ESMART TLM: ENHANCING SPATIAL SKILLS AND METACOGNITION THROUGH AUGMENTED REALITY TECHNOLOGY

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ABSTRACT

This study developed a teaching and learning material in chemistry with integrated augmented reality (AR), titled eSMART TLM. The main objective of this research is to assess the effects of using AR objects and animations on students' spatial skills (SS) and metacognitive knowledge (MK) in senior high school chemistry course. The present study utilized the design-based research paradigm in the development of eSMART TLM while the assessment of the effect of using AR in eSMART TLM on students' SS and MK employed the pre-experimental single group design. To provide the AR component of eSMART TLM, this study also developed a database of intuitive AR objects and animations that can be manipulated by tactile controls, a dedicated mobile application software designed to retrieve, display, and control the virtual 3D objects, and unique trackers printed in eSMART TLM for each virtual 3D object and animation. The AR objects and animations were used in the four intervention activities for spatial skills and metacognitive scaffolding for metacognitive knowledge enhancement. A spatial skills test composed of Purdue Spatial Visualization Test (PSVT) and Content-Specific Spatial Skills Test (CSST), and metacognitive knowledge test assessing declarative, procedural and conditional knowledge, were administered to the students before and after using eSMART TLM. Using Hake factor test, the study found out that there is medium learning gain for PSVT and high learning gain for CSST. For metacognitive knowledge, the Hake factor test revealed that there is high learning gain for declarative and procedural knowledge while only medium learning gain for conditional knowledge.

Keywords: chemistry education, augmented reality, spatial skills, metacognitive knowledge, pre-experimental single group design, Philippines