1-17-2006

Results of Rolling a Set of Dice

Sarah Jacka
The College at Brockport

Repository Citation

Sarah Jacka   January 16, 2006

Problem Addressed:

After working with experimentally probabilities and dice for several days, I began a lesson by rolling a set of dice. I held them up, I had rolled an eight (after summing the individual die). I rolled them again. Once again I held them up, I had rolled a three. We did this several times. I then threw the question at them, "Is each sum (2-12) equally likely to appear on our dice?" Most students stared, they were afraid to make a conjecture at the fear of being wrong.

I helped them along. This time I asked, "Is each side of the die equally likely to appear." They knew this one: Yes. I once again prodded, "So is each sum equally likely to appear?" Several students made the conjecture that since each side of the die is equally likely to appear, then each sum must be equally likely to appear. We left it at that.

Several days later a group of students were taken to the computer lab to test our conjecture above. They were all convinced that they were correct but when asked to prove it, they were not able to come up with any mathematically sound evidence. This would be the opportunity to prove themselves.   They would have to use at least two methods for rolling dice: Project Interactivate, TI-84, or hands on dice. After gathering their evidence in a table, they would have to represent it graphically at least two ways. Both GSP and Excel were used to create circle and bar graphs.

After having conducting the experiment, representing their data graphically students were required to determine the validity of their original conjecture. If the conjecture was wrong they needed to use their data to explain this. As a bonus, students who could explain why mathematically their conjecture was wrong would be given a bonus.

Curriculum Standards Addressed:

The original reason for choosing to do this particular project with my students was because it involved probability, which is approximately half of their NYS Math 7 exam coming in March. The goal was for students to learn about experimental probability and begin investigating central angles of a circle, which are used in drawing a circle graph. The three standards we had set out to address are:

- ✓ 7.M.8 Draw central angles in a given circle using a protractor (circle graphs)
- ✓ 7.S.2 Display data in a circle graph
- ✓ 7.S.1 Identify and collect data using a variety of methods
- ✓ 7.S.12 Compare actual results to predicted results

 After I began to plan the project I realized that it hit many other curriculum standards including those that address reasoning, explanation of results, multiple representations and how they are connected. The full list of every standard that we hit during this weeklong project is listed below. I was pleasantly surprised at how many standards could be hit in such a short amount of time and most were hit accidentally.

- ✓ 7.S.10 Predict the outcome of an experiment
- ✓ 7.S.11 Design and conduct an experiment to test predictions
- ✓ 7.S.8   Interpret data to provide the basis for predictions and to establish experimental probabilities
- ✓ 7.S.6   Read and interpret data represented graphically (pictograph, bar graph, histogram, line graph, double line/bar graphs or circle graph)
- ✓ 7.R.7   Investigate relationships between different representations and their impact on a given problem
- ✓ 7.R.1   Use physical objects, drawings, charts, tables, graphs, symbols, equations, or objects created using technology as representations
- ✓ 7.CN.1 Understand and make connections among multiple representations of the same mathematical idea
- ✓ 7.CM.8 Formulate mathematical questions that elicit, extend, or challenge strategies, solutions, and/or conjectures of others
- ✓ 7.CM.4 Share organized mathematical ideas through the manipulation of objects, numerical tables, drawings, pictures, charts, graphs, tables, diagrams, models and symbols in written and verbal form
- ✓ 7.RP.6 Support an argument by using a systematic approach to test more than one case
- ✓ 7.PS.6 Represent problem situations verbally, numerically, algebraically, and graphically

Because this experiment required students to make a conjecture, prove it using technology, create multiple representations, connect the representations, draw conclusions and finally express their findings verbally and graphically we were able to hit such an amazing amount of Math 7 standards in just 3-4 days.

Problems Encountered:

I was pleasantly surprised that there were virtually no problems encountered. I can only attribute this to the fact that I did a run through with all technology before it was brought to the students.

One problem that I did encounter was trying to fit this project into my calendar due to the fact that we were not going to hit probability until the end of January and still haven't gotten to several of the topics that I covered in the project. Because I work with a team of seven people teaching the same subject I am required to be on pace with them so that we are able to test on the same exact days. It wasn't until after the project was due that we had a 4 day catch up time.

Evaluation of Results:

This project has brought together everything students have been working on for the past several months. Students were able to collect their data and record it in a fairly timely manner. After this experience many students were better able to connect their data to the graphical representations. In doing this they also gained skills in interpreting their data. While we have not yet addressed central angles and how it relates to making a circle graph many students will now walk into that lesson with some good background knowledge. They will have more knowledge about how their percents are connected with the degrees of a circle.

Students were able to come to the conclusion that their conjecture was incorrect and could prove it using their data and many different representations of the data. However, it took much prompting in the area of finding the exact reason they were incorrect. Working with students on this we had to roll each set of dice and write down what two dice made the sum that they had gotten. This led them to conclude that it was because certain sums can occur with many different sets of numbers on the dice. They then had a reason for their conclusion and could back it up with their data and graphical analysis.

Summary of experience:

All in all, this was a good experience for both myself and the students in my class. Because of the way the project was designed I was able to hit more than 15 curriculum standards in one 3-4 day lesson. Many times we focus on one standard at a time but when we can tie many in together I think it is more beneficial to the students.

Because of the topic that I wanted to hit with my project I waited until my students had some background knowledge necessary to do a project that involved so many things that they had been learning about and some things that were yet to come. So I must admit and be very honest that I am glad I waited a little extra time to get this done. I think with out hitting some of these topics first this project would not have been nearly as meaningful to students. I chose this project because it was my understanding that we would be hitting these particular standards earlier in the school year. However, with the NYS sample tests coming out as a team we decided to wait. Probability is the largest component on the Math 7 exam and we felt that it would be most beneficial if we covered that topic as close to the exam as possible.

The week leading up to the project I felt a black cloud looming above. It wasn't until I broke the project down and began to do it myself that I had control over what I needed to do. Actually going through the project step by step as if I were the student helped to make sure I hadn't left off any piece that was necessary to keep the students organized and on task.

I am very glad that I was able to complete this program with my students. They have benefited and are beginning to ask, even though they are only in seventh grade, how they can use these programs more. It has been an enriching experience for all involved. I now have something that they love to do and wouldn't ever want to lose!

I'm sure that by the end of this year some of my students will be showing me how to do new things with the software they are learning to use!