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Implementing the statistical investigative process with real data: Effects on education in secondary schools

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Keywords: Statistics teaching, learner engagement, technology integration, problem-based learning

Theoretical background

In the Guidelines for Assessment and Instruction in Statistics Education (GAISE) College Report (2016) endorsed by the American Statistical Association following the GAISE College Report of 2005, the ASA revision committee recommends in addition to the teaching of statistical thinking and focusing on conceptual understanding, to use software combined with real data and to foster active learning. The main goal of the given recommendations for students is to develop statistical literacy and achieve the ability of thinking statistically. Therefore, students should understand the nature of data and all parts of the statistical process from obtaining and generating data to the communication and interpretation of the results after the analysis. In an international meta-analysis of 70 studies from the past 40 years Larwin & Larwin (2011) show that students in postsecondary statistics education strongly benefit from computer-assisted instruction (CAI) under certain circumstances, for example, when CAI is continuously and supplementary applied in lessons and homework. They also warn, however, of an overestimation of CAI. Several studies show the advantage of student-centered (e.g., Kuiper, Carver, Posner & Everson, 2015) and problem-based learning (e.g., Cantürk-Günhan, Bukrova-Güzel & Özgür, 2011) supported by technology (e.g., Koparan, 2015). Neumann, Hood and Neumann (2013) explored the benefits of using real data in statistical education. Gil & Ben-Zvi (2011) underline the importance of context in the emergence of younger students' informal inferential reasoning in an inquiry-based, technology-rich learning environment.

Research questions

The focus of the presented research lies on the beneficial implementation of statistics software in classes, considering, for example, the characteristics of various software programs. Another field of this research is how the use of statistical software in an inquiry-based learning environment leads to the development of conceptual understanding and not to dependence on the software and the learning of tools and procedures. This leads to the following research questions. First: How is the situation about the context- and inquiry-based learning of statistics supported by technology in Austrian secondary schools? Second: Is there an evident connection between context and using real data on the one hand and CAI on the other hand to provide a meaningful learning of the overall statistical process. Third: How should software under a given context in classes of higher secondary schools be installed to support conceptual understanding of the statistical investigative process and which characteristics of statistical software are especially beneficial to this purpose?

Research design

Various learning sequences for the 10th grade of Austrian higher secondary school are being created and will be inserted in different Austrian secondary schools. According to Strauss and Corbin's approach of Grounded Theory, diagnostic interviews will be carried out before and after the implementation of the

learning sequences. Some students' work on the sequences will be filmed and worksheets will be analyzed. The goal is, to develop provable hypotheses relating to the research questions.

The poster gives an overview of the theoretical framework, the research questions and design and focuses on a created worksheet that will be applied for this research. First results show that software in Austrian schools is commonly used in other mathematical fields, e.g. for plotting graphs, but not even in 30% of the cases for calculating statistical key figures.

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