Enhancing 7th Grade Geometry Through VR Immersive Learning Pods: An Action Research Plan

Regginee Flora-Booker

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Dr. Kristi Meeuwse

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Lamar University

Abstract

This action research study investigates the impact of Virtual Reality (VR) Immersive Learning Pods on student engagement and conceptual understanding in 7th grade geometry. As middle school students often struggle to grasp abstract mathematical concepts—particularly when taught through traditional textbooks and static visuals—this study addresses the need for more innovative, experiential instructional methods. Disengagement and math anxiety remain common barriers in STEM education, especially for students with diverse learning needs, including English Language Learners (ELLs) and students with disabilities.

With the increasing availability of immersive technologies in K–12 classrooms, this research explores how VR can enhance instruction by allowing students to interact with geometric content in a dynamic, three-dimensional space. Grounded in a blended learning model, the study aligns with Texas Essential Knowledge and Skills (TEKS) standards and is implemented over a six-week geometry unit in a public middle school setting.

A mixed-methods approach is employed, combining pre- and post-assessments, engagement surveys, classroom observations, and focus group interviews. Data analysis includes paired t-tests for academic performance and thematic coding for student feedback. This study contributes to a growing body of literature on immersive learning by examining the instructional value of VR in a specific content area—geometry—and at a critical developmental stage. Ultimately, the findings aim to support the design of more engaging, equitable, and effective learning environments through the thoughtful integration of emerging technologies in mathematics instruction.

Introduction

This action research study seeks to address the growing need for innovative, engaging, and accessible instructional methods in middle school mathematics—specifically within the domain of 7th grade geometry. Many students struggle to understand abstract mathematical concepts when instruction is limited to traditional textbooks and 2D visuals, which often fail to represent spatial relationships in meaningful ways. This disconnect can hinder students' ability to visualize, manipulate, and fully grasp geometric principles such as transformations, coordinate plane reasoning, and volume calculations. As a result, learners frequently experience disengagement, math anxiety, lower achievement, and a diminished interest in STEM-related fields.

Given these challenges, the integration of immersive technologies in the classroom presents a timely and transformative solution. Virtual Reality (VR), in particular, has emerged as a promising instructional tool capable of bridging the gap between abstract content and tangible understanding. By immersing students in 3D simulations, VR enables learners to explore math in ways that are interactive, visual, and experiential—qualities that are especially beneficial for diverse learners, including English Language Learners (ELLs), students with special needs, and those who thrive in kinesthetic or visual learning environments.

This study proposes the use of VR Immersive Learning Pods as an instructional intervention to increase student engagement, foster conceptual understanding, and promote deeper retention of geometric concepts. The pods will provide structured opportunities for students to explore TEKS-aligned geometry standards through hands-on digital experiences, while also supporting reflective learning practices. Situated within a blended learning framework, this action research project combines the strengths of traditional instruction with the innovative possibilities of immersive technology. Ultimately, this study aims to inform effective strategies for integrating VR into secondary math education in a way that is both equitable and instructionally sound.

Fundamental Research Question

How does the integration of VR Immersive Learning Pods affect student engagement and conceptual understanding in 7th grade geometry?

This research question is grounded in the recognition that many middle school students struggle to grasp geometric concepts when taught through traditional, abstract methods. Geometry often requires spatial reasoning and visualization, which can be particularly challenging for learners without access to dynamic, interactive representations. Traditional instruction—anchored in static 2D diagrams and textbook explanations—often fails to meet the diverse needs of students, leading to disengagement, gaps in comprehension, and limited transfer of learning.

By integrating VR technology into instruction, this study aims to create a more engaging, immersive environment where students can explore, manipulate, and interact with mathematical concepts in a three-dimensional space. These experiences are designed not only to support comprehension but also to promote curiosity, self-directed exploration, and academic persistence.

The research question also explores how immersive learning may reshape students' attitudes toward math and their perceptions of their own capabilities within the subject. It investigates whether providing students with multisensory, experiential learning opportunities enhances their ability to retain information and apply concepts in new contexts.

Furthermore, this inquiry is rooted in constructivist learning theory, which suggests that students build knowledge most effectively through active, meaningful engagement with content. It seeks to determine whether VR tools can serve as a viable medium for implementing constructivist principles in the middle school math classroom. Ultimately, this question is central to evaluating whether immersive digital learning tools can be both pedagogically sound and practically feasible in everyday educational practice—particularly for improving instruction in challenging content areas like geometry.

Summary of the Literature Review

The literature supports the use of immersive learning technologies as effective tools for increasing student engagement, improving comprehension, and providing differentiated instruction tailored to diverse learning needs. Research by Makransky et al. (2019) suggests that immersive VR simulations elevate student presence but must be carefully designed to avoid cognitive overload. Slater and Wilbur’s (1997) foundational work highlights the importance of 'presence'—a user’s perception of being physically and psychologically immersed in the environment—as a key factor in learning effectiveness.

Huang and Liaw (2018) further validate that VR enhances both emotional and cognitive engagement, especially for visual and kinesthetic learners. Despite these benefits, the literature also acknowledges challenges, including high implementation costs, lack of technical training for educators, and the risk of technological inequity. Nonetheless, a recurring theme across studies is that VR holds significant promise when aligned with curriculum goals and supported through professional learning. A notable gap in the literature is the lack of studies focused on specific subjects like geometry, especially within the middle school context, which this action research project seeks to address.

Study Information

The study will take place in a 7th-grade mathematics classroom at a public middle school in Texas. The selected population includes approximately 60 students, split across two class sections. These students represent diverse backgrounds and a range of learning needs, including English Language Learners (ELLs) and students receiving special education services. The intervention will occur over a six-week instructional unit on geometry, during which VR Immersive Learning Pods will be introduced during specific lessons aligned with TEKS standards. The pods will provide students with opportunities to explore geometric transformations, volume, surface area, and coordinate planes through interactive simulations. Student progress will be documented through assessments, surveys, observations, and reflection journals. Technology support and teacher facilitation will be consistently provided to ensure all students can access and benefit from the immersive experience.

This study will follow a mixed-methods design combining quantitative and qualitative approaches. Quantitative data will be collected through pre- and post-assessments focused on geometry standards, while qualitative insights will be gathered from student engagement surveys, classroom observations, and small-group interviews. A mixed-methods approach is ideal for this study because it captures both academic performance data and student perspectives on the learning experience.

Data Collection and Analysis

Data will be collected in three main phases: pre-assessment (Week 1), midpoint feedback (Week 3), and post-assessment (Week 6). Students will complete a geometry pre-test at the beginning of the unit to establish a baseline for academic performance. Throughout the unit, teachers will record observational data using a classroom walkthrough tool, and students will complete Likert-scale engagement surveys to measure changes in motivation and interest.

In Week 3, a midpoint feedback form will be distributed to collect early reflections from students on the VR learning experience. At the end of the unit, students will take a geometry post-test to assess comprehension gains. Focus groups (6–8 students) will be conducted to gather qualitative feedback. Quantitative data will be analyzed using paired t-tests to compare pre- and post-test results, while survey responses will be examined for frequency trends. Thematic analysis will be used to evaluate qualitative data from focus groups and journals. Appendices will include the geometry assessments, survey instruments, focus group questions, and the observation checklist.

Sharing and Communicating Results

Findings will be disseminated through multiple channels to ensure broad accessibility and professional relevance. At the school level, results will be shared during grade-level PLC meetings and campus-wide professional development sessions. These sessions will include presentations of both quantitative data (student assessment results) and qualitative insights (student and teacher reflections).

In addition, a summary of the research will be included in the instructional technology department's monthly newsletter to promote cross-campus learning. Plans are also in place to submit the study for inclusion in local education conferences and professional learning networks. Visual data displays, testimonials, and lesson artifacts will be curated to create a comprehensive digital presentation, encouraging replication and scalability by educators in similar learning environments.

Final Reflection

Upon completing the study, a structured reflection process will be conducted using journaling, participant feedback, and instructional review. This reflection will serve not only as a summary of the project's outcomes but as a strategic analysis of the instructional transformation that occurred. It will include a review of pre- and post-assessment data, survey responses, and student interviews to determine what aspects of the VR Immersive Learning Pods contributed most effectively to student learning and engagement. Reflection will also focus on what challenges were encountered during implementation—such as technical issues, time constraints, or student accessibility—and how these were addressed in real time. Particular attention will be paid to the degree to which immersive learning supported content mastery and whether those academic gains were sustainable across different learners and instructional contexts.

In addition to assessing the impact on students, the reflection will also examine the professional growth of the researcher. This includes the evolving role of the teacher as a facilitator of inquiry-based, technology-enhanced learning and the shift from traditional instruction toward more personalized, blended learning environments. The process will be guided by critical self-reflection questions aligned with the ISTE Standards for Educators and the principles of practitioner inquiry.

Moreover, the findings from this reflection will be used to refine future instructional strategies, inform district-level technology integration plans, and contribute to ongoing professional learning communities. The long-term goal is to build a scalable model for integrating immersive technologies into STEM instruction that supports equity, access, and academic rigor. Ultimately, this reflective practice will serve as a model for continuous improvement, data-informed decision-making, and instructional leadership in the evolving landscape of 21st-century education.

References

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