Chapter 4

Impact of Augmented Reality Gamified Math Task Design on Middle School Students' Self-Regulation:

A Cognitive Load Regulation Perspective

Biao Xu
https://orcid.org/0009-0009-3532-0171
Universiti Sains Malaysia, Malaysia

ABSTRACT

The education landscape is undergoing significant changes, and integrating gamification technology into augmented reality (AR) has become a promising field. This study applies cognitive load theory to explore the impact of AR gamified mathematical task design on middle school students' self-regulation ability, and suggests that AR optimizes learners' cognitive resource allocation through multiple mechanisms. The immersive and interactive features of AR help visualize abstract mathematical concepts, reduce internal cognitive load, and improve understanding and memory. The structured design of game mechanics manages external cognitive load through goal gradients and real-time feedback, guiding students to focus on core tasks. In addition, maintaining a dynamic balance between task difficulty and situational challenges, activating relevant cognitive load, and promoting student self-regulation.

DOI: 10.4018/979-8-3373-7508-3.ch004

The study constructed a theoretical model of "AR environment cognitive scaffold self-regulation", providing new insights for the integration of educational neuroscience and digital technology.

1.INTRODUCTION

Incorporating augmented reality (AR) technology into gamified mathematical tasks has proven to be highly influential in fostering self-regulation among secondary school students, particularly in managing cognitive load. AR serves as a pivotal tool for enhancing engagement and motivation in learning environments. Through AR applications, students can interact with virtual math objects, sparking a heightened interest in learning and prompting them to actively explore and solve intricate mathematical problems. AR technology effectively visualizes virtual objects, transforming abstract or complex topics into more comprehensible content (Milgram et al. 1995). Specifically, students are able to explore geometric shapes in three-dimensional space and interact with virtual objects through gestures. This immersive experience is not just a simple display of abstract concepts, but provides students with an opportunity for practical operation and observation. In this environment, students can manipulate virtual cubes, spheres, or other geometric shapes with gestures, and change the perspective of these objects through actions such as rotation, scaling, and movement. This interaction allows them to observe these shapes from different angles, thus better understanding their basic features such as edges, corners, and faces. For example, when students try to piece together two cubes, they can not only visually see how the two cubes fit together, but also feel the relationship and spatial sense between different shapes. This dynamic experience transforms abstract mathematical concepts into practical objects that can be operated and observed, making learning not limited to textbooks and drawings, but become vivid and concrete. By observing the changes in geometry at different positions and poses, students' intuitive understanding ability has been greatly improved, and they are now able to construct clear psychological models about space and its relationships. AR technology, through its visualization and interactive features, helps students transform complex mathematical concepts into easily understandable forms. This approach not only greatly enhances students' interest in learning, but also effectively supports their learning motivation. With the continuous exploration of these concepts, students' self-regulation ability is gradually enhancing. By adjusting their learning strategies, such as setting different goals during the learning process, or reflecting

Investigating the Influence of AI in Social Media Governance

Pranjal Khare (2025). *Ethical AI Solutions for Addressing Social Media Influence and Hate Speech (pp. 365-388).*

www.irma-international.org/chapter/investigating-the-influence-of-ai-in-social-media-governance/371744