CHANGES IN COMBINATORIAL TEST PERFORMANCE IN ONE YEAR: PRELIMINARY RESULTS OF A LONGITUDINAL STUDY

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Our study looks at combinatorial reasoning, which we interpret within the framework of Csapó's theoretical model (1988). This thinking skill is needed to analyse the complex relationships among various factors, and to arrange a given set of elements into constructs according to given criteria (Adey & Csapó, 2012). Since combinatorial reasoning could positively affect many other areas, fostering the development of this skill is essential, and requires an increase in our body of knowledge about the skill. Although exploratory studies on combinatorial reasoning exist, we are not aware of any longitudinal research on this skill.

The aims of our longitudinal study are to look at (1) changes in performance on a combinatorial test as a whole and on individual combinatorial operations within the test (the tasks of the test), and (2) the changes in students' understanding of combinatorial operations in two age groups (grades 4 and 6) that occur in a year (by grades 5 and 7). The current paper focuses on the first aim, and the following research questions are discussed: how students' performance changes (1) on the test as a whole and (2) on the individual tasks, and (3) whether there are changes in the relative difficulty of the tasks in a year.

The first data collection was carried out from 12/2017 to 01/2018, while the second one took place one year later, from 11/2018 to 01/2019. The same computer-based instrument with eight combinatorial tasks (for six different combinatorial operations) was used both times. 184 students from the younger age group (Subsample I) and 176 students from the older age group (Subsample II) participated in the surveys.

The results revealed that the reliability of the test was acceptable at both times for both age groups (.86≤Cronbach's alpha≤.89). As was expected, students' overall test performance increased significantly in a year (Subsample I: 53.41% and 57.50%, $|t|=3.02$ $p<.01$; Subsample II: 63.58% and 69.48%, $|t|=4.77$ $p<.01$). However, the observed improvement did not affect all eight tasks: an improvement was found in two tasks in the younger age group, and in five tasks in the older ($p<.05$). This indicates that not all combinatorial operations may undergo spontaneous processes of development. Looking at the relative difficulty of the tasks, there were only a few differences in the order of difficulty of the tasks between the two data collections in both groups (as shown by paired-sample t-tests).

As a next step, changes in students' understanding of combinatorial operations will be explored. In addition, we are currently developing a feedback system to support the diagnostic assessment of combinatorial reasoning. We are confident that our results on spontaneous changes in the skill and the feedback system can contribute to the explicit fostering of combinatorial reasoning.

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