

## COMBINATORIAL REASONING IN 4<sup>TH</sup> AND 6<sup>TH</sup> GRADE PUPILS: PRELIMINARY RESULTS OF A LARGE-SCALE STUDY

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The paper examines combinatorial reasoning, a skill needed to analyse the complex relationships between various factors, and to arrange a given set of elements into constructs according to given conditions (Adey & Csapó, 2012). While assessing and analysing this thinking skill, most Hungarian studies (see e.g. Csapó, 2001; Csapó & Pásztor, 2015; Nagy, 2004) focus on the accuracy of the solutions, while some international studies (see e.g. English, 1991; Halani, 2012; Lockwood, 2013) are concerned with the method of enumerating the different options. However, we are not aware of any large-scale studies that focus on both of these dimensions. Therefore, the aim of this research project is to examine these two dimensions of solving enumerative combinatorial problems among primary school pupils. In this paper, the sample of our large-scale study and some preliminary results will be presented. We tested the suitability of a previously piloted (see Szabó & Korom, 2017) and improved instrument. Furthermore, we predicted that 6<sup>th</sup> graders would perform better than 4<sup>th</sup> graders, and differences between classes in the same grades would show up in the test results. For the data collection, a computer-based instrument was used, which is composed of some background questions, a test with eight combinatorial tasks and a questionnaire with eight task-related questions. The test allows us to assess six different combinatorial operations. The survey was carried out with the participation of pupils from Grade 4 (N=789, mean age: 9.35) and Grade 6 (N=749, mean age: 11.41) from 35 Hungarian primary schools. The students' performance on the combinatorial tasks was evaluated using the 'j-index' (Csapó, 1988). The results revealed that the reliability of the test was acceptable (Cronbach's alpha Grade 4=.86, Grade 6=.88). As expected, the 6<sup>th</sup> grade pupils' combinatorial reasoning performance (M=62.74, SD=22.66) was significantly better ( $|t|=6.05$ ,  $p<.01$ ) than that of the 4<sup>th</sup> graders (M=55.91, SD=21.69). Looking at the eight tasks individually, a difference ( $p<.01$ ) was also found between the two age groups' performance for all tasks, except for one of the Cartesian product items. In terms of difficulty, the order of the tasks was nearly the same in the two groups (as shown by paired-sample t-tests). As a next step, deep log-file analyses are planned to explore students' understanding of combinatorial operations and their methods of enumerating different options. In addition to these, the results of the questionnaire section and their relationship with the test results will be analysed. Our research project contributes to our body of knowledge about combinatorial reasoning and about pupils' thinking. Furthermore, our expected results can help to make the teaching-learning process more effective.

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