How will Differentiated Instruction affect Student Learning?

A Capstone Project Submitted in Partial Fulfillment
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Abstract

This qualitative action research paper examined how differentiated instruction affected student learning in a randomly selected middle school math classroom. The students were taught by the researcher over a five-week period in a Midwestern town in the United States. The main research question, “How does differentiated instruction affect student learning?” was sufficiently answered based on the differentiation done in the classroom and the results from the three sub research questions. Qualitative data collections were gathered from researcher’s journal, class discussions, pre- and post-assessments, and students’ projects. Content, process, and products were varied or changed to meet the students’ ever changing needs. Validity was established by focusing teacher instruction to student proficiency of state math standards and completion of pre/post-assessments. Encouragements in appropriate student interaction surprisingly led to observations of mathematical conversations and discussions which demonstrated students’ content knowledge. Expected results were observed when I focused more on individual student needs and changed the dynamics of the classroom to meet those needs. Differentiated instruction with ability groups, group work, pre/post-assessments, and student interest projects had a positive impact on student learning through standard proficiency acquisition. However, teacher stress and workload levels increased dramatically during the initial stages of the differentiated unit.
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Chapter One

Introduction

Educational readiness levels vary among students (Tomlinson, 2003). One can say, with great confidence, that thirty students in a middle school math class are not all at the same place on the proficiency continuum. Some students may have content knowledge lagging years behind what the state standards say they should know. Some students are exactly where they should be; ready to learn the packaged daily lesson. Of course, some students are bored out of their mind anxiously waiting to be mathematically challenged.

How does one challenge students in a dynamic classroom with varied readiness levels, content knowledge, and attitudes about math? Differentiated instruction is a way to change the classroom scenery to meet the needs of the diverse student body (Strickland, 2007; Tomlinson, 1999a, 2001). Therefore, educators must utilize differentiated instruction to enhance the quality of learning by meeting students where they were in the proficiency continuum and pushing them to standard acquisition.

Motivation for the Project

How do I motivate students to learn for the sake of learning? Did I reach every student? How do I become a better teacher? I asked myself these questions as I regularly reflected on my teaching practices.
I am responsible for the educational growth of the students in my classroom. My challenge was meeting students on varied individual levels to help them succeed. Students are waiting to be challenged and have an inner desire to succeed. Differentiated instruction helped me increase student content proficiency while diverting the ownership of education to the students.

**Background on the Problem**

I like math and find mathematical concepts interesting. My job as a teacher would be a lot easier if every student had the same passion for math which I possess. I do not shut down mentally when mathematical concepts become complicated. I do not exert behavior problems because I lack motivation, confidence and the skill knowledge needed for math. However, the reality is often students do.

A math teaching degree school prepares you to teach math. However, a rookie teacher’s real education starts when standing before students on the first day of school. Reality slowly changes the once impeccable picture of math education. Rarely are all the individuals in the classroom mathematically where they should be. A one-size-fits-all lesson plan will not meet the needs of all learners. Some students need to be taught the prerequisite skills, which they never acquired, while others are ready to learn mathematically without the teacher. As I faced these educational issues, I knew I needed to change the way I teach math. Therefore, welcome to differentiated instruction.
Educational preparation courses mention differentiated instruction and attempt to teach it. I learned how to change instruction to meet different learning styles with the help from my undergraduate method courses. I knew how to change the mathematical content, educational process, and student product. However, I always taught the whole class as one cohesive group. To improve my teaching practices, I wanted to learn how to ability group students, provide small group instruction to the varied ability groups and become a facilitator for student interest projects.

Ability grouping, placing students into groups based on ability levels, provides students the opportunity to increase skill knowledge based on readiness levels (Levy, 2008). Small group instruction gives students the opportunity to have a larger voice in discussions and activities. It also gives opportunities for individual work time for the rest of the class. As a facilitator for student interest projects, I guided students through project that gave them a chance to demonstrate content knowledge in a student centered way.

**Statement of the Problem**

Differentiated instruction is an educational technique used to meet the needs of students. I felt that I could not teach all students successfully with the same level of difficulty in the material I present. I wanted to appropriately educate a classroom full of diverse learners with different levels of ability and interest.
levels. Therefore, to meet the educational needs of my students, I found it necessary to implement differentiated instruction into my math classroom.

**Statement of Purpose**

To meet the students where they were in the learning process, I planned to help them get to grade level, move them along at a normal pace, or speed up the learning process for advanced learners. The intensity of the learning process, for all learners, increased interest by giving students a choice in project topics. By differentiating instruction, I hope to increase student mathematical content knowledge by shifting educational ownership to the students to empower students and raised proficiency levels.

**Research Questions/Hypotheses**

My main research question was: How will differentiated instruction affect student learning? This question was answered by the following sub questions:

- How does differentiated instruction affect teacher instruction?
- How do student interest projects affect student learning?
- How does ability grouping affect student learning?

**Summary**

This project hopes to give more insight into the main research question and sub questions I have listed above. Differentiated instruction encourages changing the dynamics of the classroom to meet the individual needs of students. By changing the mathematical content, delivery process, and student products, I
intensified the learning process for all students. I investigated how the change in teaching practices affected my instruction and student content knowledge acquisition.

The literature review in chapter 2 will discuss differentiated instruction and how it affects student learning and teacher instruction.
Chapter Two

Review of Literature

The students in my classes were mathematically diverse. I wanted to use differentiated instruction to change the dynamics of my instruction to meet the needs of individual learners. The specific differentiation techniques I used to increase student content knowledge were pretesting to determine skill ability groups, small group and large group instruction, and student interest projects. The following is a review of literature for differentiated instruction, along with the techniques I implemented in my math classroom.

Differentiated Instruction

Take one look down the halls of a middle school. Does everyone dress the same? Talk the same? Have the same interests? The answer to these questions is obvious. Then why do teachers present students with the same lesson, at the same time, and in the same manner? Sure, we differentiate the lesson delivery, but we still teach all the students as one group. Tomlinson (2001, p. 1) suggested that “In many classrooms, the approach to teaching is more unitary than differentiated.” This is not enough. “It seems unlikely that differentiation defined as tinkering with one-size-fits-all instruction can be robust enough to meet the learning needs of academically diverse populations” (Tomlinson et al., 2003 p. 131-132)

There is no single “recipe” for differentiation (Tomlinson, 2005). However, maximizing the learning potential of individual students is the goal
(Tomlinson, 2001, 2003). The complexity of teaching to maximize the learning potential of all students introduces pedagogical dilemmas considering the diverse students in the classroom (Tomlinson et al., 2003). The researchers go on to suggest that teachers need practices that address learner differences in readiness, interest, and learning profiles. Differentiated instruction is a route to meet the needs of the diverse learners through modification of teaching and learning (Tomlinson, 2001). Tomlinson et al (2003, p. 121) added the following:

Differentiation can be defined as an approach to teaching in which teachers proactively modify curricula, teaching methods, resources, learning activities, and student products to address the diverse needs of individual students and small groups of students to maximize the learning opportunity for each student in a classroom.

Differentiated instruction allows teachers to recognize student commonalities while also putting varied student needs at the forefront of instruction (Tomlinson, 2001). A teacher differentiates content, process, or product, or some combination of the three (Strickland, 2007) to “offer different approaches to what students learn, how they learn it, and how they demonstrate what they’ve learned” (Tomlinson, 2001, p. 4).

Tomlinson (2001) and Levy (2008) define content as what teachers teach and what students learn. Content is the curriculum based on government mandated standards. Tomlinson (2005) suggested that “differentiation must be an
extension of high quality curriculum, not a replacement for it” (p. 263) and stated “we must have a solid curriculum […] in place before we differentiate” (Tomlinson, 1999b, p. 13). Therefore a good standards based “curriculum must focus on the concepts, principles, big ideas, essential understanding, and questions that identify and emphasize what is truly key to the understanding and practice of a discipline” (Strickland, 2007, p. 12). Differentiated instruction allows for deviations in content without regression of the curriculum students are entitled to (Levy, 2008). This is important in the math classroom because of the hierarchical structure of mathematics (Murray & Jorgensen, 2007).

Furthermore, teachers describe a good curriculum as (Strickland, 2007, as cited from Tomlinson, 2005): engaging, challenging, standards-based, scaffolded, authentic, accurate, varied, interesting, developmentally appropriate, important, connected to earlier learning, pertinent to students’ lives, incorporates technology, and promotes inquiry and high-level thinking.

Curriculum must be differentiated based on student readiness so that the content is available to the diverse learners in the classroom (Tomlinson, 2001, Murray & Jorgensen, 2007). Readiness can be defined as, “a student’s entry point relative to a particular understanding or skill” (Tomlinson, 1999a, p. 11). It can be stated that the diverse student population has varied skill and understanding levels. Common ways to meet the needs of individual content readiness levels are
tiered lessons. Tiered lessons allow for flexibility in content while still focusing on standards and curriculum (Levy, 2008).

Differentiating the curriculum based on student interest and learning profile can have a profound effect on their learning (Tomlinson et al., 2003). “Interest refers to a child’s affinity, curiosity, or passion for a particular topic or skill” (Tomlinson, 1999, p. 11). Changing how curriculum is delivered with the students’ interest in mind will invoke student motivation. Differentiating instruction and lesson delivery to touch on the specific interests of students will lead to engagement, high student autonomy, and increased productivity (Tomlinson et al., 2003). In connection with differentiating the curriculum to meet the interest needs of students, D’Amico and Gallaway (2008) suggest taking an interest in the students in your classroom by getting to know them.

The research on learning styles can be summed to one idea: different students learn in different ways (Levy, 2008). Tomlinson (1999a, p. 11) explained learning profile as:

Some students need to talk ideas over with peers to learn well. Others work better alone and with writing. Some students learn easily part-to-whole. Others need to see the big picture before specific parts make sense. Some students prefer logical or analytical approaches to learning. Other classmates prefer creative, application-orientated lessons.
While no one learning style may be more important than another, differentiating instruction to accommodate the various needs is important (Tomlinson et al., 2003).

Differentiating process, or how teachers teach (Levy, 2008, Tomlinson, 2001), involves acknowledging student readiness levels, interest, and learning profiles. Levy (2008) stated that teachers should not teach all students the same way because they all learn differently. She also declared that teachers must change teaching styles to meet the needs of the students. Similarly, Murray and Jorgensen (2007) suggested that the goal of differentiation in the mathematics classroom is to “plan for the learning needs of all students, providing them with opportunities they need to reach their full potential and become mathematically proficient” (p. 4).

Changing the way one teaches can be “ill conceived”, suggested Tomlinson (1999b, p. 16), adding successful differentiation is embedded with student engagement and student understanding. This means that even though a teacher may change how the content is learned, standards are still addressed with goals in mind and clearly stated.

Students demonstrate what they have learned through a product (Levy, 2008, Tomlinson, 2001). Levy (2008) believes students should demonstrate what they know in various ways because they have varied ability levels, learning styles, and interests. Differentiating “products should still focus on the essential
knowledge, understanding, and skills specific to content just covered” (Tomlinson & Eidson, 2003, p. 5).

The classroom teacher is responsible to clearly explain what knowledge, skills, and understanding the students must include in their work when differentiating products. Successful products draw on the application of ideas and skills and are adjusted to benefit the learning process of the individual, sometimes with the help of student (Tomlinson, 2001).

The differentiation process is embedded in assessment (Kingore, 2004; Levy, 2008, Tomlinson, 2003). Pre-assessments, formative assessments and summative assessments are utilized in today’s classrooms. Pre-assessments are a snapshot of where a student is in the educational continuum. By pre-assessing, content and process can be differentiated by readiness, interest, and learning profile. Formative assessments are used to gather information to direct instruction. Summative assessments are used to determine if students learned what was taught. Summative assessments are typically end of unit or chapter tests (Levy, 2008). Assessment is ongoing and results are orientated (Strickland, 2007; Tomlinson, 2005).

The research of Tomlinson (2001, 1999a, 199b, 2003) states we must have a foundation of best-practice curriculum and instruction to make differentiation work. Effective differentiation is knowledge and learner centered (Tomlinson et
al., 2003) with purposeful and goal orientated classroom changes based on the needs of individual learners (Tomlinson, 1999b).

**Skill Ability Groups**

A teacher may be fooled into believing that differentiation is getting students up out of their desks and moving around the room working on projects while making a considerable amount of noise. Tomlinson debunked this myth by saying, “Effective differentiated classrooms include purposeful student movement and some purposeful student talking” (2001, p. 2). The classroom is still in control and disciplined. Expected student movements and volume levels have been established and modeled by the teacher (Kingore, 2004). The differentiated classroom is one that is safe with a respectful atmosphere (Strickland, 2007) so that learning can be optimized.

Sometimes the most appropriate action for grouping is by ability (Levy, 2008). Students with below average ability level on a particular subject matter can get more individualized instruction at a pace at which they need it. Above average subject matter ability level groups can use small groups to work on open-ended tasks to further deepen understanding (Kingore, 2004).

The grouping of students by ability allows for tiered lessons. In a study “Designing Strategies That Meet the Variety of Learning Styles of Students,” Lopez and Schroeder (2008) noted that tiered assignments increased the understanding of expectations and motivation to complete assignments on time.
The researchers also recommend delivering tasks based on ability to reduce frustration along with learning and behavior problems. Levy (2008) adds that “tiered lesson planning is one way to stay focused on the standards and curriculum while maintaining flexibility in content, process, and product” (p. 163).

**Individual, Small Group, and Whole Class Instruction**

Effective differentiation includes whole class, small group and individual attention (Tomlinson, 2005). Sometimes students are working alone, with a partner, in small groups, or as a whole class. Over time, students should work in a wide range of grouping configurations (Strickland, 2007). The key to choosing how to deliver instruction is flexibility (Strickland, 2007; Tomlinson, 2001). Strickland tells the teacher what particular grouping works best: “use whatever type of differentiation and flexible grouping [that] would best help these students meet these objectives at this time” (2007, p. 21). The author is stating that it is up to the teacher to decide what type of instruction and grouping to use to maximize the learning potential of the learners. Strickland iterates by saying that “what matters most is that teachers 1) are clear on their learning goals, and 2) think carefully about how to best meet these goals” (p. 21).

Individual instruction or practice usually happens at the middle or the end of a lesson (Kutnick, Blatchford, Clark, Macintyre, Baines, 2005). Individual work is used for completion of curriculum materials that focus on practice,
mastery, test preparation, or extensions (Kingore, 2004). This means that students may be working on varied assignments at the same time based on individual readiness. If a task calls for quiet concentration, introspection, and individual practice, students should work alone (Strickland, 2007). But, for some tasks, Strickland also suggests giving the students a choice to work in a group or alone.

Kutnick et al. (2005) noted the positive effects of small group instruction, with four to six students in a group. Similarly, Tomlinson et al. showed that grouped instruction fostered positive attitudes about learning and strong self-concepts (2003). The research also illustrated that small group settings addressed learner needs by giving teachers flexibility. They concluded that teachers may group students based on the multitude of learning styles and profiles, by readiness level, or interest. Groups may be arranged by heterogeneous (different) or homogeneous (same) abilities, readiness, interest, etc (Tomlinson et al., 2003).

Whole class instruction fosters a sense of community (Strickland, 2007). There were also times when sharing information and completing activities was more effective when done as one group (Tomlinson, 2001). Whole class instruction has its benefits because students need to learn to “accept and listen to everyone in the class” (Kingore, 2004, p. 56).

Whole class instruction typically is used at the beginning of the lesson. The teacher uses this time to introduce new information and recap instruction from previous lessons. However, whole class instruction does happen at the end
of the instruction time to conclude by providing feedback from different groupings, revision of material, and assessment (Kutnick et al., 2005).

**Student Interest Projects**

As mentioned previously, teachers should differentiate based on student interest. This differentiation includes student interest projects. The research by Tomlinson et al. found that differentiating for student interest increased motivation, productivity, and achievement (2003). Tomlinson et al. (2003) also showed “that interest contributes to a sense of competence and self-determination in learners and to positive learning behaviors, such as willingness to accept challenge and persist in it” (p. 128).

Student interest projects allow for the transformation of the teacher from instructor into facilitator or coach, giving students as much responsibility as possible (Tomlinson, 2001). Students are responsible to select a topic, carry out the project, and demonstrate content knowledge. The teacher’s role is to evaluate the student’s project by holding the student accountable to meet the desired outcomes. The desired outcomes or goals must be clearly stated and evident to students (Turville, 2007).

**Summary**

Differentiation must be regarded and practiced as a reflection and extension of educational best practices and it is not a singular approach (Tomlinson et al., 2003). The goal of differentiation is to maximize the learning

Differentiated instruction involves changing content, process, and product to meet the needs of the varied student readiness levels, interest, and learning profile. This must be done in a balanced and strategic way sense students are mathematically diverse (Turville, 2007).

I differentiated my classroom by working in ability groups, varying lesson delivery settings, and providing an opportunity for student interest projects. Much research has shown that providing these forms of instruction can have a powerful positive effect on student learning (Kingore, 2004, Strickland, 2007, Tomlinson, 2001, Tomlinson et al., 2003).

The following chapter will outline the research design and methods used in the differentiation process. The specific instructional strategies and products will also be described.
Chapter Three

Research Design and Method

The purpose of this research project was to see how student learning was affected by differentiated instruction. Differentiated instruction was utilized to meet students where they were in the proficiency continuum and push them to standard acquisition. Changes in classroom dynamics to incorporate small group instruction and student interest projects were employed. This chapter describes the classroom setting, specific interventions used, methods and design used to collect data, as well as a timeline for the study. Forecasts of expected results are also discussed.

Setting

This was my third year teaching mathematics in an upper Midwestern town in the United States. The population of the middle school is 834 students in grades 7 through 9. I was responsible for teaching 103 students in either 8th grade mathematics or Algebra I. This research was implemented in a class of nineteen students, seven male and twelve female, in 8th grade math. The selection of this class was based on drawing a number out of a hat.

The class was a block class taught in an A-B schedule. The block class was ninety minutes long, interrupted by a thirty minute lunch after the first hour of instruction. The thirty minute lunch interruption benefited chunking differentiated activities.
I set the tone in the classroom and modeled expected behaviors, due to the fact that this study introduced a change to the “normal” class flow. Student absenteeism slightly affected the study because the class met every other day. Other factors that affected the research study included; classroom disruptions, time management, and honesty of student responses during surveys and questioning.

**Intervention/Innovation**

This research conducted in this study was performed while paralleling content and standards set by the district curriculum, along with an adopted textbook. The implementation commenced over the normal course of a unit (chapter).

The first step of this study was a unit pre-assessment (see Appendix A). The assessment was utilized to group students according to readiness levels based on the pre-assessment performance. There were two homogeneous groups; students that needed more help with the topic at hand, and those that needed to take the concept further. The students received appropriate small group instruction and tiered lessons based on ability levels and need. The fluidity of student moving between groups was determined by formative assessments throughout the unit.

Students normally demonstrated content knowledge in my class through a unit culminating summative assessment. The students still took a unit test similar
to the pre-assessment. However, an interest project for which students had a choice in how to demonstrate content knowledge was also employed. I assisted students in the selection of project choice and I had final approval of all projects. Students were told the project must be an individual one, but they were allowed to assist each other. If a pair of students developed a project such that a pair of students could each individually demonstrate content knowledge, it would have been considered.

**Design**

I wanted to know how differentiated instruction affected student learning in my classroom. The open ended nature of the research question indicated that I used a qualitative design method to gather most of my research as a full participant. Similarly, my sub questions about how small group instruction, student interest projects, and teacher instruction are affected by differentiated instruction were answered using observations and open ended surveys. I utilized this method for these questions because it allowed me to focus more on “what” and “why” after my research began.

I did not focus on the comparison of pre-assessment and post-assessments, or employed a Likert scale, so I did not conduct quantitative research. Teacher journaling and students responses were not mathematically tabulated. The focus of this research was not to increase scores, but look at the impact the research has on students and teacher.
Description of Methods

Proper Institutional Review Board (MSU) approval, Appendix B, was granted before research began. Students in the class were asked if they would like to volunteer to change the way the class was taught and how they participated for a unit. Details of the design, including data collection procedures, were explained upon confirmation of volunteering. Students took an informed letter of consent, Appendix C, home to parents for approval of participation and completed the research participant consent form, Appendix D, themselves. Permission from the principal was acquired. See Appendix E for the principal consent form.

Anonymity was maintained throughout the research by assigning pseudonyms when needed to highlight student discussion and responses. Confidentiality was guaranteed by keeping all electronic data password protected and all non-electronic data under lock and key in my file cabinet. All sensitive data was destroyed after completion of the research project and defense of thesis.

Data collection commenced over one unit of instruction spanning a period of approximately five weeks. The first piece of collected data was a unit pre-assessment. The data from the pre-assessment was used to ability group students into three different groups based on content readiness. Small group instruction and tiered assignments was given to the different groups. Classroom observations were recorded with the specific indicators being but not limited to: student
movement, time on task, noise levels, student interaction and conversation, teacher stress levels, one-on-one interaction, and general lesson reflection.

General and specific questions were asked to students based on current classroom activities or situations to get a feel for how the students felt about the lesson. This was done individually or as a whole group discussion. Responses were recorded in a journal.

Various typical mathematical formative and summative assessments were used throughout the course of the unit. These assessments were tiered and changed based on the needs of the students. The arrangement of groups changed based on assessment performance. The assessments were used for grading purposes. Observations and reflections about the implementation of assessments and reassignment of ability groups were recorded.

The student interest project began with an open ended interest survey, see Appendix F. The data from the interest survey drove project topic choices with teacher guidance. I want to know what interested the students because I believe I could push them to demonstrate math content in a more authentic and real world based way. Student attitude was a major focus of observation at this point.

Students demonstrated content knowledge through the use of a typical summative assessment given at the end of the unit. I observed and reflected about the general student temperaments and test performances. The post-assessment was
not compared to the pre-assessment because the comparative results were not a main focus of this study.

I culminated the unit with another open ended survey, Appendix G, asking the student how they thought the change in classroom practices affected their learning. Open ended surveys were employed because I was interested in all responses, especially atypical ones not mentioned in current literature. Students were asked for further recommendations of differentiated instruction.

I actively reflected about how the differentiated unit affected my instruction. I will included stressors, general attitude, and things I would do differently the next time I differentiate my lessons.

**Expected Results**

I expected that I would often have to demonstrate expected behaviors because of different classroom arrangements. I also expected to redirect undesirable and disruptive behaviors, because students typically do not work in groups in a math classroom. I thought I would become stressed about the different teaching strategy implemented during this study. I anticipated students taking ownership of their interest projects because it would be more meaningful to them.

A major obstacle I anticipated was the willingness of the students to be open and honest during the surveys. I thought the students would respond with answers I would like to see, not what they actually thought. If I saw this
happening, I pulled students aside for more one-on-one discussion and follow up questioning to get accurate responses.

I used a journal to track observations during implementation. Entries included, but are not limited to student responses, teacher reflections and overall lesson tendencies. Keeping the journal current was difficult because it was not a practice of mine to write down student responses and reflections on a daily basis. I tried to journal during class and immediately following the research class period to keep data current.

**Timeline for the Study**

The timeline for this study was approximately five weeks spanning January 2011 to February 2011. The intervention and data collection occurred during the unit taught at that time.

**Summary**

I saw how differentiated instruction affected student learning by using a qualitative design through observations and open ended surveys. Teacher instruction, student interest project, content knowledge and small group instruction based on readiness levels were sub focus areas. The data gathered drove the change of my classroom dynamics. The next chapter will focus on data analysis and interpretation of the results of this study.
Chapter Four

Data Analysis and Interpretation of Results

The purpose of this research was to intensify the learning process for all learners by closing the gap so they are at grade level, move them along at a normal pace, or speed up the pace. Differentiated instruction was utilized with emphasis on a pre-assessment, small group instruction, and an interest project. This chapter discusses the data analysis and interpretation of results.

Data Analysis

**Pre-assessment.** I presented the pre-assessment to the students and explained to them that I wanted to know what they knew before we began the unit. A majority of the students thought the idea of a pre-assessment was “crazy” because “of course we don’t know the material, you haven’t taught it to us yet.” I assured the students that I wanted to know if we needed to skip material, as not to waste their time, and begin instruction where needed. I discussed the importance of trying as hard as they could and not to skip any questions. I emphasized that the pretest was not to be graded. My knowledge of prior work history with the class and my observations during the test led me to believe that the students gave their best effort.

The pre-assessment was corrected and then examined for prior proficiency of the math state standards. Proficiency levels were used for the initial student ability groupings. See Appendix A for specific assessment questions and state
standards. The arrangement of student groups based on standard proficiency was analyzed within the standard reflections discussed as follows.

**Standard 8.1.7 operations with integers.** Two categories of students were recognized from this standard; those who had troubles with negative numbers and those who made one or two small errors. One student correctly answered all questions. Based on the results, 47% of students needed help with negative integers. Discovering that almost half the students needed help with negative integers, I found the need to divide the class into two groups; those needed help with negative integers and those working with multi-step integer operations. I focused instruction on one group at a time while the other group was working on individual practice work.

I had to make sure there were two different types of practice available for the two different ability groups. Additional planning time was needed, which created more teacher preparation, causing additional work. Classroom movements were different than the one students and I were used to during a regular math class. Redirection of students not working with the current small group was needed at times and noise levels rose occasionally.

**Standard 8.5.1 extend numerical patterns.** All students were able to extend the patterns presented, however, using different starting numbers and showing an algebraic expression was difficult. Thirty-six percent of the students showed the correct number of pennies on day one on question 11 (see Appendix
A). Based on class performance, instruction of this concept was first presented to the whole group. Following instruction, a packet of practice problems were given to the students. The packet contained the work for the next six class periods. This packet was due at the end of the sixth day. Individual work was checked periodically for accuracy before the due date. The problems grew in complexity. The students were allowed to work ahead and consult each other for help.

Observations and reflections of previous day student distractions and unacceptable behavior led me to give them more homework than was possible to complete in a given class period. The extra work was not a punishment. It was the work that would be assigned the following class periods. I wanted to see how the students would react, settle down or stress out, knowing that they had more work ahead of them. Ability group instruction was not necessary during this standard instruction period. All students worked on the same problems which led to less teacher stress and work load. I allowed students to consult each other for help when needed during individual practice time more than they had in my past instruction. Redirection was minimal and noise levels were acceptable. The students showed interest in the practice packet and used work time effectively.

Class discussion following the completion of the extended numerical patterns packet indicated that the students learned more and enjoyed the packet. Comments included; “the packet was fun and simple,” “I learned best from the packet,” “the packet allowed me to work at my own pace,” and “we got to work
by ourselves more without having instruction time.” One student displayed displeasure towards the packet idea because he procrastinated and fell behind quickly.

**Standard 8.5.2 using variables, expressions, and equations to represent problem situations.** The students either knew how to answer this question or did not know what to do at all. This was the only question left blank on any assessment (Question 14, Appendix A). Based on class performance, two homogeneous groups were used for instruction and individual practice work.

The major problem students had with this standard, once they used correct formulas, was that they did not know how to evaluate and simplify geometric formulas for measurements that were variable expressions. In addition, some of the students who were able to set up the correct formula did not know how to evaluate or simplify the formula. There was a reluctance by most students to use available manipulatives, such as, lab gear and algebra tiles. The reluctance of students to use available resources disappointed me because I used extra planning time to get these resources ready so that they would be able to use them during instruction time.

**Standard 8.5.3 simplifying algebraic expressions using order of operations.** All students answered every question in this section incorrectly. Whole group instruction was initially presented to the students, followed by
individual instruction based on students’ need of visual manipulatives and concrete examples.

I observed that some students did not use the visual manipulatives. With those who used visual manipulatives, nearly 31% of the students were confused on how to use them. In fact, they fully understood the abstract variable representation and the concept of like terms better. The lab gear, which was made available to all students during individual practice and assignments, was however useful for students during multiplication of two binomials representations. However, students preferred not to use lab gear at all after they learned the algebraic way of simplifying expressions.

Based on individual’s past performance, individual practice was again presented in a packet form. The students were excited to work on a packet again. A common theme was that the packet allowed the students to work ahead if needed to stay busy. Plus, the packet also allowed students to revisit previous work easily for either helping another student or for review.

During the instruction of this standard, a couple of students became very disgruntled anytime I mentioned lab gear. The reasons stated were that they knew how to perform operations with variables and perceived the usage of lab gear as a waste of time. These students were proficient in their abilities to simplify algebraic expressions. I utilized this opportunity to make these students mentors for those students having difficulty simplifying expressions abstractly.
Standard 8.5.4 solve equations and inequalities. On the pre-assessment, not one student showed the necessary properties of equality to correctly solve the equations. Based on the results, whole group instruction was utilized for the initial stages of instruction. Individual practice was presented on a daily basis. No packets were used at this time for this standard.

Discussion and observation based on this standard noted that students wanted to be instructed as a whole group and work more independently. They stated that they wanted to see the steps and practice by themselves. Instruction continued in a more traditional manner for this standard. However, small group interaction was utilized for the review portion of this standard before the assessment.

The students appeared to pay attention during instruction time. While conversing with other students, they stated that they just wanted to be shown the steps used to solve equations and then practice by themselves. They did not want to go to the board or work in groups.

The students interacted appropriately during the review small group session. I was very pleased to hear students correcting each other while I walked around observing and helping when necessary.

Group Work Discussion Survey. I discussed with the students about group and partner work. The students were becoming a bit distracted and appeared to waste in class work time throughout the previous class periods.
During the discussion about group work, I decided to have the students write down responses to questions to hand in instead of volunteer verbal answers. See Appendix H for a list of survey questions. Below is the summary of student responses to questions.

Do you like group work? Why or why not?

- It was concluded that they liked group work. The major reason they liked group work was that they can check work with and get help from the other members of the group. Students wrote that group work seemed to go faster. One student noted that group work can slow progress down because some students do not fully participate.

Do you like working on homework with partners or groups? Why or why not.

- It was concluded that students liked working on homework with a partner or in a group because then they could help each other out if they did not understand a problem. However, 16% of students noted that they just like to work on homework by themselves to get their work done. One student wrote that he does not like to work on homework with a partner or group because the other people just copy off of him. A lower level student said that he enjoyed working with a partner because he can learn another solution to a problem.

Do you like group projects? Why or why not?
The student responses fell into three categories; I like group projects, I do not like group projects, and it depends on the assignment. Students liked group projects because they could socialize more and learn from their peers. Some students did not like group projects for two reasons. Students either did not like group work because they felt like their voice was not heard in the group or they liked worksheets and book assignments better. Some students who responded with “depends on the assignment” supported the response with comments of arrangements of groups and topics.

Should the teacher or you pick groups? Why?

All but two students noted that students should be allowed to pick groups. The major reason was because they got to work with someone they got along with. Two students indicated that when the teacher picks groups, students do not work with friends and there is less off task behavior as a result.

What is the maximum number of students that should be in a group to work productively? Why?

Seven students mentioned that two is too small, so three would be the perfect number. Ten students thought four would be the perfect number because it is even. Two students noted that five per group means that everyone has a job to do, but the job size is smaller.
Why do you think teachers limit the amount of time you work in groups?

- The typical student response was that teachers limit the amount of group work time because students mess around too much and are easily distracted. Two students stated that teachers want students to work alone to see what the students know on their own. Students acknowledged that they can be easily distracted and off task when they work in groups.

**Teacher journal and reflection.** The following is the summary of journal entries and reflections. The summaries are themed according to student movement, time on task, noise levels, student interaction, teacher stress levels, and general classroom observations.

Student movements varied by lesson. The implementation of this research was the first time the students worked in two ability groups in this class. At first, students were apprehensive about working on different assignments. They were very interested about what another group was doing, so they would make excuses to wander by another group, which led to more movement in the classroom. Students were allowed to seek help from another student in the classroom, creating more student movement, especially if friends were sitting across the room.

Students wasted a lot of in-class work time at the beginning of differentiated grouping. They were busy wondering what was going on in the
other groups and talking about the difference in assignments. Friends socialized periodically while working together and students that finished work early distracted others. The implementation of packet work increased time on task immediately. The students always had more work than could be done in any one class period. However, this seemed to put more stress on the student. They seemed to take more initiative to start and do practice work. I observed students often redirecting each other to assigned work. When solving equations, students used work time extremely well.

Noise levels at the beginning were above acceptable levels. Students thought movement times were free time to talk. Students also thought that just because I was not working with their group, they were free to disturb. The off-task talking was distracting to others trying to work. The students had to be reminded about acceptable noise levels and not to distract others during the first couple class periods. Noise levels became appropriate while working in groups with redirection. Acceptable noise levels and productive work were again associated with the distribution of the work packet.

Students were encouraged and allowed to interact more with the arrangement of groups and with peers checking work. Student interaction varied from day to day. When students became more comfortable in asking one another for help, the more they were allowed and encouraged to work cooperatively together. The students liked the idea of being able to converse more often with
each other during the class period. I especially appreciated days when students would correct each other or lend a hand in an appropriate way. Math vocabulary seemed to improve with student interactions as they would use specific math terminology more often instead of speaking in general terms.

A very interesting observation was noted after approximately five days of intense group work and interaction: students had a strong desire to work by themselves. They also wanted to be taught in a more traditional manner. Therefore, I showed them how to perform the mathematical operations and they practiced them. The work packet led to a balance of interaction and individual work.

I was very stressed when the research began. I felt like I had less control of the classroom with all the student movements and higher noise levels. I explained to the students what appropriate noise levels and movements look like as to not bother working individuals. Modeling and redirection modifications helped lower stress levels and improve classroom atmosphere.

Developing two lessons and student practice added to my work load and stressed me out from time to time. The extra correcting and attention to proficiency levels was very time consuming. I noted in my journal one day that the more I differentiate, the better I will get at it, and the less time it will take me.

**Post-assessment.** A post-assessment was given upon completion of the unit. The post-assessment was the exact same assessment as the pre-assessment,
Appendix A. The post-assessment was taken on the same day as the solving equations and inequalities quiz summative assessment.

**Standard 8.1.7 operations with integers.** Six students answered all the questions in this section correctly. One student still had problems with negatives and the rest of the students made one or two small errors with the arithmetic. However, 95% of the students showed proficiency.

**Standard 8.5.1 extend numerical patterns.** Sixty-eight percent of the students answered the three questions in this section with a correct and appropriate response. Two students explained the situation incorrectly, while four students made a small error somewhere in the section.

**Standard 8.5.2 using variables, expressions, and equations to represent problem situations.** Eight students drew a picture to represent the problem and eight students represented the problem with a variable equation. Three students did not attempt the question. Based on the individual student performance, this standard could have used more work during the instruction period. However, from an instructor’s perspective, it was nice to see the problem attempted in two different ways.

**Standard 8.5.3 simplifying algebraic expressions using order of operations.** One student answered every question correctly. Two students needed more work with simplifying algebraic expressions, such as, combining like terms with negatives. The rest of the students had difficulties with questions 21 thru 23.
One could say all students were proficient with this standard based on the vague language the standard is written in and my interpretation of it. Lab gear was made available to the students when they took the assessment, however, not one student seized the opportunity to use it.

**Standard 8.5.4 solve equations and inequalities.** Fifty-eight percent of the students correctly showed all necessary work and properties of equality. Only three students made an error with the inequalities. The rest of the students only made a small error within the section.

**Student interest survey.** The student interest survey, Appendix F, was given to students after the completion of the post-assessment. The interest survey was given to the students with the intent of helping choose an interest project to demonstrate content knowledge. The results of the interest survey were helpful; however, their responses had no effect on their decision in choosing a project. This survey should have been given at the beginning of the unit to get a better understanding of the students in my class for the purpose of grouping, assignments, teaching pedagogy, etc.

**Student interest project.** Students chose an interest project after completion of the post-assessment and interest survey. The only instructions the students were given was that they have to come up with a way to demonstrate content knowledge. I limited the content to Standard 8.5.4 Solve Equations and Inequalities. This was done to limit the size of projects due to available class time.
The students had a difficult time coming up with project ideas. I did not give suggestions until they gave me a description of their project. After students had time to think about what they wanted to do for a project, a student approached me about making an instructional video. As he was talking to me about his project, I noticed that the majority of students were focused on every word he was saying. I heard in the background a couple students expressing that they could never make a video and that it would be embarrassing.

The next project that was brought to my attention was a test. Immediately after hearing the idea, eight students also wanted to make a test. I told the students that the test would have to contain a typed blank test sheet and a completed answer key with work shown. They repeatedly asked me how many questions had to be on the test. I never gave them a specific number, but instead stated that the test had to cover the necessary material and demonstrate that they understood the material. The students averaged 12 questions per quiz, 4 being inequalities. The questions varied in difficulty. The students basically covered all types of equations that I would normally put on a test. This did not surprise me too much because the students had already completed the quizzes, unit test, and post assessment.

Another project was a PowerPoint. Five students wanted to make a PowerPoint. It seemed like a couple of the students who disliked taking tests made the PowerPoint. Similar to the tests, the students had to create problems and
demonstrate the solution steps. Three of the projects were very minimalistic, while two were thorough and complete. It was obvious which students spent more time and effort on the project.

The final student interest project was a poster. The poster contained the necessary equation and inequality problems, just fewer of them. I liked the poster because I could use it for demonstration.

My stress levels were at their lowest during the interest project. In fact, I enjoyed seeing the students take ownership of the project. The students were in charge of their own project and they seemed to take ownership of it. A few students had to rework problems many times to get integer answers, because they did not want decimals or fractions.

I gave the students credit for completion. Even though I thought that the project option for demonstrating knowledge of solving equations was limited, I was pleasantly surprised with what the students produced.

**Interpretation of Results**

The first sub question, “How does differentiated instruction affect teacher instruction?” was successfully answered based on the specific differentiation techniques and students involved. Multiple data collection and instruction methods were instituted to establish credibility.

Standards were addressed to establish clear learning goals. The pre-assessment established clear standard readiness levels. Instead of normally
teaching the entire class a lesson, I broke the class up into groups based on
individual academic needs to work on skill development. This allowed for more
individual, focused instruction time for students.

Students were encouraged to help one another during group and individual
work time. This seemed to relieve my burden of feeling like I have to be
responsible to help everyone in the class with every problem. The students also
became comfortable asking a neighboring student for help and clarification before
reverting attention and reliance to me.

The different student movements and noise levels caused initial stress and
feelings of lack of classroom control. Additional preparation of multiple lessons
and student practice added to my normal work load. Compiling the additional
workload with classroom control stressors, I started to give differentiated
instruction a second thought. Was the additional work and new stress really worth
it? Instilling appropriate classroom movement modeling procedures and
redirection cues regained the sense of classroom control. Noise levels returned to
appropriate levels, maintaining a sense of productivity. Additionally, the work
packet for student practice and occasional mix of whole group instruction with
individual work activities was enough to give me the sense that I was using my
instruction time wiser than in the past. I reflected more about what would help the
individual student. I also became more comfortable and excited about changing
lessons and activities. Differentiation soon became a device for better individual education, not just a burden.

Upon completion of the post-assessment, I felt all the work that I put into differentiated preparation and implementation was valuable and beneficial.

Through the performance of the pre/post-assessments, I saw documented student growth and standard acquisition.

The second sub question, “How do student interest projects affect student learning?” was answered with completion of a student interest project and teacher observations. The dependability of the results could be questioned because the interest project that demonstrated content knowledge was given after the unit test and post-assessment. The options for demonstrating knowledge of solving equations seemed limited to the students. They were very observant of one another’s ideas. Also, an interest project could replace the normal assessment and I could have encouraged students to follow project paths more than what I did.

The student interest project shifted the ownership of product from me to the students. Once the students came up with a project, they took ownership of the material and made it their own. Most students put forth enough effort to show the necessary content knowledge. However, three students produced inferior projects from an obvious lack of effort and wasted in-class work time, which was expected given their past work history. If I were grading this project as a final unit assessment, the student’s work would not be accepted until it covered all the
necessary content. The usage of a rubric or checklist might prevent future instances of unacceptable work.

The students seemed to be proud of the work they completed. Some students worked and reworked combinations of variable expressions so that the solution would be an integer. The persistence they showed seemed to give them a sense of competence that I have not previously witnessed.

The third sub question, “How does ability grouping affect student learning?” can only be imprecisely answered based on the small amount of ability grouping that actually happened in the classroom. More group work, not ability group work, was actually used based on the student needs. Initial ability grouping was used for Standard 8.1.7 Operations with Integers, but disbanded for the rest of the standards because the students were more homogeneous with base knowledge.

The ability grouping that occurred was beneficial to the students because the students who needed help with prerequisite concepts, such as negative numbers, received the needed personalized instruction, while other students were able to work on more complicated assignments. Using ability grouping helped the lower level student achieve success and the higher level student from being bored. I believe grouping also helped the students that had difficulties with number representation better understand the properties of equality and showing work.

The initial ability grouping negatively affected students at first because of all the different student movement around classroom. Students were easily
distracted by movements and curiosities about their peers’ assignments. I expected some distractions, but not to the levels that occurred.

The main research question, “How does differentiated instruction affect student learning?” was sufficiently answered based on the differentiation done in the classroom and the results from the three sub-research questions. Qualitative data collection methods were instituted for trustworthiness. Content, process, and products were varied or changed to meet the student’s ever changing needs. Validity was established by focusing teacher instruction to student proficiency of state math standards and completion of pre/post-assessments.

Changing the activities and classroom set-up allowed the students to view material in multiple ways leading to skill mastery. Encouragements in appropriate student interaction surprisingly lead to observations of mathematical conversation and discussion. Student conversations and discussions demonstrated content knowledge.

I received the expected results I hoped for when I focused more on individual student needs and changed the dynamics of the classroom to meet those needs. Differentiated instruction with ability groups, group work, pre/post-assessments, and a student interest project had a positive impact on student learning through standard proficiency acquisition.
Summary

I have found that differentiated instruction had a positive effect on student learning as the collected data and answering three sub-research questions indicated. The pre-assessment was a driving factor for ability grouping and subsequent instruction choices. After the initial shock in routine changes, I felt comfortable changing instruction techniques and classroom arrangements. I also discovered that students enjoyed a balance of group and individual work. Giving students more work than is possible to finish in any class period helped focus work time. Allowing and encouraging students to seek help from one another relieved teacher stress and produced positive student interaction.

Conclusions, action plans, general reflections and recommendations will be presented in chapter 5.
Chapter Five

Conclusions, Action Plan, Reflections, and Recommendations

The purpose of my research was to see how differentiated instruction affected student learning. Ability grouping after a pre-assessment and a student interest project were the specific differentiation tools utilized in this study. Teacher’s instructions and reflections were also noted. This chapter will discuss conclusions, an action plan, reflections and recommendations.

Conclusions

The following is a summary of conclusions for the three sub research questions and main research question.

How does differentiated instruction affect teacher instruction?

Differentiated instruction affected teacher instruction by creating additional stress and workload for the teacher. The stress developed out of a sense of loss of control of the classroom atmosphere, due to the new and louder than normal student movements. Control was regained by using appropriate redirection methods for individual students and demonstration of expected classroom movements and productive noise. The workload increased because I needed to prepare more than one student practice activity for one class. More individual instruction time was evident during small group instruction. Also, I did not feel like I had to help every student that needed help because I encouraged students to ask a peer first before asking me. I became more comfortable using differentiated
instruction methods the more I used them. The methods were not random, but focused on the student acquisition of state standards. I feel differentiating for the sake of differentiating would have had negative effect on student achievement. Extremely high teacher stress levels and over active classrooms were the result of ill-advised differentiated instruction that is not focused.

**How do student interest projects affect student learning?**

A variety of student interest projects seemed limited because the students had never before been asked to demonstrate content knowledge. Typically, the students completed teacher made assessments. Consequently, 56% of the students wanted to make a test with a corresponding key. The tests and work were of high quality. Twenty six percent of the students made a PowerPoint, one student made a video, and the other project was a poster. The poster and PowerPoint were of lesser quality. The students took ownership of their projects. I will continue to use interest projects, both summative and informative, as I feel they are a valuable tool for assessment. Interest projects could also be utilized as a review tool before a summative assessment. The interest survey should be given before units or at the beginning of the year to get to know the students before the assessment.

**How does ability grouping affect student learning?**

Ability grouping initially affected students negatively because the students were not accustomed to the classroom set up. Through practice, the students became familiar and accustomed to working in the smaller group format. The ability
groups worked for the instruction of some standards, but not as well for others. The ability groups were very useful when prerequisite concepts were needed for the current lessons. Students did not want to work in ability groups all the time. They could also just work with a partner or in a small group format without regard to academic ability. A balance of small group work, partner work, ability group work, and whole group instruction was needed to effectively differentiate.

**How will differentiated instruction affect student learning?**

Appropriate differentiated instruction had a good impact on student learning. I focused more on the state standards and where each student fell on the continuum. The classroom activities allowed the students to see material in multiple ways leading to skill mastery, which was evident with the use of a pre/post-assessments. There is not a one-size-fits-all approach to differentiation. The differentiation and results may have looked differently in another class because other students might have different needs. The tool that I feel should be used in every classroom is a unit pre-assessment. I felt that the pre-assessment gave me the most feedback during this research. I knew students’ readiness, ability levels, and mistakes most often made before I even began instruction. Differentiated instruction also lead to increased reflection about student learning.

**Action Plan**

I plan to continue differentiating my classroom instruction. The differentiation will be focused and directed by utilizing pre-assessments. The pre-
assessments are what will drive my decision making on what differentiated instruction techniques to use with my students. I will continue to add more strategies to my “differentiation tool box”.

I will modify my differentiation by giving the interest survey at the beginning of units and/or school year. I feel that the more I know about the students earlier on, the more I will be able to help them. I will also work on developing appropriate classroom movement expectations and instilling them in the students.

**Reflections and Recommendations for Other Teachers**

This project gave me the courage to try new things and let them happen normally. I did not try to control every aspect of the classroom. Some days I stood back to watch how the differentiation would unfold. Sure, some days I felt like abandoning the project and choosing a new topic, but I stuck with it. I am glad I did as the hard work paid off and my students made academic gains.

If I were to redo this project, I would have spent more time at the beginning of instruction demonstrating how the students were to move about the classroom, what appropriate noise levels and conversation should look like in the classroom. I would also have developed an action plan for students that did not adhere to the classroom expectations. The noise levels of a differentiated classroom can be higher than normal, but there needs to be appropriate levels so
that other students are not distracted and can work productively. The classroom should never turn into a “romper room” with students constantly off task.

This project has shown that individual students have different needs. Therefore, a teacher new to differentiation should first start their journey developing a pre-assessment based on the standards they are to teach. I believe the single most important tool in differentiation is the pre-assessment. Then, based on student needs, try differentiating a little at a time. Always remember, do not differentiate just to differentiate, but differentiate in a way to help the student acquire standard proficiency.

**Summary**

This chapter discussed conclusions, an action plan, reflections and recommendations. Differentiated instruction helped me focus my instruction on the mathematical needs of individual students. The differentiated instruction had a positive effect on student learning. The pre-assessment was found to be the most important tool that drove differentiation. Teachers new to differentiation should start with developing a pre-assessment based on content standards. Differentiation should be directed to meeting the needs of students.
References


   Alexandria, VA: Association for Supervision and Curriculum Development.


   Larchmont, NY: Eye On Education


Appendices
Appendix A

Experiencing the Unknown Unit Pre-assessment

**ETU** | **Unit Pre-assessment** | **Name**____________________
---|---|---
This assessment will be used to see what you know before we begin the unit. This pre-assessment is not graded, but I expect you to answer all questions as completely as you can. The state math standards tested are written for your convenience.

*(State Math Standard 8.1.7 Operations with Integers)*

### Simplify each expression

1. $-4 + 9$
2. $-3 + (-3)$
3. $3 - (-6)$
4. $-2 - (-6)$
5. $-(1 - 7)$
6. $(−3)(−2)$
7. $−5 · 6$
8. $\frac{8}{4}$
9. $\frac{-27}{-3}$
10. $-5(3 - 4) + 6$

*(State Math Standard 8.5.1 Extend Numerical Patterns)*

Use the following to answer questions 11 through 13. Suppose you have a jar in which to save pennies. You begin with 3 pennies in the jar and add four pennies each day.

11. Find the number of pennies for days 1, 2, 3, …, up to 10 days.
12. Find the number of pennies in the jar after 50 days. Explain your thinking.

13. Describe a way that you could find the number of pennies in the jar for any number of days. Show an equation if necessary.

State Math Standard 8.5.2 Using Variables, Expressions, and Equations to Represent Problem Situations

14. The area of a rectangle is 24 square inches. The width is $x$ inches and the length is $2x$ inches. What are the dimensions of the rectangle?

State Math Standard 8.5.3 Simplifying Algebraic Expressions using Order of Operations

Simplify the following expressions.

15. $x + y + y$
16. $x^2 + y^2 + x + x^2$

17. $4x + x^2 + 1 + 5x$
18. $-x^2 - 6x + 1 + 4x^2 - 3x$

19. $3(x + 2)$
20. $-(y - 2)$

21. $x(x + 6)$
22. $(x + 4)(x + 3)$

23. $(x + 2)^2$
24. $(4y + 3) - (y + 8)$
State Math Standard 8.5.4 Solve Equations and Inequalities

Solve the equation. Show all work.
25. \(5x = 25\) \hspace{2cm} 26. \(y - 7 = 6\)

27. \(3x + 5 = 23\) \hspace{2cm} 28. \(4y - 11 = y + 10\)

Solve the inequality. Graph the solution on a number line. Show all work.
29. \(2x > 6\) \hspace{2cm} 30. \(3x - 5 = 19\)
Appendix B

IRB Approval Form

Notice of IRB Approval

Name of Principal Investigator: Dominique Bondley

University Address: Mathematics

Title of Project: How Will Differentiated Instruction Affect Student Learning

December 14, 2010

The above project has been reviewed and approved by the IRB under the provisions of Federal Regulations 45 CFR 46.

This approval is based on the following conditions:

1. The materials you submitted to the IRB provide a complete and accurate account of how human subjects are involved in your project.

2. You will carry on your research strictly according to the procedures as described in materials presented to the IRB.

3. You will report to the chair of the Institutional Review Board any changes in procedures that may have a bearing on this approval and require another IRB review.

4. If any changes are made, you will submit the modified project for IRB review.

5. You will immediately report to the IRB Chair any problems that you encounter while using human subjects in your research.

Dr. Brent A. Askvig
Chair, Minot State University’s IRB
Appendix C

Parent/Guardian Research Consent Form

How Will Differentiated Instruction Affect Student Learning

**Invitation to participate:** Your child is invited to participate in a study of differentiated instruction to see how it will affect student learning. This study is being conducted by Dominique Bondley, mathematics teacher at Simle Middle School, and a graduate student at Minot State University. Mr. Riehl, principal of Simle Middle School, has approved this research study.

**Basis for Subject Selection:** Your child has been selected because he/she is in Mr. Bondley’s 3A Math 8 class. This class was chosen based on a random selection process. If everyone agrees to participate, there will be nineteen students who will meet the criteria for the study.

**Overall Purpose of Study:** The purpose of this research is to help me and possibly other mathematics teachers improve teaching strategies to benefit the students. The main goal of this study is to see how differentiated instruction, specifically small group instruction and student interest projects, will affect student learning.

**Explanation of Procedures:** If you decide to allow your child to participate, your child will be asked to do the following:

1. You will participate in an ungraded unit pre-test to determine ability groups. They will work in groups on tiered assignments that meet the students on their own individual levels.
2. You will be asked to take an interest survey. The results of the interest survey will be utilized to develop an interest project where the student will chose how he/she will demonstrate content knowledge.
3. You will participate in a normal unit post-test for grading purposes.
4. You will take a unit completion survey to gather student responses about the differentiated instruction.

The identity of all participants will remain confidential. Students will not be identified in the research report. All research and observations will be done in the classroom. The implementations will span approximately 5 weeks, from January 2011 to February 2011.
Potential Benefits: Each participant will receive more individual and small group instruction. Students will also participate in the development of a project based on individual interests, hopefully, leading to ownership of education.

Alternatives to Participation: If you decide to not allow your child to participate, he/she will still work on the same material. However, any teacher observations or student responses to survey questions will not be included in the research report.

Assurance of Confidentiality: The identity of all participants and their data will remain confidential and stored in a locked file cabinet or on a password-protected computer. Any data collected will not be linked to the participants or the school district in any way. Following the study and completion of my master’s degree, all data will be destroyed.

Withdrawal from the Study: Your child’s participation is voluntary. Your decision whether or not to allow your child to participate will not affect his/her grade. If you decide to allow your child’s participation in the study, you are free to withdraw your consent at any time by contacting Mr. Bondley and your participation will be discontinued.

You are free to ask questions now or at any time during the study. If you have questions, you can contact Dominique Bondley at 323 - 4600 or dominique_bondley@bismarckschools.org. This project has been approved by Minot State’s Institutional Review Board. If you have questions about the rights of research subjects, contact the Chairperson of the MSU Institutional Review Board (IRB), Brent Askvig at 701-858-3052 or Brent.Askvig@minotstateu.edu.

Guardian Consent: You are voluntarily making a decision whether or not to allow your child or legal ward to participate. You signature indicates that, having read and understood the information provided above, you have decided to permit your child or legal ward to participate. You will be given a copy of this consent form to keep.

Participant (please print student name)

_________________________________________  Date

Signature of Parent or Guardian

_________________________________________  Date

Signature of Researcher
Appendix D

Research Participant Consent Form

How Will Differentiated Instruction Affect Student Learning

Invitation to participate: You are invited to participate in a study of differentiated instruction to see how it will affect student learning. This study is being conducted by Dominique Bondley, mathematics teacher at Simle Middle School, and a graduate student at Minot State University. Mr. Riehl, principal of Simle Middle School, has approved this research study.

Basis for Subject Selection: You have been selected because you are in Mr. Bondley’s 3A Math 8 class. The class was chosen based on a random selection process. If everyone agrees to participate, there will be nineteen students who meet the criteria for the study.

Overall Purpose of Study: The purpose of this paper is to help me and possibly other mathematics teachers improve teaching strategies to benefit the students. The main goal of this study is to see how differentiated instruction, specifically small group instruction and student interest projects, will affect student learning.

Explanation of Procedures: If you decide to participate, you will be asked to do the following:

1. Participate in an ungraded unit pre-test to determine ability groups. The students will work in groups on tiered assignments that meet the students on their own individual levels.
2. Take an interest survey. The results of the interest survey will be utilized to develop an interest project where the student will chose how he/she will demonstrate content knowledge.
3. Participate in a normal unit post-test for grading purposes.
4. Take a unit completion survey to gather student responses about the differentiated instruction.

The identity of all participants will remain confidential. You will not be identified in the research report. All research and observations will be done in the classroom. The implementations will span approximately 5 weeks January 2011 to February 2011.
**Potential Benefits**: You will receive more individual and small group instruction. You will also participate in the development of a project based on individual interests hopefully leading to ownership of education.

**Alternatives to Participation**: If you decide not to participate, you will still work on the same material. However, any teacher observations or student responses to survey questions will not be included in the research report.

**Assurance of Confidentiality**: The identity of all participants and their data will remain confidential and stored in a locked file cabinet or on a password-protected computer. Any data collected will not be linked to the participants or the school district in any way. Following the study and completion of my master’s degree, all data will be destroyed.

**Withdrawal from the Study**: Your participation is voluntary. Your decision whether or not to participate will not affect your grade. If you decide to participate in the study, you are free to withdraw your consent by notifying Mr. Bondley and discontinue participation at any time.

You should feel free to ask questions now or at any time during the study. If you have questions, you can contact Dominique Bondley at 323-4600 or dominique_bondley@bismarckschools.org. This research has been approved by Minot State’s Institutional Review Board. If you have questions about the rights of research subjects, contact the Chairperson of the MSU Institutional Review Board (IRB), Brent Askvig at 701-858-3052 or Brent.Askvig@minotstateu.edu.

**Participant Consent**: You are voluntarily making a decision whether or not to participate. You signature indicates that, having read and understood the information provided above, you have decided to participate. You will be given a copy of this consent from to keep.

_______________________________
Participant (please print name)

_______________________________
Signature of Participant  Date

_______________________________
Signature of Researcher  Date
Appendix E

Principal Consent Form

I. Research Background (to be completed by researcher)

Title of the Study: How will differentiated instruction affect student learning?

Name of Researcher: Dominique Bondley Phone: (701) 222-3287

Street address: 61 N Stanley Dr. City: Lincoln State: ND Zip: 58504

E-mail: dominique_bondley@bismarckschools.org

II. Description of Research Proposal

The purpose of this research is to see how differentiated instruction affects student learning. The researcher will use small group instruction and student interest projects to answer the main research question. Students will complete pre-tests, post-test and surveys during the course of the research. The researcher will record observations and conversations in a daily journal. The researcher will also provide the principal with a copy of the executive summary.

III. Agreement (to be completed by principal)

I, __________________________, principal of _______________________school, understand

- the study and what it requires of the staff, students, and/or parents in my school,
- that the privacy and confidentiality of any staff or student will be protected,
- that I have the right to allow or reject this research study to take place at my school,
- that I have the right to terminate the research study at any time,
- that I have the right to review all consent forms and research documents at any time during the study and up to three years after the completion of the study.

☐ I grant permission to the researcher to conduct the above named research in my school as described in the proposal.

☐ I DO NOT grant permission to the researcher to conduct the above named research in my school as described in the proposal.

☐ I understand that data should be released only by the departments that own them. My staff and I shall not release data to the researcher without approval from the IRB.

_________________________________  ________________
Signature of Principal                  Date
Appendix F

ETU Student Interest Survey

Student Interest Survey

Name ____________________

1. Person who is my hero is because

2. The three things I do best in school are:

3. Math can be more exciting by:

4. Outside of school, my favorite activity is:

5. Something about me that I would like to share:

6. Favorite kind of music:

7. Favorite place to be and why.

8. Name someone you admire and why.

9. What is a responsibility you have?

10. What do you want to do for a career?

11. What are two common activities you do after getting home from school.
12. What is something that you daydream about?

13. What would the title of a book about your life be?

14. If you could go back two years ago, what advice would you give yourself?

15. Describe yourself as a friend.

16. School would be better if...

17. If I had a million dollars I would...

18. I like most about this class when...

19. I like least about this class when...

20. I am good at...

21. When I have quiet time I like to ...

22. If you really want to interest me in school you would...

23. I like to work:
   By myself in pairs in a small group

24. When I work in a group I tend to
   Listen more than speak be a leader help where needed
25. I like to learn by:
   Listening   doing   talking things through with someone else

26. When my teacher gives an assignment, I like to
   Have exact steps for completing it   create my own steps for completing it
Appendix G

Differentiated Instruction Student Survey

Differentiated Instruction Survey

Name_______________________

Please answer all questions as thoroughly and completely as you can. All answers will be used to better future student instruction. Honesty is greatly appreciated.

1. Do you like pre-assessments? Why or why not?

2. How do pre-assessments affect your learning?

3. What did you think/feel about working in different groups?
4. How does working in groups affect your learning?

5. What did you like and dislike about the interest project?

6. How did the student interest project affect your learning?

7. How did you feel taking the post-assessment (Unit test)?

8. How did this differentiated unit affect your learning? Give specific examples and explanations.
Appendix H

Group Work Survey Questions

1. Do you like group work? Why or why not?

2. Do you like working on homework with partners/groups? Why or why not?

3. Do you like group projects? Why or why not?

4. Should the teacher or you pick groups? Why?

5. What is the maximum number of students that should be in a group to work productively? Why?

6. Why do you think teachers limit the amount of time you work in groups?