F) We expect the implementations to occur.

The remaining questions will be asked regardless of how the previous questions were asked.

Question 7: What are the challenges in your district for creating new math courses? Please select all that apply.

- 1) Teacher Training
- 2) Teacher Licensing
- 3) Teacher Availability
- 4) Additional costs such as text books and other resources
- 5) Lack of School Board Support
- 6) Other: please specify: _____

7) No challenges exist in our district

Question 8: What is your position in your school district? Select more than one if appropriate.

- A) Curriculum Director
- B) District Administrator
- C) Principal
- D) Superintendent
- E) Other: _____

Question 9: Please list the number of years you have been in your current position:

- A) Three years or less.
- B) More than 3 years, but less than 7 years.
- C) Seven or more years, but less than 10 years.
- D) Ten or more years.

Question 10: What is the average graduating class size for the high school in your district?

- A) Less than 50 students.
- B) 50 – 100 students.
- C) 101 – 150 students.
- D) More than 150 students.

Question 11: What is your gender?

- A) Female
- B) Male
- C) Other: _____
- D) Prefer not to say.

Question 12: What is your age?

- A) Under 30 years old.
- B) 30 – 39 years old.
- C) 40 – 49 years old.
- D) 50 – 59 years old.
- E) 60 years and older.

We thank you for your time spent completing this survey. Your response has been recorded.

Appendix C: Consent to Participate in UW-Stout Approved Research

The purpose of this study is to better understand the factors that are impeding the pursuit of alternative high school math credit options that were created through the 2013 Wisconsin Act 63 legislation that increased the graduation requirements from two to three credits of math. The survey is being sent to the key curriculum decision makers in the eight county area comprised of Barron, Bayfield, Burnett, Douglas, Polk, Rusk, Sawyer and Washburn counties. The benefits to be obtained from completing this survey are that better information is available to help school districts understand what challenges are faced regarding the implementation (if desirable) of non-traditional math courses.

The survey should take less than 10 minutes to complete. Your responses will be anonymous. No identifying information will be gathered and your name will not be included on any documents related to this research.

Your participation in this study is entirely voluntary. You may choose not to participate without any adverse consequences to you. You have the right to stop the survey at any time. However, should you choose to participate and later wish to withdraw from the study, there is no way to identify your anonymous document after it has been submitted. If you do not want to participate in this survey, please let me via email and I will not follow up with you again.

This study has been reviewed and approved by The University of Wisconsin-Stout's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by federal law and University policies. If you have questions or concerns regarding this study, please contact the Investigator or Advisor. If you have any questions, concerns, or reports regarding your rights as a research subject, please contact the IRB Administrator.

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By completing the survey you agree to participate in the project entitled, *Identification of Factors Impeding Implementation of Non-traditional Math Courses in Northwest Wisconsin.*

Appendix D: Initial Email Language

Greetings,

Several days ago you should have received a letter from me regarding the research I am conducting to complete my master's thesis through UW Stout. The letter explained that I am conducting research to better understand the factors that are impeding the pursuit of alternative high school math credit options that were created through the 2013 Wisconsin Act 63 legislation that increased the graduation requirements from two to three credits of math. The link to a brief survey is included below. Your participation in this survey will provide useful information about your school district's response to this legislation.

The link to the survey is here: <survey link>

If you have any questions, or do not wish to participate in this research, please let me know. I can be reached at 715-651-8883 or adamss5068@my.uwstout.edu.

Thank you in advance for completing this survey.

Steven H. Adams
Graduate Student
UW Stout Career and Technical Education

Appendix E: First Reminder Email Language

Greetings,

Approximately one week ago you should have received an email inviting you to participate in a survey for the research that I am completing for my master's thesis through UW Stout. If you have already completed the survey, thank you and you may delete this email.

If you have not had the time to complete the survey a link to the survey is included below. Your input is important to me and I truly appreciate the time you spend helping me complete my research. The purpose of this research to better understand the factors that are impeding implementation of the non-traditional high school math credit options that were created through the 2013 Wisconsin Act 63 legislation that increased the graduation requirements from two to three credits of math.

The link to the survey is here: <survey link>

If you have any questions, or do not wish to participate in this research, please let me know. I can be reached at 715-651-8883 or adamss5068@my.uwstout.edu.

Thank you in advance for completing this survey.

Steven H. Adams
Graduate Student
UW Stout Career and Technical Education

Appendix F: Second and Final Reminder Email Language

Greetings,

Approximately one week ago, you should have received a reminder email inviting you to participate in a survey for the research that I am completing for my master's thesis through UW Stout. If you have already completed the survey, thank you and you may delete this email.

If you have not had the time to complete the survey, this is the last request that I will be making. Your input is important to me and I truly appreciate the time you spend helping me complete my research. The purpose of this research is to better understand the factors that are impeding the implementation of non-traditional high school math credit options that were created through the 2013 Wisconsin Act 63 legislation that increased the graduation requirements from two to three credits of math.

The link to the survey is here: <survey link>

If you have any questions, or do not wish to participate in this research, please let me know. I can be reached at 715-651-8883 or adamss5068@my.uwstout.edu.

Thank you in advance for completing this survey.

Steven H. Adams
Graduate Student
UW Stout Career and Technical Education