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Developing Physical Science Teachers' Conceptual Understanding of Electromagnetic Theory by Means of Hands-on and Virtual Experiments

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Abstract

Teachers are expected to continuously improve their content knowledge of what they teach, and how they teach, to advance academic performance and classroom practices. Such understanding is part of pedagogical content knowledge (PCK) which forms a basis for successful teaching and learning in Physical Science. This article describes science teaching practices that add value to the quality and standards of STEM (Science, Technology, Engineering, and Mathematics) education. Two different Teaching Learning Sequences (TLS) were compared to document the influence of hands-on and virtual experiments in a Physical Science teachers professional development workshop. The teachers' preferred way of teaching was predominantly the traditional method, which explained the lack of confidence to apply appropriate methods for physical science teaching. The TLS were designed, and one method incorporated virtual and hands-on experiments. TLS were used as an intervention strategy to improve teachers' knowledge of electromagnetic theory; a topic that was prescribed for the learners that were taught by the sampled group. The study used primarily qualitative data, as well as some quantitative data. The participatory observation method and a pre-post-test questionnaire were designed to obtain data from in-service Physical Science teachers. The teachers' conceptual understanding of Electromagnetic theory was attributed to the application of virtual and hands-on experiments in a teaching learning sequence. The re-evaluation of TLS and the significant role of blended practical work in science classrooms was recommended to uplift the standard of physical science teaching and STEM education

Keywords: Hands-on experiment, practical work, teaching learning sequence, virtual experiments, Physical science teaching