Sally Circles

A Final Report

Created by Sally

all names and identifiers have been masked/changed to retain anonymity

Introduction

Throughout [our class], we have learned that students need to be able to understand concepts in their own ways and terms. Each math problem, even the most difficult algebra problem, can be solved by a first grader if it is presented in the proper way. After seeing a student I tutor have issues with solving fraction problems, I tried to use tools I already had to help him find the solutions. However, it wasn't until I used multiple manipulatives that he even started to understand his homework, and even then, he was mostly grasping for answers. I realized that the issue wasn't that he didn't know how to do the problems, but that he didn't understand fractions in general. I created a tool that I believe will help him understand fractions as a concept, and therefore help him tackle the more abstract problems. My goal is to use this tool to help all students of all ages begin to understand fractions, and use the tool as the stepping stone for their further education into fractions.

Design Idea & Rationale

My design is a series of rings that rest on a cylinder. The rings are the main aspect of the design, the cylinder is merely for storage and to assist in manipulation. There are eight rings, each with a set number of notches, from one notch to eight. The notches help divide the rings up into pieces to represent parts of a whole. Each ring represents a different number of parts, like sixths and eighths. The rings are all the same color with no markings outside of the notches. The notches are all the same in size, though the spaces between them vary depending on the number of notches. On each ring, the spaces between the notches are equal size. Besides the number of notches, each ring is identical in appearance. The reasoning behind this is that colors and numbers take away reasoning from a child. If a student believes that a yellow ring represents sixths, they will immediately reach for yellow the second that they hear sixths, even if the yellow

ring doesn't actually represent sixths. By leaving the rings unmarked besides notches, I'm forcing them to count each time they use Sally Circles.

The purpose of Sally Circles is to help students compare, add, and understand fractions. When you incorporate numbers into a problem, many students get confused, especially when it comes to fractions. For example, a student new to fractions may believe that to use Sally Circles, named in a similar vein to Katie Cubes, students simply line up one notch on one ring with another notch on another ring and compare. For example, let's say a student wanted to compare halves and fifths. By lining up one notch on each ring, the rings are able to be compared, showing how many fifths are in one half, or that five fifths equals two halves. The goal is simply to be able to have a visual representation of how fractions compare. At this point, there is not an option for mixed numbers, but if a student was asked "How much is ⅔ plus ⅚?", they can see how many sixths are in ⅔ and add from there. However, since it is a manipulative, however students chose to use the tool is up to them.

Key Design Decisions

I've had many different design ideas, that I continue to struggle with, even with this final design being submitted. My idea initially was to create something to make fractions, then to teach children how to divide fractions, and then I finally decided on simply comparing fractions. At the end of the day, coming up with a final design was combining my ideas and trying to come up with a tool that students could use in multiple ways. My goal was to simply help students understand fractions. The main challenge I had to overcome was making sure that my tool didn't just give students the answer and was able to be used in multiple ways.

I had several versions of my design. The first was little shapes that represented fractions, but I realized that that didn't accomplish my idea of comparing fractions at all, so I needed to

begin again. The next thing I tried was basic rings, but I realized I couldn't even figure out how to divide those up so it was not going to work. I then tried to make rings that rested within one another, but I realized that students could simply identify the first time what ring represented which fraction and then simply keep going with that information when they used the tool again. In addition to this, the main purpose of my tool is to be able to compare fractions, and in all of my original designs, students could not compare equivalent fractions by sight without making inferences.

I do not remember exactly how I came upon my final design but my final design has eight rings that have the same dimensions with different grooves that represent fractions. The fractions go from wholes to eighths. The grooves are all equal as well, though this was a process I had difficulty with. To create each ring, I used the whole as my template and simply copied, pasted, and aligned. So, for example, for sixths, I made six copies of the whole ring and arranged them to create a ring with six grooves. To make sure the the rings were correctly sized, I used the degree tool for rotation. However, I forgot to align the grooves vertically, so when I aligned and grouped my rings, the grooves didn't encompass the whole shape. I had to then disassemble all of the rings I'd grouped, realigned them vertically, and then regroup. Eventually, I ended up with eight rings that represented the design I was attempting. I decided to not color them because I felt that having them be uniform forced students to genuinely think every time they used the rings, instead of just assigning a physical trait to a number.

In addition to the rings that I created, I decided that there needed to be a placeholder for them. While the rings being mobile was great for comparing two or three fractions, if students wanted to see all eight together, it was difficult for them to see this on their arms or in their hands when holding the rings. A podium provided a place for all of the rings to rest, and so they

could be compared as a large group instead of individually. We've learned that students need to be able to come up with their own strategies in order to solve specific problems, and having the podium and the mobile rings allows for students to have agency in how they use the manipulative. Each student could use it in a completely different way to achieve the same result, and that was my main goal with this manipulative.

Task Statement

The first task I did was having students identify what each ring represented. This was to see if Sally Circles could be used independently from me, and that students were able to tell what their purpose was. I believe that students would take the rings off the podium and identify which ring represents which type of fraction, such as sixths or fifths. The next task I did was having students compare two fractions with the same numerator. I asked my student to tell me which was bigger, four sixths or four eighths, then use the manipulative to either prove or disprove their answer, anticipating an incorrect answer initially and then a correct solution once the Sally Circles were implemented. This was to see if the visualization aspect of my manipulative worked. The last task I had my student do was tell me what she thought the manipulative could be used for. The main purpose of this manipulative was to help students come up with different ways to compare fractions on their own. If I was creating all of the ideas behind the manipulative, then I wasn't letting students explore on their own, and I was, theoretically, teaching them a strategy instead of letting them find it on their own.

Findings

To whom did you implement your task along with your manipulative?

I decided to bring my manipulative with me when babysitting a first and a fourth grader, a boy and girl respectively. They will be referred to in this paper with the first grader as B and

the fourth grader as G. I began by showing them the Sally Circles and podium and asking them what they thought it was. B had no idea, but G said that she thought it had something to do with math. To get them excited, we went into their bathroom and turned off the lights to see the rings glow, as they are currently printed with a glow-in-the-dark filament. They were very excited and ran around their house for five minutes seeing if the rings glowed in other rooms. Once they decided that the rings definitely glowed, they decided to get to work.

For the first task, B sorted the rings by how many grooves they had. With his sister's help, he discovered that the grooves went from one to eight. First, he laid them out next to each other and then he placed them back on the podium from largest to smallest. When prompted, B told me that he only knew that they were different because he counted the grooves himself, but that by looking at them initially, he wouldn't have known. This proved to me my theory that the rings were identifiable but required students to think as they used each ring.

For the second task, I had G compare four sixths and four eighths. First, I asked her which one was bigger. She said that four eighths was bigger because eight is bigger than six. G is in fourth grade, so she is familiar with fractions, but struggles in math, so I was not discouraged by this answer. Rather, I was excited to see if she realized her error while using the manipulative. To solve the problem, she lined up a groove on the sixths ring and a groove on the eighths ring and then counted four sections on each. She realized immediately that four sixths was larger. To take this a step further, I asked her if she could find another fraction that was equal to four sixths. After comparing several rings, she realized that two thirds was equal to four sixths. We repeated this for four eighths, which she realized was a half. She then found the other rings with halves and compared them.

Finally, I asked the two of them to tell me how they would use the manipulative. B said that he could use the Sally Circles to count, but that in first grade, he probably wasn't going to encounter fractions frequently. G said that she'd use it whenever she was doing comparison problems, because she could see everything. She also said that having it to help in counting would probably be helpful as well. The two of them then provided suggestions for what they would do to improve my design, which I will include in my reflection. Their mother, a fourth grade English teacher in North Caldwell, NJ, also provided suggestions for how I could update my design.

Reflections

The main thing that I've learned is that my interpretation of an assignment and a material can change over time. I started this assignment with an idea to help with a specific type of fraction problem solving and ended it with a much broader interpretation, one that students can genuinely manipulate instead of simply using procedurally. I learned from my interview process that all students can use this manipulative, though those who understand fractions will be able to use it better. However, there are many things that I can do to improve this design. G and B's mom suggested that I have a groove on the side of the podium so that the rings can't be moved once they are lined up (she brought up the fact that there can be students who simply want to spin the rings and therefore disrupt the work of their classmates). G suggested that I make a smaller version of the circles, so that students can have a portable version. If I was to remake my design, I'd include the groove that G's mom suggested and have two versions: a large version, similar to the size I currently have, for classroom use and a small version for students to carry around with them. In the future, I'd like to take this manipulative into a classroom and see if I get similar results to those of G and B, and learn more from them.

This project was fascinating to me. I learned a lot about TinkerCad and what goes into inventing something. I learned how to teach an entirely new concept to a child, and how to teach that concept to myself at the same time. I will be attempting to do this assignment in a classroom, but having students work in teams to create their own manipulative. I learned a lot about math in general from this assignment, and I believe that the same could be said for my students. The only suggestion I have for a change in the assignment is that I wish we had more time for testing. Other than that, I am proud of my Sally Circle's and feel as though this project increased my learning greatly. Thank you!