Navigating the Implementation of an Inquiry-Oriented Task in a Community College

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Abstract: Teachers implementing inquiry-oriented, discourse-promoting tasks can face a number of challenges (Speer & Wagner, 2009; Ball, 1993). In this study we will examine the challenges faced by two community college instructors as they implement such a task in a "transition to proof" course. In this task students initially use their informal ideas of symmetry to develop a criteria to quantify the symmetry of six figures (see Larsen & Bartlo, 2009), these criteria are then formalized into definitions for symmetry and equivalent symmetries. During this task a number of conflicts arise, and to resolve these conflicts the students engage in rich mathematical discourse. While this task and ensuing discourse offer opportunities for learning mathematics, they also offer significant challenges for effective implementation. We aim to identifying these challenges and the ways in which these challenges were navigated as the class worked towards formal definitions of symmetry and equivalent symmetries.

While working on a project aimed to develop a community college "transition to proof" course, bases on an inquiry-oriented abstract algebra curriculum, we began to wonder what sort of challenges the community college instructors would face as they navigated the curriculum. In order to begin looking at this question we decided to focus our attention on an inquiry-oriented task in which the students reinvent and define the concepts of symmetry and equivalent symmetries.

In this task students are initially given six shapes (see figure below) and are asked to arrange the figures from least to most symmetric. The students work on this task individually and then in small groups prior to a whole class discussion. The groups share how they ordered the figures and how they came to that decision. The students are then asked to determine a way to quantify the symmetry of each figure and, using their quantification criteria, the groups rank the figures and present both their criteria and their ranking to the whole class. Following these presentations the groups work to develop both a definition of what a symmetry is and what makes two symmetries equivalent (see Larsen & Bartlo, 2009).

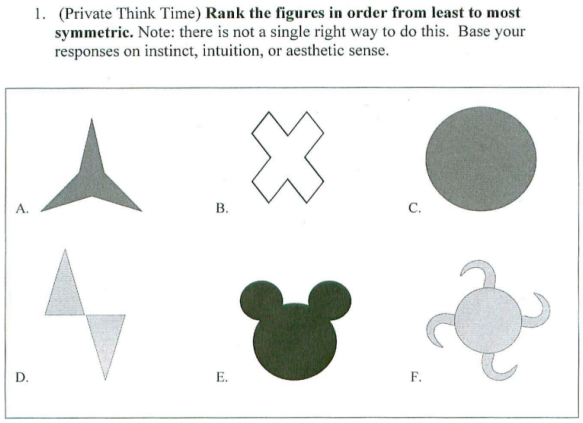

Fig. 1 Symmetry Task Launch

This task typically promotes rich mathematical discourse (Larsen & Bartlo, 2009) as the students work to resolve ranking discrepancies and develop definitions. Common points of contention are whether "doing nothing" should be counted as a symmetry, if a symmetry is a property of a shape or a function acting on the shape, and if symmetries are equivalent when they produce the same result or when the action done to the figure is the same (essentially making equality the criteria for equivalence).

By engaging in rich mathematical discourse, including questioning, challenging, and justifying, students can learn what it means to do mathematics (Stein, 2007). However, managing and facilitating student discourse comes with an array of challenges, such as respecting students as mathematical thinkers, even when their ideas are not in alignment with standard mathematics (Ball, 1993), and providing analytic scaffolding during whole class discussions to move the mathematical agenda forward (Speer & Wagner, 2009).

While such challenges have been documented and analyzed at the elementary and undergraduate level, in this study we are looking at how these challenges are addressed and negotiated by community college instructors, specifically related to this symmetry task. Through our analysis we aim to answer the following research questions:

1) What challenges do the two community college instructors we were working with face as they facilitate this discourse-prompting task?
2) How did these two community college instructors navigate and manage these challenges?

To answer these questions video data of the classrooms of the two community college instructors will be analyzed through iterative stages (Lesh & Lehrer, 2000). This analysis will focus on how the instructors implemented this task and facilitated the ensuing class discussion. Specifically, we will look at how the classes arrived at their formal definitions of symmetry and equivalent symmetries and how instructors use student thinking to formalize these definitions.

Questions for the Audience:

We had considered using data from a university professor's introduction to group theory classroom for comparison purposes.

- Would in make sense to compare how this task unfolded given the different student populations?
- Would it make sense to compare the two different teaching populations?
- If so, how might we compare between community college instructors and university professors in a way that does not cast the university instructor as the 'expert'?

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