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Hypothesis

For our response device we devised a tool that will help test and further children's knowledge of the Cartesian coordinate system. Or so we hope. The premise is simple. A dry erase board is positioned on a table with a grid and major axis for the first quadrant of a coordinate system drawn onto it. A dry-erase marker has four strings attached to it that will be laid out in the four directions on the board: up, down, left, and right. The exercise will have four children control the strings, one to each string. A fifth child will have a piece of paper with a similar grid drawn onto it. This paper will also have a drawing or design on the grid that will match up nicely with the grid lines. The child will read off the coordinate points corresponding to the drawing on the paper. The four children controlling the marker will have to work together to move the marker to the coordinates called by the other child in order to make the drawing on the board. We will begin with simple shapes to get the children used to working together and let them figure out how to do simple lines and diagonal lines. From there, the drawings will progress to more complicated designs. This will hopefully be a successful test of the childrens' knowledge of the Cartesian coordinate system and teamwork skills.

While we have high expectations for our response device, we do have some reservations about it. We worry that the children who are not positioned so that the x and y axis are in the traditional orientation, i.e. the children who are at the top, left, and right of the board, will have difficulty becoming acclimated to the system and responding correctly to the directions called by the fifth child. We also worry that some of the kids who are not as strong with the mathematical concept might be anxious about being the direction caller. To help ease any anxiety problems, we will work closely with the kids, assisting them wherever they require it and attempting to connect with the children to make them feel more comfortable. If we can successfully make the children feel comfortable with us, we hope that they will be much more inclined to give feedback to us about our response device.

Response

The reaction to our response device went much better than any of us had anticipated. The children were initially confused upon seeing the grid and did not have any inkling of what we had planned for them. Upon sitting down and asking them if they knew what was laid out on the table before them, some of the children spoke up and responded with "a graph," or "a grid." One student frantically tried to remember what it was called, a graph being the word she was looking for, and after receiving help from another student exclaimed "I love graphs" and a look of excitement washed over her face. With this initial positive reaction, we felt more confident in our device despite the initial confusion.

After explaining the task to the students, we began by having them draw anything they wished—effectively scribbling on the board using the strings—to get them used to the concept and what pulling on each string would result in. In some of the groups, the students worked together very well, with one or two students often taking a leadership role and helping to direct the other students when each point was called out. In another group, one of the boys, who acted out a little bit last time we met with them, argued with the boy next to him over who got to control the last string. After he decided it was his, we told the other boy that he got to look at the drawings and direct the rest of the group in the task. Upon hearing this, the first boy who had assumed control of the string decided that he would rather direct the group and gave up his string for that. The other boy, did not put up any resistance and took control of the string. The group did not perform as well as the other groups due to a combination

of factors. The boy who led the group got distracted often, requiring us to constantly ask him what point was next in the drawing and help him focus on what the values for each point were. I believe that he wanted to lead the group because he likes to feel in control of others, but did not have a good enough grasp on the concept of Cartesian coordinate systems. To cover up his lack of knowledge of coordinate systems, he goofed off and made it appear that he did not care about the task at hand. I may be completely off base with my assumption, but I have seen this occur many times in my experience with teaching swimming lessons to children ages 1-12 for several years and being a counselor at several children's camps.

In one of the groups, there was a very shy girl who did not speak much other than a few words when I asked her a question. In our previous meeting with the children, this girl was very shy and did not want to draw much. I do not recall her saying more than a few words that time as well. During the middle of the activity with this group while she was in control of one of the strings, I called on her to step up and direct the team how to get to the point that had just been called by the group leader. Her eyes opened wide with what I think was nervousness, but she promptly stood up and pointed firmly on the graph to where the group needed to go. She then directed two of the group members to work together to reach the point. She sat down after this was accomplished and had a big smile on her face. This was perhaps the best reaction of the entire meeting with the children. Even more so than the students who cried out in despair that they wanted to keep playing when they were told time was up.

Another thing that really stood out in my mind was the children's use of the word 'playing' when talking about using our device. This struck me as a good thing that we were able to help them practice a curriculum topic while having enough fun to think of it as playing. We hope to keep this mood and response intact with our next prototype and final device.

With this initial response device, we only made use of quadrant one of the coordinate system. This was done to make sure we could get a good response from the students rather than making it too complicated for them to be able to successfully interact with it. In the future, we hope to make use of a projector and perhaps a Kinect to bring customizable graphs and other interactive designs to the table rather than having a single printed out graph paper. This would allow us to change the graph on the fly and allow students to practice what they need to, whether it be focusing on solely quadrant one or making use of all four quadrants.

We also noticed a few small flaws with our initial concept that we will need to make sure we address in future iterations. The most notable of the flaws was the inability to accurately draw straight lines on the board. This was a result of either the students varying the speed in which they were pulling the string, even at very slow speeds, or not pulling exactly the same as their partner when drawing a diagonal line. It was also quite difficult for the students to draw close to the edges of the graph due to the string placement on the cup and the wooden dowels used to keep the strings down. This was a key oversight on our part and resulted in needing to modify one of the designs on the fly when we realized our error.

All in all, we deem our response device a success on two fronts. First, we were able to gather a lot of data with how the kids interacted with the device and their thoughts on it. Second, we were able to bring them a device that captured their interest. The beauty of the concept is that what it can be used to make is only limited by the imagination of the users.