Enhancing Juvenile Corrections Education through a Curriculum Unit on Linear Relationships

A PROJECT in MATHEMATICS

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Abstract

This project investigates instructional materials promoting understanding of linear relationships among at-risk students in juvenile correctional schools in South Texas. The problem addressed by this project comes from a consistent lack of mastery of linear relationships among students in correctional schools in South Texas. Based on extensive experience in the project setting and a review of related literature, I approached this problem by compiling more robust instructional strategies for teachers to support students' mastery of the representations and procedures of tasks involving slope-intercept form. The project includes a supplemental curriculum guide for teaching the slope-intercept form of linear relationships through a self-contained unit of five lessons with supporting resources and teacher notes. The significance of this project comes from the potential of the new curriculum unit to support teaching and learning linear relationships among students in correctional facilities. Teachers now have access to easily modified, classroom-ready, materials organized and developed by an experienced teacher using research-based principles of mathematics education in juvenile corrections schools.
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Introduction

The most basic concepts involved with linear relationships include independent and dependent variable, linear graph, the $x$- and $y$-axes, and ordered pairs. Beyond these, the slope-intercept form of a line, $y = mx + b$, is a common beginning step when students are learning about lines. Learning this concept and the more general concept of linear relationships can be a very difficult task for students who may have a hard time understanding arithmetic and the number system, much less understanding variables, functions, the coordinate plane, and multiplicative relationships. Nonetheless, to be ready for algebra, students need to be able to understand the slope-intercept form of a line in a variety of representations, including symbolic, graphical, numerical and verbal forms. Students need to be able to transition smoothly between a graph, a table, an ordered pair, an algebraic rule, a description the relationship between two variables, or a symbolic equation. These are ideas students are expected to know and understand, but for what may seem to be unknowable reasons, most students in correctional facilities do not learn or retain the essentials of linear relationships through traditional direct instruction and practice exercises.

In Texas, all districts encounter students who struggle with understanding the concept of linear relationships. In my experience in teaching my target population, the juvenile boot camp setting, I have observed students having no clue what a linear relationship is, how linear relationships relate to real world situations, and how to graph linear equations/linear functions. Through my experience as an educator, students produce more when they know what is expected from them. I counsel my students a lot. At times, the students are discouraged, but I tell them that I will stay on them until they
reach the goal of mastery of the skills or concepts which we are working to understand. Yes, students will learn what they did not achieve previously in their other education setting as long as they keep trying and do not give up on themselves.

The motivation for this project is a lack of comprehensive curriculum materials for teachers in juvenile corrections school settings. I addressed this problem by developing materials that help students in correctional schools master linear relationships through the important foundational concepts in the slope-intercept form. The completed unit will guide and assist instructors as they work with students with a variety of backgrounds and experiences who may be struggling with the concepts of linear relationships and need to master the concepts.

The problem of inadequate materials for teaching linear relationships in juvenile corrections schools is important because all mathematics standards emphasize the importance of understanding linear relationships during the transition to learning algebra, including state standards of Texas (TEKS, 2010), and national standards for teaching and learning mathematics (NCTM, 2000); CCSS-M, 2009). Both teachers and students are directly impacted by improved curriculum for mastering the concepts of linear relationships. Teachers are required to make sure their students have an in-depth understanding of linear relationships. Students are required to demonstrate their knowledge on linear relationships on annual state assessments in mathematics. Moreover, the community is indirectly impacted when students fail to learn linear relationships because students fall behind in real world situations and in schools and may lose confidence in their ability to progress through high school mathematics.
The need for improving mathematics performance among juvenile corrections students is urgent and acute. Foley (2001) reported that academic performance of students in juvenile corrections was typically at the 5th to 9th grade levels, and a high percentage of youth had failed a course, been retained a grade, or had earned no high school credit prior to being incarcerated. Zamora (2005) found only 25% of male juvenile detainees in Texas achieved middle or high school level mathematics and reading performance on state assessments. One common approach to addressing these deficiencies has been to introduce students to remedial mathematics programs that emphasize mastery of elementary-level arithmetic skills, but students enrolled in such programs are twice as likely as youth in a matched comparison group to recidivate (Archwamety & Katsiyannis, 2000). The individual and societal costs of this recidivation are large.

A key component of education in juvenile corrections schools is the high number of students who exhibit learning disabilities as well as emotional and behavioral disorders. In non-corrections schools, just 5-10% of school-aged mathematics student's exhibit learning disabilities and the limited research into developing mathematics curriculum for special education students have focused almost exclusively on elementary levels content (Beatty & Bruce, 2012). There has been very little research on teaching linear relationships for students among students with learning disabilities in general, much less those in correctional facilities.

As I review in the literature section of the project, there are effective research-based instructional strategies which can be used successfully in working with the target population. However, there are still teachers who use ineffective instructional strategies
that may have little benefit and may even do more harm to the student’s learning of linear relationships (Maccini, Gagnon, Cutting, & Leone, 2006).

In the target context for development of the curriculum materials, I use an exit level formula sheet for 9th -12th grade which is used on standardized state assessments to structure the student’s practice with slope-intercept form. I model for my students several procedures on using the slope-intercept form for problems in which given information may include slope, intercepts, and points on the line, a graph, or even a verbal description of dependence between two variables in a real-life context. Also, I review the basic concepts which lead to linear relationship, such as the coordinate plane, graphs of lines, slope as a proportion, linear functions, and intercepts. Students often struggle with the use of variables, terminology, vocabulary, and translating between equation-based descriptions of a line and graphical or verbal descriptions. I do not have access to well-developed materials employing research-based teaching strategies for this topic, and I often need to generate many examples and practice exercises for students to get adequate repetition as they work toward mastery.

In a broader sense, the purpose of my project curriculum unit is to generate materials that assist instructors of students in correctional facilities as well teachers with a high proportion of students with learning and/or emotional/behavioral disorders as they work to teach linear relationships. I made the materials freely available on the internet for teachers to use and adapt for their specific needs.
The following guiding principles have influenced my development of the project and approach to developing a curriculum unit for linear relationships in juvenile corrections schools:

1) To master the slope-intercept form for linear relationships, students who have learning disabilities need to be supported by effective curriculum and research-based instruction.

2) Teachers in correctional schools will see benefits from having a comprehensive curriculum unit on linear relationships.

3) Teachers will be more likely to use a unit on linear relationships if it is self-contained, follows research-based strategies, and aligns with state mathematics standards.

4) A quality curriculum unit on linear relationships includes a sequenced set of materials which can be used all-together or separately to teach students with diverse needs and backgrounds.

Experience in teaching students in juvenile corrections schools can be a valuable resource in the development of curriculum for students with learning disabilities and/or emotional/behavioral disorders.
Related Works and Justification

Three areas of educational literature are especially important for the design of the project: (1) best-practices for teaching linear relationships to students with middle-school levels of mathematics achievement, (2) general principles for the development of effective mathematics curriculum and (3) the particular educational needs and successful instructional strategies for mathematics students in juvenile corrections schools. In the sections that follow, I describe how this related literature can be used to develop a justified and researched-based instructional strategy for supporting understanding of linear relationships in juvenile corrections settings.

Best Practices in Teaching School Mathematics

According to Bartz (2011), instructional pedagogies such as visuals aids, effective incorporation of technology, cooperative learning, and real world problem solving can be considered best practices in mathematics instruction that may help students like those targeted by this project to learn the concept of linear relationships and master the mathematical processes and standards recommended by NCTM. These instructional pedagogies are likely to enhance students' knowledge on linear relationships by enabling students to engage in multiple learning strategies.

Through research in mathematical instructional practices, Anderson (2009) identified ten suggested instructional practices in math. One suggested instructional practice in math according to Anderson is lecture; this will be a presentation of no more than 20 minutes. Anderson next suggests collaborative lecture is best instructional practice in math; this is teacher-centered base and includes interaction with students. Third, cooperative learning is also a best instructional practice which encourages
students to work together in small groups to complete tasks. Another best instructional practice in math is inquiry-based learning which requires students to explore, discover, and comprehend mathematical concepts. There is an emphasis on applications problems that emphasize the ability for students to make connections between classroom learning and the real world. Project based learning, according to Bartz (2011), is a best instructional practice which focuses on multiple representations of mathematical concepts, allowing students to better see the relationships between graphs, tables, algebraic functions, and word problems. Under this best practice, students will be required to communicate orally and in writing about their learning.

*Linear Relationships through the Slope-Intercept Form*

The content focus of this project is mathematical representations and how they enhance student learning of linear relationships. In the following paragraphs, there are several overviews of research, which relate to the different representations of linear relationships including real life situations. Green (2010) illustrated the power of Bloom’s revised taxonomy for teaching, learning, and assessing in alignment with school’s curriculum expectations and assessment tools. Through this analysis we gain additional understanding of why students may have difficulty in performing well on certain activities.

The juvenile students are reasoning through the problem and connecting the graphs with functions. Green (2010) says no, and I agree to a certain extent. I have found in my teaching that these juvenile students have a very short memory span to recall important factual knowledge, which is most needed in graphing equations and functions. Pirie and Martin (1997) found that there exists a variety of cognitive problems
to learning linear equations with understanding. Using a model called the Pirie-Kieran model; the researchers analyzed and accounted for successful growth of understanding of the low ability year eight pupils in one classroom. There were still cognitive skills that needed to be addressed for the low ability students. I had to agree with the researchers, because I have encountered similar problems with low ability high school students who were very much behind on their cognitive skills; they were required to attend one to one tutorial with the teacher tutorials.

Friel, Curcio, and Bright (2001) reported on the critical factors that influence graph comprehension. They described the three main components:

1) to read information directly from a graph, one must understand the conventions of graph design (e.g., Kosslyn, 1994); 2) to manipulate the information read from a graph, one makes comparisons and performs computations; and 3) to generalize, predict, or identify trends, one must relate the information in the graphs to the context of the situation. (p.152)

Mathematics Instruction in Correctional Education Programs

The overall problem of education levels, emotional or behavioral disorders, and students in correctional education programs is that many students are on a path to, or are perceived to be on a path towards, academic failure. According to research (Jolivette K. & Nelson, C. M. (2010), nearly 93,000 youth are held in secure residential care, almost 7,000 are held in adult jails, and 2,000 are in adult prisons. Closely half of the incarcerated juvenile population has been identified with educational disabilities. Two-thirds of males and three-fourths of females meet diagnostic criteria for one or more psychiatric disorders not include conduct disorders. Jolivette and Nelson report that educational status of at-risk and incarcerated juveniles suffer; both school attendance and school completion fall significantly below that of same-age peers.
Many American youths do not complete high school: the national graduation rate 72% for females and 64% for males. According to a 2004 report by the Policy Research Institute, lack of education correlates with crime rates:

- A one-year increase in average educational levels reduces arrest rates by 11%, lowers the murder and assault rates by about 30%, motor vehicle theft by 20%, arson by 13%, and burglary and larceny by 6%.
- Approximately 50% of students labeled with emotional or behavior disorders dropped out of school; only 42% of those who remained in school graduated with a diploma.
- 10% of children and adolescents suffer from mental illness severe enough to cause impairment, yet nearly 80% do not receive needed services. Untreated mental illness among youth leads to school failure, delinquency, substance abuse and entrance into the criminal justice system.
- Failing to earn a high school diploma is costly to states and society as a whole: Adults without a high school diploma had a median income of less than $12,000 - only $3,000 over the federal poverty level.
- Early stage identification and intervention for serious emotional disturbances can help children graduate and lead independent and productive lives.

Foley (2001) reviewed the literature on the academic characteristics of incarcerated youth in correctional educational programs. Foley found a high percentage of such youth have learning disabilities, etc., but only 15 to 25% of students in correctional education programs earn a GED or high school diploma. Because of this,
incarcerated students can really benefit from experiencing structured, well-supported, and research-based approaches to teaching mathematics in correctional education programs. The outcomes of Foley’s literature review specified that interned adolescents function typically in the low to below average range of intelligence and perform between fifth-and ninth–grade levels academically. These interned adolescents have high rates of academic failure and grade retention.

The particular juvenile correctional educational program offers a broad continuum of curricular offerings, ranging from elementary school to postsecondary school levels. The availability of special education services for youth with disabilities varies from state to state. In particular, effective instructional strategies for incarcerated youth appear to be direct instruction and tutoring-based approaches.

The design of this project emphasizes best practices for helping at risk students to succeed in mathematics. Slavin (1990) describes several things that have been shown to have a positive effect on the learning of at risk students, including:

1. comprehensive materials, including:
   a. teacher’s manuals
   b. curriculum materials
   c. lesson guides
   d. other supportive materials
2. intensive programs, such as one-to-one tutoring or computer-assisted instruction
3. frequent assessment of students' progress, and use of the assessment to modify instructional content or groupings to meet students' individual needs.
Of the characteristics described by Slavin (1990), the project is designed to offer comprehensive materials in the form of curriculum materials, teaching guides, and lesson guides, as well as tools for frequent assessments to inform teachers and students of progress toward mastery goals.

Meisel, Henderson, Cohen, and Leone (1998) have outlined 9 elements needed for effective instruction of special education students in correctional facilities. The two components directly addressed by this project (described and in bold) form crucial instructional components in the overall system:

- **Competency-based curriculum options**: Curriculum defines the content of the school program. In other words, what is taught.
- **Direct and peer-mediated instructional strategies**: Direct instruction of the topic; Peer mediated instructional strategies include cooperative learning and peer tutoring. Instruction should include attention to the development of higher-order problem solving and decision-making skills.
  
  - Integrated, multi-disciplinary framework for service delivery.
  - Functional curriculum-based assessment.
  - Pro-social skills curriculum.
  - Business and community involvement.
  - Professionalism, leadership, and advocacy.
  - Ongoing professional development.
  - Sufficient fiscal resources.
Of the 9 elements identified by Meisel, Henderson, Cohen, and Leone (1998), this curriculum project is specifically designed to support (2) competency-based curriculum, and (3) direct and peer-mediated instructional strategies.

*Teaching Linear Relationships to Students with Learning Disabilities*

According to Beatty and Bruce (2012), students who have learning disabilities were able to make connections among the different representations of linear relationships and predict how changes in one representation would affect other representations. There were four particular areas of learning discovered in the teacher's in-class assessments. There were students who understood the functional rules of linear patterns, students who were able to create a graph of a linear equation from a given rule, students who were able to identify the linear function, and students who were given a graphical representation of a linear relationship and were able to make connections among three representations: patterns, rules, and graphs.

One approach to teaching mathematics for students with learning disabilities is the step-by-step Math Strategy Instruction format presented by Gagnon and Maccini (in press). While the sequence of lesson plans in this project differs from the structured format at times, the organization helps explain some of the "best practices" for teaching students in the target situation.

Step 1: Provide an advance organizer.

- Connect new information to previously learned skills.
- State the new skill to be learned.
- Provide the rationale introducing the new topic.

Step 2: Provide teacher modeling.
• “Think aloud” to students while introducing a strategy.

• Then, fade teacher prompts while involving students in application of the strategy. For example, following the teacher model, students answer questions and write down their responses using the graphic organizers or structured worksheets.

Step 3: Provide guided practice.

• Provide opportunities for students to practice the new strategy with teacher assistance.

• Fade teacher assistance until students can perform the task independently.

Step 4: Provide students with independent practice.

• Assess student mastery of the skills by providing problems without teacher prompts/assistance.

Step 5: Provide positive and corrective feedback throughout the lesson.

• Document student performance (e.g., calculate the percentage correct).

• Target error patterns/incorrect answers.

• Reteach content if necessary.

• Provide student practice with similar problems and monitor student performance.

• Close with positive feedback.

Step 6: Program for generalization to other situations.

• Problem-solving situations

• Content areas
• Real-world situations

The comprehensive curriculum unit implements some of the steps from the Math Strategy format which are the following: In Step 1, the lessons provide an organizer to connect new information to previously learned skills and state the new skill to be learned. Next in Step 2, the teacher “thinks aloud” to students while introducing a strategy. Then, in Step 3, students engage in guided practice on related tasks with the assistance of the teacher. In Step 4, students have opportunities for independence practice. Lastly, in Step 5, the teacher uses their observations of student work to guide decisions to reteach the content when needed. These steps are required for students to make sure they understand the content skill and master it. These are the steps which I use in my teaching practices, and form a consistent structure for the planned curriculum materials.

Alignment of Content with Standards

In the state and/or national standards for teaching and learning of mathematics, there are a number of standards mentioned in NCTM, CCSS, and TEKS documents which relate to the project.

According to NCTM (2000), mathematics students in Grade 8 are required (1) to create and use representations to organize, record, and communicate mathematical ideas, (2) to select, apply, and translate among mathematical representations to solve problems and (3) use representations to model and interpret physical, social, and mathematical phenomena. Moreover, students in Grade 9 are required to (1) understand patterns, relations, and functions, (2) represent and analyze mathematical situations and structures using algebraic symbols, (3) use mathematical models to
represent and understand quantitative relationships, and (4) analyze change in various contexts (NCTM, 2000).

Table 1.

<table>
<thead>
<tr>
<th>NCTM Standards</th>
<th>Equations</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpret representations of functions of two variables.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Write equivalent forms of equations, inequalities, and systems of equations and solve them with fluency-mentally or with paper and pencil in simple cases and using technology in all cases.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Use symbolic algebra to represent and explain mathematical relationships.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Understand relations and functions and select, convert flexibly among, and use various representations for (functions).</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The National Council of Teacher of Mathematics standards (NCTM) and The Common Core State Standards (CCSS) established set standards for Algebra I. These standards informed teachers which standards need to be addressed for the students to master in Algebra I. Both sets of standards have emphasis on problem solving. They also require students to manipulate linear equations and functions in one and two variables in problem solving. Refer to Tables 1 and 2 for the required standards.

Table 2.

<table>
<thead>
<tr>
<th>CCSS Algebra Standards</th>
<th>Equations</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-SSE.1. Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients. Interpret complicated expressions by viewing one or more of their parts as a single entity.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>CCSS Algebra Standards</td>
<td>Equations</td>
<td>Functions</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------------</td>
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<td>-----------</td>
</tr>
<tr>
<td>A-CED.1. Create equations and inequalities in one variable and use them to solve</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>problems. Include equations arising from linear and quadratic functions, and simple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rational and exponential functions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-CED.2. Create equations in two or more variables to represent relationships between</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>quantities; graph equations on coordinate axes with labels and scales.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-CED.4. Rearrange formulas to highlight a quantity of interest, using the same</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>reasoning as in solving equations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-REI.3. Solve linear equations and inequalities in one variable, including</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>equations with coefficients represented by letters.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-REI.6. Solve systems of linear equations exactly and approximately (e.g., with</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>graphs), focusing on pairs of linear equations in two variables.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-REI.10. Understand that the graph of an equation in two variables is the set of</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>all its solutions plotted in the coordinate plane, often forming a curve (which</td>
<td></td>
<td></td>
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<tr>
<td>could be a line).</td>
<td></td>
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<tr>
<td>F-IF.7. Graph functions expressed symbolically and show key features of the graph,</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>by hand in simple cases and using technology for more complicated cases.</td>
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<td></td>
</tr>
</tbody>
</table>

**Justification for this Curriculum Development**

According to research by Maccini, Gagnon, Cutting, and Leone (2006), few teachers at correctional schools use research-based instructional approaches which have been identified as being successful for students who are classified as having learning disabilities or emotional/behavioral disorders, including limited use of technology, real world problem solving lessons, or direct instruction on strategies. None of the teachers in the study used effective strategies such as instructional sequencing.
that begins with concrete manipulative and progresses to pictures and then numbers and symbols, or formal peer tutoring/collaboration organized in small group learning environments. The only instructional approach that any teachers reported using on daily basis was strategy-focused instruction (Maccini, Strickland, Gagnon,& Malmgren, 2008).

As reported in Beatty and Bruce (2012), some teachers claim that students with learning disabilities can be helped to build an understanding of linear relationships through working with hands-on materials. Many of these students have problems retaining knowledge. They were given more abstract representations of linear growing patterns initially, then moved to linear graphs, and then to patterns, rules, and equations. Teachers observed an increase of student confidence in these sessions which used Critical Learning Instructional Paths Supports (CLIPS) activities to provide students means for thinking and reviewing their own ideas. The CLIPS are designed to direct students’ attention in order that they would discern details and recognize relationships particularly in making connections among different representations.

The existing instruction /curriculum is not optimal because it does not include effective instructional materials to assure the teacher that students have understood the concepts well enough to move on to another concept. Teachers have to make up their own exams and create their own activities because in the textbook, very few activities exist. Teachers have to attend staff development sessions to get new ideas. Teachers sometimes have to take a day off from work to attend.

After all these years, I still have a passion for teaching students, especially the ones that struggle and I am always looking for different lessons to use to get certain
concepts across to the students. Going through the research, finding different approaches to reach these students, I find myself using some of the instructional approaches identified in the literature for juvenile corrections students. I feel that this comprehensive curriculum unit will contribute greatly to the community of mathematics teachers and my colleagues at many similar institutions; therefore, I submit this curriculum, for consideration as the culminating project in the master’s degree program in mathematics at Texas A&M University – Corpus Christi.
Methodology

In developing materials to teach linear relationships, I used the results of the literature review to create a research-based series of five lesson plans that include activities in a comprehensive curriculum unit to facilitate at-risk students' learning linear relationships in multiple representations. Also, I use the best practices for teaching this diverse population, the step by step Math Strategy Instruction format by Gagnon and Maccini (in press), which includes advance organizer, teacher modeling, provide guided practice, provide students with independent practice, provide positive and corrective feedback throughout the lesson, program for generalization to other situations, and applications in real world situations.

The resources which I used for my project included previous experience in the research site, the previously developed Walbey’s table/list, literature research, and a concept-map based activity from a local teacher (with permission). In creating the equations, I made them up as part of the lesson development and worked them out to make sure I targeted the objectives I wanted my students to acquire as they worked in the lesson.

As shown in the timeline below, from the comprehensive curriculum unit here are the produced lessons, with a teacher guide, and a project narrative. In the produced lessons, the main objective is for students to be able to understand linear relationships. The teacher guide is made to assist the instructor in providing different ways to teach linear relationships. The project narrative provides the instructor instructions how to present the materials from a teacher viewpoint.
<table>
<thead>
<tr>
<th>Date</th>
<th>Planned Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2012</td>
<td>Learn about proposal, brainstorm possible topics</td>
</tr>
<tr>
<td>July 2012</td>
<td>Begin review of proposal formats, narrow down topics</td>
</tr>
<tr>
<td>August 2012</td>
<td>Focus the project scope, conduct literature review, pilot action research study</td>
</tr>
<tr>
<td>August 2012</td>
<td>Begin reading and literature review, make connections to classroom strategies</td>
</tr>
<tr>
<td>September 2012</td>
<td>Continue literature review</td>
</tr>
<tr>
<td>October 2012</td>
<td>Narrow scope of the project, focus the topic on linear relationships</td>
</tr>
<tr>
<td>November 2012</td>
<td>Investigate curriculum frameworks, continue literature review</td>
</tr>
<tr>
<td>December 2012</td>
<td>Submit draft proposal, reschedule project defense for Spring 2013</td>
</tr>
<tr>
<td>January 2013</td>
<td>Begin development of structured proposal, write abstract and introduction</td>
</tr>
<tr>
<td>February 2013</td>
<td>Continue structured proposal, write draft proposal, and attend juvenile corrections education conference</td>
</tr>
<tr>
<td>March 2013</td>
<td>Convert structured proposal to narrative, submit to committee</td>
</tr>
<tr>
<td>April 2013</td>
<td>Present and defend the proposal, begin preliminary project work</td>
</tr>
<tr>
<td>May/June 2013</td>
<td>Complete curriculum project, including lesson materials and teacher guide</td>
</tr>
<tr>
<td></td>
<td>Complete project narrative, submit to committee for review and comments</td>
</tr>
<tr>
<td>July 2013</td>
<td>Defend project, apply for graduation</td>
</tr>
</tbody>
</table>
Results

I created a special curriculum unit to be used for this special diverse population while addressing the 8th and 9th grade content standards and TEKS. This curriculum unit will enable students to understand the concept of linear relationships and master this concept completely. Instructors will be pleased with this unit because after completion of the curriculum unit, they will discover how successful their students’ achievement and knowledge can rise up to a higher level than before.

This project will produce a curriculum unit which will address the following topics in lesson plans and activities:

- Elementary concepts of linear relationships
- Different representations relating to linear relationships

I created 5 activity-based lessons which build students’ knowledge and basic skills. The unit addresses the following topics in lesson plans and activities.

In lesson 1, there is an introduction of vocabulary words on algebraic concepts which are used in teaching linear relationships. For example, relationships, linear functions, independent variable, dependent variable, linear graphs, x-axis, y-axis, ordered pairs, value table, x-y-intercepts, slope of a line, slope-intercept form. Students are required to define terms in their own words and draw a picture for each term, as appropriate. After completing the assignment, they are allowed to check how close their definitions were by using the math dictionary or math textbook. A pretest is given to students on the vocabulary words relating to linear relationships. After several days, the instructor will assess the student to see if they comprehend the algebraic concepts. During the next two days, students practice on the vocabulary words through a game
where they will have to match a term with a picture and a practice sheet which the student will have to fill in the blank with the correct algebraic concept.

Also in lesson 1, each student should be able to graph equations no matter which form the equation or function is given; therefore, they must be able to graph with or without the graphing calculator. These students are given a pretest on graphing equations without using the graphing calculator. If needed, the teacher reteach this skill and reassess the students. Practice sheets are given on one day where the students are not allowed to use the calculator, and on the other day, they are allowed to use the graphing calculator.

In lesson 2, students are given a pretest on graphing x and y-intercepts, discover the x and y-intercepts on the graph, graph the equation, and label the x and y-intercepts on the graph. After the pretest, the teacher will model the activities. Students will receive an activity sheet, “Identifying Intercepts,” where the students identify the x-intercept and y-intercept from given equations. The next activity sheet, “Equations,” the student has to graph the given equations and identify the x and y-intercepts. After a few days, students are assessed on graphing x and y-intercepts and the algebraic concepts from previous lessons.

In lesson 3, A pretest is given to the students on finding slope from observing a graph, and given two points (ordered pairs), using the slope formula. After the pretest, the teacher will model how to use the slope formula and how to find the slope from the graph, using the rise and run method. Students are given an activity sheet, “Slope of the Line,” students need to find the slope from different graphs. Students are given another activity sheet, “Slopes,” they are required to select the x-intercept and y-intercept and
use the slope formula. Students discover how easy it is to find the slope by using the intercepts. Also students are given an activity sheet, “Find the Slope-intercept form,” that contains 10 pairs of ordered pairs and requires students to find the slope and slope-intercept form.

In lesson 4, a pre-assessment is given to students on finding the equation of line, \( y = mx + b \), changing the line to standard form, \( Ax + By = C \), and doing the reverse procedure of changing a line from standard form to slope-intercept form, \( y = mx + b \). The instructor model focuses on how to change standard form to slope-intercept form using the graphing calculator. This technique is important because if they are given standard form, students may have to change this form to slope-intercept in order to use the graphing calculator. Students are given activity sheet, “Standard form equation,” that contains 10 standard form equations and requires students to change each equation to slope-intercept form and use the graphing calculator to get the value table. The next activity sheet, “Slope-intercept forms,” requires students to identify and give x- and y-intercepts for each equation by letting \( x=0 \) and \( y=0 \) and the given slope. Students will be required to observe the equations and explain what they discovered. On the next activity sheet, “Real world situations,” students will work with word problems which are solved by using linear relationships and graphing.

In lesson 5, students will be introduced to the Walbey’s Table or List. The table includes all the algebraic concepts which are needed to cover the multiple representations on linear relationships. Based on the pilot study conducted in an action research course, approximately 30% of students (many of whom have learning disabilities) prefer the information presented in list format. The table and list each
require students to use the point-slope form of a line, which comes later in their curriculum. Students will take a pretest on the multiple representations using the Table/List. After three to four weeks of instruction, they will be assessed with the Table or List (whichever format they prefer). During this period of time, students receive quick reviews periodically using this teaching tool and they are assessed. Based on experience in the classroom, the Table/List is an excellent tool to be used in juvenile corrections schools, especially for students who struggle the most due to learning disabilities and/or behavioral disorders. The students can use the multiple representations in the Walbey list to see the whole picture and how different descriptions of linear relationships connect with each other.

Please see the following for a list of contents in the curriculum unit.

Overview

Lesson 1: Vocabulary of Lines & Graphing

Teacher Notes for Lesson 1
Pretest on Graphing Equations without a Calculator
Pretest on Graphing Equations with a Calculator
Graphing Lines
Graph Lines with a Calculator
Pre/Post Assessment on Vocabulary
Answer Key for Pre/Post Assessment on Vocabulary
Assessment on Graphing Linear Equations

Lesson 2: Connecting Pictures with Symbols

Teacher Notes for Lesson 2
Pre-Assessment on Graphing with Intercepts

Identifying Intercepts

Graphing using Intercepts

Post Assessment on Graphing with Intercepts

Lesson 3: Slopes of Lines

Teacher Notes for Lesson 3

Pre-Assessment on Slope & Slope-Intercept Form

Pre-Assessment on Slope & Slope-Intercept Form

Identifying Slope from a Graph

Slope-Intercept Form from Two Points

Lesson 4: More Forms of Linear Equations

Teacher Notes for Lesson 4

Pre-Assessment on Standard Form

Using Slope-Intercept Form

Standard Form

Modeling the Real World with Linear Relationships

Lesson 5. Multiple Representations of Lines

Teacher Notes for Lesson 5

Walbey’s Table

Walbey’s List

Linear Function Web
Conclusion

The comprehensive curriculum unit developed during this project is designed to be available for mathematics instructors who teach linear relationships at the middle school, high school, and college levels, with special emphasis on those working with students in correctional facilities. When an instructor decides to use this curriculum unit, he or she will find several activities and assessments which are ready to implement separately or in sequence. The materials are teacher-friendly and it is easy for teachers to follow the suggestions in the lesson notes while preparing lessons for their students. After working with the curriculum unit, the instructor should feel that if the majority of students pass the given assessments with 80% proficiency or above, then it is reasonable to assume that students have met the expectations for understanding linear relationships.

The comprehensive curriculum guide presented in this project corresponds to the approved work in the proposal because it has a lesson on the basic vocabulary and algebraic terminology that relate to linear relationship, instructional strategies for teachers to support students' mastery of linear relationship with multiple representations, and procedures for engaging students in tasks involving slope-intercept form. Graphing concepts are emphasized throughout the lessons, a focus which is essential for so many students in the 9th grade through college level. Converting standard form to slope-intercept form is a required skill for students to be able to use the graphing calculator, since the graphing calculator has the slope-intercept form. Knowing how to graph equations, student will be able to identify the x & y intercepts and type of slope is expressed by the linear relationship. Also, students need to be able to use the slope
formula by using two points and to identify the slope in the slope-intercept form equation. Based on my pilot study, using the Walbey table/list is good both as an instructional tool and as a method for assessment, and I think it can be especially useful with a diverse population of students, including those with learning disabilities and behavioral disorders. I found the success rate of my students on assessments for linear relationships was raised to more than 80%, and I believe these even more developed materials can help many more students succeed in juvenile corrections settings.

**Value for Juvenile Corrections Education**

This project targets the national and state standards for linear relationship and the curriculum unit is definitely aligned with these standards. By using this particular curriculum unit, the teacher can determine if his or her students achieve mastery of learning linear relationship with 80% proficiency or better. If not, re-teaching may be needed, and the project includes ample materials for presenting material in many different ways.

Another reason why this unit is valuable is that it gives teachers in juvenile corrections schools a flexible way to teach students with a wide range of backgrounds and issues over an extended period of time. Also, it gives teachers and curriculum developers in juvenile corrections schools a template for making standards-based curriculum units that serve the students in their context. Another reason is that students will benefit from multiple representations and a variety of teaching strategies, an approach which appeals to both teachers and students with all kinds of learning styles. Finally, this project gives teachers in special education and inclusion classrooms some
tools to supplement their regular instruction of linear relationships and target activities to individual students’ needs.

Suggested Extensions

After reading and using this curriculum unit in their classroom, teachers or researchers may find it useful to consider the following extensions:

1. The teacher may be able to make up their own equations and search for more word problems using linear equations and linear functions
2. Teachers could use the format of the unit to rethink how they teach other subjects
3. A teacher could add more cooperative learning activities to the curriculum, including different approaches to putting students in groups by ability levels
4. Teachers can develop activities with similar approaches to students mastering the point-slope form of linear relationships
5. Teachers can develop activities with similar approaches to students learning about systems of linear equations, including multiple representations
References


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