Med uppgift att lära
Om matematikuppgifter
som en resurs för lärande

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Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av filosofie doktorsexamen framläggs till offentligt förvar i N 360, Naturvetarhuset fredagen den 10 januari, kl. 13:00. Avhandlingen kommer att förvaras på svenska.

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Students’ opportunities to develop their mathematical skills are influenced by the tasks they engage in. A routine task is a task that a student can solve by using familiar methods, or by imitating a template. To solve a mathematical problem, however, the student needs to construct, a for her, new solution method. It has been shown that students working with mathematical problems develop a greater mathematical understanding than students who work with routine tasks. Through problem solving a student can develop both a creative, problem-solving skill, and a conceptual, mathematical understanding. Too much emphasize on root learning and work on routine tasks is one reason for students’ difficulties in learning mathematics. This thesis consists of five studies. The purpose of study 1-3 was to investigate the opportunities to work with mathematical problem solving for students in upper secondary school. This was done through a textbook task analysis, a study of students’ work with tasks and a study where students’ beliefs were examined and compared to their work with mathematical problems. The results revealed that students’ opportunities to work with mathematical problems were limited. Approximately 10 percent of the analyzed textbook tasks were mathematical problems. The students worked almost exclusively with the tasks labeled as easier. Among these tasks, the proportion of mathematical problems was 4 percent. Students seldom worked on mathematical problems. Instead, routine work and imitation constituted the greater part of their work on tasks. Students’ held beliefs that routine work is safer and also something that is reasonable to expect in mathematics which may impact their strive for mathematical problem solving. There is potential in both development of textbooks to increase the proportion of mathematical problems, as in a deliberate task selection from these textbooks. In studies 4 and 5, an analytical framework was developed and tested to identify creative and conceptual challenges in students’ problem solving. To further deepen the understanding of the challenges and of mathematical problem solving, the respective challenges were characterized. In study 4, observations and interviews supported the analysis of students’ mathematical problem solving and the challenges they encountered. In study 5, data was collected from group interviews with teachers. Their expectations of the challenges that students encounter in problem solving were analyzed. The analytical framework was developed with the support of the theory of concept image and used the concept of discrepancy in order to describe the challenges. Conceptual and creative challenges proved to be the most central in students’ problem solving. Through the characteristic that was linked to each of the challenges, a discussion on the relationship between task and challenge is made possible.