A modelling approach for teaching statistics and probability

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Introduction and background

Recent research on students' reasoning during the process of *statistical inference* (SI) has highlighted an informal way to approach SI in statistics teaching. This informal approach, *informal statistical inference* (ISI), might be seen as either a skill for the statistically literate citizen or as the root of understanding of formal inference (Biehler & Pratt, 2012).

Recent research suggests that developing an understanding of SI-methods should take place over a long period of teaching starting at an early age. For example, Lehrer and Schauble (2004) illustrate a developmental process of younger students' investigations and inquiries of meaningful phenomena during a period of two months. The basic ideas is that statistics teaching should be viewed as *data modelling* - developed in the context of real world situations where students make inference from unknown distributions. In a similar manner, based on a broad view of statistical inference, Makar and Rubin (2009) have found *generalization, using data as evidence* and *probabilistic language* as key principles that describes a successful process of informal statistical inference (ISI).

The traditional mathematics teaching in Swedish upper secondary school consists largely of individual procedure-oriented work and with less attention to discussing and reasoning mathemical strategies. Therefore, it is of great value to study students at the upper secondary level involved in learning statistical inference by a modelling approach.

Aim and research questions

The main aim of this research is to deepen our understanding of teaching and learning statistical inference at pre-tertiary education. Biehler and Pratt (2012) note that recent evolution of statistical education mainly concerns data handling and calls for research that deepens our understanding of how students handle probability and uncertainty. With special focus on the reasoning behind the students' use of probabilistic language, following research questions have guided the study.

1. How can we characterise a lesson sequence for developing productive and meaningful learning trajectory in statistical inference at upper secondary school?

2. What does it mean to understand informal statistical inference and how do these understanding develop during a learning trajectory of data modelling in the teaching of statistical inference at upper secondary school?

3. How can we effectively integrate core concept of informal statistical inference with problem solving in teaching statistical inference at upper secondary school?

4. How do groups of students at upper secondary school process informal statistical inference confronted with their own measured data from an unknown distribution?

Method

The research method can be characterized as a *design experiment* (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003) providing both increased understanding and improved products such as instructional materials. This work was mainly based on a pre-study performed by the researcher along with literature review of research concerning sampling investigation and data modelling in collaborative inquiry-based learning environments.

To address the research questions a learning trajectory based on a data modelling approach was designed in collaboration with a teacher teaching an upper secondary school class. To capture the students' reasoning and developmental process of ISI, groups of students were challenged to communicate their reasoning by drawing inference on data collected by their own. Students working in groups' were videotaped, partially transcribed and analysed with qualitative strategies by using an inductive analytical method. The transcriptions and collected groups´ reports were interpreted and categorized according to a developed framework based on ISI and data modelling. Finally, this result was implemented to answer each question.

References

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