UNDERGRADUATE STUDENTS' UNDERSTANDINGS FOR DERIVATIVES IN MULTIVARIABLE CALCULUS

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Multivariable calculus is a generic extension of the single variable calculus. However, there are relatively few studies about how students understand and interpret the meanings of derivatives in multivariable calculus. This leads to the problem that we overlook the process of how multivariable calculus students extend their prior concepts through the course (Dorko & Weber, 2014). The concepts of derivatives in multivariable calculus can be generalized from those in single variable calculus, and generalization is an essential factor of mathematical thinking. Therefore, this study aims to analyze how students generalize the meanings of derivatives concepts in multivariable calculus from those in single variable calculus.

Eight undergraduate students who complete a course of multivariable calculus were selected, then given three interview tasks. Each student has participated in an individual interview. Tasks were based on (1) what are students' understandings for derivatives in single variable calculus, (2) those in multivariable calculus, and (3) how students relate and extend those two understandings. The interviews were analyzed based on actor-oriented generalization framework; generalizing actions (relating, searching, and extending), and reflection generalizations (identification, definition, and influence) (Ellis, 2007) with symbolic and geometric understandings.

Firstly, students understand the meanings for derivatives both symbolically and geometrically in single variable calculus, and symbolically in multivariable calculus, but go through difficulties in geometrically in multivariable calculus. Secondly, students only showed generalizing actions on relating the symbolic understandings, yet suffered on the other cases; relating geometric understandings, expanding both symbolic and geometric understandings. Finally, in students' modified responses, their reflection generalizations on identification were found in both symbolic and geometric understandings for derivatives in multivariable calculus weakly. This study provides a helpful perspective on multivariable calculus learning by analyzing how students generalize their prior knowledge. Thus it contributes to research on identifying the process of students' understanding multivariable calculus concepts.

References

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