

Institutionen för didaktik och pedagogisk profession

Att urskilja grafiska  
aspekter av derivata –  
hur elevernas möjligheter påverkas av  
innehållets behandling i undervisningen

av

Ulf Ryberg

AKADEMISK AVHANDLING

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## Abstract

Title: Discerning graphical aspects of the derivative – how the handling of the content during instruction influences students' opportunities

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The aim of this thesis is to investigate in what ways students' opportunities to discern graphical aspects of the concept of derivative can be related to the design of instruction. The thesis is based on two empirical studies that together included 144 Swedish upper-secondary students who were enrolled in the course in which the derivative is first introduced. Study 1 was conducted in natural settings and involved collaboration between researchers and teachers. The study generated three different 120-min lesson designs, all of which concerned the same mathematical content, the relationship between a graph and its derivative graph. The designs were equivalent regarding organization and teaching methods. However, the content was handled differently during instruction. Design 1 used multiple representations and graphs of polynomial functions. Design 2 restricted instructions to fewer representations but used a broader variety of graphs. Design 3 was a hybrid of Designs 1 and 2 and contained limited variation regarding both representations and graphs. The results of the study, which were based mainly on qualitative data consisting of observations and students' explanations on posttest questions, suggested that Design 2 offered the best opportunities to discern graphical aspects of the derivative. The results of Study 1 were further tested in Study 2 wherein Design 1 and a slightly modified Design 2 were implemented in more controlled experimental conditions. Statistical analyses of quantitative data showed that the students who participated in Design 2 performed significantly higher posttest scores. Overall, the results of the studies highlight the importance of examining how the handling of the content may affect students' learning of mathematics. In particular, they challenge the assumption that the use of multiple representations is always beneficial and suggest that how to use representations during instruction concerned with the derivative is an important topic for further investigation, both with regard to practice and research.