The Effect of Small Group Interactions on Opportunities for Student Learning

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Mathematics instructors frequently incorporate group work as a pedagogical tool to enrich students' comprehension and engagement. This approach promotes social interaction and encourages student autonomy, potentially leading to deeper student learning (e.g., Amit & Fried, 2005; Smith & Confrey, 1991). Our research investigates the intricate relationship between group dynamics and mathematical learning, specifically focusing on students' comprehension of graphs and distances within the Cartesian coordinate system. Understanding the impact of group dynamics on mathematical learning provides insights into how students collaboratively approach mathematical concepts, which can significantly influence their individual learning outcomes. Accordingly, we center our research around the following question: How do social interactions among undergraduate math students completing a graphing activity influence individual opportunities for mathematical learning?

Data for this study was collected from four sections of a Calculus II course at a small, private college in 2022 and 2023. The primary data source includes student work and 23 video recordings of small groups of 2-3 students working on an "Interpreting Graphs for Calculus Activity" during one 50-minute class period. This activity required students to write algebraic expressions to represent distances in one- and two-dimensional graphs. Data was also collected from students completing a pretest item before the activity, two questions on their third exam, and questions on their final exam, all assessing skills relevant to the graphing activity.

We draw on a preliminary analytical framework (Parr et al., 2023) to develop knowledge-based questions (e.g., who is being sought for knowledge?) and five questions related to social dynamics (e.g., who directs the group's activity?) to guide our video data analysis. Throughout video analysis, the first author created content logs, documenting key elements of students' behavior and interactions within the group work. Additionally, the first author documented emerging themes and patterns across group videos. Thus far, analysis has been conducted on ten videos, with plans to continue to analyze additional videos and work from the larger dataset.

Our analysis revealed a diverse spectrum of group interactions among students during the completion of the graphing activity. While some students demonstrated a high level of collaboration, others adopted a more independent approach, primarily cross-checking their answers and communicating only when uncertainties arose. Two prominent themes emerged across groups in the interactions, which impacted their responses to the tasks. First, the role of pattern recognition emerged, in which students validated solutions through pattern identification from previous tasks in the activity, valuing consistency. Second, the extent to which students were willing to correct their peers, reflecting variations in students' perceived comfort levels with correcting their group members, emerged as a significant distinction in varied opportunities for mathematical learning across groups.

The diverse group dynamics observed during students' group completion of the graphing activity highlights the need to comprehend the complex interplay between social interactions and mathematical learning. As our research progresses, we intend to use position codes to analyze selected episodes more closely from the videos that are expected to yield intriguing results.

References

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