

A CROSS-SECTIONAL STUDY OF MIDDLE SCHOOL STUDENTS' DOMAIN-SPECIFIC PRIOR KNOWLEDGE IN MATHEMATICS

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Solving a mathematical problem requires a complex set of cognitive, behavioral, and attitude components that depend on the deep structures of prior knowledge and experiences. Prior knowledge, including procedural and conceptual, is a crucial factor influencing students' performance in mathematics. Several researchers investigated students' mathematics domain-specific prior knowledge (DSPK) across grades with the results that higher grades outperformed lower grades, but the difference was barely noticeable (Ameer & Singh, 2013; Yagoubi et al., 2005). However, they only focused on a single topic and knowledge rather than comparing several mathematics topics across grades. This study aims to assess students' mathematics DSPK across grades in four mathematics topics (i.e., number, ratio and proportion, geometry, and statistics), targeting both procedural and conceptual knowledge. The study applied an online 30 item multiple-choice test that has good validity and reliability ($.90 \leq \text{mean-square value} \leq 1.16$; EAP/PV reliability = .706). The instrument was administered to 1067 students in grades 7 to 9 in East Java, Indonesia. They were selected from A-accreditation schools with random classes. The students' scores were converted into a logit scale (i.e., weighted likelihood estimate or WLE) using the Conquest application. The description of students' scores across grades and their differences through one-way analysis of variance (ANOVA) are reported and presented by using a pirate graph using R studio with yarr package. The results revealed that students in grade 9 outperformed the others in mathematics DSPK ($F_{(1,066)} = 18.936, p < .001$). This result confirmed the results of previous studies (Ameer & Singh, 2013; Rittle-Johnson & Alibali, 1999; Yagoubi et al., 2005). Students in grade 9 outperformed the others in all topics, regarding both procedural and conceptual knowledge. However, students' mean scores in conceptual knowledge are higher than in procedural knowledge, with the application of knowledge as the most difficult skill. Although students in grade 9 had a higher mean score, there was no significant difference in statistics and knowledge of meaning or conceptual knowledge. Students in grade 8 were slightly better in the topics of geometry and statistics DSPK than students in grade 7, but the mean scores were not significantly different. Students' DSPK showed the highest and the lowest means regarding ratio and proportion, and statistics, respectively. The results of this study will be beneficial for teachers to enhance students' prior knowledge in the most difficult knowledge and mathematics topics. In addition, teachers can design comprehensive teaching and learning to improve students' prior knowledge when such knowledge is needed but appears to be poor.