Tenth Grade Mathematics:
Intervention Materials for Frequently Missed Objectives

A PROPOSAL for a PROJECT in MATHEMATICS

by

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ABSTRACT

The Texas Assessment of Knowledge and Skills (TAKS) test is an integral part of every Texas student’s life. In order to receive a high school diploma, students must master the concepts included in the Texas Essential Knowledge and Skills (TEKS) which are contained in the objectives of the TAKS test for all core subject areas. Mathematics and Science TAKS tests have the highest student failure rates and are a primary reason many students do not graduate from high school. In the author’s experience, many students miss passing the test by only a few questions. Across the state, in the local district and at the high school targeted by this project, the three most frequently missed objectives for mathematics involve functions, geometry and measurement. The purpose of this project is to provide teachers with easy access to rich instructional materials to use during regular instruction and for TAKS preparation tutorials. The materials will be created for these three objectives with consideration of learning styles and differentiated instruction. It is hoped that an intervention such as this will allow students to master these objectives and perform successfully on correlated TAKS questions.
INTRODUCTION

Of the many high-stakes tests that Texas students take throughout their twelve years of education, only one test impacts whether or not a student graduates from high school. The Texas Assessment of Knowledge and Skills (TAKS) test must be passed at the eleventh-grade level in Mathematics, Science, Social Studies, and English in order for a student to earn a diploma. Since this test is an integral part of a student’s graduation, passing this test in all four subject areas is crucial. This project will focus on tenth grade mathematics objectives in preparation for the eleventh-grade exit exam.

The high school mathematics TAKS tests contain ten objectives (see Table 1) covering the Texas Essential Knowledge and Skills (TEKS). The three most frequently missed mathematics objectives across the state are objectives two (functions), six (geometry) and eight (measurement and similarity). This trend is also reflected in the test scores for the author’s district and high school. In the author’s experience, many students are extremely close to passing this exam and often miss meeting the target score on the TAKS test by only a few questions. Mastering the most difficult and frequently missed objectives of TAKS can greatly affect a student’s outcome on this test. Instructional materials reinforcing these objectives will give students a greater chance of passing the test.
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<thead>
<tr>
<th>Number</th>
<th>Objective</th>
<th>Questions</th>
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<tbody>
<tr>
<td>1</td>
<td>Functional Relationships</td>
<td>5</td>
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<td>2</td>
<td>Properties and Attributes of Functions</td>
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<td>3</td>
<td>Linear Functions</td>
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<td>4</td>
<td>Linear Equations and Inequalities</td>
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<td>5</td>
<td>Quadratic and Other Nonlinear Functions</td>
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<tr>
<td>6</td>
<td>Geometric Relationships and Spatial Reasoning</td>
<td>5</td>
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<tr>
<td>7</td>
<td>2-D and 3-D Representations</td>
<td>5</td>
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<tr>
<td>8</td>
<td>Measurement</td>
<td>7</td>
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<td>9</td>
<td>Percents, Proportions, Probability and Statistics</td>
<td>5</td>
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<tr>
<td>10</td>
<td>Mathematical Processes and Tools</td>
<td>9</td>
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Table 1: High School Mathematics TAKS Objectives

The concepts in objectives six and eight are not formally studied in high school, but are foundations for the learning of concepts in previous, current and future classes. For this reason, other mathematics classes that students take, from Algebra I to Calculus, are affected by the lack of understanding of the content contained in these objectives. The problem occurs because eighth grade students do not learn the TEKS within these objectives deeply enough during regular classroom instruction. Therefore, it is difficult for them to retain and transfer the content from the eighth grade TEKS to subsequent mathematics courses and higher-level objective-based assessments.

The purpose of this project is to produce classroom lessons and activities as part of an intervention packet for teachers to help students master the targeted mathematics TAKS objectives. These lessons and activities will meaningfully engage students in learning the targeted objectives both in the classroom and in TEKS review tutorials. The author hopes that the project curriculum will leave a lasting impression on students and help them perform successfully on the TAKS test.
This project will be based on the following guiding principles:

1. Mathematically rich instructional materials should be used to address student learning styles and diverse abilities.

2. These materials should help students retain and transfer the content of the three frequently missed objectives in order to perform successfully on correlated TAKS questions.

RELATED WORKS AND JUSTIFICATION

Stutz (2007) reported that a record 40,182 (16%) students did not graduate from high school because they failed one or more portions (Mathematics, English, Science and Social Studies) of the exit-level TAKS test. Only 50% of tenth graders and 69% of eleventh graders passed all subject areas (Stutz, 2007). This high-stakes test impacts students' futures at every public high school in Texas.

The three most frequently missed mathematics TAKS objectives across the state are two, six and eight. The most frequently missed objective was eight, which covers measurement and similarity (mainly from eighth grade TEKS). Only 54.9% of tenth grade students answered questions for this objective correctly. Objective two addresses properties and attributes of functions (Algebra I TEKS) and had a 57.3% success rate. Objective six includes geometric relationships and spatial reasoning (mostly eighth grade TEKS) and had a 58.5% success rate (TEA, 2007).
The target district had only 50.9% of tenth grade students answer the same objective eight questions correctly and the target high school had only 52.1% successful. Objective two had a success rate of 56.4% and 54.6% respectively. Objective six was passed at the district and high school with 56.8% and 59% success rates respectively (see Table 2). Since students state-wide and locally follow the same trends, there is definitely a need for intervention in these areas.

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<tr>
<td>8</td>
<td>54.9%</td>
<td>50.9%</td>
<td>52.1%</td>
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<tr>
<td>2</td>
<td>57.3%</td>
<td>56.4%</td>
<td>54.6%</td>
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<tr>
<td>6</td>
<td>58.5%</td>
<td>56.8%</td>
<td>59%</td>
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Table 2: Percent of Tenth Grade Students Who Answered TAKS Questions Correctly by Objective.

Students take many benchmark assessments throughout the year and this data as well as data from previous TAKS tests is analyzed so that each teacher and student knows of individual weaknesses. The trends are usually the same between the benchmark and the actual TAKS data. Researchers and educators have looked for various causes for this gap in students' knowledge from eighth grade to high school. One of the most common reasons for this gap is students who take Algebra I rather than the typical eighth grade mathematics class. A local teacher educator focus group reported that students who take Algebra I in eighth grade and then Geometry in ninth grade really struggle on the tenth and
eleventh grade TAKS exams. They usually miss the eighth grade objectives, especially geometry, probability and statistics questions (Del Mar College, 2003).

This gap has caused students to have misconceptions about many of the eighth grade TEKS during later mathematics classes since these TEKS were not covered during Algebra I in the eighth grade. Many teachers use “re-teaching” as a tool for battling these challenging objectives. According to the Georgia Department of Education, re-teaching should focus on the skills and knowledge that have not yet been mastered, using research-based instructional strategies (Cox, 2007). From the author’s experience, many teachers re-teach with the same methods that they originally used to deliver the instruction. Since the material is presented the same way, students who did not understand the material the first time usually do not understand the material the second time. When it comes to addressing students who need intervention, differentiated strategies may improve learning. Using differentiated strategies means that teachers do not teach with the same method every time. Teachers can use different methods in order to help students with different learning styles. Many students who need intervention struggle to learn concepts because they are not able to grasp abstract concepts (Glencoe, 2005). Interventions should help students better understand the material, which can lead to success on assessments covering these objectives.

Many schools throughout the state have tried to develop strategies to increase student success on this exam. The administration at the targeted high school has decided to use a pull-out program this year. Other schools throughout
Texas also use this method of taking students out of elective classes and having them attend a TAKS tutorial class (Nelsen, 2007). Typically in this type of program, students are taken out of an elective class and put in a classroom with a teacher that is not certified in mathematics and the students are usually just given worksheets. The author believes that if the teachers teaching these TAKS pull-out classes had easy access to more mathematically robust and cognitively engaging instructional materials, the students would be more likely to gain a deeper understanding of these critical objectives during the tutorials.

Soon the TAKS test will be phased out and replaced with End-of-Course exams for each core class. This would require students to pass twelve exams in order to graduate. Many educators fear this will be an even larger obstacle for students to overcome (Cromer, 2007). Even though the TAKS exams are being phased out, reinforcing these three objectives would still benefit high school students on any type of exam that also covers material contained in these objectives.

Many textbook publishers and outside tutoring services have discovered the importance of the TAKS test and have developed lessons to teach the TEKS contained in the TAKS objectives. One example of this is Study Island (2008). This site allows people to buy a program that students can use at their own pace to help them master the TEKS that are tested on the TAKS. The problem with many of these materials is that many developers have not been in the classroom recently or, in some cases, at all. Without having recent classroom experience, it is difficult for someone to develop lessons that will actually work well in today's
classroom. For changes in mathematics education to be effective, it is crucial that a mathematics curriculum is developed that will impact the current philosophies in education and provide instruction with methods that are appropriate to the population at the present time.

Differentiated instruction is one way to increase student achievement. Ken Dobush (2007) explains, "Differentiated instruction is teaching with student variance in mind. It means starting where the kids are rather than adopting a standardized approach to teaching that seems to presume that all learners of a given age or grade are essentially alike. Thus differentiated instruction is "responsive" teaching rather than "one-size-fits-all" teaching" (1). This strategy could also be applied to lessons and activities that are geared toward student success on standardized achievement tests such as TAKS. By realizing that students do not learn from the same methods, teachers can differentiate lessons and reach more students. As a result, there would be a larger student success rate at standardized exams.

Having mathematically rich lessons and activities is another way to boost student success. According to the National Council of Teachers of Mathematics (NCTM), mathematically rich lessons involve challenging, coherent, well-presented and engaging mathematics (2006). In order for materials to be considered mathematically rich, they need to be designed to contain these qualities. An aspect of lesson design that is critical to address is "learning styles". Every student does not learn with the same method and using diverse methods is necessary to reach more students. NCTM (2007) has also researched learning
styles and found that "teachers know that multiple representations of mathematical ideas have the power to transcend language barriers and learning styles, but textbooks frequently just show one representation" (1). Teachers can step in and supplement the textbook content with multiple representations but often do not which leaves many students lacking in understanding. Another aspect of lesson design to be taken into account is diversity in student's ability levels. Students of many different ability levels are often in the same classes and the teacher is left to adjust instruction so that the lowest level student can grasp the material but the highest level student is still challenged. This is often a difficult task for teachers because there can be a large gap between the lowest and the highest students' abilities. Creating student-centered lessons is one key to solving this problem. Cognitively-high students can discover information and solutions on their own and lower level students can be guided and still create some learning on their own. By differentiating instruction and allowing students to discover some concepts on their own, more students can be successful.

Creating instructional materials that aid in retention and transfer of knowledge is another integral part of lesson design. Students must be able to retain the information that they learned over time. In order for students to retain information, the material needs to be presented and learned in a way that is meaningful and relevant to the students so they will remember. The tenth grade TAKS exam covers material from 8th to 10th grade, so it is crucial that students retain information from previous years' classes. The final aspect is transfer. Students must be able to take what they have learned about these concepts and
transfer it to new situations. Many times students will see new problems that cover material that they have already learned, but it is presented in a different manner and they do not know how to solve them. With a deep understanding of the concepts, students should be able to retain and transfer the material to new situations with ease.

This project is appropriate for a project for a master’s degree because there is a need to identify and correct student misconceptions about these frequently missed objectives. By targeting these objectives with rich educational materials, students can obtain a deeper understanding of these critical objectives. Many teachers do not have easy access to rich instructional materials to help their students with these difficult concepts. However, it is critical that students have a deep understanding of the concepts in these objectives so that they can retain and transfer this knowledge to other situations building on the concepts in these objectives.

PLANNED ACTIONS

This project will begin with the author investigating methods currently used to teach and reinforce these three frequently missed tenth grade mathematics objectives. The author will research student learning styles and differentiated instruction and various methods of targeting learning styles with differentiated instruction.

The instructional materials will target tenth grade objectives because the author has experience with tenth grade students and wants to develop materials
that could be used in her own classroom. These intervention materials will teach these objectives and the activities will reinforce the concepts and facilitate retention and transfer. These materials will address multiple learning styles and target students at various cognitive levels. These lessons will be formatted to help students with different learning styles and cognitive levels. The lessons will incorporate various instructional methods such as direct, student-centered, and differentiated. Technology will be incorporated as a tool for reinforcing these difficult objectives. Each objective will have two different core lessons to address different learning styles, a review game, and a formal assessment. There will also be a cumulative game that contains material from all three objectives. These materials will be made available to teachers through the Internet. In addition, local high school teachers within the target district will have access to the materials on a CD.

TIMELINE

January – February 2008  Prepare Project Proposal
February 27, 2008  Distribute Project Proposal to Committee Members
March 12, 2008  Project Proposal Defense
March – April 2008  Research TAKS data, initiatives, and lessons
April – May 2008  Create lessons covering objectives 2, 6, and 8
June 2008  Distribute Project to Committee Members
June 2008  Project Defense
August 2008  Graduation

END RESULT INTENDED

This project will target a metropolitan district and high school in South Texas. This project will produce lessons and activities to help mathematics
teachers find alternative ways to teach concepts that are difficult for tenth grade students to master on the Texas Assessment of Knowledge and Skills (TAKS) test. The materials will focus on eighth to tenth grade objectives as they appear in the Texas Essential Knowledge and Skills (TEKS), and are tested on the tenth grade Texas Assessment of Knowledge and Skills (TAKS). The intervention curriculum will be posted on the Internet for public use. It is the hope of the author that these lessons and activities will be implemented in tenth grade classrooms within the targeted district and high school so that more students will understand these difficult concepts and obtain a passing score on the TAKS test in order to graduate with their class.

Results may include greater achievement levels for tenth grade students on the objectives covered, greater student confidence, higher passing rates overall on the test and a higher graduation rate. This project is intended to be an ongoing process in which teachers build on the lessons and activities within their own classrooms and develop their own. It is the author's goal to encourage teachers within the target district and high school to test the materials for their effectiveness to improve students' performance on objectives for the TAKS test.
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