Mathematics at Horizon

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GraSUS - II Project Overview:

GraSUS-II is a GK-12 project funded by the National Science Foundation. GK-12 (Graduate Teaching Fellows in K-12 Education) programs provide support and funding to graduate students in STEM (Science, Technology, Engineering, and Mathematics) disciplines. NSF GK-12 programs provide opportunities for graduate students to gain expertise communicating science and research to a broad range of audiences.

GK-12 Fellows bring innovative, leading edge ideas from their field into the classroom, sparking interest in science and engineering among K-12 students and teachers. These projects provide the means to establish lasting and productive partnerships between K-12 schools and universities.

In the GraSUS-II project, undergraduate and graduate students (Fellows) are placed in schools throughout the Fargo-Moorhead area. They work with science or math teachers to develop and implement curricular projects that enhance the experiences of classroom students.

GraSUS Mission:

The mission of the NDSU GraSUS program is to enhance awareness, interest, and learning among Grades 6-12 students in the areas of science, technology, engineering and mathematics (STEM). The collaborative efforts of NDSU faculty, graduate and undergraduate fellows, and area math and science teachers will encourage future collegians to explore a post–secondary education in STEM studies.

GraSUS Goals:

- To enrich learning by science and mathematics students in Grades 6-12.
- To improve communication and teaching skills of GraSUS fellows
- To provide professional development opportunities for middle and high school teachers
- To strengthen partnerships between NDSU and school districts
- To document project outcomes and inform others of the potential impact of GraSUS activities
- To incorporate GraSUS-II activities as an integral part of NDSU's STEM graduate programs

Vision of GraSUS:

Utilizing and expanding the partnerships of area employers and the surrounding community, the NDSU GraSUS program will be institutionalized and sustainable by the year 2010.

We will continue to employ up to nine fellows, collaborate with 12-15 secondary teachers per semester, develop 45- 50 lessons/labs/presentations and impact approximately 2,000 students annually.

NDSU Graduate Student-University-School
Collaborative for Science, Mathematics, Engineering & Technology

Probability Project

Title: What are the odds of that?

Content: 8th grade Pre-Algebra

Topic: To explore the relationship between experimental and theoretical probability in everyday situations, and relate the concept of theoretical probability to odds.

Background: Students need to know how to set up and solve equations from formulas and basic arithmetic.

Skills: Students will be able to demonstrate an understanding of how to compute experimental probability through experiments. Students will be able to compare a real-life situation with what happens in a perfect universe.

Objectives: Generally, students at this level intrinsically understand the concept of theoretical probability on a small scale. This project aims to extend their knowledge of theoretical probability on the micro level to complex and multifaceted problems. The project intends to explain and exhibit the use of formulas for quick computation of probability problems. It also hopes to give students a thorough understanding of how theoretical and experimental probability relate. It is also the intention to introduce the concept of odds in such a way that students are able to compute odds directly from theoretical probability.

Project: Students are put into small groups at stations and given work-sheets. Each station contains a different probab-ility experiment: flipping coins, rolling dice, picking a card, and pulling marbles out of urns. Students complete the given experiment at the station recording result of the experiment after each trial. Once all necessary data is collected, the students complete a worksheet on computing different experimental probabilities based on the information on the data sheet. Students also compute the theoretical probability. On a follow up day, the students compare the theoretical probability to the odds, and the experimental probability to theoretical probability.

Outcomes: Students responded very well to this project. Most groups finished all probability experiments with ample time left in class to calculate the experimental probabilities. A number of the theoretical probabilities were computed as a large group. Students, however, had no background with computing the theoretical probability of multi-step experiments using equations, which caused a slight confusion. All students were able to compute the experimental probability. Students were also exposed to the notations of probability, which for almost all was a new concept. Using proper probability notation becomes important when probability is presented at both the high school level and at the college level.

On the follow-up day when odds were presented, most students were able to efficiently extrapolate the odds from the theoretical probability. As an extension problem, the students who finished quickly were then asked to compare their own experimental probabilities to the theoretical probabilities by first converting their fraction to a decimal and percent, and finding the difference in the two values.

IV Drip Rate

Title: Calculating IV Drip Rate

Content: 8th grade Pre-Algebra

Topic: Ratios and proportions in real-life contexts.

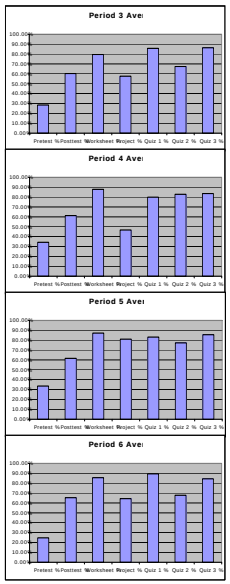
Background: Students should understand the basic concepts of ratios. Students are expected to know arithmetic. Students are expected to know how to solve for a variable as well as manipulate variable equations.

Skills: Students will be able to apply their knowledge of ratios and proportions to the real-life situation of IV drip rates. Students will demonstrate recognition of different applications of the same type of problem. Students will know how to manipulate equations to solve for different variables.

Objectives: This project aims to provide an example of the importance having a strong mathematical background in everyday careers. In completing this project, students will have measured, computed, and adjusted drip rates in much the manner that a nurse does. Students must demonstrate their knowledge of proportional reasoning in order to complete computations.

Pretest: A 30 point pretest was given before any material concerning ratios or proportions was presented. Students in eight grade have been exposed to fractions and how to find equal fractions. For many, the concept of fractions as proportions representing quantities is new. Over the course of 3 weeks before the project, numerous class periods were devoted to rational and proportional reasoning, including worksheets presenting the material in multiple ways.

Project: Students are divided into small groups and given the necessary materials, including an IV, stopwatch, graduated cylinder, and drip bucket. First students calculate the drip rate necessary for a particular dosage. Students calibrate the IV to the approximate drip rate necessary for proper dosage. Then students measure the amount of IV fluid gathered over a period of time with a graduated cylinder. They check their result with the calculated result and account for high margin of error.



Outcomes: The IV project was one in a series of different projects and worksheets created to stimulate a deeper understanding of proportions and ratios done with the students over a period of time.

All classes showed significant improvement from the pretest to the post-test, which were given 4 weeks apart. Also included is data from the scores on the project, accompanying worksheet, and three quizzes given over the course of those weeks.

Most notable about the improvements that the students made over the period of time the project data spanned is their ability to use their proportional reasoning in other contexts. Proportional reasoning is a concept that is used heavily throughout the course of the year.

Histogram Project

Title: Histogram Project!

Content: 8th grade Pre-Algebra

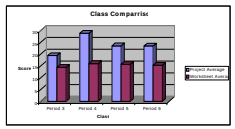
Topic: Organizing student-generated data into a frequency diagram. Creating and analyzing histograms with a variety of scale factors.

Background: Students need a very basic knowledge of how to use the Cartesian plane. Students must be able to classify information into categories.

Skills: Students will be able to fluently collect, organize, and interpret data through a histogram. Students will analyze the difference in appearance of histograms when different scale factors are used on the y-axis of the histogram plot.

Objectives: This project not only focused on how to create a histogram, but also how to analyze different looking graphs to determine what information is being presented. Oftentimes students are exposed to information that appears to be more or less significant than it is. A primary goal of this project was to teach students to carefully and critically analyze histograms in the context of shape versus numerical value.

Pretest: Students were given a relatively simple pretest, which asked them to determine the histogram with a higher value and to create a histogram with a set of data. There were also questions involving student "favorites." Students were graded on a three-tier scale for their answer to the value problem, and were on a point scale for their histogram. Most students did not know how to organize data for a histogram.



Project: Following the pretest, one day in class was spent explaining what histograms are and how to create them. This lesson also explained frequency diagrams and how to create them. The data sets for the project were organized class-by-class and consisted of the favorites collected in the pretest. This gave students a statistical representation of their own classmate's preferences. Students were broken up into groups of three and asked to first organize their data into a frequency diagram. Next, they tallied the frequencies and plotted points onto the graph to make the histogram. Each group member was given a different y-axis scale with which to plot the values for the histogram. This gave each group three different view points on the exact same set of data. Students finished the project by answering a series of questions on the shapes of their different-looking histograms.

Outcomes: The students for the most part responded very well to making the histograms. Based on the results of the pretest, most students did not know how to make a histogram but had encountered them at one point or another. One odd trouble encountered was that students did not always create their frequency diagram as efficiently as possible, and had trouble with plotting the points later. Few students did not understand how the same set of information can be represented graphically different. Based on comparison of the results of the pretest versus the project, many students significantly improved not only their ability to create a histogram, but also how to critically evaluate the information presented in a histogram.

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