



A Case Study on Peer Tutors: Their Understanding and Teaching of the Derivative



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When considering her interactions with students, peer tutor Hannah emphasized developing a conceptual understanding of the derivative as opposed to a procedural understanding.

Introduction

There is a long research history into the knowledge that is used and needed when teaching mathematics (Ball et al., 2008). Most of this research has centered on K-12 teaching and therefore our current understanding of the knowledge required for teaching does not incorporate those in non-traditional teaching roles. At the university level, peer tutors take on a role of teacher for other undergraduate students who are often younger students taking classes that the peer tutor has performed well in (Johns & Burks, 2023). On the surface, the roles of peer tutors and classroom teachers may seem quite similar; however, this is not always true (Johns & Burks, 2023). One main difference is that peer tutors have to be able to adapt to students and the problems they bring in on a case-by-case basis whereas classroom teachers often follow more structured lesson plans which allows them to better prepare for possible student questions that occur in the moments of teaching.

A popular course for undergraduate students seeking help from peer tutors is Calculus 1 (Johns & Burks, 2023). This study aims to classify the knowledge demonstrated by peer tutors when solving mathematical tasks and examining student work in the context of the derivative.

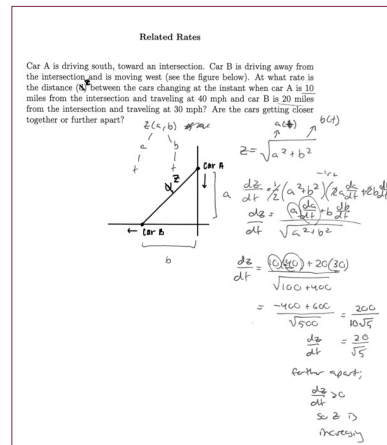
Methods

Semi-structured interviews were conducted with four undergraduate peer (mathematics) tutors currently employed at a large research university. Interviews lasted one hour on average and were audio- and video-recorded. These recordings were transcribed using Temi and uploaded into Dedoose for analysis.

Qualitative data analysis included multiple rounds of deductive coding using Ball et al.'s (2008) domains of mathematical knowledge for teaching and Zandieh's (2000) derivative concept framework as an a priori coding scheme. Codes were discussed by both researchers. Preliminary findings related to one peer tutor, Hannah, are presented here.

Findings

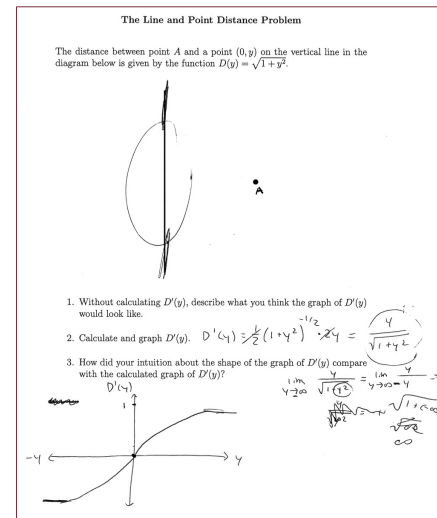
How does one undergraduate peer tutor conceptualize the derivative and their role as a peer tutor in the context of Calculus 1?



Work performed by Hannah solving a related rates problem presented during the interview

"I would probably try to come back to like the central relationship between like a function and the first derivative and the second derivative. 'cause I really do think that's something that like is neglected a lot"

Hannah on discussing concavity while solving the bottle problem



Work performed by Hannah on the dot and stick problem presented during the interview

"when students will make a small mistake like this and that throws off the whole problem, they'll feel bad about it. And I try to point out that it's like, no actually the, the more of your mistakes that are tiny stupid mistakes, the better you're doing 'cause you clearly understand the theory of it"

Hannah's response to student mistake on Optimization problem

Discussion

Hannah displayed a dynamic understanding of the derivative and its applications. This is demonstrated by her fluency between viewing the derivative as a special kind of relation (e.g., a ratio between quantities), a rate of change, and as a stand-alone function, following the framework laid out by Zandieh (2000).

While emulating her approach with students, Hannah repeatedly emphasized a deeper conceptual understanding of the problems, usually accompanying her explanations with a visual or graph. She routinely stated a preference for students making procedural errors rather than conceptual ones. Her approach also alluded to a strong understanding of the course design (e.g., how students are taught, the expectations held by the teachers). This approach was also outlined in Johns and Burks (2023).

Possible further analysis could be conducted to better understand the differences between peer tutors who emphasize conceptual understandings versus those who emphasize procedural understandings.

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References

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