Proofs without words with geometric representations: a trigger to self-efficacy and mathematical argumentation.
Summary: Proofs without words (PWWs) are visual representations that provide the observer with clues to stimulate mathematical thought. There is an increasing consensus among researchers that visual representations can potentially contribute to mathematics learning processes and better understanding of problems. In schools, PWWs are less common than logical proofs. Evidence from many meta-analyses of more than two decades of study shows that efficacy beliefs contribute significantly to level of motivation and learning, socio-cognitive functioning, emotional well-being, and performance accomplishments. Therefore, efficacy beliefs are crucial for educating young people. Efficacy beliefs provide students with a sense of agency to motivate their learning through use of self-regulatory processes. We performed a qualitative exploration of how PWWs activity contributed to efficacy beliefs and performance in mathematics. Two groups of mathematics student-teachers and teachers (n = 50) aged 20–27 participated in the study. Research tools were semi-structured reflections (50), non-participant observations (3), and field notes (10). The PWWs activity was presented in the methodology courses as a pedagogical device that the participants had to experience for future use in their classes. Data were analyzed using a constant-comparative method and grounded theory techniques. PWWs (a) enhanced participants’ self-efficacy to make argumentations, (b) contributed to making mathematical argumentation, divergent thinking, creativity, and (c) fostered self-regulation. Difficulties with PWWs among some participants also emerged. The contribution of this study is threefold: strengthening this “old-new” genre as a pedagogical thinking tool to foster future mathematics thinking; engaging students in activities that make them realize the beauty and elegance of mathematics, thus enhancing their self-efficacy to learn mathematics, and enhancing thinking performances. Providing students with PWWs opportunities is recommended.

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