KINDERGARTEN STUDENTS' SPATIAL THINKING: PRACTICES ON DEBUGGING OF BUILDING BLOCKS

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Spatial thinking is a process to mentally represent and transform objects and to interpret the relationship among these objects (Clement. 1998). Abstraction is a core component supporting faster and more effective spatial thinking by removing unnecessary details and producing a simpler representation (e.g., in mental rotation; Lovett & Schultheis, 2014). Computational thinking (CT) is a concept rooted in computer science, which refers to a set of problem-solving methods to solve complex problems (Wing, 2006). CT has suggested abstraction as one of the main concepts (Wing, 2006). Indeed, CT and spatial thinking interrelate with each other (Román-González, Pérez-González, & Jiménez-Fernández, 2017). This study focuses on the interrelation between spatial thinking and CT.

Giving more attention to abstraction as a concept of CT could support students' mathematics learning (Rich & Yadav, 2020). Likewise, spatial thinking is essential for students to develop some mathematical ideas (e.g., number sense) in early ages (Cheng & Mix, 2014; Geary & Burlingham-Dubree, 1989; Gunderson et al., 2012; Stieff & Uttal, 2015; Verdine et al., 2014). Further, some researchers argued that playing blocks is associated with improving children's spatial thinking (e.g., Caldera et al., 1999; Connor & Serbin, 1977; Verdine et al., 2014). Although many studies have concentrated on constructing blocks as an intervention to promote children's spatial thinking, far fewer have examined children's computational thinking in the constructing and deconstructing process. To help fill this knowledge gap, this study investigated the possible impact of debugging (finding and fixing mistakes) –an approach of CT (Angeli et al., 2016) – on kindergartener's spatial thinking. Further, debugging might also be helpful for their mathematics skills by enhancing spatial thinking.

The design of the study includes a paper guideline that serves as algorithms and an authentic model. The guideline is a series of solid figures showing detailed steps. Each step includes the shape of a building block being used and the outcome for this step while the model has mistakes when matching with the guideline (e.g., the incorrect orientation of piece on correct place, missing piece). The students need to deconstruct the given model by following the guidelines to detect the mistakes. Once they find and fix a mistake, they need to reconstruct the model with the guideline. In addition, pre- and post-tests will be used to measure students' spatial thinking and mathematics. We hypothesize that CT-inspired-heuristic such as debugging an authentic model of building blocks will have a positive impact on spatial thinking and mathematics in early ages. The findings will contribute to the theory and practice of developing students' spatial thinking in early ages. The study will also expand and enrich the discussion on the interplaying relations between computer science and mathematics.

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