

## VR in the Middle School Classroom-An Experimental Study on Spatial Relations and Immersive Virtual Reality

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**Abstract :** Middle school science, technology, engineering, and math (STEM) teachers experience an exceptional challenge in the expectation to incorporate curricula that builds strong spatial reasoning skills on rudimentary geometry concepts. Because spatial ability is so closely tied to STEM students' success, researchers are tasked to determine effective instructional practices that create an authentic learning environment within the immersive virtual reality learning environment (IVRLE). This study looked to investigate the effect of the IVRLE on middle school STEM students' spatial reasoning skills as a methodology to benefit the STEM middle school students' spatial reasoning skills. This experimental study was comprised of thirty 7th-grade STEM students divided into a treatment group that was engaged in an immersive VR platform where they engaged in building an object in the virtual realm by applying spatial processing and visualizing its dimensions and a control group that built the identical object using a desktop computer-based, computer-aided design (CAD) program. Before and after the students participated in the respective "3D modeling" environment, their spatial reasoning abilities were assessed using the Middle Grades Mathematics Project Spatial Visualization Test (MGMP-SVT). Additionally, both groups created a physical 3D model as a secondary measure to measure the effectiveness of the IVRLE. The results of a one-way ANOVA in this study identified a negative effect on those in the IVRLE. These findings suggest that with middle school students, virtual reality (VR) proved an inadequate tool to benefit spatial relation skills as compared to desktop-based CAD.

**Keywords :** virtual reality, spatial reasoning, CAD, middle school STEM

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