

MTA-SZTE Metacognition Research Group

Progress report– from September 2021 to August 2023

1. Progress report

The research plan covered four content areas, so in the following, we review the ongoing data collections, data analyses, and the already published findings along these lines.

1.1. Number concept, arithmetic skills

A new online test of understanding fractions has been developed (Karika and Csíkos, 2022) for lower secondary students. A new test measuring different metacognitive and non-metacognitive components of arithmetic skills (based on the theoretical model proposed by Csíkos, 2022) has been developed and piloted.

The field of arithmetic skills provides an area for investigating the summer set back effect (data analysis in progress in Grades 3, 5, 7, and 9). This data collection also serves as a starting point for a longitudinal investigation.

An online test measuring the development of proportional reasoning has been piloted and then further developed. The first findings have already been presented (Bereczki and Csíkos, 2023).

1.2. Mathematical word problems

A developmental model for both arithmetic skills and word problem solving was proposed by Csíkos (2022), uniting metacognition theory and already available empirical evidence on the developmental dynamics of metacognitive and non-metacognitive components of arithmetic skills. The model concerns students' beliefs on the relative importance of arithmetic skill components and different steps in word problem solving.

There have been several data collections and there are papers already published on secondary students' word problem solving ability and its connections with affective and metacognitive variables like attitude and beliefs (e.g., Hidayatullah and Csíkos, 2022, 2023).

An emblematic PISA task and additional tasks related to the mathematical and reading comprehension components were administered to Hungarian and Indonesian lower secondary students. Data analysis is in progress, the preliminary calculations show that although students in grades 5 and 6 already possess the necessary arithmetic skills, reading vocabulary, and spatial ability components, the genre of mathematical word problems raises serious hindrances for them.

1.3. Reading comprehension

A cross-sectional developmental study on morphological awareness revealed the important role of some sub-tests in reading comprehension was published by Varga et al. (2022).

The inter-relatedness of mathematical thinking and reading comprehension has been studied in both small-sample and large-sample investigations. We used eye-tracking to detect primary students' inflexible strategy use while solving word problems (Turzó-Sovák et al., 2023)

Together with János Steklács, a new questionnaire was developed and is piloted now on secondary students' reading strategies. We address the so-called "support" reading strategies, i.e. the frequency and the causes of using external devices to support their own reading comprehension. There has been further research on reading published (see publication list), and collaboration with the MTA-PTE Reading Fluency and Comprehension Research Group continues.

1.4 Metacognitive scaffolding, pedagogical culture

The concept of metacognitive scaffolding, together with the phenomenon of noticing has been introduced and used in conference papers already, and some small-scale data collections and data analyses have been completed (Biró, 2021, Biró et al., 2022, 2023). Eye-tracking as a research method was used to detect pre-service teachers' noticing ability.

The instructional strategy of "conceptually teaching" that is rich in metacognitive scaffolding tools was assessed in an educational experiment (Hussein and Csíkos, 2023).

An intervention program on fostering creative problem solving in kindergarten is about to be launched this year (Szilvia Kiss). An observational checklist has already been developed, and the program enables for detecting children's interactions via mobile eye-tracking.

Action research collaborations are launched in 2023 in several fields of mathematical thinking, e.g., introducing negative numbers in primary school, and teaching percentage calculation.

2. Publications (please find enclosed)

3. Efficiency indicators

3.1. Dissertations supported by the Research Group

Ruth Wafubwa: Formative Assessment as an Instructional Approach in the Teaching and Learning of Mathematics: A Case of Secondary School Teachers and Students in Kenya
<https://doktori.hu/index.php?menuid=193&lang=HU&vid=24761>

3.2. PhD students working in the Research Groups (N = 9)

Fanni Biró, Ildikó Bereczki, Nikolett Turzó-Sovák, Achmad Hidayatullah, Szilvia Kiss, Orsolya Kis-Volentér, Zsóka Sipos, Ruth Wafubwa, Tímea Karika

3.3. Number of in-service teachers participating in the project, N = 8

Csaba Csíkos delivered plenary lectures at conferences attended by in-service teachers in Kaposvár (Képzés és Gyakorlat), Rátz László Vándorgyűlés, Veszprémi Érseki Főiskola Konferenciája.

Publications written in Hungarian (see the publication list) also serve the purpose of disseminating the project results, and "*aiming to educate domestic language*"¹.

¹ <https://mta.hu/english/history-of-the-hungarian-academy-of-sciences-106111>