

RECENT DISSERTATIONS

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Trends in Physics Competence. Using TIMSS for in-depth studies to characterize Norwegian students' physics competence and factors influencing and explaining changes in this competence

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Abstract

This dissertation aims to identify and explore 1) trends and characteristics of Norwegian students' physics competence and 2) factors influencing and explaining changes in this competence. Two of the studies in the dissertation focus on physics competence and includes the following aims and types of competencies: 1) to identify pertinent mathematical competencies in physics and how they develop over time in upper secondary schools and 2) to identify the characteristics and influence of discourse practises and attitudes on conceptual understanding in lower secondary schools. The choice of aims and type of physics competencies were informed by an overarching framework for physics competence and previous findings from TIMSS (Trends in Mathematics and Science Study) and TIMSS Advanced.

The second part of the overarching aim is related to influential factors with special focus on two aspects of school climate, *School Emphasis on Academic Success* (SEAS) and *safe schools*. The new curriculum, *Knowledge Promotion* which was implemented between the two last cycles of TIMSS, had a larger focus on performance and success. Moreover, measures had been taken to reduce bullying in schools. Hence the hypothesis is that these school climate variables may explain increased performance in the large-scale international trend study TIMSS from 2007 to 2011.

The methodology of the three studies includes, for the most part, quantitative analyses of TIMSS and TIMSS Advanced data (mainly structural equation modelling with confirmatory factor analysis), but also qualitative analyses (interviews and categorization) of data from own survey.

The main findings related to physics competence indicate that the most pertinent mathematical competency in physics for Norwegian students in upper secondary schools was algebra. Moreover, this study indicates that the reason for the large decline in students' performance in physics from 1995 to 2008 seemed to be related to poor performance on physics items requiring algebraic skills. In lower secondary school, I found that students' increasingly high competence in astronomy may be related to positive attitudes and extensive discourse.

Findings related to influential factors indicate that School Emphasis on Academic Success (SEAS) partly explained the increased science performance in TIMSS from 2007 to 2011. Furthermore, teachers' increased perception of school safety seemed to promote SEAS. The findings may inform educational policy to continue to prioritize SEAS and *safe schools* and may contribute to the field of Educational Effectiveness Research (EER) conceptually and methodologically. Contributions to practise may include utilizing students' positive attitudes towards astronomy to teach other topics within physics and to strengthen students' algebra competency in physics.

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