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TAMÁS VARGA'S REFORM AND COMPLEX MATHEMATICS EDUCATION (CME) AS A POSSIBLE FIELD OF EDUCATION FOR DEMOCRACY – FROM THE MID-20TH CENTURY TO THE PRESENT

Summary: In our research, we investigated how the idea of *mathematics as a possible field for democracy education* is present in the CME-inspired tradition of mathematics education in Hungary. 13 interviews were conducted with Tamás Varga's direct collaborators, his students, and practising teachers who teach in the spirit of CME. In this paper, we give a short overview.

Keywords: education for democracy, Hungarian tradition, CME, Tamás Varga

Tamás Varga (1919–1987) was one of the most prominent figures in 20th c. mathematics education in Hungary. His work is associated with a subject-specific experiment that ultimately served as the foundation for a nationwide curriculum reform[1,2].

The reform initiated by Varga in the late 1950s and early 1960s is closely tied to the Complex Mathematics Education (CME) method he developed. Both

[1] M. Halmos, T. Varga, *Change in mathematics education since the late 1950s – Ideas and realisation. Hungary*, "Educational Studies in Mathematics" 1978, vol. 9, no. 2, p 226.

[2] K. Gosztonyi, *The New Math in Hungary: Tamás Varga's complex mathematics education reform*, [in:] *Modern mathematics. An International Movement?*, ed. by D. De Bock, Springer, Cham 2023, p. 285–301.

in timing and in approach, it was somewhat parallel to Freudenthal's Realistic Mathematics Education (RME)[3], conceived as a response to the New Math movement. Thanks to Varga, along with his collaborators and successors, the influence of CME continues to resonate in school teaching and university teacher education even decades after the movement began[4].

In 2019, marking the centenary of Tamás Varga's birth, we conducted 13 interviews with mathematics teachers and researchers[5]. These interviewees either worked with Varga himself, belonged to his intellectual circle, or were contributors to preserving and advancing his theories and practices. Our goal was to cover the educational domains influenced by Varga's work. The interviews vividly outline the core principles of his methodology, which were summarised by Sándor Klein in his work *Psychological Impact Analysis of the Complex Mathematics Education Method*[6]. Among these principles, we highlight three key aspects: *the autonomy of learners, the authority*[7] *derived from work instead of authority from principle*, and *collaboration rather than hierarchy*. Additionally, the interviews underscored several defining characteristics of CME in practice, including the value placed on *debate* and the freedom to make *errors*. Within this framework, mathematics education emerges as a potential tool for fostering democratic values. In the spirit of CME, everyone is equal when stepping into the world of mathematics. Mistakes are not only acceptable but are also seen as integral to productive mathematical thinking, while truth is determined through correct reasoning. Consequently, reasoning and respectful discourse become central to the learning process.

CME does not exist in isolation from the broader tradition of Hungarian mathematics education. For instance, the textbooks developed during the CME experiment for the first four grades of primary school (age: 6–10) have been modernized and adapted to meet contemporary needs. While their underlying philosophy remains aligned with the original concepts, the mathematical content has been updated to comply with current educational regulations. These textbooks are now part of the limited, state-subsidized free textbook market. In addition, there has been a notable increase in doctoral research on topics related to CME. For ex-

[3] Ibidem, p. 300.

[4] See the Research Programme for Public Education Development of the Hungarian Academy of Sciences, https://mta.hu/kozoktatas-fejlesztesi-kutatasi-program [accessed 22.06.2025].

[5] G. Szmerka, *Das Erbe von Tamás Varga – Film, Didaktik und narrative Identität*, [in:] *Komplexer Mathematikunterricht. Die Ideen von Tamás Varga in aktueller Sicht*, ed. by G. Ambrus, J. Sjuts, É. Vásárhelyi, Ö. Vancsó, WTM-Verlag, Münster 2020, p. 53–63.

[6] S. Klein, *A komplex matematikatanítási módszer pszichológiai hatásvizsgálata* [Psychological impact analysis of the Complex Mathematics Education method], Akadémiai Kiadó, Budapest 1980.

[7] It is primarily about the authority of the teacher, but when used in this sense, it also means the authority of the student.

ample, Anna Kiss addressed the possibility of the implementation of CME into teaching practice[8]. In her dissertation, she emphasized the importance of freedom – both for teachers and students – as a core concept[9].

Below are some citations from the interviews that reflect these ideas. These have not been published so far, they are in manuscript[10]:

> Mathematics is like creating a play area, like a board game. You create the board, you make the pieces, you make the rules – you have to play within the board. […] So we can create small closed worlds, small closed systems within mathematics. Once we have agreed – the key word is agreed – that this is how it will be, we have to follow it strictly. Or agree on modifications. […] mathematics creates the kit for itself in different situations. One has much more freedom. Perhaps that is why mathematics is such a game for those who practise it. (Erika Jakucs)[11]

> When taught well, […] mathematics equips individuals with the ability to make decisions, communicate effectively, engage in debate, step outside their own perspective, and view the world through someone else's eyes. It fosters critical thinking and self-awareness, cultivating individuals who are not subordinates but citizens – capable of making their own decisions and taking responsibility for them. It teaches students to accept their place in a hierarchy not as a given but as a conscious choice. (István Lénárt)[12]

And finally, we would like to substantiate the idea that mathematics can be a tool for education for democracy[13] with a quote not from our own interviews, but from a film about Marta Winkler from 1979. She was a close colleague of Tamás Varga, who, as a primary school teacher, was able to develop her own pedagogical innovations in mathematics with the help of CME. A parent who worked as a psychologist and had a child in Márta Winkler's class said the following in a documentary (in 1979!).

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[8] Short thesis of a PhD dissertation: A. Kiss, *Complex Mathematics Education in the 21. century – educational design research*, https://edit.elte.hu/xmlui/static/pdf-viewer-master/external/pdfjs-2.1.266-dist/web/viewer.html?file=https://edit.elte.hu/xmlui/bitstream/handle/10831/111175/T%c3%a9zisf%c3%bczet_angol_v%c3%a9gs%c5%91%20%281%29.pdf?sequence=3&isAllowed=y [accessed 22.06.2025].

[9] A. Kiss, *Complex Mathematics Education: An integrated and inquire–based mathematics teaching method*, "Canadian Journal of Science, Mathematics and Technology Education" 2022, vol. 22, no. 4, p. 758–782.

[10] The following citation appears in the film G. Szmerka, *Legacy of Tamás Varga*, https://youtube/q7BHawAbT0M [accessed 22.06.2025].

[11] Teacher in Budapesti Fazekas Mihály Gyakorló Általános Iskola és Gimnázium.

[12] Teacher, inventor of Lenart Sphere, https://lenartsphere.com/ [accessed 22.06.2025].

[13] A. Kiss, *Complex Mathematics Education: An integrated and inquire–based mathematics teaching method*, p. 762.

> The most important thing that distinguishes Marta's class from other classes is self-awareness: […] they do not tolerate oppression, they do not tolerate dictatorship, they judge themselves, but they also make judgments about others. They become self-conscious, and they become leaders. They are also critical of themselves, and they see the falsities, they see not only the faults of others, but also their own faults.[14]

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Szmerka Gergely, *Legacy of Tamás Varga*, https://youtu.be/q7BHawAbT0M [accessed 22.06.2025].

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[14] A. Péterffy, *Iskolapélda*, part 2, 10:14–11:03, https://winklermarta.com/ [accessed 22.06.2025].