Data collection activities in algebra 1

Science, Mathematics

Algebra has long been taught in the same way. This usually means teachers rely heavily on the textbook. Though some textbooks have changed in recent years, the central focus is till on paper and pencil, memorization of rules, and use of algorithms. The Curriculum and Evaluation Standards for SchoolMathematics(NCTM 1989) asks mathematics teachers to seek activities that " model real-world phenomena with a variety of function" and " represent and analyze relationships using tables, verbal rules, equations, and graphs".

The standards also urge teachers to give students the opportunity to be actively involved in math through data analysis and statistics that are integrated into the curriculum. My hope is to show that these types of activities can be incorporated into an algebra I course as a way of teaching slope, y-intercept, and linear equations. I plan to teach a unit on linear equations during the third nine weeks of an eighth grade algebra I course next semester.

The project will begin with one class learning the material typically covered in most algebra textbooks. I do not plan to pretest the students because this is new material for them. This class will also go to the computer lab and complete a lesson on the computer covering linear equations. In addition, they will work in pairs using T1-82 graphing calculator to explore slope and y-intercept. All of these methods are what I have typically taught over the past 5 years.

Another eighth grade class will be given several data collection activities as a unit of study for linear equations. The primary resource for this class will be Algebra Experiments I by Mary Jean Winter and Ronald J. Carlson. My focus

will begin with a whole class participation data collection activity. The class will perform “ the wave” in small sections at a time until the entire class has completed it. As a group will record the number of seconds it takes (for example) 3, 5, 8, 13, 15, 20, etc. to complete the wave.

Students will then use a prepared activity sheet that requires them to draw a diagram of the experiment, describe the procedure, identify the independent and dependent variables, create a table of data, graph data, choose two representative points to connect and create a “ line of best fit”, find the slope and y-intercept of this line and describe it algebraically and verbally, then interpret the data through certain questions designed to create understanding of the purpose of the data and using the data to make predictions. This same format will be used for all subsequent activities uring the unit of study. The authors of the book say “ Algebra Experiments I reflects the basicphilosophyof the NCTM standards for learning, teaching, and assessment. Students have an opportunity to work collaboratively, to interact, and to developcommunicationskill. ” The whole idea is to “ bring the real world into your algebra classroom. ” I plan to require the class that does the experiments to keep a daily journal. It will include hot they felt about the daily activities, a description of any specific new topic or topics they learned and a list of questions they still have.

Each day the class will address any concerns from the previous day's activity. After several activities have been done by hand, I will instruct the class on how to analyze the data on the T1-82 graphing calculator. They will then be given the opportunity to use the calculator on another experiment. This class will also do the same graphing calculator activity on slope and y-

intercept that the other class will do. I will give each class the same test and compare scores. I will also give each class a survey to compare attitudes, interest and understanding of the use of the material in a real-world application.

My hope is that the students in the experiment class will have grasped the basic concepts of linear equations as well if not better than the other class and be able to relate this knowledge in a very real way. My search for articles about my proposed topic was lengthy and I have chosen to comment on a few. My goal next semester is to read and use each of these articles in my actual action paper. I have only read one article in its entirety. What I gathered from the abstracts was the importance of using real-world applications and incorporating the use of the graphing calculator.

Since my goal is to show that data collection activities can provide a way to teach the basic concepts of linear equations in a real-world setting, I tried to find articles that would bear this out. Mercer (1995) presents lessons that teach slope-intercept concepts of linear equations through the use of the graphing calculator. Held (1995) uses Computer-Intensive Algebra (CIA) to focus on the use oftechnologyand real-world settings to develop a richer understanding of algebraic concepts. Dugdale (1995) has written about technology and algebra curriculum reform. She focuses on “ current issues, potential directions, and research question”.

Assessment issues are addressed. Algebra is “ a way of reasoning involving variables/functional relationships, generalizations/modes of representation and mathematical investigation/argument. Harvey (1995) was the keynote speaker at the Algebra Working Group of the Seventh International

Conference on MathematicalEducationin Quebec City, Canada. He spoke of how important technology was in new algebra curriculum reform based on the NCTM standards. Bell (1995) was also a speaker at the Quebec conference. He suggest curriculum modifications and reviews research on students' performance.

Menghini (1994) “ claims that, to be meaningful, algebra must be linked to real-work problems. ” Wallace (1993) offers a data collection activity similar to one I have used in the past. I would like to include this one in my lesson plans. It “ compares the trends of women's and men's world records for the 800-meter run using the linear and power Regression capabilities of a graphing calculator. A very promising article by Magidson (1992) “ addresses the challenges, risks, and rewards of teaching about linear functions in a technology-richenvironmentfrom a constructivist perspective.

Describes an algebra class designed for juniorhigh school studentsthat focuses on the representations and real-world applications of linear functions. ” I hope this will help me next semester as I begin to encounter problems. References Bell, A. , (1995). Purpose in school algebra. Journal of Mathematical Behavior, 14 (1), 41-73. Dugdale, S. and others, (1995). Technology and algebra curriculum reform: current issues, potential directions, and research questions. Journal of Computers in Mathematics andScienceTeaching, 14 (3), 325-57. Harvey, J. nd others. (1995). The influence of technology on the teaching and learning of algebra. Journal of Mathematical Behavior, 14 (1), 75-109. Heid, K. (1995). A technology-intensive approach to algebra. MathematicsTeacher, 88 (8), 650-56. Magidson, S. (1992). From the laboratory to the classroom: a technology-

intensive curriculum for functions and graphs. Journal of Mathematical Behavior, 11 (4), 361-37. Menghini, M. (1994). Form in algebra: reflecting, with Peacock, on upper secondary school teaching. For the Learning of Mathematics, 14 (3), 9-14.

Mercer, J. (1995). Teaching graphing concepts with graphing calculators. Mathematics Teacher, 88 (4), 268-73. Wallace, E. (1993). Exploring regression with a graphing calculator. Mathematics Teacher, 86, (9), 741-43. Example 2 Use of Algebra Tiles to Enhance the Concept Development of Operations on Polynomials and Factoring in Ninth Grade Algebra Students The purpose of this action research project is to find out if the use of Algebra Tiles will enhance the concept development of operations on polynomials and factoring in ninth grade algebra students.

Mathematics teachers are guided by the Arkansas State mathematics Framework. The following three student learning expectations are covered by this research project. 2. 1. 5 Describe, visualize, draw and construct geometric figures in one, two, and three dimensions. 2. 3. 7 Represent problem situations with geometric models and apply properties of figures in meaningful context to solve mathematical and real-world problems. 2. 3. 8 Represent one, two and three-dimensional geometric figures algebraically. Algebra Tiles allow students “ hands-on” experience with polynomials.

The tiles give students the opportunity to model, to create a mental image, to draw, and to then symbolically manipulate polynomials. They are based on area and multiplication concepts that students are familiar with. Howden (1985) states “ It is generally recognized that understanding the meaning of a mathematics concept, as opposed to merely performing the associated

computation, is an essential element of true learning and achievement” and “ research shows that modeling and visualization promotes such understanding”.

Two units on polynomials will be taught in ninth grade algebra. One focusing on operations on polynomials and the other focusing on factoring. Two teachers will teach the same material using the same methods and tests. No pre-test will be given because ninth grade students have had no previous experience with these concepts. Both teachers will teach two of their own classes each of these two polynomial units. One class will receive traditional instruction by symbolic manipulation only. The other class will use the Algebra Tiles along with the traditional method.

The student's scores for each unit using Algebra Tiles will be compared to the scores based on the traditional method only. Differences will be compared and noted. In addition, students receiving instruction with the tiles will keep a journal each day describing how they feel about using the tiles. According to Sharp (1995), students using algebra tiles “ found it easy to think about algebraic manipulations when they visualized the tiles” and “ the majority of students stated that the tiles added a mental imagery that made learning `easier. ” Another possible comparison will be to see if there is any difference in scores or perception between boys and girls using the tiles. The goal of this research project is to see if Algebra Tiles or “ modeling” will enhance the understanding of polynomials and make the process of factoring “ easier”. References Howden, Hilde. Algebra Tiles for the Overhead Projector. New Rochelle, NY: Cuisenaire Company of America,

1985. Sharp, Janet M. Results of Using Algebra Tiles as Meaningful Representations of Algebra Concepts, ERIC search, 1995.

Related article: “ Study Guide Algebra”