Chapter 3
Augmented Reality as a Tool to Enhance the Learning Experience and Outcomes of Spatial Geometry

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ABSTRACT

Mathematics, specifically spatial geometry, is a highly abstract discipline that requires students to use a substantial amount of imagination while studying. Geometry poses several obstacles for pupils owing to improve the instruction of spatial geometry, educators must discover, use, and integrate technology to enhance the process of learning. It is essential to enhance the process of learning. Educators find this disturbing. Augmented reality (AR) is significant in math education, providing several advantages. Examine and use the uses of augmented virtual reality technologies to construct models that assist in instructing spatial geometry. The instruction

DOI: 10.4018/979-8-3693-8317-9.ch003

of spatial geometry. Research findings indicate that augmented virtual reality has many notable functions, including boosting engagement, visually representing complex ideas, improving problem-solving abilities, and promoting individualized learning.

1. INTRODUCTION

Augmented Reality (AR) has emerged as one of the most innovative technologies in the field of education, offering new ways to engage learners and improve learning outcomes. AR integrates digital information and media into the real world through devices such as smartphones, tablets, and AR glasses, allowing students to interact with virtual objects in their physical environment. This combination of real and virtual worlds presents unique opportunities for teaching complex subjects, particularly in fields such as mathematics and science, where abstract concepts can be difficult for students to grasp through traditional methods.

Spatial geometry, which deals with three-dimensional shapes and spatial relationships, is one such subject that poses significant challenges for learners. The abstract nature of spatial geometry often requires students to visualize 3D objects mentally and understand how these shapes interact in space, which can be a complex task for many. Traditional teaching methods, such as static diagrams and 2D representations, are often insufficient in conveying the dynamic and interactive nature of spatial relationships. This is where AR technology can make a substantial impact by allowing students to manipulate 3D models and interact with these objects in a way that mirrors real-world spatial experiences.

The motivation behind this study stems from the growing interest in how emerging technologies like AR can transform education by making learning more interactive, engaging, and effective. Research has shown that AR can improve student engagement, motivation, and learning outcomes, especially in subjects that require strong visual and spatial reasoning skills (Nanthanasit & Wongta, 2018). In mathematics education, AR has been applied as a blended teaching tool that enhances traditional methods by providing a more hands-on, immersive learning experience (Kamal & Junaini, 2019). Despite its potential, AR remains underutilized in many

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