Differentiated Instruction in Secondary Mathematics

By:

Rachel Amadio

A Thesis Submitted to the Graduate Faculty

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science in Education

University of Wisconsin – Superior

August 2014

Differentiated Instruction in Secondary Mathematics

By:

Rachel Amadio

August 13, 2014

A Thesis Submitted to the
Graduate Faculty in Partial Fulfillment
of
the Requirements for the Degree of
MASTERS OF SCIENCE IN EDUCATION

Suzanne C Griffith

Dr. Suzanne C. Griffith, Advisor, Professor of Educational Psychology

and Chair, Educational Leadership

APPROVED: Elizabeth Twining Blue

Elizabeth Twining Blue, M.S.W., Dean of Graduate Studies

Abstract

Response to Intervention (RtI) is a framework used to increase student performance by continuously monitoring student progress and then differentiating instruction to meet students' needs (Minnesota Department of Education, 2013b). The Minnesota Department of Education recommends that schools implement RtI as one method to improve student academic success. While differentiated instruction is endorsed by the Minnesota Department of Education, it is unknown how effective differentiated instruction is in secondary mathematics as perceived by teachers at the secondary level in a metropolitan school district in Minnesota. This study examined teachers' perceptions about the effectiveness or lack of effectiveness of differentiated instruction in secondary mathematics in a metropolitan school district in Minnesota. This study used a survey and teacher interviews to build understanding of teachers' perceptions. The researcher concluded, based on the results, that secondary mathematics teachers in the metropolitan school district in Minnesota would benefit from more time, more concise curriculum, and more professional development to effectively implement differentiated instruction in secondary mathematics.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1. INTRODUCTION

Differentiated instruction has been studied extensively in many areas such as reading, English language learners, and special education in elementary levels. Studies about differentiated instruction in mathematics are very few. Most of the studies that do exist about differentiated instruction in mathematics examine classrooms in elementary schools. Studies are needed to examine teacher perceptions about the effectiveness or lack of effectiveness of differentiated instruction at the secondary level.

Statement of the Problem

While differentiated instruction is endorsed by the Minnesota Department of Education (2013b), it is unknown how effective differentiated instruction is in secondary mathematics as perceived by teachers at the secondary level in a metropolitan school district in Minnesota. This district is (for this study) referred to as BEST. Therefore, this study proposes to discover the effectiveness or lack of effectiveness of differentiated instruction at the secondary level in mathematics as perceived by teachers in the BEST school district in Minnesota.

Purpose of the Study

The purpose of this study is to examine teacher's perceptions about the effectiveness or lack of effectiveness of differentiated instruction in mathematics at the secondary level in the BEST school district in Minnesota. The Minnesota Department of Education recommends that schools implement Response to Intervention (RtI) as one method to improve student academic success (Minnesota Department of Education, 2013b). RtI is a framework used to increase student performance by continuously

monitoring student progress and then differentiating instruction to meet students' needs (Minnesota Department of Education, 2013b). Students are diverse in their interests, strengths, and weaknesses. Additionally, how a student learns best varies from student to student. Differentiated instruction is student-centered and used to reach and engage students, based on their diverse interests, strengths, and weaknesses, and how they learn best (Tomlinson, 2001). This study examines teacher's perceptions of the effectiveness or lack of effectiveness of differentiated instruction at the secondary level in mathematics in the BEST school district in Minnesota.

Research Questions

This study asks two questions. How do secondary mathematics teachers in the BEST perceive differentiated instruction in the classroom? To what extent do teachers in the BEST school district in Minnesota perceive differentiated instruction at the secondary level in mathematics to be effective?

Nature of the Study

This research study used a mixed methods approach to build understanding about teacher's perceptions of the effectiveness or lack of effectiveness of differentiated instruction. The researcher used surveys and interviews as the primary tools for collecting data. A survey is used to record people's opinions or attitudes, such as teacher's perceptions about the effectiveness or lack of effectiveness about differentiated instruction in secondary mathematics (Leedy & Ormrod, 2013). The survey consisted of questions with a rating scale answer. This allowed the researcher to collect data about how often secondary mathematics teachers are using differentiated instruction, as well as how effective or ineffective they believe it is. The qualitative method will be

phenomenological study. A phenomenological study is used to interview participants who have direct experience with what is being studied (Leedy & Ormrod). Participants will have the option of being interviewed by the researcher. The interview was used to help the researcher gain a better understanding of participant's perceptions about the effectiveness or lack of effectiveness of differentiated instruction in secondary mathematics.

Significance of the Study

This study is significant in two ways. First, educational intervention for improving student learning is a federal government funded program. By supplying these funds to schools across the nation, the government is supporting intervention in the classroom. Differentiated instruction is one intervention that the Minnesota Department of Education supports (Minnesota Department of Education, 2013b). Second, secondary level classrooms are different than elementary level classrooms, which have already been studied. Students at the secondary level are more mature, more aware of their learning, and are learning more abstract concepts. This means that differentiated instruction looks different at the secondary level. Students are better able to teach and learn from each other. For example, a teacher at the secondary level can have a jigsaw activity where students learn different concepts and then teach each other the concepts. Students at the secondary level are capable of teaching each other and also being in charge of their learning. Secondary students can be given an open-ended problem to solve using available resources and working together.

This study will add to existing research of differentiated instruction, which until now has focused on the elementary level. Instead, it will move the field forward by

investigating the effectiveness or lack of effectiveness of differentiated instruction at the secondary level in mathematics as perceived by the secondary mathematics teachers in the BEST school district in Minnesota.

Definition of Terms

Unless otherwise noted, all definitions come from Tomlinson (2001)

Content: The terms content and learning target are used interchangeably in this study. They both refer to what is being learned by students.

Process: Process refers to how students make sense of ideas and information.

Product: Product refers to how students demonstrate what they have learned.

Environment: Environment refers to which situation learning is taking place such as independently, in small groups, or in whole-class.

Readiness: Readiness is how closely a task matches a student's skills and understanding of a topic.

Differentiated Instruction: The terms differentiated instruction and differentiation are used interchangeably in this study. Differentiation recognizes that different learners have different needs, so teachers tailor their instruction to provide a variety of ways for students to understand the content and express learning. It is proactively planned, so that each lesson will have an appropriate fit for many learners. Instruction can be differentiated by content, process, product, and/or environment.

Direct Instruction: A unitary approach to teaching in which all students experience the same content and all complete the same processing activity.

Learning profiles: Learning profile refers to way in which a student learns best. Factors include: learning style, gender, culture, and intelligence preference.

Learning style: Environmental or personal factors that affect how students learn best, such as moving around or sitting still.

Measures of Academic Progress (MAP): A computerized adaptive assessment that measures growth of students from fall to spring of a school year. It changes questions given to students based on whether the student answers the question correctly or incorrectly. Provides a detailed breakdown by topic of student understand for each student. (Northwest Evaluation Association, 2013)

Response to Intervention (RtI): A framework designed to improve the academic achievement of students. Students are assessed and then instruction is modified and differentiated to meet the needs of students. Interventions are also implemented to help improve students' academic success. (Minnesota Department of Education, 2013b).

Secondary education: For the purpose of this study, secondary education refers to the education of students in grades 7-12.

Student or learner: The terms students or learners are used interchangeably throughout this study. These terms are used to describe any child in an educational program.

Assumptions, Limitations, and Delimitations

This study was based on the three assumptions. First, this study assumed that all participants answered questions to the best of their knowledge. Second, it assumed that all participants would answer all questions honestly. Finally, it assumed that the teachers participating have experience with differentiated instruction at the secondary level in mathematics.

This study has its limitations. The number of teachers who completed the questionnaire and agreed to participate in this study limits the generalizability of the study. The study focused on only one district and one field of study and may not be similar to findings in other districts and other fields. This study was also limited by the level of detail provided by the participants in their responses to the questions posed by the researcher. Finally, the number of participants who volunteered to be interviewed limits this study.

There are specific delimitations to this proposed study. The primary delimitation is that this study was focused on differentiated instruction of secondary mathematics and does not examine any other intervention. Additionally, this study only examined differentiation through the perspective of secondary mathematics teachers in the BEST school district in Minnesota and does not look at whether there is a difference in student learning based on teacher utilization or not. It purposefully excluded other subjects and other ages, as well as the perspectives of students, administrators, and parents/guardians of students.

Summary of Study

This study examined the effectiveness or lack of effectiveness, according to teacher perspectives, of differentiated instruction in secondary mathematics in the BEST school district in Minnesota. While differentiated instruction has been studied, studies on differentiation at the secondary mathematics level are scarce. Additionally, differentiation has not been studied in the BEST school district in Minnesota. The literature reviewed here suggests that differentiated instruction is effective but had not been studied before in the manner proposed.

CHAPTER 2. REVIEW OF RELATED LITERATURE

The Minnesota Department of Education has implemented Response to Intervention (RtI) as one method to promote student academic success (Minnesota Department of Education, 2013b). RtI is a framework used to improve student performance by constantly monitoring student progress and then modifying and differentiating instruction to meet a student's needs (Minnesota Department of Education, 2013b). Students are diverse in their interests, strengths, and weaknesses, as well as how they learn best. Differentiated instruction is student-centered and used to reach and engage students, based on their diverse interests, strengths, weaknesses, and how they learn best (Tomlinson, 2001). This review examines education literature and studies about differentiated instruction: what it is, how it is used in classrooms, with a specific focus on mathematics classroom, and how effective differentiated instruction is, according to test scores and teacher perceptions.

This review is divided into three sections. The first section defines differentiated instruction and why it is implemented in schools. It includes several definitions, examples, and variations of differentiated instruction. The second section discusses what differentiated instruction looks like in a classroom. It reviews examples from studies about differentiated instruction to give a clearer picture of a classroom in which the teacher is using differentiated instruction. It examines differentiation in any classroom and then specifically reviews differentiation in a mathematics classroom. The third section draws from studies that examine the teacher's perspectives on the effectiveness, or lack of effectiveness, of differentiated instruction in the classroom. Teachers use both

qualitative and quantitative measurements as evidence for their views on the effectiveness, or lack of effectiveness, of differentiated instruction. The studies reviewed also examine the factors to consider when implementing differentiated instruction and its effectiveness, according to teachers and researchers.

Differentiated Instruction

This section defines what differentiation is and why it is relevant to the classroom. Differentiation is a proactive teaching strategy (Tomlinson, 2001). It is one method that is designed to enable teachers to reach and engage all students in their classroom. According to the Tomlinson, students are more motivated to learn when they feel a connection to what is being taught and when they believe they can be successful. When students are motivated, more learning occurs and therefore students become more successful. Additionally, there exists a reason to learn what is being taught as well as an appropriate way to learn what is being taught. As Vygotsky discovered (Chamberlin & Powers, 2010) there is a zone in which students can be challenged and therefore learn and grow. However, if the tasks are too easy, then students are bored. On the other end, if tasks are too difficult, then students become frustrated. Scigliano and Hipsky (2010) argue that with differentiated instruction, ideally, each student is given the appropriate level of challenge based on his or her current understanding of the concept. Furthermore, differentiated instruction allows students multiple options for learning and understanding information, an asset Pham (2012) discussed. One student might learn visually whereas another student learns by manipulatives. Because students have a variety of methods to grasp a concept, they are more likely to achieve a higher level of understanding. Differentiated instruction is an example of teaching in which the teacher identifies

student's needs and then designs his or her instruction to ensure students maximize their academic achievement (Pham). Some students might need remediation before they are ready for the learning target, whereas other students do not. In a differentiated lesson, the teacher provides remediation for the students who need it.

Differentiated instruction helps to address the needs of the changing population being educated in the United States. According to Minnesota 2010 census, the African American population has increased by 59.8%, the Asian population has increased by 50.9%, and people identifying with two or more races has increased by 51.2% over the past ten years (Minnesota Department of Administration, 2010). The U.S. Census Bureau Projections predict that the Hispanic and Asian populations will double within our lifetime and minority populations are expected to reach 57% by 2060 (United States Census Bureau, 2012). During the 2011-2012 school year, Minnesota had a student population in which 15.2% are receiving services for special education, 7.3% are English Language Learners, and 37.9% are eligible for free and reduced lunch (Minnesota Department of Education, 2013a). Ten years prior during the 2001-2002 school year in Minnesota, 12% of students received special education services, 5.8% students were English Language Learners, and 26.7% were eligible for free and reduced lunch (Minnesota Legislative Reference Library, 2001). In summary, over the course of ten years, students receiving special education services increased by 3.2%, students who are English Language Learners increased by 1.5%, and students who are eligible for free and reduced lunch increased by 11.2%. As evidenced by the statistics, the population of students being educated in Minnesota, as well as the general population of the United States, has been changing and will continue to become more diverse. The growing

diversity of students means that teachers need to consider changes to their instruction to meet the needs of students and improve student success and academic achievement. Differentiated instruction is a strategy to meet the needs of a constantly changing student population according to the Minnesota Department of Education (2013b). This strategy is expected to increase student achievement and academic success but there is little supportive research at the secondary level. As it is a new program, it is unknown how effective it is in the BEST school district in Minnesota.

Differentiation also provides students multiple options for learning content and demonstrating their knowledge. It is student driven, so content being taught is made relevant to all students, according to Tomlinson (2001). Each student should have a personal connection to the content in order to engage with the learning and to remember it for the future. Little, Hauser, and Corbishley (2009) defined differentiated instruction as varied instruction that appeals to students' interests, responds to their personal learning styles, and appropriately challenges the students based on what they know and understand.

Differentiated Instruction in a Classroom

According to Tomlinson (2001), every student has different ways of learning and different background knowledge. A teacher who differentiates his or her instruction recognizes this and uses a variety of strategies to reach and engage all learners. Differentiated instruction takes a variety of forms in the classroom. Tomlinson also noted instruction can be differentiated according to what is learned (content), how it is learned (process), how learning is demonstrated (product), or what environment it is learned in.

One differentiation strategy is varying content. Using different levels of difficulty for the same activity is one example of differentiating content (Christenson, 2012). For example, if the learning goal is to predict events in a story, then each student is reading a book that matched their current reading level. Students may be reading different stories, but they all learn how to predict events in a story based on the book they are reading at their appropriate level. Mathematics can have activities or worksheets with varying degrees of difficulty, so that all students can be challenged at an appropriate level. For example, when practicing adding numbers, one practice worksheet can be positive and negative integers, another set can have decimal numbers included, and a third set can also include fractions.

Open-ended tasks, as described by Kobelin (2009), are one method of differentiating process. Kobelin wrote, "Open-ended tasks are those that have no single answer and/or no single method to determine an answer" (p. 13). This allows students to use approaches that make sense to them, while still challenging all students to answer the question. Additionally, students can see a variety of answers and/or methods from their peers and use other methods when appropriate. It is assumed that students will remember more efficient methods their peers used and use those methods in the future.

Scaffolding is another way of differentiating instruction based on process (Scigliano & Hipsky, 2010). When a teacher scaffolds an activity, it means that he or she designs it with multiple entry points for students. This ensures that all students can access the lesson so that they may learn the desired content for the lesson. Students can be paired to help scaffold a task, the teacher can model the correct process, or challenging tasks can be split into smaller tasks.

Portfolios are an example of differentiated product (Tomlinson, 2001). Portfolios can contain successful completion of each learning target or more in-depth studies about the applications of content in the real world. Students can demonstrate their knowledge and academic achievement through the portfolio.

Gordon (2013) discussed multiple-centres is another option for differentiated instruction in the mathematics classroom. It raises a problem that students and teachers work together to make sense of that problem. The example used in the study done by Gordon has students looking at parabolic equations. The students studied water fountains to calculate the horizontal distance the water traveled as well as the height of the water fountain. Next students and teachers establish new problems that are extensions of the initial problem. Gordon argued that this provides students opportunities to look at aspects that are interesting to them or to a group of students. It also places the learning in the hands of the student. They must figure out how to solve the initial problem and the extension problems; the teacher is merely a resource. From here, students were able to differentiate the content by choosing a variety of options for further exploration. A few options for further study, noted by Gordon, were drawing and creating their own fountain, studying the history of fountains, or exploring the flow rate of the water. The multiple-centres approach argues that students have the most academic achievement in mathematics when students are problem solving and exploring with minimal teacher guidance.

Small grouping of students is a strategy in which the environment is differentiated (Ensign, 2012). In order to be most effective, these groupings must be constantly changing based on student understanding. One teacher described by Tomlinson (2001)

uses groups of five or six for a Civil War project in which students investigate a topic. The teacher must continually assess student knowledge in order to make the most effective groups. Tomlinson writes that grouping size is also flexible, as some students work best in pairs and other students learn best in groups of three or more. The study done by Ensign reports that one teacher has trays that contain math activities. Students are allowed to work on the math trays with a partner or individually.

Allowing students to choose their environment is another way to differentiate instruction. Kobelin (2009) discusses how she taught a mini-lesson to the entire group and then allowed students to stay, meaning they wanted more practice with the teacher in a small group, or go, meaning that they felt ready to practice independently. Once all students felt comfortable working independently, then the teacher could give advanced students more challenging work. According to Kobelin, this guarantees that students are mastering the learning target and being appropriately challenged. Additionally, because students are appropriately challenged based on their mastery of the learning target, students are able to reach their highest potential and maximize their academic achievement.

Furthermore, within each differentiation of content, process, product, and environment, classroom instruction can also be differentiated by student's readiness, interests, or learning profiles (Chamberlin & Powers, 2010; Patterson, Connolly, & Ritter, 2009). Differentiation focuses on the student's strengths and interests, and uses that knowledge to teach and engage the student (Tomlinson, 2001). By differentiating instruction, teachers expect to increase student understanding and academic achievement.

Ensign (2012) discusses how one teacher grouped students into three ability groups: readiness, at level, and enrichment. This teacher met with students in the readiness level, while the other students worked in pairs with one student from each of the at level and enrichment groups. Then the teacher would switch groups, so that she met with all students.

Differentiated instruction enables teachers to present curriculum in new ways based on students' personal interests (Chamberlin & Powers, 2010). In their 2010 study, Chamberlin and Powers grouped students by similar personal interests and then instructed them to write a word problem using their similar interest as the context for the story problem. When working on a unit about colonial life, students could dress in costumes, learn a dance from the time period, or cook a dish that was popular (Scigliano & Hipsky, 2010). These students were building a personal connection to content by using it within the context of their interests.

Learning profiles are another way to differentiate instruction. According to Tomlinson (2001), students learning profile is made up of four categories: learning style, intelligence preference, gender, and culture. Learning style refers to the environment in which a student learns best (Tomlinson, 2001). For example, some students prefer to move around when working, while other students like to sit down. Intelligence preference refers to Gardner's theory of multiple intelligences (as cited in Tomlinson, 2001). Students can be strong musically, logical reasoning, or verbally, to name three of the eight possible intelligences. A learning contract is one example of differentiating according to types of intelligence (Scigliano & Hipsky, 2010). A learning contract offers multiple options for assessment based on learning targets. For example, a student who is

strong verbally could write a poem about a main character in the story, while a student who is visually intelligent could create a diorama about a scene in the story. Gender can also play a role in how one learns. For example, more males than females may prefer competitive learning (Tomlinson). Finally, culture can influence how we learn. For example, culture can shape whether a student is more likely to create or conform. Tomlinson does write that it is important to keep in mind the great variance in gender and culture.

Teacher Perceptions of Differentiated Instruction

According to the literature reviewed, teacher perceptions of differentiated instruction are mostly positive although the reasoning varies. Some teachers notice quantitative evidence, such as improved grades or test scores. Other teachers notice qualitative evidence, such as student engagement or attitudes toward mathematics.

One perception that teachers noticed in several studies was significant improvements in grades and testing. In a study conducted by Patterson et al., (2009) researchers who studied the effects of differentiated instruction noticed that one student went from failing to earning B's and C's in mathematics. Beecher and Sweeny (2008) noticed several improvements made by students on standardized tests during their research. On one state assessment, this particular school studied by Beecher and Sweeny started with a 30% gap in achievement between students with free or reduced lunch and their non-free or reduced lunch peers. After differentiated instruction was implemented, the achievement gap narrowed to 10%. Furthermore, on this same state assessment, Beecher and Sweeny reported all ethnic groups improved their test scores, with Asian students making a 60% gain.

In another classroom studied by Patterson et al. (2009), 67% of students who had differentiated instruction in mathematics improved on the Measures of Academic Progress (MAP) from winter to spring (2009). When differentiated instruction was implemented in the classroom, one study done by Ernest, Thompson, Heckaman, Hull, & Yates (2011) observed that students improved by 30% from pretest to posttest scores. This study indicated that differentiated instruction greatly improved student understanding.

Within the multiple-centres approach discussed by Gordon (2013), there are many academic benefits. The author explained that each student is able to explore what he or she is interested in and then deepen his or her understanding, as well as the understanding of others, during the presentation to the class. Additionally, the open-ended problem promotes critical thinking and problem solving skills, since students must figure out the solution to the problem largely on their own. It also increased the students' ability to work together and independently to solve the problems presented to them. Students in Gordon's study also used mathematical habits of mind such as reasoning, logic, and problem solving, because they are not given formulas or example problems to use.

Phelps (2012) discovered that differentiated instruction helps students construct meaning. Phelps wrote that students developed their own understanding of the content instead of just memorizing a rule. In that study, students used differentiated problem sets to develop understanding on how to add and subtract fractions with unlike denominators. When the teacher came back to the topic later on in the year, students did not need remediation, as done in previous years, because their own understanding was deep enough that the students remembered the concept according to Phelps. Therefore, the

study conducted by Phelps may indicate that because of differentiated instruction, students' understanding of adding and subtracting fractions with unlike denominators was deeper than with the traditional teaching the teacher used in years past.

These studies seem to suggest that with differentiated instruction, every student is challenged at his or her own level. This would allow students to achieve their highest potential within their zone of proximal development and therefore increase their understanding and knowledge to the fullest extent possible. Students are then expected to maximize their academic growth and potential.

In the literature, teachers have also noticed an improvement in student's attitude towards mathematics when differentiated instruction is used (Chamberlin & Powers, 2010; Patterson, et al. 2009). One student in the study by Patterson et al. (2009) was described as starting with low skills, a negative attitude, and crying daily at school. After beginning differentiated instruction, this student started volunteering, participating, socializing, and was excited about school. This student demonstrated improved academic success potentially due to differentiated instruction. The results of this teacher using differentiated instruction also are reported as having a positive impact on the rest of the class. After a year in a classroom that started with traditional instruction and changed to differentiated instruction in mathematics, the authors report that responses to a survey given to students by the teacher were as follows:

> Eighty-seven of the students said they preferred the current class structure when compared to how things had been done at the beginning of the year. Furthermore, 87% also reported they felt they were learning more, 87% felt more confident to

> speak up in class, 95% felt more comfortable in class, and 92% felt they received more individualized attention. (Patterson et al., 2009, p. 51)

These students had very positive views on the changes to instruction. While students had positive perspective, the study is unclear about the academic achievement made by students during the course of the school year.

The benefits of using differentiated instruction extend beyond the classroom. Beecher and Sweeny (2008) noticed that students became interested in afterschool classes. The school studied by Beecher and Sweeny had, on average, 200 students participating in afterschool classes. The authors propose that students wanted to spend extra time studying and learning because they felt it was valuable and related to their lives, which increased their academic achievement.

In one study conducted by Ernest et al, (2011), participants varied across all four of Tomlinson's (2001) domains: content, product, process, and environment. Over the course of five weeks, these participants gave pre-tests, implemented differentiated instruction, and then gave post-tests. For example, the study reported that if using 60% as a cutoff for passing, only eight teachers of the thirty-five participants had average student pre-test scores of passing. However, on the post-test, thirty-four of the thirty-five had average scores of passing. This led teachers to report that they perceived students had learned more than in years past.

Teachers also have negative perceptions about differentiated instruction. Kobelin (2009) reports that teachers felt overwhelmed by the amount of curriculum they were required to teach, without even considering further differentiating instruction. As stated by Scigliano and Hipsky (2010), "it… can be daunting to differentiate instruction" (p.

83). Gordon (2013) acknowledged that with the multiple-centres approach, it does take quite a bit of effort to create a problem that is workable for all students. Patterson et al. (2009) noted that teachers must take time, or have time set aside for them, to create the problems for multiple-centres or to differentiate instruction in general. Teachers must also spend time figuring out grouping. Further, Chamberlin and Powers (2010) found student understanding must be constantly monitored, so that instruction can be adjusted to fit their needs. This often means that teachers must be constantly grouping students and then re-grouping them, as their understanding grows and changes. Teachers must have the time to make productive groups, as well as time to re-group students as needed, in order for grouping to an effective way to build student understanding.

Additionally, studies suggest that differentiated instruction requires student take responsibility. While the teacher is working with a group of students, the other students are working independently, with a partner, or with a small group (Christenson, 2012; Ensign, 2012). These researchers point out that students are expected to work without a teacher directly telling them what to do. If students are off-task, then their learning drastically decreases and differentiated instruction is not effective. Kobelin (2009) found that teachers worry about how to keep all the students busy. If the teacher is working with one group, then he or she cannot help other students without interrupting the group that is working with the teacher. When students are not getting the extra help they need, the students can become disruptive (Kobelin). This makes all the more important that students be given tasks or activities which they can complete independently while the teacher works with a group of students.

Finally, another factor to consider is time and resources. Beecher and Sweeny (2008) spent eight years working with an elementary school on differentiated instruction. This would seem to indict that the school district and/or school must make differentiated instruction a priority and set aside the time and resources to effectively implement it. What these various studies underscore is that differentiated instruction must be done in such a way that teachers do not feel overwhelmed by effort and lack of time.

Conclusion

In summary, the literature reviewed here noticed significant improvements in academic achievement of students when differentiated instruction was implemented. While differentiation requires increased time to prepare lessons, increased student responsibility, and more district resources, the literature argued that academic improvements made by students can outweigh the drawbacks. Teachers can differentiation instruction by varying what is learned, how it is learned, or how the learning is demonstrated, as well as by readiness, interests, and/or learning profile. The literature appears to argue that when instruction is differentiated, teachers report that students were more engaged and performed better in the classroom and on standardized tests. While this literature also found areas of concern it also argued that with careful planning by districts and with sufficient time for support and training this approach could be beneficial.

CHAPTER 3. METHODOLOGY

The Minnesota Department of Education recommends that schools implement Response to Intervention, a framework used to increase student performance by continuously monitoring student progress and then differentiating instruction to meet students' needs (Minnesota Department of Education, 2013b). Students are diverse in their interests, strengths, and weaknesses, as well as how they learn best. Differentiated instruction is described as student-centered and can be used to reach and engage students, based on their diverse interests, strengths, weaknesses, and how they learn best (Tomlinson, 2001). Differentiated instruction is endorsed by the Minnesota Department of Education as one method to improve student's academic success (Minnesota Department of Education, 2013b).

Many studies have been done on differentiated instruction in areas including special education classrooms, English language learners in the general elementary education classrooms, and reading for all learners in the elementary education classrooms. However, differentiated instruction in the secondary mathematics classroom has been studied very little. Additionally, the few studies on differentiated instruction in the mathematics are in elementary classrooms. Since the expectation is that this approach will be utilized with secondary students, this thesis argues that studies need to be done on differentiated instruction in the secondary mathematics classrooms. This study examined secondary mathematics teachers' perceptions about the effectiveness or lack of effectiveness of differentiated instruction in mathematics at the secondary level in the BEST school district in Minnesota.

Design

This study utilized a mixed methods approach. It is part descriptive quantitative research and part qualitative research. A survey was conducted for the descriptive quantitative data and was used to record people's opinions or attitudes, such as teacher's perceptions about the effectiveness or lack of effectiveness about differentiated instruction in secondary mathematics (Leedy & Ormrod, 2013). The qualitative method consisted of teacher interviews. The researcher interviewed participants who have experience with differentiated instruction in secondary mathematics. These two approaches allowed the researcher to study teachers' opinions and perceptions, both quantitatively and qualitatively, about the effectiveness or lack of effectiveness of differentiated instruction in mathematics at the secondary level in the BEST school district in Minnesota.

Participants

Participants in this study consisted of secondary mathematics teachers in the BEST school district in Minnesota. There were a total of thirty-five secondary mathematics teachers in the BEST school district in Minnesota. All teachers had, at minimum, completed a degree in education, with an emphasis in mathematics, and had a current Minnesota teaching license.

Instrumentation

This study used two instruments to conduct research. Before beginning, participants consented to their participation (Appendix A). After they consented, participants answered questions in a survey (Appendix B). The participants used a rating scale to report their opinions on the effectiveness or lack of effectiveness of differentiated instruction in mathematics based on varying qualities such as student participation,

learning desired outcome, or student engagement of activity. Participants also had the option of participating in an interview with the researcher. If participants choose to be interviewed, then the researcher interviewed willing participants at a later date (Appendix C).

Procedure

The researcher first submitted the proposal to the Institutional Review Board for approval (Appendix D). Second, the researcher submitted the study to the BEST school district for approval. The researcher e-mailed all potential participants the link to the survey with the consent form. Participants had the option to consent and complete the survey. Afterwards, participants were e-mailed the option to continue their participation by volunteering to be interviewed by the researcher. The researcher then interviewed the participants who volunteered. The interview consisted of open-ended questions. These questions were meant to allow participants to elaborate in more detail on their perception of the effectiveness or lack of effectiveness of differentiated instruction. Participants also discussed the positives and negatives of differentiated instruction, which gave the researcher more insight into teacher's perceptions surrounding differentiated instruction.

Analysis

Responses to these two instruments were analyzed separately. The survey was analyzed to assess the percentage of teachers with specific opinions, from strongly disagree to strong agree, about the effectiveness or lack of effectiveness of differentiated instruction in the mathematics classroom. Based on the array of responses, it was possible to regroup into one of three groups: Agree; Neutral; Disagree and assign percentages to each group. For example, sixty-percent of teachers surveyed found the differentiated

instruction strongly increased student engagement in the secondary mathematics classroom in BEST school district in Minnesota. These percentages were used to discuss the perceived effectiveness or lack of effectiveness of differentiated instruction in secondary mathematics as perceived by secondary mathematics teachers in the BEST school district in Minnesota. The interview was used to investigate how teachers developed their conclusions about the effectiveness or lack of effectiveness of differentiated instruction in the mathematics classroom. These responses were also categorized and percentages given on how many fell into a category. Qualitatively the responses allowed for a better appreciation of the complexity of differentiated instruction and the participants' perceptions. For example, a teacher noticed that all students were participating in the differentiated activity and therefore believed that differentiated instruction was very effective in the secondary mathematics classroom in BEST school district in Minnesota. The findings are used by the researcher to draw inferences about the effectiveness or lack of effectiveness of differentiated instruction in secondary mathematics as presently perceived by secondary mathematics teachers in the BEST school district who took part in the survey.

CHAPTER 4. RESULTS

This study proposes to gain better understanding about the perceived effectiveness or lack of effectiveness of differentiated instruction at the secondary level in mathematics as perceived by teachers in the BEST school district in Minnesota. While differentiated instruction is endorsed by the Minnesota Department of Education, it is unknown how effective differentiated instruction is in secondary mathematics as perceived by teachers at the secondary level in a metropolitan school district, referred to as BEST, in Minnesota. This research study used a mixed methods approach to build understanding about teacher's perceptions of the effectiveness or lack of effectiveness of differentiated instruction. The researcher used surveys and interviews as the primary tools for collecting data.

This chapter presents the data gathered by survey on the effectiveness or lack of effectiveness of differentiated instruction in secondary mathematics as perceived by secondary mathematics teachers in the BEST school district in Minnesota. The data was collected through a survey and an interview.

Survey Results

The results of the survey are presented first. The survey was designed for this study and looked at teachers' perceptions about the effectiveness or lack of effectiveness of differentiated instruction in secondary mathematics. (See Appendix B) Before sending it out, permission to carry out the study was gained from the BEST school district and the Institutional Review Board at the University of Wisconsin Superior. (See Appendix D) The link to the survey was e-mailed out to all secondary mathematics teachers in the BEST school district in Minnesota. The survey had the consent form at the beginning

(See Appendix A) and then the survey questions following. When answering, participants were not required to provide any identifying information. Of the 35 potential participants for the survey, 26 responded, which equates to 74% response rate. Table 1 represents how often participants use differentiated instruction in their classroom, which gave the researcher an understanding of how valid the participants responses would be and what participants based their responses on.

Table 1

Frequency of Differentiated Instruction

Frequency of Differentiated Instruction	Number of Responses
0-2 times per month	11
3-5 times per month	14
0-2 times per semester	0
3-5 times per semester	0
0-2 times per year	0
Other	1

The other response filled in the blank that they use differentiated instruction 1-2 times per week.

Table 2 represents how the range of the participants' agreement with the statements on the left. They rated their belief on a scale of 1-5, with 1 being strongly disagree, 2 being disagree, 3 being neutral, 4 being agree, and 5 being strongly agree. The number of each response is recorded in the boxes below the scale. A total of 26 secondary mathematics teachers participated in the survey, out of the 35 total secondary mathematics teachers in the BEST school district in Minnesota.

Table 2

Survey Responses

	strongly disagree	disagree	neutral	agree	strongly agree
	1	2	3	4	5
1) I believe differentiated instruction engages students in their learning.	0	2	6	14	4
2) I believe students learn more with direct instruction than with differentiated instruction.	1	7	13	3	2
3) I believe differentiated instruction helps students learn the intended learning target of the lesson	0	0	7	19	0
4) I believe students learn as much with direct instruction as they do with differentiated instruction.	1	3	14	7	1
5) I believe differentiated instruction is meaningful to students.	0	4	4	12	6
6) I believe that differentiated instruction is an ineffective method of instruction.	5	13	3	4	1
7) I believe that all teachers should differentiate their instruction in secondary mathematics.	2	7	5	7	5
8) In my personal practice, I have seen that differentiated instruction improves student learning.	0	4	8	11	3
9) In my personal practice, I have seen that differentiated instruction does not improve student learning.	3	11	10	2	0
10) I believe that differentiated instruction is an effective method of teaching.	0	2	7	14	3

Interview Results

After the survey closed, an e-mail request was sent out asking for volunteers to participate in a 15-30minute interview about their opinions on differentiated instruction in secondary mathematics. Of the 35 possible participants and 26 actual participants, 10 volunteered to be interviewed. Questions in the interview were developed specifically for this study and were designed to further explore teacher's perceptions about differentiated instruction, such as effectiveness, positives, negatives, and current use in the classroom. (See Appendix C) All participants in the interview had to sign a consent form. (See Appendix A) The interviews lasted about fifteen to twenty minutes and took place at various locations designed to provide most convenience to participants. Once the interviews had taken place, participant's answers were typed and e-mailed back to participants for their verification. The answers below are the participants' verified responses. Responses were grouped together based on similar themes and phrasing. All ten responses for each question are provided in brief to maintain anonymity.

The first interview question was "Do you believe differentiated instruction in secondary mathematics to be effective or ineffective? Why?" Six of the ten participants responded that differentiated instruction is effective. Four of the six went on to say that it is best or effective to meet the needs of individual students. Two of the six added that it is effective if given enough time to plan. Two participants said that it is both effective and ineffective. Both said it is ineffective in big classrooms and there are too many students for differentiated instruction to be effective. One participant said that it can be effective. Another participant said that he/she has not done a lot of it, but sees how it could be effective if done well.

The second interview question was "What are some specific examples that you can provide to support your opinion?" Nine of the ten interviewees mentioned doing ability based grouping of students, such as multiple leveled assignments and/or assessments, grouping by what they were struggling with, or having one group work with a teacher and the other do an activity independently. However, teachers mentioned that one must be careful when grouping by ability for two reasons. First, when the teacher is working with one group, some students are not able to work independently due to maturity or motivation. The teacher must be monitoring all groups. Second, students may notice the ability grouping and may feel uncomfortable. One teacher mentioned that he or she feels it is not the material holding students back; it is other factors such as motivation, perseverance, and attendance.

"What are some positives about differentiated instruction?" was the third interview question. Six teachers mentioned that it allows the teachers to meet the needs of different students or types of learners. Two teachers mentioned that it builds students confidence, because they are working at their level. One teacher mentioned that it allows each student to be appropriately challenged, while another teacher mentioned that it alleviates boredom for some students.

Interview question four asked participants to discuss the negatives of differentiated instruction. Nine of the ten participants said that it was time consuming; with the tenth saying it is more work for the teacher. Interviewees mentioned a variety of aspects that were time consuming. Four teachers talked about the amount of curriculum to cover, with three mentioning that there is too much to cover and differentiate and one discussed that all students still have to get to the same end goal. Three teachers

mentioned that it takes time to figure out where each student is at and therefore appropriately differentiated for him or her. Three teachers talked about ability grouping singling out students or groups of students and that may not being good for students. Two teachers mentioned that the class sizes are too big to adequately differentiate.

The final interview question asked teachers if they used differentiated instruction in their classroom and why or why not. Seven of the ten teachers said that they did use it. Five of the seven said they use differentiated instruction from time to time or occasionally. Two said they used it minimally. One teacher said he or she did not use it. Five of the participants mentioned not having enough time to differentiate instruction. One teacher mentioned that he or she feels the professional development has been okay, but not great. Therefore, this teacher did not think he or she understood differentiated instruction and would use it more if he or she had the resources.

CHAPTER 5. DISCUSSION

Differentiated instruction is one intervention endorsed by Minnesota Department of Education (2013b) that is used to help students be successful in the classroom. This study aims to contribute information about teachers' perceptions about the effectiveness or lack of effectiveness of differentiated instruction at the secondary level, specifically in mathematics. The study took place at a metropolitan school district in Minnesota, referred to in this research as BEST school district. Due to the limited nature of this study in the number of participants, the specific discipline and location of the study, and frequency in which teachers' used differentiated instruction, this study should not be generalizable to other disciplines or other districts. Both a survey and interviews were used to gather information about teacher perceptions of effectiveness or lack of effectiveness of differentiated instruction in secondary mathematics in the BEST school district in Minnesota.

Discussion of the Survey

The survey was designed for this study and looked at teachers' perceptions about the effectiveness or lack of effectiveness of differentiated instruction in secondary mathematics in the BEST school district in Minnesota. (See Appendix B for the survey.) Twenty-six out of 35 eligible staff completed the survey for a 74% participation rate. The results reported below are the opinions of the twenty-six participants and are not necessary representative of the entire district. Fifteen of the 26 participants use differentiated instruction 3-5 times per month or more, while the other eleven use it 0-2 times per month. (See Table 1) In the survey participants were given a statements on the left and then they rated their agreement or disagreement with the statement on a scale of

1-5, with 1 being strongly disagree and 5 being strongly agree. In the charts below, responses of agree (response of 4 on scale) and strongly agree (response of 5) are grouped together in the category of "agree" and responses of disagree (response of 2) and strongly disagree (response of 1) are grouped together in the category of "disagree." A response of 3 is considered neutral on the scale. The percentages are based on the twenty-six respondents. Percentages are rounded to the nearest whole number and therefore charts may or may not total to be 100%.

Figure 1

Believe that differentiated instruction engages students

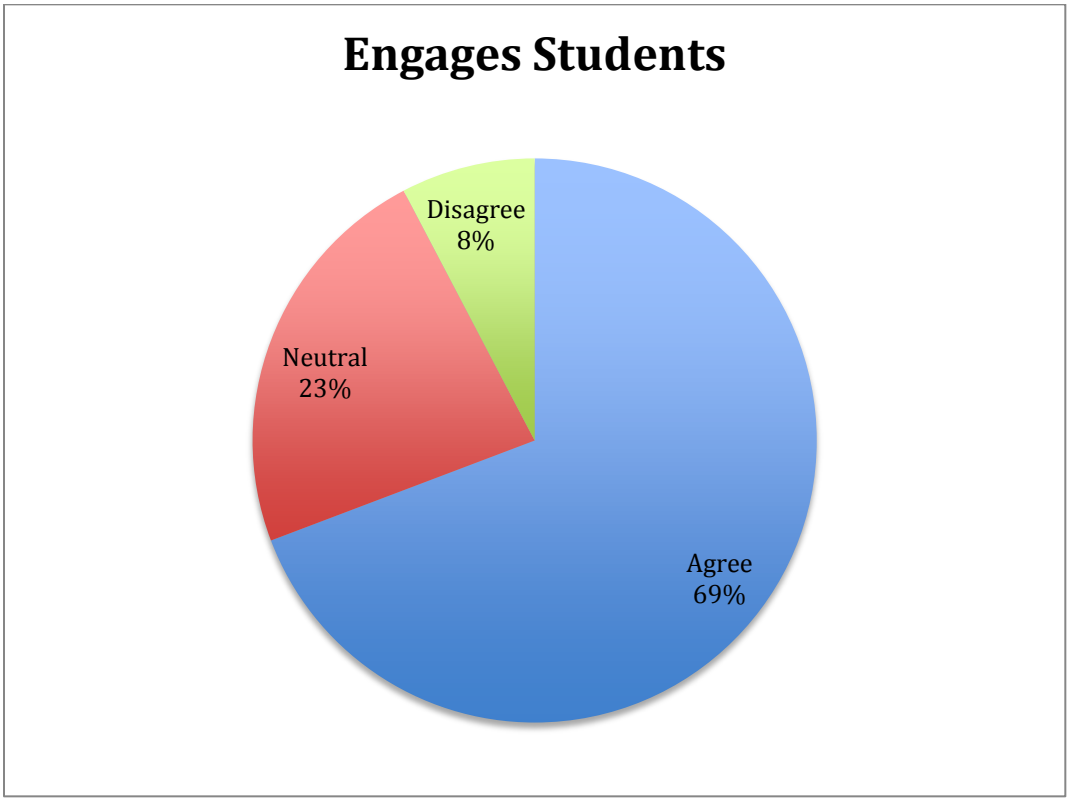
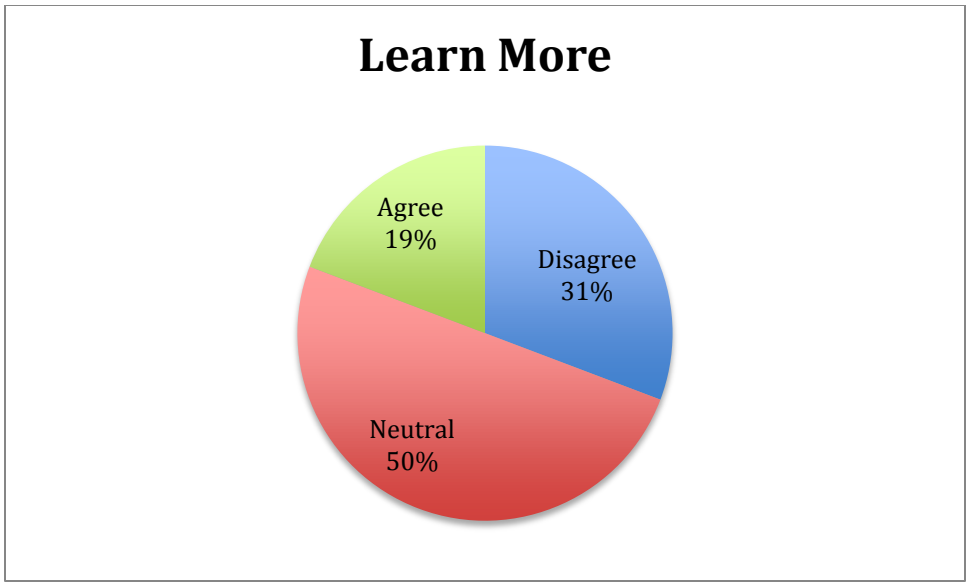


Figure 2

Learn more with differentiated instruction than with direct instruction

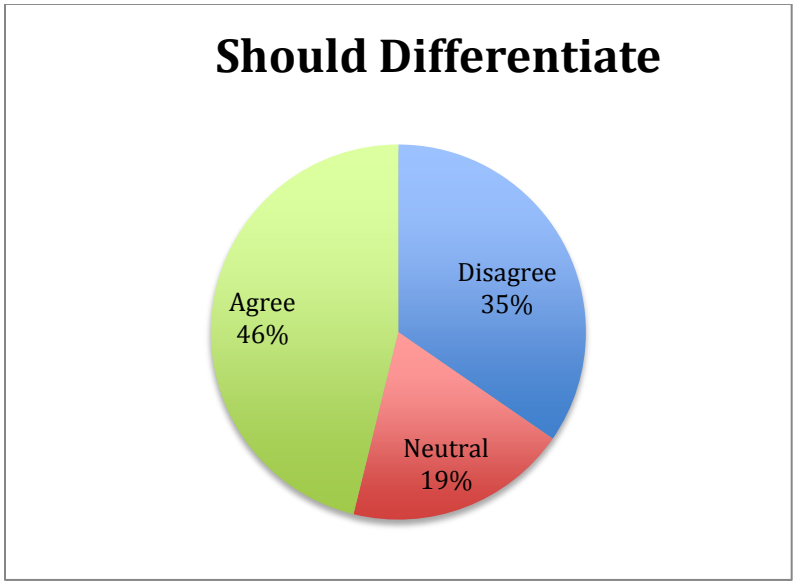


As shown in Figure 1, it is clear that the majority of teachers perceive that differentiated instruction engages students. However, even though the majority of teachers believe differentiated instruction engages students, only 19% agree that students learn more with differentiated instruction. According to Figure 2, half of participants are neutral on which method is more effective and 31% disagree that students learn more with differentiated instruction than with direct instruction. This is contrary to several studies already published. The research conducted by Patterson et al., (2009) noticed that one student went from failing to earning B's and C's in mathematics. In that same classroom studied by Patterson et al. 67% of students who had differentiated instruction in mathematics improved on the Measures of Academic Progress (MAP) from winter to spring. Beecher and Sweeny (2008) noticed on one state assessment, this particular school started with a 30% gap in achievement between students with free or reduced lunch and their non-free or reduced lunch peers, but after differentiated instruction was implemented, the achievement gap narrowed to 10%. When differentiated instruction was implemented in the classroom, one study done by Ernest et al. (2011) observed that

students improved by 30% from pretest to posttest scores and the study also reported that if using 60% as a cutoff for passing, only eight teachers of the thirty-five participants had average student pre-test scores of passing, but on the post-test, thirty-four of the thirty-five had average scores of passing. While some studies are showing students are learning more with differentiated instruction, secondary mathematics teachers at BEST school district in Minnesota does not perceive the same results. In fact, only 19% of teachers at BEST school district in Minnesota perceive that students learn more with differentiated instruction.

Figure 3

All secondary mathematics teachers should differentiate instruction

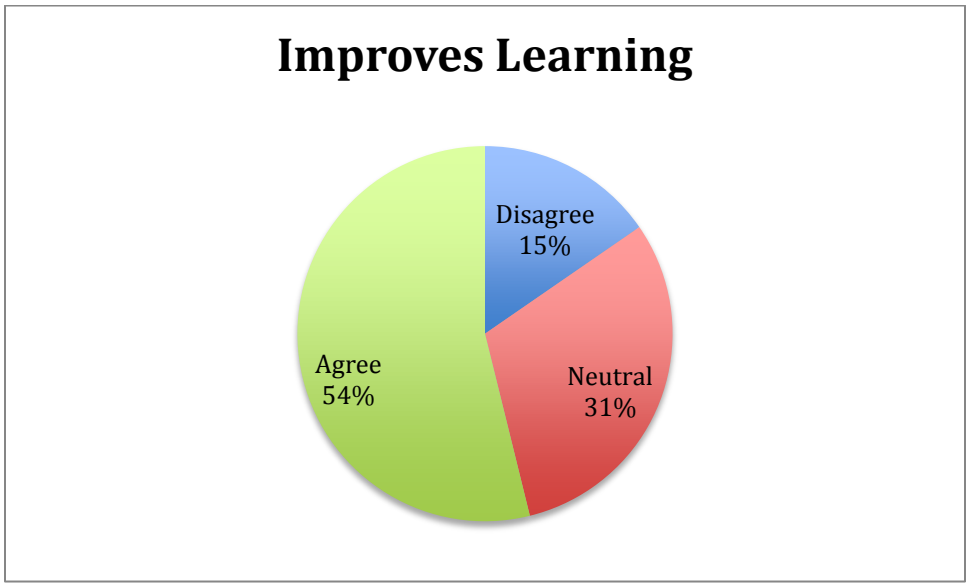


According to Figure 3, 46% of teachers believe that all secondary mathematics teachers should differentiate their instruction, 19% are neutral and 35% disagree with the statement. However, the Minnesota Department of Education has implemented Response to Intervention (RtI) as one method to improve student performance by constantly monitoring student progress and then modifying and differentiating instruction to meet a

student's needs (Minnesota Department of Education, 2013b). Even though differentiated instruction is endorsed by the Minnesota Department of Education, secondary mathematics teachers in the BEST school district do not think that all teachers should differentiate their instruction. According to the results of this survey, only 46% of secondary mathematics teachers surveyed believe all secondary mathematics teachers should differentiate instruction and 54% of participants surveyed are neutral or disagree that all secondary mathematics teachers should differentiate their instruction. Over half of participants do not agree that all secondary mathematics teachers should differentiate their instruction.

Figure 4

Differentiating instruction improves learning

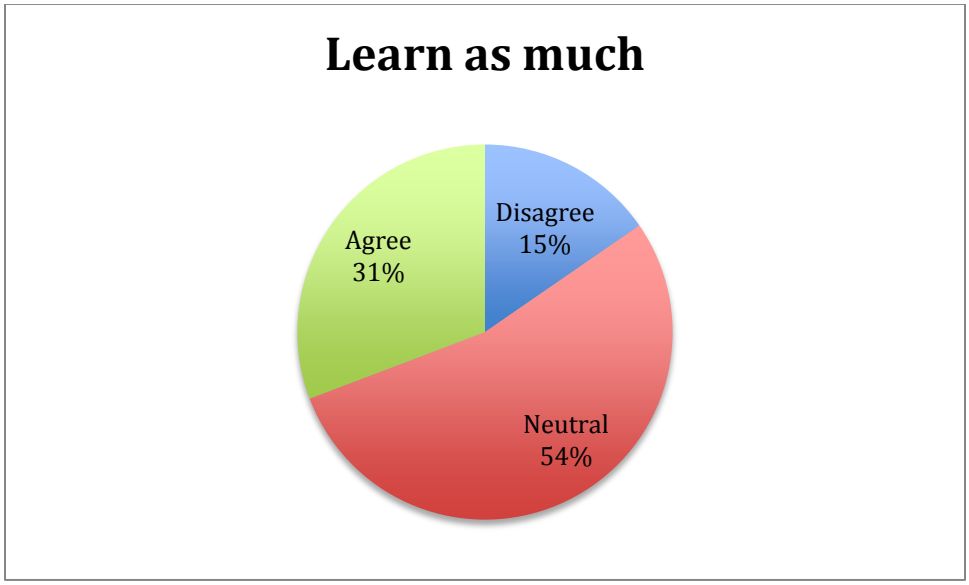


Fifty-four percent of secondary mathematics teachers surveyed do believe that differentiated instruction improves learning, as shown in Figure 4. As previously mentioned, the research conducted by Patterson et al., (2009), and by Beecher and Sweeny (2008), and by Ernest et al. (2011), supports teacher perceptions at BEST school

district that differentiated instruction improves student learning. However, when comparing responses to Figure 3, even though the majority of participants believe that differentiating instruction improves learning, the majority do not believe that all secondary mathematics teachers should differentiate their instruction. This leads to the possible interpretation that even though teachers believe differentiating instruction improves learning, teachers are not confident enough with this belief to require all teachers to differentiate their instruction. This is further confirmed in Figure 5 below.

Figure 5

Students learn as much with direct instruction as they do with differentiated instruction



Fifty-four percent of secondary mathematics teachers are neutral on whether students learn as much with direct instruction as they do with differentiated instruction. While secondary mathematics teachers believe differentiated instruction improves learning, they are unsure whether or not students learn as much with direct instruction.

Therefore, it appears that secondary mathematics teachers at BEST school district are not confident; they disagree that direct instruction is as effective as differentiated instruction.

Discussion of Interviews

According to the interviews conducted, nine out of ten participants said that differentiated instruction is time consuming. The study conducted by Beecher and Sweeny (2008) found similar perceptions. In that study researchers spent eight years working with teachers in an elementary school on differentiated instruction. Patterson et al. (2009) noted that teachers must take time, or have time set aside for them, to create the problems for multiple-centres or to differentiate instruction in general. Five out of ten participants in the interview stated they do not have enough time to differentiate instruction.

Additionally, four participants that were interviewed mentioned that the amount of curriculum they are required to cover is another hindrance to differentiated instruction. Kobelin (2009) also reported that teachers feel overwhelmed by the amount of curriculum they are required to teach, without even considering further differentiating instruction. Research conducted by Scigliano and Hipsky (2010) stated, "...it… can be daunting to differentiate instruction" (p. 83). One teacher in the BEST school district specifically mentioned that he or she felt the professional development has been okay, but not great. Therefore, this teacher did not think he or she understood differentiated instruction and would use it more if he or she had the resources.

Recommendations

Based on the survey results and the interviews this study seems to point to three possible recommendations:

1. For differentiated instruction to occur more and be effective, the BEST school district creates the necessary time for staff to effectively develop and implement differentiated lessons.
2. The BEST School district takes the time to assess and to eliminate unnecessary curriculum, so as to allow teachers to focus on what is important for students to know and then differentiate instruction on these topics. This could strengthen student success on the crucial learning targets of the course.
3. The BEST school district provides professional development and follow-up over time to facilitate the implementation of differentiated instruction.

Conclusion

This study set out to examine teacher's perceptions about the effectiveness or lack of effectiveness of differentiated instruction in mathematics at the secondary level in a metropolitan school district, referred to as BEST school district, in Minnesota. A mixed methods approach was used to build understanding about teacher's perceptions of the effectiveness or lack of effectiveness of differentiated instruction. The researcher used surveys and interviews as the primary tools for collecting data. The survey consisted of questions with a rating scale answer. This allowed the researcher to collect data about how often secondary mathematics teachers are using differentiated instruction, as well as perceptions of how effective or ineffective they believe it is. Participants had the option of being interviewed by the researcher. The interview was used to help the researcher gain a better understanding of participant's perceptions about the effectiveness or lack of effectiveness of differentiated instruction in secondary mathematics.

This study contributes to existing research in two ways. First, educational intervention for improving student learning is a federal government funded program endorsed by the state of Minnesota. While differentiated instruction is one intervention that the Minnesota Department of Education supports (Minnesota Department of Education, 2013b) it is not broadly adopted in the secondary mathematics in the BEST school district. Second, secondary level classrooms are different than elementary level classrooms, which have been studied more extensively. This study indicates that differentiated instruction, while it is perceived somewhat positively by the teachers surveyed, is employed in a limited fashion at the secondary level.

This study aimed to help the BEST school district in Minnesota improve their differentiated instruction by exploring teacher's perceptions about differentiated instruction in secondary mathematics. While most secondary mathematics teachers in the BEST school district who participated in this study believe differentiated instruction can be effective, teachers feel limited by time and curriculum. Therefore, this study recommends that the BEST school district give teachers time and additional professional development to assist teachers in implementing effective and successful differentiated instruction. To do this effectively there may also need to be a review of the curriculum with the intention of eliminating "unnecessary curriculum" that may be interfering with broader application of differentiated instruction.

References

Beecher, M. & Sweeny, S.M. (2008). Closing the achievement gap with curriculum enrichment and differentiation: One school's story. *Journal of Advanced Academics, 19* (3), 502-530. Retrieved from http://journals.prufrock.com/IJP/b/journal-of-advanced-academics.

Chamberlin, M. & Powers, R. (2010). The promise of differentiated instruction for enhancing the mathematical understandings of college students. *Teaching Mathematics and Its Applications, 29*, 113-139, doi: 10.1093/teamat/hrq006

Christenson, B. (2012). Increasing participation through differentiation. *Teaching children mathematics, 19* (3), 194-200.

Ensign, J. (2012). Teacher-initiated differentiation. *Teaching children mathematics, 19* (3), 158-163.

Ernest, J.M., Thompson, S.E., Heckaman, K.A., Hull, K. & Yates, J. (2011). Effects and social validity of differentiated instruction on student outcomes for special education. *The Journal of International Association of Special Education, 12* (1), 33-41.

Gordon, M. (2013). The mathematics of fountain design: a multiple-centres activity. *Teaching Mathematics and Its Applications. 32,* 19-27, doi: 10.1093/teamat/hrs013

Kobelin, M. (2009). Multi-age made me do it: A teacher tackles differentiation in math instruction. *Schools: Studies in Education, 6* (1), 10-22. Retrieved from http://dx.doi.org/10.1086/597653

Leedy, P.D. & Ormrod, J.E. (2013). *Practical research planning and design.* Upper Saddle River, New Jersey: Pearson Education, Inc.

Little, C.A., Hauser, S., Corbishley, J. (2009). Constructing complexity for differentiated learning. *Mathematics Teaching in the Middle School, 15* (1), 35-42.

Minnesota Department of Administration (2010). *Minnesota State Demographic Center.* Retrieved from http://www.demography.state.mn.us/Census2010/

Minnesota Department of Education (2013a). *Minnesota Education Statistics Summary.* Retrieved from http://w20.education.state.mn.us/MDEAnalytics/Summary.jsp

Minnesota Department of Education (2013b). *Response to Intervention.* Retrieved from http://education.state.mn.us/MDE/EdExc/BestPrac/RespInterv/index.html

Minnesota Legislative Reference Library (2001). *Minnesota Edocs: State Government Publications*. Retrieved from http://www.leg.state.mn.us/edocs/edocs.aspx?oclcnumber=159937649

Northwest Evaluation Association (2013).*MAP*. Retrieved from http://www.nwea.org/products-services/assessments/map®

Patterson, J.L., Conolly, M.C., & Ritter, S. A. (2009). Restructuring the inclusion of classroom to facilitate differentiated instruction. *Middle School Journal, 41* (1), 46-52. Retrieved from http://www.mnsa.org/Publications/MiddleSchoolJournal/Articles/September2009/tabid/2011/Default.aspx

Pham, H.L. (2012). Differentiated instruction and the need to integrate teaching and practice. *Journal of College Teaching & Learning, 9* (1), 13-20.

Phelps, K.A.G. (2012). The power of problem choice. *Teaching children mathematics, 19* (3), 152-157.

Scigliano, D. & Hipsky, S. (2010). 3 Ring circus of differentiated instruction. *Kappa Delta Pi Record, 46* (2), 82-86.

Tomlinson, C. A. (2001). *How to differentiate instruction in mixed-ability classrooms.* Alexandria, VA: Association for Supervision and Curriculum Development.

United States Census Bureau (2012). *Newsroom Press Releases.* Retrieved from http://www.census.gov/newsroom/releases/archives/population/cb12-243.html

APPENDIX A: INFORMED CONSENT

Project Title: Differentiated Instruction in Secondary Mathematics

Researcher: Rachel Amadio (952) 707-2865 rachelamadio@gmail.com

Description: The purpose of this experiment is to examine the effectiveness or lack of effectiveness of differentiated instruction in secondary mathematics as perceived by secondary mathematics teachers in the BEST school district in Minnesota. If you volunteer for this research study, you will be asked to participate in a survey and will have the option of participating in an interview. The topics are neither embarrassing nor intended to be upsetting. You will first be asked to complete a survey. After the survey, you will have the option of providing your contact information to be interviewed. The total time for your participation will be *fifteen minutes* for the survey and an additional *one-hour* if you volunteer to be interviewed.

The results of each individual's participation will be strictly confidential. An identification number will be used to record the results of your participation. No names or individual identifying information will be maintained. With the exception of the researchers involved in running this study, nobody will be allowed to see or discuss any of the individual responses. Your responses will be combined with many others and reported by identification number in a professional journal article.

It is not anticipated that this study will present any risk to you other than the inconvenience of the time taken to participate.

The overall nature of the study will be explained as soon as you have completed your session. A summary report and explanation of the results will be made available to you when the study is completed if you so request.

Authorization: I have read the above and understand the nature of this study and voluntarily agree to participate. I understand that by agreeing to participate in this study I have not waived any legal or human rights. I also understand that I have the **right to refuse to participate** and that **my right to withdraw from participation at any time during the study will be respected with no coercion or prejudice.**

If you have any concerns about your treatment as a subject in this study, please call or write:

Eleni Pinnow, IRB Chair
Telephone: *(715) 394-8312*
Email: *epinnow@uwsuper.edu*

This research project has been approved by the UW-Superior Institutional Review Board for the Protection of Human Subjects, protocol #__1031_____

_____ _____

Subject signature Date

Identification number: _____

APPENDIX B: SURVEY

Differentiated Instruction in Secondary Mathematics Survey

For the purposes of this study, differentiated instruction is defined as: teachers tailoring their instruction to provide a variety of ways for students to understand the content and express learning. It is proactively planned, so that each lesson will have an appropriate fit for many learners. Instruction can be differentiated by content, process, product, and/or environment (Tomlinson, 2001).

Please rate your opinion on a scale of 1 to 5, with 1 being strongly disagree, 3 being neutral, and 5 being strongly agree.

1) I believe differentiated instruction engages students in their learning.	1	2	3	4	5
2) I believe students learn more with direct instruction than with differentiated instruction.	1	2	3	4	5
3) I believe differentiated instruction helps students learn the intended learning target of the lesson	1	2	3	4	5
4) I believe students learn as much with direct instruction as they do with differentiated instruction.	1	2	3	4	5
5) I believe differentiated instruction is meaningful to students.	1	2	3	4	5
6) I believe that differentiated instruction is an ineffective method of instruction.	1	2	3	4	5
7) I believe that all teachers should differentiate their instruction in secondary mathematics.	1	2	3	4	5
8) In my personal practice, I have seen that differentiated instruction improves student learning.	1	2	3	4	5
9) In my personal practice, I have seen that differentiated instruction does not improve student learning.	1	2	3	4	5
10) I believe that differentiated instruction is an effective method of teaching.	1	2	3	4	5

APPENDIX C: INTERVIEW QUESTIONS

1) Do you believe differentiated instruction in secondary mathematics to be effective or ineffective? Why?

2) What are some specific examples that you can provide to support your opinion?

3) What are some positives about differentiated instruction?

4) What are some negatives about differentiated instruction?

5) Do you use differentiated instruction in your classroom? Why or why not?

APPENDIX D: IRB APPROVAL LETTER

March 12, 2014

TO: Rachel Amadio
Student Researcher

FROM: Eleni Pinnow
Chair, Institutional Review Board for Human Subjects

Institutional Review Board (IRB) Expedited Status Determination for Research Involving Human Subjects: *Differentiated Instruction in Secondary Mathematics.*

Your research proposal, IRB protocol #1031 has been determined to meet the guidelines for expedited status. The reader was George Wright. Data collection is approved for one year from yesterday. Should collection need to extend beyond that date, you will need to resubmit your protocol to the IRB for an extension.

The purpose of the Institutional Review Board is to review research projects conducted by UW-Superior students, faculty, and staff to ensure that ethical practices and protocols with regards to use of human subjects are followed. Retain this memorandum with your research protocols. Please note that you must follow the proposal submitted to and agreed upon by this committee. If you change protocols or practices, or if data collection is expected to extend beyond the approved date, you must return to the committee for review of the modifications or extension.

Good luck in your research endeavor.

Cc: Dean of Faculties
Suzanne Griffith
IRB Committee members
Eleni Pinnow
Andrew Breckenridge
Peter Cook
James Geidner
George Wright