CMST Challenge Project
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First Year

Problem Statement:

How can the students use slope to help a submarine dive into the ocean and change directions to rise to the surface?

This is the essential question the students will need to answer. It involves the mathematical formula for slope, $y = \dfrac{\text{vertical change (rise)}}{\text{horizontal change(run)}}$

This is leading the students to the Slope-Intercept Form of a linear Equation.

$$y = mx + b$$

The goal is to understand the effects of the variable "m" in the slope formula. The students will command a submarine in the Stella program as a simulated real life activity. It will enable the students to change the slope, or essentially the variable "m", to move the submarine in a downward negative slope or to return to the surface with a upward, positive slope. The students will quickly realize the difference between the positive and negative slopes. The Stella program will allow the students to make adjustments as needed.

Use of CMST Tools

We are utilizing the **Stella** computer program to initiate the introduction of slope. The teacher will give some background information and discuss the idea of rise over run. It will be up to the student to apply this information with the Stella program called RED OCTOBER and dive the submarine and return it to the surface. This will lead the students to better understand the letter "m" as we continue to explore in the Slope-Intercept Form of a linear Equation.

The second tool is **Project Interactive**. The students will first experience Project Interactive with the Power Point presentation. There is a hyper link set up to launch the internet location and is then easily accessed during the presentation. Here the positive and negative slopes are quickly identified and the sliders show the connections made to the graph. The y-intercept is also presented with interaction graphs that help to make learning more clear and easy to understand. The students will have more opportunities to discover this tool in the computer labs.

Analysis of data and results

This CMST Project began as a surface area project. The idea was to use wings of airplanes and identify the surface area compared to the amount of lift it provided. The problems came quickly. Surface area was only a small piece of the flying dynamics. I began to change my thinking to what the school curriculum had planned. In a few weeks we would be teaching the Slope-Intercept form. I began to think of airplanes taking off and landing. This could be a great place to show slope. I began to look at the reasons the slope would change in an aircraft. But aviation reasons were challenging. The idea came when I began to watch a movie called , "The Hunt for Red October". Here we had fewer variables to change the slope of a submarine.

I presented this idea to a hand full of students, but it was difficult for them to understand. I had 9th grade students and they would learn about slope in another month or two. It was part of their curriculum, but they did not want to do much thinking ahead. So I started with baby steps. They all liked the submarine idea and we looked through many pictures on the internet. Some had not seen the movie "The Hunt for Red October" and so we showed it one rainy afternoon. This was helpful to pull more ideas into the project. The students began to ask more and more questions and I began to answer these questions with the project. This was when I introduced the "Project Interactive". Each student had some time with a computer to play with slope of lines.

The students were really doing research about slopes, but they thought they were finding ways to help with the submarine project. We talked about submarines blasting out of the water and ways we could use this with the project. The students began to understand the positive and negative slopes, as it applied to a submarine. They would also use the internet to do a google search for ideas about slope, subs and underwater canyons.

My main problem came with the Stella program. The students initially liked the Stella Program but began to become frustrated when we all had trouble making our ideas work. I ended up doing most of this work. The program was to ask for the negative slope of a submarine as it descends and a positive slope as it ascends to the surface. I was able to initiate the down slope of the submarine (on the graph), but could not get the graph to go up from that ending point. I played with this problem for a good couple of days. But them I realized that I had all the information right there and should use it. I knew where the graph (submarine) was at any particular time and so I set the graph to continue for a set amount of time. Then I was able to use the down slope at that time setting to find the location and apply the positive slope to bring the sub to the surface. It worked well.

The students who worked with me were great. The idea of the submarine was a good enough reason for the students to find out more about slope. For this project, I did not have all the answers to what direction we needed to go and the students seemed to really enjoy this. I should have taught them more initially, but in this case, it really lead to a lot of interesting questions. Some students began to quiz others by using pictures of

the subs and asked to identify the slope. Those different slopes graduated to vertical or undefined slopes and this was a great teachable moment. The students felt as if they had discovered this and they made sure that it was represented in the poster.

The few students who saw the final Power Point thought it was great. This was just recently completed and it will be the kick-off for slopes in my regular classroom. The CMST project was slow to begin and almost too fast at the end. We had different students in the beginning than we had at the end. But for the most part, I believe those student walked away with some information about slopes. Project interactive was a wonderful way for the students to understand the different values of positive and negative slope. I hope that in a few weeks when the 9th grade students begin slope-intercept lessons, that these few students will have some prior knowledge to use and their grades will be positively sloped.