Upper secondary physics teachers' views of mathematics

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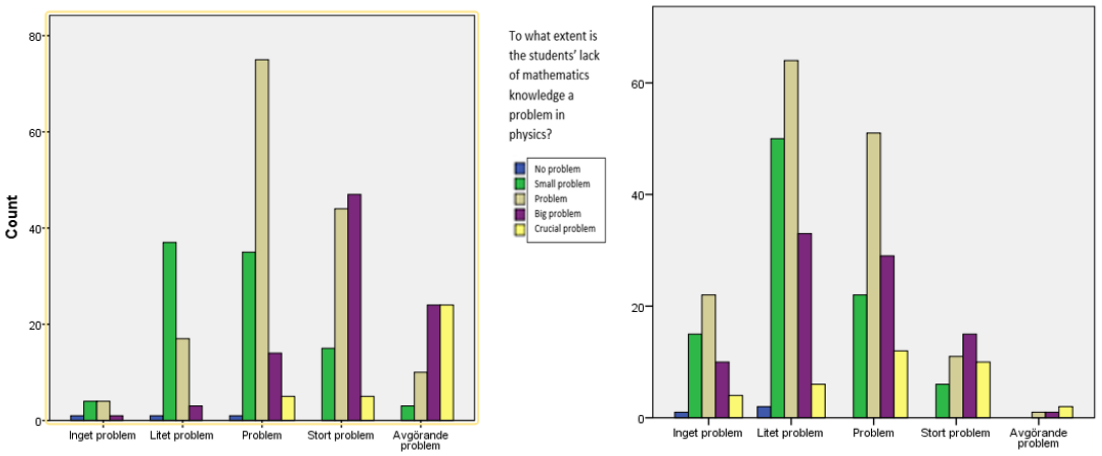
Physics teachers at upper secondary school indirectly teach mathematics in their physics classes through their teaching strategies and preferred ways of using mathematics. Their views of physics and mathematics are important for the way they depict mathematics to the students. A web-questionnaire was administered to Swedish physics teachers. Part of the questions investigated views of mathematics, i.e. as a means for application, as a schema, as a formal construct or as processes. Mathematics as a means for application was the dominant opinion. Students' lack of knowledge in mathematics was regarded as a problem to many of the teachers, and particularly problem solving and modelling. Students' conceptual and relevance proficiencies in mathematics were less problematical.

Introduction, the study and results

Mathematics is a significant aspect of physics education in upper secondary school. Physics teachers' views of mathematics may affect their teaching approach in physics, e.g. how they portray and use mathematics in presentations, modelling and deduction. A pilot study about a physics teacher's focus on mathematics in physics lectures, lab-work and problem solving was conducted in terms of expressed relationships between *reality*, *theoretical models* and *mathematics* (Hansson, Hansson, Juter & Redfors, 2015). The study showed that the teacher had a strong emphasis on mathematical handling of formulas in teaching physics, with an instrumental use of mathematics. The study of physics teachers has continued and physics teachers at science programs in Swedish upper secondary schools were invited to participate by responding to a questionnaire. The aim being to learn more about how mathematics is presented and used in physics at upper secondary school. The questionnaire was constructed with 154 questions about teaching experience, education and physics- and mathematics attitudes, teaching and learning. The main part of the questions was Likert's type. Nine questions, referred to in this presentation, are from Grigutsch and Törner's (1998) research on attitudes towards mathematics. The questionnaire was sent to 845 physics teachers of which 379 responded, i.e. a 45% response rate.

The nine questions aforementioned were subjected to a factor analysis in SPSS to find aspects measured with the questions. The results were similar to those in Grigutsch and Törner's much larger set of questions. The factors were mathematics as a means for *application*, as a *schema*, as a *formal* construct and as *processes*. Mathematics as a means for application was the dominant opinion among the teachers. The teachers were also asked to what extent the students' lack of mathematics knowledge was a problem in the physics teaching with responses in a 5 level Likert scale from 'No problem' (0.8%), 'Small problem' (25%), 'Problem' (41%), 'Big problem' (24%) to 'Crucial problem' (9.1%). This result was then compared to specific mathematical areas, e.g. students' problems handling algebraic formulas and estimations. Figure 1 shows a comparison to the area of algebraic formulas (left chart) and the area of estimations (right chart), using the same 5 level Likert scale. The areas of estimations and derivatives turned out to be small problems or problems. Other areas like equations, functions, trigonometry and vectors were symmetrically distributed, similar to the left-most chart with respect to the extent students' lack of mathematics knowledge was a problem. Arithmetic was described as a small problem. Statistics was seen as no or a small problem. Student proficiencies were also investigated. Problem solving and modelling were regarded as big or crucial problems, whereas conceptual proficiency, communication and relevance were no or small problems. Procedure- and reasoning proficiency both had symmetric distributions round the largest post 'Problem'. Further results describing the teachers' views of mathematics and physics teaching will be presented at the conference.



Algebraic formulas Estimations

Figure 1: Cross tables of teachers' views of students' math. knowledge.

References

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