Teacher's training in inferential statistics with a parallel application of classical and Bayesian approach

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Keywords: Statistical hypothesis testing, combinatorics, teacher training, education.

Introduction and background

In 2019 a pilot program was launched, aiming to investigate the conditions and methods to introduce inferential statistics, including hypothesis testing, in public education in Hungary, where at the moment only descriptive statistics is part of the curriculum (Fejes-Tóth, 2020). Although statistical hypothesis testing has been incorporated in teacher education in the past 15 years, most active teachers graduated before this happenedand never studied this subject before. Thus, to introduce the subject in education, first teachers themselves have to be equipped with relevant knowledge. In a new experiment, launched in December 2022 and built on the lessons learnt in the pilot program, we provided 9 teachers with a training in 8 hours. While the informal approaches of inference focus on simplification by re-randomisation and bootstrap to enhance understanding (Garfield & Ben-Zvi, 2008), others refer to shortcomings of this informal approach and suggest a parallel introduction of the classical and Bayesian approach (Borovcnik, 2017). In our current design we followed this path, and besides introducing the classical approach of statistical reasoning which was covered in the pilot program, we also integrated the Bayesian view, hoping to reach a better understanding and clearer interpretation of inferential statistics by the students (Gigerenzer, 1993; Vancsó, 2009).

Methods

The assessment framework of the curriculum can be considered an action-oriented Design Based Research approach: the training was initially designed based on theoretical considerations and empirical results of educational science, tested it in real-life school settings, then adjusted and refined accordingly. Our main research question was whether the curriculum is acceptable for users (both teachers and students), and if it confers knowledge effectively. With teachers our main data collection method is semi-structured interviews. Our poster describes our experiences with teachers' training.

The training itself consisted of three main blocks: an introduction, the content itself, and technical information regarding the measurement and evaluation of the experiment. In the first part, we described the goals and reasoning of our initiative. In the third part, we described the experimental curriculum: mostly the method of evaluation of the experiment and how they can support this by the input and output measurement on students. The main part of the training was the actual teaching of the content and methods to be used. During the training course we used examples that can be solved combinatorically (e.g., coin tossing), and we also introduced the chi-square test (independence and the goodness of fit). To equip teachers with a broad perspective and suitable knowledge, all three

aspects of probability (classical, frequentist and subjective) is introduced at their training (Carranza & Kuzniak, 2012), for which purpose we used a well-known real-word problem, the "medical tests paradox" (see Chenguang, 2020).

Results, conclusions and future plans

Statistical hypothesis testing was new to all 9 teachers, as well as Bayesian statistics. Altogether, all participants had a positive impression about the course, even if it was obvious that the given timeframe (8 hours) is insufficient for this material. Some of the teachers asked for extra practice problems before starting the teaching phase. For this reason, we plan to develop and deliver a broader, 15-30 hour long, accredited teacher training program. It will include the basics of hypothesis testing, confidence interval, linear regression and the elements of Bayesian statistics.

On the poster, among others, we will show the teacher-related results of the experiment.

Acknowledgment, Funding

This study was funded by the Research Program for Public Education Development of the Hungarian Academy of Sciences (KOZOKT2021-16).

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