# Undergraduate Students' Positions and Interactions during Group Work in a Calculus Class

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Group learning in the mathematics classroom aims to encourage deeper individual learning through creating a sense of autonomy and making space to negotiate new ideas. When a student proposes a new idea to the group, they reposition themselves with increased authority and autonomy; furthermore, the acceptance or rejection of new ideas may impact the success or failure of a group in reaching their desired goal (Barron, 2003; Cobb, et. al., 2009; DeJarnette & González, 2015). From this perspective, examining the positions of group members during collaboration may provide insight into what makes a group is successful. The central goal of this research is to evaluate how the interactions within groups of students impact individual learning. In this study, we examine undergraduate students' group interactions while learning to express distances within the Cartesian coordinate system.

The primary data set includes 31 videos that were taken in an undergraduate Calculus II course at a small, private college from 2022-2024. The recordings show groups of 2-3 students working on an "Interpreting Graphs for Calculus Activity" during a 50-minute class period. The activity begins with expressing distances on number lines and then advances to representing distances on the Cartesian plane. Data was collected from the same group of students in an individual pre-test, two questions on their third exam, and one question on their final exam. From these videos, we narrowed the dataset to 27 episodes involving pairs of students, roughly one to five minutes in length, which contained what we considered to be significant interactions. Significant interactions included discussions around the validity and certainty of a proposed solution, instances in which students shared different solution paths, and those in which students provided new ideas, or the students or instructor gave feedback on a proposed solution.

Currently, we are applying a coding scheme for interactional positions (Parr et al., 2023; in preparation) to identify the roles that students were taking on during these episodes of interaction, expanded from coding schemes developed by Lo & Ruef (2020) and González & DeJarnette (2015). The central codes that we have found to be relevant to this dataset are codes of primary knower (K1), secondary knower (K2), and primary uncertain knower (K1-U). Based on the application of these codes, we created categories to represent themes of interaction we found within the groups: Independently Working (each student displayed K1 and K2), Shared Understanding (each student displayed K1), Shared Uncertainty (each student displayed K1-U and K2), and Single Understanding (one student displayed K1 and the other displayed K1-U and K2). These categories capture both individual student roles and the nature of the students' interaction. Notably, of the first 16 coded episodes, we have identified 10 (62.5%) as Single Understanding, 3 (18.8%) as Shared Understanding, and 2 (12.5%) as Shared Uncertainty.

These differences in collaborative interaction between groups indicate the complexities of mathematical learning within a group. Analysis is ongoing to examine the relationship between these categories and positional codes with students' individual performance on related tasks following the group interaction.

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