Gender and Educational Background as Determinants of Computational Thinking Skills among First-Year Students at the Sapientia Hungarian University of Transylvania

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Introduction Computer skills and computational thinking are to a large extent socially biased. The research question addressed in this paper is whether men and women have different computational skills. The rationale for the study is provided by the lower share of female students in computer sciences which originates in the alleged gender differences in computational thinking. The paper presents the results of a study which attempts to identify the similarities and differences in understanding algorithms in male and female students. Methods A randomized controlled trial was conducted with 228 first-year students from different specializations in September 2022. Three visualization methods were used: animation, folk dance and theatre performance. After having seen the visualizations, participants answered the same questions about the algorithms by filling in questionnaires. Results This study presents the impact of the three visualization methods upon the understanding of algorithms in university students, as well as the gender differences in efficient learning with the different visualization methods. Although slightly over-represented in the worst results quartile and underrepresented in the best results quartile, women students did not score significantly lower on the computational thinking test, that is, they understood the algorithms to a similar extent as men. For both genders, lowest results are provided when learning with folk dance, but for women, the differences are negligible. Animation is not only the most efficient visualization tool but also the favourite one for both genders. On the second place, women prefer dance choreography, whereas men would rather learn with theatre performance.

Keywords: computational thinking, visualisation, gender, randomized controlled trial

References

[1] Osztián, P.R., Kátai, Z., Sántha, Á., Osztián, E. Investigating the AlgoRythmics YouTube channel: the Comment Term Frequency Comparison social media analytics method, *Acta Universitatis Sapientiae Informatica* **14,** (2022) 273–301.

[2] Crompton, C. J., MacPherson, S. E. Human agency beliefs affect older adults' interaction behaviours and task performance when learning with computerised partners, *Computers in Human Behaviour* **101,** (2019) 60–67.

[3] Leahy, W., Sweller, J. Cognitive load theory, modality of presentation and the transient information effect, *Applied Cognitive Psychology* **25** 6 (2011) 943–951.

[4] Wagner, I., Schnotz, W. Learning from static and dynamic visualizations: What kind of questions should we ask?, *In: R. Lowe, R. Ploetzner (Eds.): Learning from dynamic Visualizations: Innovations in research and application*, Berlin, 2017.