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Designing a 3D and Virtual Reality Course: Integrating Technology and Creativity for Immersive Learning

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Designing a 3D and Virtual Reality Course: Integrating Technology and Creativity for Immersive Learning

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Abstract: The rapid advancement of 3D modeling and virtual reality (VR) technologies has created a demand for innovative educational approaches to equip students with the skills necessary for careers in these fields. This paper outlines the development of a comprehensive course in 3D design and VR, emphasizing the integration of foundational knowledge, practical skills, and immersive learning experiences. The course framework incorporates Bloom's Taxonomy to structure learning outcomes, promoting critical thinking, creativity, and real-world application. Key methodologies such as experiential learning, project-based assessments, and regular feedback mechanisms are employed to ensure an engaging and effective learning environment. By using industry-standard software and providing access to VR technology, the course prepares students for the evolving demands of the 3D and VR industries.

Keywords: 3D modeling; virtual reality; curriculum design; experiential learning; VR technology; project-based assessment; creative design

Introduction

The field of 3D design and virtual reality (VR) is rapidly growing, impacting industries like entertainment, education, and engineering. Educational programs must not only teach technical skills but also foster creativity and problem-solving abilities. VR has been shown to enhance spatial awareness in design fields such as landscape architecture and engineering [1,2]. This paper outlines a course that combines theoretical knowledge and practical VR design, using tools like Unity and Oculus Quest 2 to teach students 3D modeling, VR development, and immersive experiences. Project-based learning and H5P interactive tools support student engagement and understanding [3]. VR-based learning improves spatial relationships and design capabilities, benefiting fields like design and manufacturing [6,7]. Experiential learning through hands-on projects and industry-standard software helps students apply theoretical knowledge to real-world scenarios, with Blender for 3D modeling and Unity for VR development [8]. Additionally, project-based learning and peer reviews foster problem-solving and collaboration. Continuous feedback through assessments like scene creation and interaction design ensures iterative improvement. Surveys and interviews gather insights into teaching methods and course effectiveness, ensuring adaptability to technological advancements [10].

The integration of VR in educational programs enhances technical skills and promotes creative problem-solving. VR allows students to visualize and interact with 3D models in real-time, offering a unique advantage over traditional methods. As VR technologies evolve, it is crucial for programs to adapt to the growing demands of industries like gaming and architecture. Research supports the benefits of VR in enhancing comprehension, student engagement, and performance in areas like engineering [13,14]. Using tools such as Unity and Visual Studio, along with platforms like Google VR, VR courses can integrate cognitive and affective learning outcomes [15,16]. Interdisciplinary

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collaboration in VR course development promotes broader integration into curricula and stimulates creativity [12,17].

Methods

The course on Virtual Reality (VR) design was structured to provide students with both theoretical knowledge and hands-on experience in creating VR environments using Unity and C#, with a focus on Oculus (Meta) Quest 2. The learning objectives included mastering the Unity engine, designing 3D environments and objects, coding in C#, and deploying projects to the Oculus platform. The course was organized into multiple stages, beginning with introductory content on 3D UX and Blender for 3D UI design, advancing to Unity-based scene and interaction design, and culminating in the creation of fully functional VR experiences. H5P was utilized as an interactive tool for student engagement and assessment. Students submitted motivation letters and engaged in word games related to VR and programming terms. Interactive videos were embedded into the Moodle course to evaluate students' understanding of theoretical concepts. These videos included tutorials on VR design, 3D software, and AR/VR design principles, providing additional resources to complement the main instructional content.

The course also employed project-based learning to encourage real-world application of the skills learned. Students worked individually or in small teams to design and develop VR projects. They were required to upload their final projects to SideQuest, a platform for sharing and testing VR apps. A well-structured evaluation process was in place, where students submitted project proposals, design stages, MVP definitions, and a pre-defense with testing. The final evaluation criteria for projects included submitting APK files, providing scene screenshots, and offering a gameplay description with references and credits for assets used. Students' projects were assessed for their adherence to the MVP concept, creativity, the quality of the VR experience, and proper documentation.

Results

The first cohort faced challenges with the submission process, with only three teams successfully uploading their projects to SideQuest. In the second batch, seven projects were submitted, showing improved understanding of the platform. Final projects were assessed through a series of assignments, including a proposal with project description, participants, roles, mechanics, and MVP. Students also submitted screenshots of their scene, an APK build file, and a gameplay description, along with internal testing and final adjustments before submission. The final assessment covered both technical aspects, such as VR interactions, and non-technical elements like documentation and asset attribution, evaluating both individual and team contributions.

Analysis

The analysis of attendance and total grades in the VR course revealed a positive relationship between consistent participation and academic performance. Students with higher attendance rates generally achieved better overall grades, highlighting the importance of regular engagement in the course. However, the data also showed some exceptions to this trend. A few students with low attendance managed to perform well, possibly due to strong individual effort or proficiency in completing assignments and projects independently. Similarly, there were students with high attendance who did not achieve high grades, suggesting that attendance alone is not sufficient to guarantee success.

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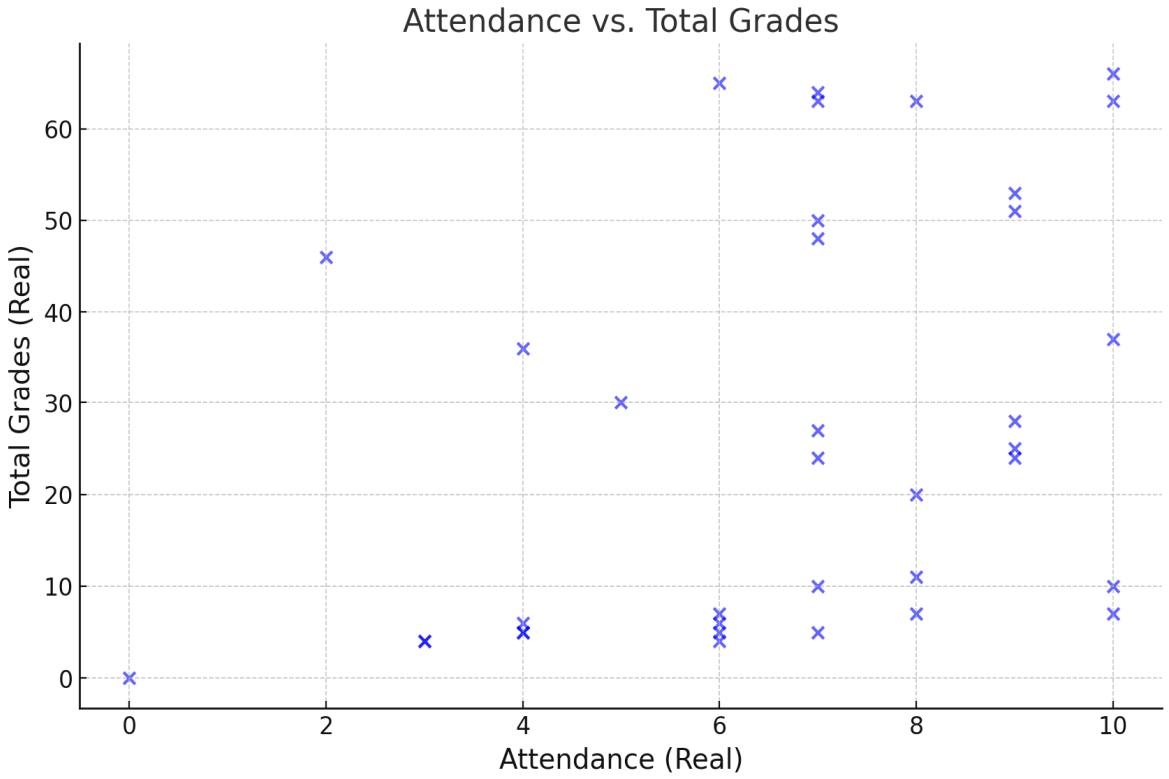

These findings emphasize that while attendance is a significant factor in fostering better performance, other elements such as the quality of assignments, the ability to grasp course content, and the effectiveness of teaching methods also play crucial roles. Addressing the specific needs of students who attend regularly but struggle with performance, as well as understanding the success strategies of those who excel despite limited participation, could provide valuable insights for improving course outcomes. This underscores the need for a balanced approach that combines encouraging attendance with fostering deeper engagement and learning.

Assignment	**Students with grades**
3D interior with furniture design	28
C# projects	0
Your first VR game	2
Pitch document	5
Final project: proposal	15

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Final project: Scene	6
Final project: MVP	**30**
Final project: Predefence and Testing	**30**
Midterm project - 50 pts max	6
MVP	8
Side Quest project page	7
Final project	**29**

The table shows that the most ratings were given for Final project: "MVP", "Final project: Predefence and Testing", "3D interior with furniture design" and "Final project". The least ratings were given for "C# projects", "Your first VR game", "Pitch document", "Midterm project", "Side Quest project page".

Discussion

The Virtual Reality (VR) course effectively integrated project-based learning, H5P interactivity, and real-world submission via SideQuest. Students learned Unity, C#, and Oculus Quest 2, though only three groups successfully uploaded their projects in the first batch due to technical challenges. By the second batch, seven projects were uploaded, showing improved familiarity with the platform. H5P tools like interactive videos and word games were engaging but limited in capturing the full scope of VR design, suggesting the need for more hands-on experience and real-time VR simulations in future courses.

Project-based learning, where students defined an MVP, collaborated in teams, and documented their work, was a key strength. However, access to Oculus Quest 2 hardware was a limitation, affecting some students' experiences. Future iterations could explore alternative platforms or provide loaner devices. Overall, the course successfully taught foundational VR design skills, with improvements in submissions over time. Addressing hardware access and incorporating more immersive simulations could further enhance learning outcomes.

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