

5-2009

# Differentiated Instruction and Tiered Assignments

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Differentiated Instruction is not a new concept for teachers. Since the days of the one-room school house teachers have been differentiating to help their students reach deeper understandings of content and to succeed in their education. Teachers have used several strategies to teach content; one in particular is tiered assignments. Through pre-assessments teachers can evaluate students' readiness, group them by standard knowledge and create tiered assignments based on these readiness levels. Each tier will be based on the same content standard and carry the same workload, however, the nature of the assignments will vary. Through this effort teachers can teach from their students' content knowledge, not from where the curriculum starts. Results of this study show that despite several unavoidable factors, differentiation can still affect students' basic understandings of mathematics content, help them to improve assessment scores, and achieve success.

## **Document Type**

Thesis

## **Degree Name**

MS in Mathematics, Science, and Technology Education

## **First Supervisor**

Diane Barrett

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Differentiated Instruction and Tiered Assignments

By

Elizabeth R. Hogan

Submitted in partial fulfillment of the requirements for the degree

M.S. Mathematics, Science and Technology Education

Supervised by

Dr. Diane Barrett

School of Arts and Sciences

St. John Fisher College

May 2009

## Abstract

Differentiated Instruction is not a new concept for teachers. Since the days of the one-room school house teachers have been differentiating to help their students reach deeper understandings of content and to succeed in their education. Teachers have used several strategies to teach content: one in particular is tiered assignments. Through pre-assessments teachers can evaluate students' readiness, group them by standard knowledge and create tiered assignments based on these readiness levels. Each tier will be based on the same content standard and carry the same workload, however, the nature of the assignments will vary. Through this effort teachers can teach from their students' content knowledge, not from where the curriculum starts. Results of this study show that despite several unavoidable factors, differentiation can still affect students' basic understandings of mathematics content, help them to improve assessment scores, and achieve success.

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### Differentiated Instruction and Tiered Assignments

Differentiated instruction is not a new philosophy; teachers have been doing it for years and possibly not even knowing it. Differentiated instruction has evolved and taken several different forms, one form is tiered assignments. By researching differentiated instruction one can learn more about tiered assignments and how to implement them into a classroom. Through tiered assignments teachers can guide their students to greater achievement by creating assignments that will better suit their learning styles and ability levels. Tiered assignments are used so that all students focus on essential understandings and skills but work at different levels. They also ensure that each student is appropriately challenged and that they each come away with the skills and understandings needed for continual success. Students can attain continual success because teachers can begin at each student's individual level. Tiered assignments allow teachers to start where their students need to.

The following study explores differentiation, generally, and a specific differentiation method, tiered assignments. It will explain how to tier assignments and give various examples. It will also explore how differentiation and the implementation of tiered assignments can affect students' achievement levels. Students will be introduced to tiered assignments and will work at the tier that best suits them. By working at individual tiers the students will gain essential understandings and be able to achieve success.

## Literature Review

Similar to the one-room schoolhouse of years ago, teachers today are still challenged with effectively reaching out to the diverse learners in their classroom. Today, the students in one classroom are relatively the same age but differ in their readiness level, personal interests, cultural background, and experiences. Differentiated instruction is an effort to reach all students so that they each may succeed in their educational careers. Aspects of differentiated instruction covered in this literature review are differentiation, defined; application and assessment of differentiated instruction; tiered assignments and various examples of tiered assignments.

### *Differentiation by Definition*

Tomlinson (1999) stated that “in a differentiated classroom, teachers begin where the students are, not in front of the curriculum” (p. 2). She also stated that through differentiation “they [teachers] embody common sense and recognize that students are individuals.” By recognizing that students are individuals “teachers ensure that a student competes against himself as he grows and develops more than he competes against other students” (p. 2). This allows students to work harder and continually achieve success, reach goals, and challenge themselves. Tomlinson further claimed that (2001) “a differentiated classroom provides different avenues to acquiring content, to processing or making sense of ideas, and to developing products so that each student can learn effectively” (p. 1). A different avenue to acquiring content allows students the opportunity to learn by their own learning style. It allows students the chance to be creative and demonstrate their uniqueness.

Differentiated instruction is proactive, meaning that teachers need to work with their students to help them to have a positive learning experience. Teachers need to express the importance of the qualitative attribute of learning, and not focus on the quantity. Differentiated instruction can become student centered and organic because the learning can be adapted for the students so they may gain the most success. Pierce and Adams (2004) stated that, "it is an organized, yet flexible way of proactively adjusting teaching and learning to meet students where they are and help all students achieve maximum growth as learners" (p. 59). A key term to Pierce's definition is that differentiated instruction must be flexible. Differentiated instruction must allow students the opportunity to learn using a method that is most comfortable to them. By doing this, each student can achieve maximum growth. Levy (2008) defined differentiation as, "a set of strategies that will help teachers meet each child where they are when they enter class and move them forward as far as possible on their educational path" (p. 162). Levy suggests that each student is unique and has a variety of experiences when they enter the classroom and in order for them to reach success in their education teachers must meet them where they are in their education.

Tomlinson and Eidson (2003) stated, "Differentiated Instruction refers to a systematic approach to planning curriculum and instruction for academically diverse learners, which means that a classroom should have dual goals of honoring each student's learning needs and maximizing each student's learning capacity" (p. 3). Honoring each student's learning needs can be done by utilizing the differentiated instruction strategy of tiering assignments. This will help students to maximize their learning. Differentiation affects several aspects within a classroom. For all students to achieve success Lewis and

Batts (2005) said that “the practice of adjusting the curriculum, teaching strategies, and classroom environments will meet the needs of all students” (p. 27). Kapusnick and Hauslein (2001) agreed by stating that “students learn better and more easily when teachers use a variety of delivery methods providing students with learning experiences that maximize their strengths” (p. 156).

Students come from different backgrounds and have various experiences when they enter a classroom. Cox (2008) said that, “rather than adopting a standardized approach to teaching that seems to presume that all learners of a given age or grade level are essentially alike, one has to start where the students are. Differentiated instruction is teaching with student variance in mind” (p. 53). Keeping student variance in mind allows students to learn by their unique style. According to Chapman and King (2005), “differentiated instruction adapts learning to the students’ unique differences” (p. 20). Adapting learning to the students’ unique differences allows the students to use their own creativity as they learn. They are given the chance to learn by a style that they are comfortable with thus reaching success in learning.

The goal of every teacher is to maximize learning for all students. According to Allen et al. (2008) that is the definition of differentiated instruction, “a concept that makes it possible to maximize learning for ALL learners” (p. 5). All learners can learn if the differentiation is fair and developmentally appropriate. Wormeli (2005) adds, “including giving students the tools to handle anything that is undifferentiated” (p. 29). Proof of the learning, and of differentiated instruction practices, comes when students do well on assessments.

Differentiated instruction has several components, each that can be highlighted, discussed, and explained in various ways; although, among all of these components there are underlying commonalities. Differentiated instruction is student centered and allows for flexibility as it varies instruction to meet students where they are in their educational and life experiences. It offers students the chance to be creative and maximize their learning qualitatively. This is how differentiated instruction will be defined throughout this study.

### *Differentiation in Action*

Classrooms that incorporate differentiation will have characteristics such as these outlined by Kapusnick and Hauslein. (2001). "teachers recognize development of their students and use information about readiness, interests, and learning styles as the basis of instruction, and they use that information in a variety of modalities to address individual needs" (p. 157). Some presentation can be varied orally, visually, through demonstration, by showing a part to a whole, and by showing a whole to a part. One will also see that "students participate in purposeful, valued learning activities, and students have choice of topics or modes of expression based on their own interests and learning styles" (Kapusnick and Hauslein, 2001, p. 157). Another important attribute in a differentiated classroom is that homework is seen as an extension of individual understanding and skill level. These are just some of the characteristics of a differentiated classroom that one may see from the outside looking in.

Looking deeper into ways to differentiate, Tomlinson and Eidson (2003) said there are "five classroom elements that can be differentiated or modified to increase the likelihood that each student will learn as much as possible" (p. 3). The five elements are:

content, process, product, affect, and learning environment. Content is what is being taught and how we give access to the information and ideas that matter. How students come to understand and own the knowledge, understanding, and skills essential to a topic is process. When a student demonstrates what he or she has come to understand and is able to do as a result of study is the product. Affect is how students link thought and feeling in the classroom. The learning environment is the way the classroom feels and functions.

The material one teaches is the content and it is derived from national, state, and local standards. When dealing with content Tomlinson and Eidson (2003) said that, "the teacher is the source of synthesis for standards, texts, and guides" (p. 4). It is important to differentiate content in response to student traits because students vary in readiness, interest, and learning profile.

Process is similar to content, however, Tomlinson and Eidson (2003) said, "the process can be thought of as the beginning when the teacher asks the students to stop listening or reading and to begin making personal sense out of information, ideas, and skills they've accessed" (p. 5). This requires that students think about ideas, deal with problems and use information. Process is often in the form of activities. During process students can relate the information to prior experiences and knowledge they have, thus making deeper personal connections.

Products are demonstrations of what students know, understand and are able to do. They are generally a culminating demonstration of student learning at the end of a long period of learning. They call on students to use what they know and use it in a professional manner. As defined by Tomlinson and Eidson (2003), "high quality product

assignments are written and guided in ways that support success in both the process of working and the product itself” (p. 5). Powerful products are produced when flexibility is allowed. Flexibility in products needs to be allowed especially in classrooms with learner variance. Tests are the typical product assignment, and Tomlinson and Eidson stated that, “tests should enable rather than impede a student’s ability to show how much he or she has learned” (p. 8). Other examples of products are stories, summaries, dioramas, music, comic strips, and videotaped dramatization of a scene, written script or PowerPoint presentations on what was learned.

Affect is how students link thought and feeling in the classroom. Affect can be taught by example. The teacher can model respect, help students develop multiple perspectives on important issues, help students to develop empathy for each member in the classroom, ensure that students are each accountable in participation, coach students to work for their personal best and celebrate growth. According to Tomlinson and Eidson (2003) “affect is differentiated both proactively and reactively by the teacher” (p. 11) one must be able to plan differentiation and be ready for on-the-spot differentiation.

The visible and invisible classroom structure that enables the teacher and the students to work in ways that benefit both individuals and whole class is the learning environment. Differentiating learning environment can be done by allowing for flexibility in space, time, and materials. Decisions about space, time, and materials can be made by the teacher and the class. In a learning environment Tomlinson and Eidson (2003) stated that, “the goal of flexible space is to enable the teacher and the students to work in a variety of configurations and to do so smoothly and efficiently” (p. 11).

Tomlinson and Eidson also stated that, “goals related to flexible materials in

differentiated classrooms include making sure students have both what they need to pursue their own learning goals in preferred ways and what they need to work together toward class goals" (p. 12). Time is the most valuable commodity in any classroom. It enables and inhibits learning. Teachers have to differentiate time and cut it into chunks so that they may distribute it evenly to everyone.

Teachers must differentiate or modify these five classroom elements to increase the likelihood that each student will learn and in addition respond to student characteristics as they craft curriculum and instruction. There are three characteristics to look at: readiness, interest, and learning profile. Readiness reflects what a student knows, understands and can do today in light of what the teacher is planning to teach. Tomlinson and Eidson (2003) stated that "the goal of readiness differentiation is first to make the work a little too difficult for students at a given point in their growth and then to provide the support they need to succeed at the new level of challenge" (p. 3). Teachers have to present several learning options at different degrees of difficulty to be sure students are challenged at varied readiness levels. For example in a science class where magnetism is being studied, "one tier of students at a lower readiness level might work very concretely by investigating the kinds of objects that a magnet can attract given a set of 10-12 objects" (Adams & Pierce, 2003, p. 32). The second tier would be where students of a more advanced level of readiness investigate whether the size of a magnet affects its strength. This is a more abstract concept for students.

A student's interest is what they enjoy learning about, thinking about, and doing. Tomlinson and Eidson explained that, "the goal of interest differentiation is to help students connect with new information, understanding, and skills by revealing

connections with things they already find appealing, intriguing, relevant, and worthwhile” (p. 3). A way to get to know students like Tomlinson said is to pre-assess their interests. Adams and Pierce (2003) claimed that a “teacher can design an interest inventory that lists several topics students will be studying or several activities that the teacher is considering” (p. 32). Students will rank their choices then the teacher will use these rankings to assign students to groups based on their choices.

A student’s learning profile is their preferred mode of learning and it is influenced by style, preference, gender, and culture. Tomlinson and Eidson reinforced this idea and stated that, “the goal of learning profile differentiation is to help students learn in the ways they learn best” (pp. 3-4). It is also to extend the ways in which they can learn efficiently. Adams and Pierce (2003) added, “if you choose to tier via students learning profiles, it is best to control the number of tiers by using only a few different learning styles” (p. 32). For example, a lesson could be tiered to focus on three learning styles: auditory, visual, and kinesthetic. Students would then be placed in the tier that best matches their learning style. Getting to know students will help teachers to respond and adjust learning to students’ readiness, interest, and learning profile.

### *Tiered Assignments*

There are several methods to differentiate instruction to meet the needs of all learners. One in particular is tiered assignments. According to Lewis and Batts (2005), “tiered assignments are assignments designed at different levels of complexity according to students’ readiness level” (p. 29). Similarly, Johnson (2001) stated a “tiered assignment or activity is where students manipulate or practice the same concept or skill; however, they do so at differing levels of complexity and sophistication” (p. 62). Both

definitions are important because they highlight different things. Lewis focuses on student readiness level while Johnson focuses on the different levels of complexity.

Tiered assignments allow several pathways for students to arrive at an understanding of these components based on their interest, readiness, or learning profiles. It is a great way to stay focused on the standards and curriculum while maintaining flexibility in content, process, and product. These types of assignments meet the needs of at-risk students and address differing student abilities, learning styles and interests. Kapusnick and Hauslein (2001) said that they work when the “teacher describes tasks of varied complexity, number of steps, and outcome products” (p. 159). Students are then encouraged to select the outcome product they wish to reach. Some teachers like to assign students to specific tiers. Others like to give students the option and choose which they prefer. Johnson (2001) said that, “the latter may be more preferred for two reasons. First, all students enjoy choice and the empowerment that comes with it. Second, students will naturally gravitate to the level that is best suited to them” (p. 63).

Pierce and Adams (2004) claimed that, “a lesson tiered by readiness level implies that the teacher has a good understanding of the students’ ability levels with respect to the lesson and has designed the tiers to meet those needs” (p. 60). Many examples of tiered lessons based on readiness have three tiers: below grade level, at grade level, and above grade level. The number of tiers used will depend on the range of ability levels in each classroom, and these are based on student assessments. Allen et al. (2008) explained that, “you cannot successfully tier unless you have assessments to back your decisions on how you grouped your students and how you created the tiers” (p. 64). Often your groupings

for students will change depending upon the tiered assignment; the reorientation is based on pre-assessments for each lesson or unit.

When designing tiered lessons Allen et al. (2008) said to, “think of the tiers as: tier 1. approaching the standard; tier 2. ready for the standard; and tier 3. moving on” (p. 62). Generally for tier 1 the student says that they need help and this is where the teacher needs to spend most of his or her time. These students do not have the basic skills or background knowledge to be successful. The teacher must find ways to build their skills and knowledge in order to meet the standard. When students understand the material the teacher may spend some time with them because these students have the knowledge for the state or district standard for that grade level and or subject. Students who have shown mastery of the standard through pre-assessment need more. They need to be challenged with more depth and complexity. These students will need some direction from the teacher but will be mostly independent.

#### *Assessment*

To meet the goals of education, there must be a tight alignment among curriculum, instruction, and assessment. The goals can be met through differentiation, the use of tiered assignments, and by basing the tiering on pre- and post- assessments. Moon (2005) stated that, “assessment is appropriately seen as the process of observing student learning by collaborating with students to collect and interpret data about their academic strengths and weaknesses, interests, and learning preferences, with the goal of making decisions that benefit their instruction” (p. 227). Pre-assessments of material are used before setting up tiered assignments. The pre-assessments will help the teacher determine which students should be included within each tier. Benjamin (2006)

explained that there must be “variety in assessments” (p. 58). Benjamin also stated that, “students are more likely to be successful if the assessment system encompasses a broad spectrum of abilities and modes of expression” (p. 59). One way to help students to show these abilities and modes of expression are to use formative and summative assessments. Wormeli (2005) stated that formative assessment “is made of smaller assessments and checkpoints done en route to mastery. Students get regular and frequent feedback in a timely manner that they can use” (p. 32). Formative assessments are important because students need different levels of support which can be determined by recording observations on flip cards or sticky notes as students work through the tiered assignments. Since it is important to determine how much support students need Wormeli said that, “teachers should spend at least as much energy designing their formative assessments as they do their summative assessments” (p. 32). Summative assessments are used mainly to evaluate instruction after the tiered assignments have been completed. “Summative assessments are often varied in form, for example, portfolios, authentic problems to solve, oral presentations, and tests” (Tomlinson, Kalbfleisch, & Layne, 1998, p. 55). Rubrics can also be developed for each tier based on the assignment as a form of summative assessment.

#### *Examples of Tiered Assignments*

Allen et al. (2008) provided an example of an elementary level tiered assignment tiered by readiness level. This example focused on the “standard: understand the life cycle of a butterfly” (p. 71). Tier 1 was to show the life cycle of a butterfly. This tier dealt exactly with the standard. It was basic and asked specifically for the student to demonstrate their knowledge of the life cycle of a butterfly. The students working here

were not ready to expand on this topic. Tier 2 was to compare the life cycle of a butterfly with another insect (teacher gave student the life cycle of the other insect). This tier dealt with the standard but went slightly beyond it. First, it asked the student to demonstrate their knowledge of the life cycle of a butterfly. Second, it asked the student to compare it to another insect's life cycle. Students had to notice the different attributes between the two life cycles and explain them in writing. Tier 3 was to show how the environment affected each segment of the life cycle of a butterfly (teacher gave the environment: cold, hot, wet, etc.). This tier allowed the student to demonstrate their knowledge of the basic butterfly life cycle and then expand on the discussion by including how outside conditions can affect its life cycle. Such an assignment requires the student to think critically and make predictions. By having students work at each of these tiers it can be determined just how well they understand the life cycle of a butterfly.

Heward (2003) shared a great "tiered lesson using riddles to promote thinking and problem solving skills" (p. 552). A pre-assessment for this lesson would deal with verbal proficiency since the riddles have varying levels of vocabulary. During this lesson the whole class would be introduced to a basic lesson on poems then be split up into three groups. The three groups would be split up by basic, middle, and high difficulty. Heward (2003) stated the three levels of riddles would consist of "level 1: three simple riddles, level 2: one medium-hard riddle, and level 3: one difficult riddle" (p.552). The standards were set to help students develop skills necessary to achieve any standard that involved problem solving. It also would extend to math or science problems and social studies or analysis of literature. The difficulty level was different per the three groups but

they had the same goal in mind, at the end of the lesson all students should be able to solve riddles.

Pierce and Adams (2004) gave an example of a third grade lesson. The tiered lesson would be presented after several lessons about geometric shapes, slides, flips, congruency, and symmetry had been taught. Pierce's and Adams example was "tiered in process according to learning style" and focused on the standards "#5 geometry and #6 spatial sense." In this lesson students were looking for lines of symmetry of objects. Tier 1 was designed for kinesthetic learners. Here, "pairs of students use brightly colored papers to make several simple origami designs" (Pierce and Adams, 2004, p. 65). When the students finished they took the origami apart to find the congruent figures and identified lines of symmetry. Finally the students shared the origami figures and had classmates try to construct them. Tier 2 focused on visual learners. Pierce and Adams (2004) stated for tier 2, "pairs of students work with pictures of items from nature, such as a butterfly, sunflower, rainbow, or starfish. Students find any congruent figures and identify lines of symmetry for each item" (p. 65). The students then went on to color the pictures and cut them out for classmates to look at and find the lines of symmetry.

Willard-Holt (2003) provided a fourth grade tiered assignment for science which focused on the "standard: know basic weather elements. Along with this science standard it incorporated a math standard: organize and display data using pictures, tallies, tables, charts, bar graphs, and circle graphs" (p. 74). This set of tiered assignments allowed the students to learn how to gather weather data and graph it. Tier 1 was to make a bar graph that showed the average monthly temperatures in two cities. For this tier the students had to collect the data of two cities and then present it in within a bar graph. The students

were using their prior knowledge of bar graphs. Tier 2 was to choose two appropriate types of graphs to show the proportion of rainy days to sunny days, and the average rainfall by months in a city. This required that the students recall different types of graphs and determine the two best types to present the data. Generating two appropriate graphs on the computer to show the ratio of rain to snow, and monthly temperature and precipitation in a city was tier 3. This tier incorporated a lot and expanded on the student's knowledge. This tier allowed them to present their work on the computer, again they must know which type of graph is best to present the data, plus show the ratio of rain to snow, another expanded idea. Students could choose among these tiers as they knew their abilities and interests and which task they would be able to complete with success.

Allen et al. (2008) provided another example of a tiered assignment that used the "standard: students will identify characters in a story" (p. 77). Tier 1 included having the students show the characters in the story. For this tier the students were given the freedom to show the characters in a way that they chose, for example, an illustration or written description. Tier 2 had the students compare and contrast the strengths of the characters in the story. This tier looked at the characters and took it one step further asking the students to find the characters strengths. For tier 3 the students were asked to examine how each of the characters changed over time. Tier 3 required students to analyze the characters during different points in the story. Again, each tier kept the standard in mind while developing understanding of characters for students at different levels.

Another example given by Willard-Holt (2003) showed a two tier model where the students were given a choice of method to learn the material. A 10<sup>th</sup> grade life

science course focused on the following “standard: identify and characterize major life forms by kingdom, phylum, class, and order. The teachers’ first tier was to read the text and work through a packet of exercises at their own pace. This packet consisted of activities crucial to understanding the topic” (p. 73). This tier offered the students who enjoy independent work the chance to begin right away and learn by reading the text. The second tier was to read the text together and work through similar activities that were more step-by-step. This second step offered those students who were not comfortable with independent work a chance to learn the material with support from the teacher.

#### *Summary:*

Differentiated instruction is an excellent element to utilize in a classroom because it allows students to start learning from the appropriate level based upon their prior knowledge. It allows them to begin building deeper meanings and understanding from the content. George (2005) said, “educators must move forward, rapidly and visibly, in the successful implementation of classroom-level strategies that provide differentiated curriculum, instruction, and assessment: strategies that, when implemented effectively, result in challenging and supporting all students within the regular, mixed-ability, heterogeneous classroom” (p. 186). To differentiate effectively in an academically diverse classroom a lot of time, energy, and patience are required.

Teachers can easily differentiate curriculum by utilizing tiered assignments. Teaching by tiered assignments provides teachers the opportunity to utilize their students’ strengths by still allowing flexibility in how they learn. Teachers can adjust their presentation methods for instruction and use different forms of assessment so their students can achieve the most success. No matter what grade level or subject area

differentiation is being used for. all students need to be engaged in respectful, engaging, and challenging work.

### Methodology

Ninth grade Integrated Algebra students were participants in this study. The total population of seven consisted of 3 boys and 4 girls. There were students with varied ability levels within the class. As eighth graders they were identified as students in need of academic intervention services. They had earned a 1 or 2 on the New York State grade eight mathematics assessments, which implied that they were not meeting learning standards or were only partially meeting learning standards. The class was designed to allow for extra time and additional support in mathematics. The schedule - meeting twice a day every other day and once on the opposite days - gave the students greater exposure to the material to help fill in gaps from previous years, as well as help them learn the new material and build on it.

The first task within this class was to get to know the students. Information had to be gathered about the students readiness, interests, and learning styles in order to differentiate and get these students learning at a deeper level. Several methods, such as: whole group instruction, small group, partner work, independent work, hands on learning, and computer based lessons were presented. Specifically, their mathematical abilities were reviewed during each of these modalities to establish readiness. Student's attitudes, work ethic, and grades during these lessons were used to determine their learning styles. The information was used to decide which modalities to use so each student could be successful and so that their individual needs were met.

The next task was to determine which classroom elements could be differentiated to increase the chance for each student to learn as much as possible. Content was presented in modified forms such as guided lesson notes and homework designed for

various ability levels. In this manner the content gave only the important ideas that were essential for the current topic. Students created products that demonstrated what they had come to understand from the material. Some tasks required them to walk the halls seeking out math problems related to the material; these problems were either given to them and they had to figure out the solution, or the students were given the topic and they had to create the problems. They were also given paper tests, partner quizzes. They were also given opportunities to demonstrate their knowledge on computer, graphing calculator, or simply by writing an example of what they had learned on the white board. Formative and summative assessments allowed the students several chances to demonstrate their knowledge. In order for the students to work at their best abilities the learning environment had to be such that they felt safe, comfortable, respected and challenged in a positive manner. These elements were demonstrated, reevaluated, and encouraged often as to highlight moments of respect, helpfulness, sharing, and caring.

Pre-tests were used to help determine student readiness and to assess their prior knowledge. The pre-tests were given on each section of a chapter, which included topics on writing and solving systems of linear equations. The pre-tests were designed to explore concepts students already knew, give them the chance to expand on those concepts and were generally 4-6 questions long. The questions were categorized by level. A student's pre-test was considered low level, if that student could not completely answer the questions correctly that should have been mastered from the previous chapter. For a student's pre-test to be considered middle level, that student had to answer the questions correctly from the prior chapter and make a logical, solid attempt at the problems to be introduced in the next lesson. Only students who could answer all

questions correctly or whom had written accurate, logical, meaningful responses to all of the questions were considered high level. See appendix A for a sample pre-test.

Based on these pre-tests, lessons were differentiated to meet the needs of the learners. Several students needed more reinforcement of the previous chapters' concepts before beginning to expand and build on them. Thus, the differentiation took place during the introduction to the lesson, within the lesson or through homework. Some lessons required students to be grouped by ability level and assigned a tiered assignment. The groupings were affected by the students learning needs. Each group was taught the same main idea, however, the idea was presented in a manner more suited to the group's level and learning style. The assignments were geared to challenge the students to use higher level thinking skills in a comfortable modality. Through these groupings students learned significant skills and concepts and then were able to apply them to future topics.

Before each lesson of the chapter the students participated in mini-lessons to refresh their prior knowledge needed for the day's lesson. Prior to the first lesson of the chapter, which focused on the point-slope formula, the students reviewed slope by working with a partner on a lesson practice sheet. Students did not have to memorize the point-slope formula nor how to implement it. Instead, they were required to use a three step method to write equations of a line. First they had to find the slope, then the y-intercept, and finally plug both into the slope-intercept form of an equation of a line. The second lesson of the chapter on parallel and perpendicular lines was prefaced by a slope exploration activity. The students worked in pairs to explore lines with the same slope and then they made conjectures about how the slopes of perpendicular lines were alike or different. As a class the conjectures were discussed and conclusions were drawn. The

actual lesson was differentiated by rotating students through stations. In the first station, students worked with the mathematics teacher on three concepts: 1) learning about parallel and perpendicular lines. 2) determining if lines are parallel or perpendicular by looking at the equations of the lines and/or their graphs, and 3) writing equations that are parallel or perpendicular to an equation or line given. Station 2 focused on the chapter's vocabulary. Their task was to define 10 out of 12 vocabulary words in their composition notebooks then choose an extension activity incorporating those 10 words. Students worked on a computer for the last station. They had to listen and follow along as a gentleman discussed parallel and perpendicular lines on a YouTube video. Prior to the third lesson of the chapter, which focused on solving systems by graphing, students explored graphing two lines on one coordinate plane individually on their graphing calculator. There was no lesson 4 in the chapter; it was the mathematics department's decision to skip this section. Lesson 5 of the chapter was tiered to help the students gain the most success with a difficult concept, solving systems by elimination. Tier 1 was for beginning students who still had difficulty with certain concepts: combining like terms, or realizing variables can cancel out. At tier 2 students understood how variables can be cancelled out by opposites. Students understood the concept of canceling out variables and solving in tier 3. Each tier remained focused on the goal of the lesson, to find both variables and to realize that together the variables created a solution set. This concept is outlined in the New York State Standards, which requires students to solve a system of two linear equations in two variables algebraically.

## Results

This study explored how differentiated instruction and tiered assignments could help student's gain deeper understanding of mathematics content. Specifically working with a small section of Integrated Algebra students, the teacher worked to teach from where the students were in their content knowledge, not from where the curriculum started. The teacher chose to focus on one chapter of the material, pre-test on each section and differentiate according to the pre-test results. Each lesson had a brief mini-lesson that was modified to meet the learners' needs, as well: parts of the lessons were modified.

The pre-tests showed that the majority of the students were at the low level. If a student's pre-test was considered low level that student could not completely answer the questions correctly that should have been mastered from the previous chapter. There was a large range of low level scores, for some pre-tests 29 percent of the class had below or basic understanding of the previous topic while for others this was 86 percent. See table 1 for the pre-test results.

Table 1

Pre-test Results

	<b>Absent</b>	<b>Low</b>	<b>Middle</b>	<b>High</b>	<b>Total</b>
<b>Pre-test 1</b>	0(0%)	5(71%)	2(29%)	0(0%)	7(100%)
<b>Pre-test 2</b>	0(0%)	6(86%)	1(14%)	0(0%)	7(100%)
<b>Pre-test 3</b>	3(42%)	2(29%)	2(29%)	0(0%)	7(100%)
<b>Pre-test 5</b>	2(29%)	3(42%)	2(29%)	0(0%)	7(100%)

Students had to apply the new knowledge from the differentiated lessons to complete the assessment. Based on the comparison from pre-tests to individual assessment questions, most students did show improvement. For privacy purposes students names have been omitted and they will be known as Student A, B, C, D, E, F, G. Student A improved his skills and did better on about half of the assessment compared to his pre-tests scores. There was no improvement for student B; her pre-tests scores were poor as was her assessment score. One student, student C made little improvements from the pre-test to the assessment in the later sections of the chapter. Student C did well on the first two sections of the chapter and was consistent with that material on the assessment. There was considerable improvement on all parts of the chapter for Student D. Student E's knowledge and understanding stayed the same. The student made the same errors in the pre-tests as were made on the assessment. For the majority of the assessment Student F stayed the same, however, there was improvement on a couple concepts. Student G also showed improvement on a couple concepts. This student utilized mathematical knowledge not taught in this chapter but it did still apply. Student G used the guess and check method to solve a few problems on the assessment instead of graphing or elimination, which were the methods the chapter actually taught.

Besides the student successes from the pre-test to the chapter assessment the students grew as individuals. The students began to show empathy for their classmates and their surroundings. Specifically they showed great respect and support for one another. They felt that if they worked to their best ability and achieved success their classmates could, too. They showed this support during small group and partner work.

offering each other a pat on the back for a job well done or a thank you for explaining the information so that they could understand it.

### Discussion and Conclusion

Differentiated instruction is a method used to help students reach deeper understandings of content and succeed in their education. There are several strategies of differentiating that allow the teacher to teach from the students' content knowledge not where the curriculum starts. By implementing some of these strategies students should have excelled and gained deeper understandings of the mathematics content, however, the results show that they did not improve in all sections of the chapter. These results suggest that even though content and lessons were modified to meet the students at their level they did not gain a solid understanding. Students did progress when working in small groups or partners, also when other modalities were applied.

Tomlinson (1999) stressed the importance of "recognize[ing] that students are individuals" (p. 2). Students came into this classroom with several different attitudes, interests, personalities, and ability levels. The range in these variables was so vast that it was difficult to meet all of the students' individual needs. As Lewis and Batts (2005) say "the practice of adjusting the curriculum, teaching strategies, and classroom environments will meet the needs of all students" (p. 27). These results imply that this is not always true. The curriculum in the chapter was adjusted per response from the pre-tests; however, most students still did poorly at the end of chapter assessment. The teaching strategies were adjusted as well, students learned by small group, partner work, and hands on exploratory activities. Kapusnick and Hauslein (2001) said, "students learn better and more easily when teachers use a variety of delivery methods providing students with learning experiences that maximize their strengths" (p. 156). The second lesson of the chapter offered students the chance to learn in different methods. One

station was direct small group instruction from the teacher, another offered the students the choice of how to learn the vocabulary and lastly they could work through a lesson on the computer. The vocabulary station worked well because students could choose which activity they wanted to complete using all of the vocabulary. The students took control over their learning and felt empowered. In today's society the computer is a huge asset and very important to students' lives. They see it as a means for information, communication, research, fun, and much more. During this lesson when the students were allowed to work on the computer they did excel. This lesson allowed them to use the computer, a tool that they were confident in using and it helped to maximize their learning of parallel and perpendicular lines.

Tomlinson et al. (2003) spoke about the "five classroom elements that can be differentiated or modified to increase the likelihood that each student will learn as much as possible" (p. 3). The five elements are: content, process, product, affect, and learning environment. The students' learning environment was safe, comfortable. Content, process, and product were adjusted to meet the students' needs. Perfect affect, however, was not reached. Affect is how students link thought and feeling in the classroom. The students did not link the concept of solving systems of equations by graphing to anything in their lives. If they had been given concrete evidence to how these systems were going to enhance their lives or how they were going to use them in their future lives they would have created deeper understanding. Students did, however, learn about respect, empathy for all members of the class, and accountability in participation in class. There were obvious demonstrations about how to respect and treat others and how to celebrate growth when they did their best.

There were multiple factors that did not help this differentiated instruction study. Multiple instructors did not help. In total, there were three teachers of this Integrated Algebra class. This group of students started the year with a teacher, referred to as Teacher A, who had little management skills. Teacher A did not get to know the students personally or even very well educationally. Teacher A sat at the overhead projector and taught from there with no movement, no matter what the students were doing. Not very often were the students attentive to Teacher A or even sitting at their desks while teaching was in progress. These students ran the classroom and paid no respect to Teacher A or their classmates. Simply put, the students talked nonstop, horse-played and did very little quality mathematics everyday, which in turn affected their assessment scores on this chapter assessment.

After Teacher A left, another teacher referred to as Teacher B, came in for a short stint of about three weeks. Again, this teacher had poor management skills. Teacher B attempted to teach mathematics but got frustrated quickly when the students were inattentive and out of their seats. The students took advantage of Teacher B, as well. This teacher required the students to complete homework, however, never graded it or returned it to them.

Results from this study could have been very different had the students had one consistent teacher all year. The class size, ratio of boys to girls, their ability levels, and personalities had potential for a wonderfully run differentiated mathematics classroom. Unfortunately, the students were too far behind and so accustomed to chaos in the classroom that it was very difficult to rope them in to learn and appreciate mathematics.

There were several student specific factors that affected the students' assessment scores that were unrelated to the differentiation. Student B was new to the district at the beginning of the chapter. The student had been home schooled for years in addition to being in and out of several public schools. Due to these circumstances there were several holes in student B's mathematics education, and a lot of inconsistencies. As well, student C was only in school for the first two sections of the chapter. This student was on vacation for the remainder of the lessons and during the initial assessment. Student C did not complete the assessment until a week and a half later, when the class was considerably into the next chapter. Student E posed another obstacle: this student was an English language learner. The algebra content came very slowly to this student due to the language barrier.

Overall, the majority of the students were in the low level on the pre-tests. Looking at the assessment scores overall all but one of the students earned below a 65. There does seem to be a correlation between the pre-test, the students' prior knowledge their ability to apply it to new topics, and the chapter assessment scores. However, looking deeper into the chapter assessment and breaking it down per question, and comparing it to the students' pre-test scores, several students did show improvement. The improvements may have been small and only pertained to a couple sections per student of the chapter but they were improvements. Thus, despite overall poor assessment scores the differentiation efforts were positive and worthwhile.

Looking back at the difficulty of the chapter assessment the students took it shows that there was no flexibility in the product. There was no room for learner variance when completing this assessment. Tomlinson et al. stated that, "tests should enable rather than

impede a student's ability to show how much he or she has learned" (2003, p. 8), the chapter assessment could have impeded some students' abilities. If the study was to be done again various forms of assessment should be considered to enable all students to achieve success.

Differentiated instruction is a philosophy that has been around a long time and will continue to be around. It has evolved and taken on many different forms which aid students in learning essential skills and earning greater achievement. The more teachers practice differentiation and learn how to relate the content to students' lives will help them to achieve deeper meaning. There were few opportunities for students to relate the information to their prior experiences and current lives in this study. What this study shows is how important that is; in order for students to achieve success they need to work at their ability level, in their learning style, be appropriately challenged and shown affect where students can link thought and feeling in the classroom.

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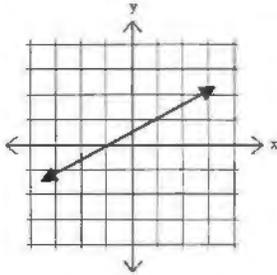
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Appendix A

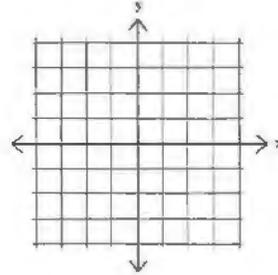
Sample Pre-Test

Pre-test 2

1) Find the slope of this line.



2) Draw two lines that are perpendicular.



2) What does it mean if two lines are *perpendicular*?

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4) What does *reciprocal* mean?

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