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The effect of shift-problem lessons in the mathematics classroom.

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Summary: It remains difficult to foster problem-solving and mathematical-reasoning capabilities in classrooms where students and teachers are accustomed to the more traditional forms of education. Several studies suggest that this difficulty might be related to the kind of knowledge students acquire in such environments, which could be fragmented and superficial. In our research, we developed specific tasks that might improve student's learning and consequently the kind of knowledge when used in small group work. The learning process we aimed at in this setting is directed at strengthening, grounding and integrating students' fragmented and pseudo-mathematical knowledge. We called the lessons in this approach – shift-problem lessons – and we investigated the effect of learning arrangements that replace some of the regular lessons with shift-problem lessons. We conducted two quasi-experimental studies: one in geometric proof and another in integral calculus with 16/17-year-old students in pre-university education. Each study involved three experimental classrooms and three comparable classrooms. The results indicate that the learning arrangement seems to have a positive influence on the students' performance as the experimental group outperformed the control group in particular tasks. We also found that, with regard to small group work in the shift-problem lessons, the groups of students' success in solving the tasks throughout the course followed different patterns in the integral calculus and geometric-proof courses. These results and the implications of the study for mathematics educators and researchers are discussed.

Classification: D34 D44 E54 D54 G44 I54

Keywords: collaborative learning; geometric proof; integral calculus; mathematical reasoning; mathematical tasks; secondary education; student thinking; textbook

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