

Washington State University College of Education

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will defend the thesis on

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Faculty, students and the general public are encouraged to attend

THE EFFECTS OF HANDS-ON LEARNING ON STEM STUDENT MOTIVATION: A META-ANALYSIS

Chair: Olusola Adesope

Traditionally, the predominant instruction mode in a typical classroom is a lecture where instructors explain the concepts verbally. There is a growing use of different active learning techniques in the classroom today. Some of these techniques include game-based learning, flipped classroom, collaborative learning, and hands-on learning. While many studies, over the past 20 years, have investigated the effects of hands-on learning on student performance, other studies have also examined the effects of hands-on learning on student motivation. However, to date, there is no comprehensive synthesis of the literature on the effects of hands-on learning on student motivation, especially in Science, Technology, Engineering, and Mathematics (STEM). Hence, the overarching goal of this meta-analysis was to examine empirical research regarding the effects of hands-on learning on student motivation. Following well-established standards for conducting rigorous meta-analyses, selection criteria were developed, and searches were systematically conducted on relevant databases using specific keyword combinations for both published and unpublished studies investigating the effect. Data from 21 independent studies involving 2,087 participants were extracted and analyzed. Overall weighted mean effect size shows a moderate statistically significant hands-on learning effect ($d = 0.50$, $SE = 0.08$, $p < 0.01$). Several variables moderated the overall effect size in various ways. For example, both learners with low prior knowledge and high prior knowledge benefitted from hands-on learning. However, learners with low prior knowledge benefitted more from hands-on learning than high

prior knowledge learners. Learners at all educational levels equally benefitted from hands-on learning of science and engineering topics. There was no significant difference across educational levels. This meta-analysis suggests that hands-on learning in the classroom may be associated with increased motivation and, therefore, beneficial for learning. Theoretical and practical implications are discussed.

Keywords: hands-on learning, active learning, motivation, meta-analysis, systematic review.