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Module 2
ETEC 602 – Dr. Sherry

Learning the Characteristics of the Slope of a Line

Part I - Learner Analysis

Cognitive Characteristics:

For this lesson, students in this activity will be at a *reading level* that is consistent with their grade level in the class. Some students may be slightly above or below average. Since this learning activity is taught at a 9th grade level, most students in the class read on a 8th - 10th grade level.

Specific prior knowledge that is required for this learning activity is consistent with an Algebra student that has learned the basics of an equation with x and y variables. The students should be proficient in solving an equation for x or y, and they should be proficient in graphing equations using an x/y plotting system.

Physiological Characteristics:

Since this lesson will be taught at an all-girls' school, the *gender* of the students is all female.

Because the goal of the school is to be college-preparatory, most students fall within an age that is consistent with being a 9th grader in Algebra 1. So, the *ages* of the students may vary between 14 and 16 years old.

Affective Characteristics:

Because the school's goals are focused on college preparatory, this same idea becomes programmed into most of the students. They are very concerned with getting good grades. This desire comes from their peers and teachers, but mainly from their parents who want their daughters to get into higher-end colleges. This "programming" of the students creates a *motivation to learn* that is not always what the teacher wants. Of course, we want students to want to do well, but we want them to do well for their own intrinsic desire to learn and achieve, rather than a "programmed" need to get good grades.

The *academic self-concept* of most students is usually good. Because they are small classes, teachers have the opportunity to focus more on helping each student to achieve, which usually, but not always, relates to a better success in school and, thus, a better academic self concept.

Social Characteristics:

Most students have a *good relationship with their peers* in the classroom setting. There are advantages to having an all-girl class. While there are petty issues related to gossiping and such, for the most part, the girls are very accepting of each other, listen well in class and feel free to participate in class discussions. There is a distraction of having boys in the classroom, which is not present making peer relationships stronger.

The *socioeconomic background* of most of the students is middle to upper-class. This is not always true as a portion of our students are on some type of financial aid, but, for the most part, the students have a safe place to live and a nurturing family. Many of the families participate in school functions and use their spare time to help make the school a better place.

Part II - Learning Context Analysis

Needs Assessment:
Because 9th grade is the beginning of high school, many of the students that come to Algebra I, come in with different levels of learning when it comes to understanding equations, graphs and slopes. Sometimes many of the students have bad feelings about Mathematics; some say "they hate math". This can be tough to overcome, but I have found that a great way to change these feelings is to find ways to have students learn the concepts differently through discovery learning. In this way, using websites to allow students to see, interact with and discover the concepts is a great way to re-empower students with their own learning.

Learning Environment:
As indicated before, the class will be composed of mainly 9th grade students who are all girls. The classroom is set up in cooperative groups of 2-4 desks. There are white boards along the front wall for use by teachers as well as students. The teacher has a computer hooked to an LCD projector for showing projects or web sites. In this lesson, the teacher will start by projecting the website on the screen for everyone to see and allow students to come up and show specific examples on the teacher computer so all students can see them.

For this lesson, the students will be using wireless iBook laptops with access to the Internet. The iBooks are stored in a mobile cart, which is used by many teachers on campus and checked out through a sign up sheet located on the mobile lab.

Part III - Objective

A (Audience): **The Algebra 1 student (8^{th} – 10^{th} graders)**

B (Behavior): **will be able to determine the characteristics of the slope of an equation**

C (Condition): **given five random equations in slope-intercept form**

D (Degree): **with 80% accuracy.**

Part IV - Learning Outcome and Strategies

The anticipated learning outcome for this activity is a *concrete concept objective*. From the Smith and Ragan (1999) book on Instructional Design, they define a concept objective as one that reflects "the learners' ability to classify and label ideas, objects, and events as examples/nonexamples of a concept. They may require that the learner state how/why such classification was made" (Page 86). This fits perfectly with asking my students to look an equation and determine the characteristics of the slope of its line. The students will need to "classify and label" each slope as either positive, negative, horizontal or vertical. And for slopes that are positive or negative, they need to classify the "steepness". Additionally, the concept objective is concrete, because the slopes are "known by their physical characteristics" (Page 179).

The instructional strategy I will be using for this concept is the *inquiry approach*. I will be using the web site as the tool for allowing the students to "discover" the characteristics of the slope of the equations.

Part V - Web Site and Its AURA

ExploreLearning - http://www.explorelearning.com/
Point-Slope Interactive Page - http://www.explorelearning.com/index.cfm?method=cResource.dspView&ResourceID=166

A (Authentic) – It is not totally clear from the site where this company is located or who the actual owners of the site are. However, from the details and information provided on the site, it is clear that the authors have an understanding of "discovery math" as I call it and the ability to have students "discover" concepts through the use of online, interactive examples. There are pages in the site that show how these examples would fit into a Mathematics or Science curriculum and there are worksheets available for download with a subscription.

U (Unbiased) – Sort of, the concepts that are shown are very good and very easy to use, but the ultimate goal of this company is to get us as teachers to buy a subscription to get more than just the basic interactive tools. My goal would be to buy a subscription from this site, find another interactive tool like this, or build my own tool in Director.

U (Up-to-Date) – In reviewing how the site's interactive tools or "Gizmos" correlate with the state standards, they even talk about integrating with 2004 textbooks, so it is clear to me that the site is staying up-to-date with the most recent curriculum goals in Science and Mathematics.

R (Relevant) – This site is very relevant to me in being able to have students discover concepts.

A (Absent of excessive special effects) – Dr. Sherry, in reading your write-ups and the examples, I am still not very clear what this one means. I think this site has great special effects and graphics that don't deter from the ultimate goal of using this site. It is disappointing that I

am unable to find the actual author or contact information, but I have found this to be common on the Internet. So, maybe the graphics do tend to try and sell more than teach on the home page, but for my students, I would send them directly to the interactive page, instead of the home page.

Part VI - Expanded Event of Instruction

INTRODUCTORY EVENTS

1.1 Activate Attention/Gain Attention
Students are asked for homework to draw sketches of the roof of their house and one other house that is different. For some, their roof might be flat. For others, it might have a steep roof or a steep slope.

1.2 Establish Purpose/Inform Learner of Purpose
When students return to class we will examine some of their sketches. As the teacher, I will show some pictures on the screen of some of the "slopes" of real roofs. I will discuss why some houses have different slopes. Since students already know about graphing equations, I will explain that we will be learning more about the characteristics of the slopes of the lines formed by equations.

1.3 Arouse Interest and Motivation/Stimulate Learner's Attention
Then, I will talk about how the slope of a roof is critical especially in areas where there is snow (a strange concept in Hawaii). But, in areas with heavy snow, they require that slope of a roof be at least 8 in 12. What does that mean? It means that the rise of the roof is at least 8 inches for every 12 inches in the run. Then, we will look at a site that shows this - http://www.roofhelp.com/roof_slope.htm. And discuss what this means.

1.4 Preview the Lesson/Provide Overview
I will talk about in class, how we will be learning more about the characteristics of the line drawn from an equation and how students will

be able to determine where the line goes up or down, is horizontal or vertical or how steep the slope is based on the equation only without even graphing anything!

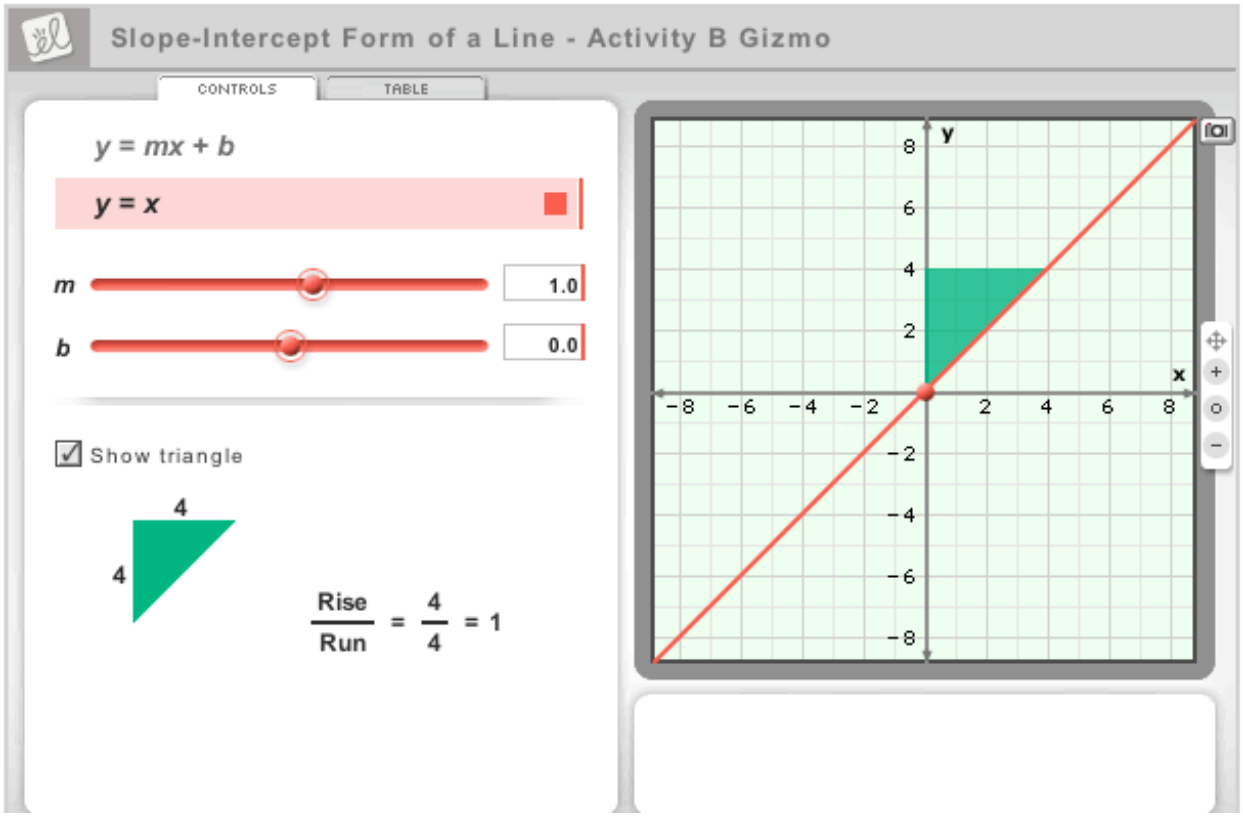
BODY

2.1 Recall Relevant Prior Knowledge/Stimulate Recall of Prior Knowledge
In the beginning, we will start by reviewing how to get an equation in the slope-intercept form. This means taking an equation in any form and solving for y.
So an equation like: $6x + 3y = 9$ would become: $y = -2x + 3$
We will review what slope means and that the formula for slope-intercept form is $y = mx + b$, where m is the slope of the line or the rise/run.

2.2 Process Information and Examples/Present Information and Examples
Then, students will be directed to the web page (explained in Part V). They will be directed from the screen and the teacher's computer to set the slope (m) value to 1.0 and the intercept (b) value to 0.0. I will direct them to not change the b value for now, but leave it as 0.0, as we are focusing just on the slope for now.

Then, I will allow students to play a little and try different settings. I might write on the board or ask them to think about what values produce negative or positive slopes (as defined by looking at the line from left to right). Also, asking them to think about what values produce a "steeper" slope like the roofs, or which ones produce other strange looks.

Here is what the tool looks like:



2.3 Focus Attention/Gain and Direct Attention

To redirect during the discussions, I might ask students to come up and present specific examples that are interesting like when m = 0, which produces a horizontal line. We might stop for a minute to discuss this.

2.4 Employ Learning Strategies/Guide or Prompt Use of Learning Strategies

I will ask them to make a chart of m values and explain what happens to the slope at certain values. A possible student chart:

Specific Examples:

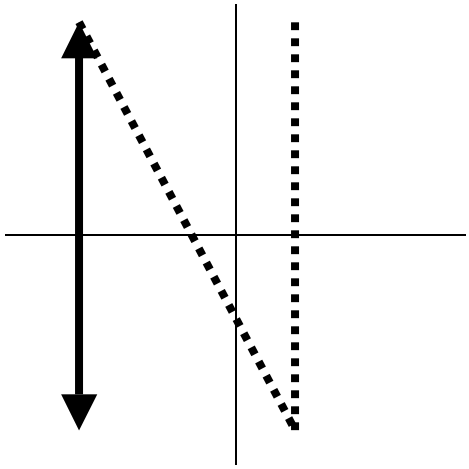
M value	Slope Direction	Steepness Value
1.2	Positive	Very steep
-0.2	Negative	Not steep

2.5 Practice/Elicit Response
To continue practicing, we look at more examples and I will have the students start making some generalizations, something like this:

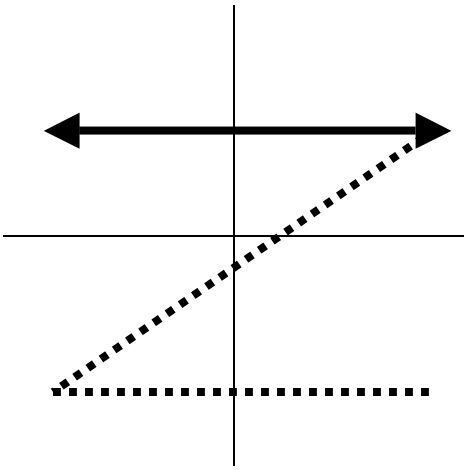
Generalizations:

M value	Slope Direction	Steepness Value
0	None, horizontal line	None
If m > 0	Positive	Gets steeper as m gets bigger

2.6 Evaluate Feedback/Provide Feedback
After working on their generalizations, I will ask students to close the laptops and then I will put examples on the board and we will practice to see if they can determine the answer. After they have done many of these, I might ask them this one – x = 5. At first, they might make some guesses and be a little confused. It will be a great opportunity to discuss the one example that is not possible with the web site and that is the vertical line where there is no y value and the slope is undefined. I will also use this time to compare the two special cases the vertical and horizontal lines and how there is a great visual cue for determining their slopes. (This employs the use of *imagery* strategy for seeing the differences.)



For vertical lines, the slope is NO slope or an undefined slope. So, the line becomes the letter "N" for no slope.



For horizontal lines, the slope is always zero slope or 0 value for the slope. So, the line becomes the letter "Z" for zero slope.

CONCLUSION

3.1 Summarize and Review/Provide Summary and Review
Finally, I will work with the students to produce a generalization sheet that covers the examples we have discussed. It might include some sketches of the graphs of certain examples for ones they are having trouble remembering.

3.2 Transfer Learning/Enhance Transfer
With generalizations in hand, I might ask students to look at examples of actual lines and tell me what we can say about the slope. In this way the knowledge they have gained can be re-applied the other way, instead of using the slope to find the line, we use the line to estimate the slope.

3.3 Remotivate and Close/Provide Remediation and Closure
As an exercise, I might ask students to go home and measure some roofs to determine the slope. Obviously, I don't want them on their roof! But, they could measure the slope of a doghouse or a dollhouse or the slope of a car windshield. Then, we could discuss the results and talk more about the rationale for a steeper or less steep slope.

ASSESSMENT

4.1 Assess Learning/Conduct Assessment
Students will be given a set of five random equations in slope-intercept form and asked to tell me the characteristics of the equation of the line. They will have 4 choices – vertical, horizontal, positive or negative slope. Then, they will have two choices chose either very steep or not very steep. This assessment will either be on a paper test or verbally depending on timing and class abilities.

4.2 Evaluate Feedback and Seek Remediation/Provide Feedback and Remediation
For students that do not achieve an 80% on this assignment, I will work with them individually until they can take a second test and achieve the desired outcome.

At the end of the lesson, I will ask the students what they thought of the lesson. Did it actually help them to understand slope and how it is used in the real world? Did the web site interactivity provide them a more visual understanding of the concept? With their advice, I will revise the lesson for next time.