SUMMARY

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One of the key challenges in mathematics and science education in secondary school is to realise coherence between these school subjects. The idea explored in this PhD thesis is that statistical modelling is one of the possible ways to let students experience the connections between mathematics on which statistical modelling techniques are based, and scientific contexts in which they can be applied. One set of techniques that receive rather little attention in education and in the literature is that of correlation and regression.

The purpose of this PhD project was to find out how to support upper-secondary school students' learning and understanding of correlation and regression models in such a way that they can apply the techniques in new situations and experience coherence between mathematics and the natural sciences. We addressed the following main research question: "What are characteristics of a valid and effective teaching and learning strategy to teach students about correlation and regression in such a way that they experience coherence between mathematics and the natural sciences?"

To answer the research question we designed a teaching and learning strategy based on authentic professional practices. In our investigations we focused on four related aspects. After a broad focus on informal inferential reasoning (1), we zoomed in on specific concepts required for inferential reasoning: variability in measurement data (2) and sampling (3). Measurement and sampling are also important interfaces between mathematics and science. Last we zoomed out and focused more broadly on the coherence between mathematics, statistics, science and professional practices (4). We tested our teaching and learning strategy in four studies, each with its own research question.

In this thesis we formulated a set of selection criteria for authentic practices related to correlation and regression modelling activities. On the basis of these criteria we chose the professional practices of sports physiologists, researchers who monitor dyke heights, and calibrators of measurement devices. As part of the teaching and learning strategy we designed three chapters for an instructional unit, each inspired by one of the three authentic professional practices. We tested different aspects of our strategy in the four studies.

Our conclusion to the main research question is that our teaching and learning strategy seems valid and effective. It seems valid because we designed the strategy in line with prevailing epistemological ideas of the involved school subjects. It seems effective because the involved students learned to solve real-world problems by correctly using correlation and regression models. They also appeared to understand the modelling process and statistical concepts involved, and were able to combine mathematical and statistical techniques with concepts of the natural sciences when solving real-world problems. We think that students who engage in education of correlation and regression models based on authentic professional practices with a compelling purpose can gain an understanding of data analysis and modelling. We argued that tasks about statistics based on such practices can have the potential to be engaging for students while they develop concepts relevant for their school subjects.