Literature Synthesis

Slicing Our Way Through Geometric Shapes

For the second lesson study cycle of this year, we were planning a 10th grade geometry lesson on cross sections of three-dimensional shapes. We sought to build a lesson that would create visual and language support for all students, with a focus on welcoming emergent bilingual students' voices into the conversation. This lesson would use hands-on manipulatives to create a common ground for students to observe what they were learning.

The two main themes that were focused on are:

1. Encouraging emergent bilingual students to share their ideas with the class and creating a comfortable environment for them to participate in discussions
2. Promoting mathematical discourse between all students by encouraging the visual manipulatives to become a support for exploration

The equity goal of this lesson centered around creating opportunities for emergent bilingual students to access the learning goal of understanding cross-sections as well as creating opportunities for them to share their ideas authentically. Three students in the class are classified as emergent bilingual, with seven students having parents that speak primarily Spanish at home. These students have the incredible asset of being able to communicate and learn in two different languages, both within and outside of the classroom (Morales Jr & DiNapoli, 2018). This lesson sought to bring these students' ideas in so that they could add to the larger conversation around cross-sections. Therefore, the three focal students chosen were emergent bilingual students whose voices were sometimes heard in class discussions.

The learning goal for all students to achieve was to understand that when one of the three-dimensional shapes that we had already learned about (a cone, cylinder, pyramid, or cube) was sliced, it would create cross sections of different two-dimensional shapes.

The arc of the lesson was to follow a Launch, Explore, Discuss framework to enable students to engage with the lesson, work through the nuances of cross-sections, and discuss their learning as a class.

Launch: We began with a game in which students were assigned one of the four three-dimensional shapes of focus. Pictures of real-life objects that took on these shapes were hanging up around the room - for example, there was a picture of a birthday hat hanging up to remind students of objects that are cones. These pictures were there to allow students to connect what they were already seeing around them to the mathematical task at hand (Chikiwa, C., & Schäfer, M. 2019). Students would pretend to build an object out of clay that took on the shape that they were assigned, then share about their creation with a small group of students. Each group member would complete the task based on their assigned shape.

Explore: Play-doh was brought out for the exploration of slicing geometric shapes. Students were put into pairs and tasked with building a cylinder, cube, pyramid, and cone out of the

Play-doh. Once built, they would slice into the shapes in order to see what two-dimensional shape would emerge. Notes and observations were recorded for each shape.
Discuss: We reconvened as a class and worked on extension problems, which were pictures of other slices being made on three-dimensional shapes that we had not covered, such as pyramids with pentagon bases.This allowed us to assess students' understanding of slicing cross-sections and address any misconceptions that may have emerged.

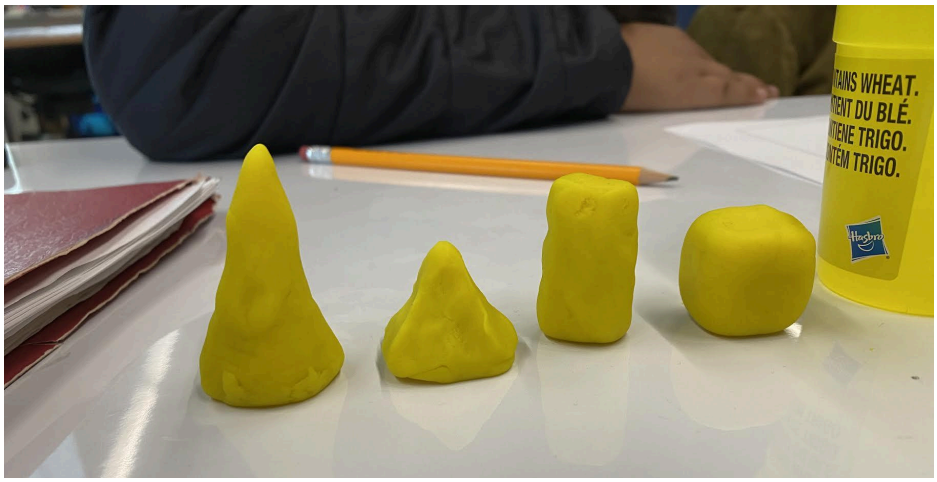

Figure 1: Three-dimensional shapes built out of Play-doh for lesson

The most notable impact was that each focal student shared their ideas with their group, and two of the focal students shared to the class. As they were sharing the ideas, the Play-doh slices became the backbone of the ideas that they were sharing. One student was quick to correct her friend in saying that the slice was shaped like a rectangle, not a square, because not all of the sides were equal. Another focal student shared that slicing a pyramid vertically (not at the apex, however) would reveal a "rhombus" (although he meant to say a trapezoid), which when you put two of them together, forms a trapezoid. The third focal student shared her finding that the shape of the cross-section depends on the shape of the base (i.e. a cone has circular cross-sections because it is made up of circles that are getting smaller gradually). Overall, this lesson gave our focal students the opportunity to connect with a mathematical concept in a tangible way.

Works Cited

Chikiwa, C., & Schäfer, M. (2019). Teachers' use of verbal language to evoke visualizations in multilingual mathematics classes. Perspectives in Education, 37(2), 124-140.

Morales Jr, H. & DiNapoli, J. (2018). Latinx bilingual students' perseverance on a mathematical task: A rehumanizing perspective. REDIMAT Journal of Research in Mathematics Education, 7(3), 226-250.