

Title:

Eye movements during solving an enumerative combinatorial problem among 3rd grade students

Authors:

Zsófia Gabriella Szabó[1], János Steklács[2]

Affiliations:

1. Doctoral School of Education, University of Szeged;
MTA-SZTE Science Education Research Group 2. Teacher
Training Faculty, Pallas Athena University, Kecskemét

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Abstract:

Combinatorial reasoning is a process of creating different constructs from given set of elements and given conditions (Adey & Csapó, 2012). There are two dimensions of combinatorial reasoning, the first one is the correctness of the solution, so the rate of the correct and incorrect constructs, while the second one is the strategy of thinking, in other words the way we enumerate the different options (based on Csapó, 2003). This second dimension is called combinatoric strategies by English (1991). Several international studies deal with combinatoric strategies (e.g. English, 1991, 1993; Halani, 2012; Lockwood, 2013), however we are not informed about any national research which focused on measurement of combinatoric strategies.

Therefore, the aim of our research project is to investigate primary school children's combinatoric strategies in different combinatorial operations. As a first step, we carried out a small-sample study to examine children's task-solving activity and eye movement during one selected combinatorial operation. We assumed that we will find out relationship between fixation duration and fixation count, as well as the correctness of the solution and the used strategy.

To achieve this, we measured forty-eight third grade pupils with one selected task from the digitalised version of Csapó's combinatorial test (Csapó & Pásztor, 2015). Using a special monitor, we recorded eye movement of each student. After the data collection, thirty students were selected with properly available data. From the screenshot of the task five areas were determined, and total fixation duration, fixation count as well as visit count were calculated for all areas.

As the results showed, there are different tendencies regarding the three variables (fixation duration, fixation count, visit count) if we divide the sample into sub-samples based on children's performance as well as the strategies used by the participants. We found that

fixation duration is longer and fixation count is higher in case of student with better performance and less developed combinatoric strategy. At the same time, the mentioned variables are shorter and lower in case of student with better performance and more advanced combinatoric strategy or among lower-performing children. Furthermore, to present the differences we would like to show gaze opacity and gaze plot figures in connection with three factors: various fill patterns, strategies and performances.

Our research contributes to learning more about children's task-solving behaviour during solving a combinatorial problem. Based on these results we can design our future investigations. Furthermore, they can help us develop a training program to improve students' task-solving and thinking strategies.

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