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Introduction

Studies on early pattern competencies in the primary grades show a close relationship between children's competencies in this domain and their general mathematical competencies. Furthermore, several studies suggest that children's pattern competencies can be fostered by implementing patterning activities in intervention programs or in regular mathematics lessons (Lüken & Kampmann, 2018). Those interventions usually involve concrete objects or iconic representations. In contrast, the exploratory study presented in this poster focuses on physical activity to foster children's patterning abilities. This pilot study aims to develop, implement and evaluate movement games dealing with a variety of activities concerning repeating patterns.

Theoretical Background

In accordance with Lüken and Kampmann (2018) a mathematical pattern can be defined as any predictable regularity. One of the types of patterns relevant for the primary grades are *repeating patterns* with a cyclic structure, consisting of a sequence of elements (the *unit of repeat*) that is repeated indefinitely (e.g., ABAB…). A longitudinal study reported by Lüken et al. (2014) reveal a significant effect of children's repeating patterning abilities one year prior to school on their mathematical competencies at the end of grade 1. Furthermore, elaborated repeating patterning abilities are also relevant for further mathematical developments, e.g. in algebraic thinking (Warren & Cooper, 2006). Tasks and interventions are frequently based on a variety of activities, such as conceiving, reproducing, and extending repeating patterns (Warren & Cooper, 2006), often involving concrete materials. While dealing with materials solely involve fine motor activities, a higher level of motoric engagement is realised by whole-body movements. In this domain, two approaches can be distinguished: either the movement accompanies the learning process only in time, or it is directly related to the content (Bayer & Rottmann, 2018). While there is evidence of positive effects of physical activity for the learning process in general, research investigating the added value of connecting the movement to the specific content is largely missing. One of the few exceptions is the exploratory study by Bayer and Rottmann (2018), which shows an improvement of first and second graders understanding of multiplication in an intervention based on movement games.

Methodology

The exploratory study (09-10/2017) reported in this poster aimed to answer the following research question: To what extent can children's repeating pattern competencies be fostered by physical activity? Therefore, a diagnostic tool and three movement games directly related to repeating

patterns have been developed and trialed in a German primary school with 19 first graders. The trial included seven teaching units. The diagnostic tool was conducted as a paper-pencil-test in the first and the last unit in a pre- and post-test-design. It contained tasks to reproduce and extend repeating patterns with various units of repeat as well as tasks demanding to identify the unit of repeat, extrapolate a pattern and create a new one. Typical movement games from physical education (e.g. "Reversal Relay Race") were implemented in the remaining five lessons. Each movement game focused on different activities relating to the learning content. For example, to extend a repeating pattern by physical activity in the Reversal Relay Race, children had to rerun a unit of repeat consisting of single whole-body movements like *jumping with one's legs apart – jumping with one's legs tightly* to move on in the gym. A reflection phase to direct children's attention to the unit of repeat in the pattern was integrated into each game. Apart from playing the games in physical education lessons once a week, further teaching of repeating patterns did not take place.

Results and Outlook

The results of the pre- and post-test indicate a positive development of children's repeating pattern competencies. In the pre-test, an average of 9.2 tasks (from 16 tasks in total; 58% of tasks) is answered correctly, whereas the number of successfully solved tasks increases to an average of 12.7 tasks (79% of tasks) in the post-test. It is conspicuous that there are considerable differences within the sample regarding students' mathematical competence level. Compared to the pre-test, the group of four students with difficulties in learning mathematics demonstrated an increase of 5.25 tasks solved correctly in the post-test. Progress was related with identifying the unit of repeat, continuing and completing repeating patterns. These first results indicate a positive influence of physical activity on children's repeating pattern competencies. However, it is still an open question to what extent this positive effect was caused by the physical activity itself, or by the respective (linguistic) reflection of the activity induced in the reflection phases following each movement game. A subsequent research project is in preparation to further investigate this question.

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