

*First Annual Report 2023*

**MTA-ELTE Theory of Learning Mathematics Research Group**

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**Report Milestones in the research plan and their achievement** List the research activities planned in your approved research plan for the reporting period and explain when and how they were completed. One of our primary goals was to involve as many researchers, teachers, and researcher-teachers as possible from schools of different socio-cultural backgrounds and various parts of the country in our experiments. We had two motivations behind this. Firstly, we wanted to ensure that we could examine the effectiveness of our methods on a sufficient number of students and a wide variety of groups. Secondly, we wanted to open (new) doors to the world of research for the participating teachers, thereby promoting their development and strengthening their research mindset. We view the project as a way to connect research and practice, by facilitating both young and experienced teachers to participate in experiments, and read and write articles. We would also like to enable researchers to gain a better insight into the everyday matters of public education, the problems that concern practising teachers, and the practical implications of the developed methods. In the first year of the project, we selected the schools, teachers, and groups to participate in the experiments. Due to the decrease in the budget, the investigation and financing of only two topics (see point 2) was feasible. Our goal was to examine the research questions both broadly and in-depth. Therefore we decided to reduce the number of the explored topics to avoid fragmenting the limited resources. We chose the following two topics for further research: The application of gamification in education. The examination of the effects of board games on cognitive development. A total of 14 schools and 36 teachers from various parts of the country participated in the experiment (including Budapest, Debrecen, Győr, Gödöllő, Kalocsa, Hódmezővásárhely). Students from 5th grade to 12th grade took part in the experiments. The members of our research team were responsible for ensuring that the experiments progressed without impediments in each grade level. Grade-level coordinators regularly consulted with teachers individually and held meetings at key stages of the experiments. This was important because teachers not only needed to be aware of their exact tasks but also had to familiarize themselves with the theory behind the respective topic. Understanding the theoretical underpinnings is crucial for them to effectively apply the researched method. After presenting the theory behind the research topics, the experiments began in each grade level. We examined the two mentioned methods within two different mathematical topics (over 8-10 weeks) at each grade level. At the beginning and end of each experiment, every participating group completed a logic and geometry test before and after the intervention, which we assembled. Additionally, each group wrote two final tests on the two chosen mathematical topics. Apart from assessing their knowledge of the learned material and mathematical skills, we also examined changes in the students' math anxiety and attitude.

**Problems Encountered During the Implementation of the Research Plan and Their Solutions** Describe the problems that necessitated modifications to the research and/or publication plan. How did the plan change, and how does this modification impact the overall progress of the research program? The critical factor affecting the realization of the research project was the decrease in the financial budget. Only 65% of the initially designated budget was available at the time of application, and this amount had to cover the expenses for teachers' work and the acquisition of necessary materials for the experiments (board games). The increased inflation also had an unfavourable impact on the financial stability of the

project. The financial support we were able to provide to the participating researchers was very limited. To address the financial instability, our junior research leaders took on part-time jobs and offered private lessons. Additionally, out of the originally indicated research topics, only two were studied, as it was only feasible to finance the investigation of two topics. We aimed to examine each method extensively and comprehensively, thus avoiding the fragmentation of limited resources, which led to the decision to reduce the number of topics. Several teachers who initially expressed their intention to participate in the project eventually declined upon realizing the workload it meant to take part in the project and the minimal financial compensation provided for their efforts. Another issue arose when, in several instances, students' completion of pre-and post-test assessments did not align with the conditions of the experiment. This was due to substitutions, missed classes, miscommunications, and the competitive spirit among teachers, leading them to assist their own students during the test-taking process. The main subjects of the original research plan remained unchanged, with the modification being the initiation of experiments in only two selected research topics.

**The Most Significant Publications Related to the Research Program** Please describe the five most important publications that were written during the research period and indicate their relevance to the research plan. Among the published works, we included publications on knowledge assessment and testing. Our research group has long been investigating the testing effect in various circumstances. Originally, we had planned to continue research related to this within the framework of the project. However, we could only partially do so since we focused on gamification and board games. As a result, the testing effect was not investigated as a standalone topic during this year but was instead incorporated into our research as part of the gamification component.

Szabó, Csaba; Zábó, Csilla ; Muzsnay, Anna; Szeibert, Janka ; Bernáth László. Investigating the efficacy of retrieval practice in university mathematics. *REVISTA DE EDUCACION* 401 : 1 pp. 79-96. , 18 p. (2023) <https://doi.org/10.4438/1988-592X-RE-2023-401-584>. spanyolul: Investigación de la eficacia del aprendizaje potenciado por recuperación en las matemáticas universitarias. Q3, beküldéskor Q2

Berezky-Zábó Cs., Szabó Cs., Muzsnay A., Szeibert J.(2022) Passing the exam and not mastering the material in geometry. *Annales Mathematicae et Informaticae*. <https://doi.org/10.33039/ami.2022.12.009>. Q4

Szilágyi, B., & Megyeri, K. (2023). Az online gyakorló tesztek bevezetésének első tapasztalatai a Dr. Ámbédkar Iskolában. *Opus et Educatio*, 10(1).

Sipos, B., & Szilágyi, B. (2022). Investigation of processing test results based on knowledge similarity. In *Towards a new future in engineering education, new scenarios that European alliances of tech universities open up* (pp. 710-719). Universitat Politècnica de Catalunya.

Sipos, B., Berezvai, S., & Szilágyi, B. (2022). Changes in learning strategy and learning time in the wake of the pandemic. In *Towards a new future in engineering education, new scenarios that European alliances of tech universities open up* (pp. 720-728). Universitat Politècnica de Catalunya.

**Dissemination Events** How did you present your research results to the participants in the public education system? What feedback did you receive? Will this feedback influence the second phase of the research program? As shown in the attached lists, we conducted experiments and delivered lectures in many schools that can be considered typical in public education. Our earlier work laid the foundation for our current research, so throughout the year, we held lectures based on both previous and recent experiences. Testing, as a facilitator of retrieval, was adopted in at least 14 educational institutions, generally at the teacher (rather than class or school) level. Several participating teachers in this research indicated their intention to continue applying some of the studied methods even after the completion of the project. Even though many expressed the importance of further collaboration in the second phase of the program, we will focus on the evaluation of previous experiments and the publication of their results in Q1 and Q2 journals in this phase, instead of further experimentation to allocate the resources more efficiently.