

A Study on the Development and Evaluation of VR Learning Materials in Traffic Safety Education

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Abstract: *This research adopted the ADDIE instructional design model to plan the learning content and used Cospaces to create virtual reality learning materials for traffic safety education. These materials will be provided for third to sixth graders through reward mechanism and game-based approaches. Finally, this study invited experts to test and evaluate the suitability of this VR material, and their feedbacks were used for revising the VR content. The quantitative evaluation results showed that this educational material is appealing to elementary school students and can enhance their learning motivation. It is suitable for integration into traffic safety education.*

Keywords: ADDIE, Traffic safety education, Virtual Reality, Game-based learning

1. Introduction

This study adopted Virtual Reality (VR) technology to develop traffic safety learning materials, utilizing a game-based learning approach to deepen students' awareness of traffic safety. The incorporation of gaming elements in VR aims to engage students in the learning content actively. Through the use of VR, the educational material showcases scenarios depicting traffic-related issues, encouraging students to proactively propose solutions (Nguyen & Dang, 2017). The digital learning materials developed in this study through VR aim to assist students in establishing awareness of traffic safety within a virtual and immersive 3D environment, and comprehending the severity of traffic violations.

This study employed the ADDIE instructional design model for VR material planning and analysis. The subjects are elementary school students. After completing the VR-based learning materials, expert evaluations were conducted to ensure their suitability.

3. Development and evaluation

3.1. Development of Traffic Safety VR Material Using the ADDIE Instructional Design Model

In the analysis phase, this study analyzed the learning objectives of traffic education in elementary school through teacher interview, including the familiarity with traffic rules. Children are more susceptible to external interference and incentives when crossing the road, which can lead them to unsafe behaviors, so children's traffic safety education is very important (Leung et al., 2021).

In the design phase, this study designed instructional frameworks for elementary school's students based on the literature review and interview. This VR material in the study included "Hazard perception ability", "Road ethics and responsibility", "Walking and vehicle use", "Traffic performance and technology use" and "Traffic incident response". Through teacher guidance, students will understand the current traffic safety conditions and develop key learning scenarios.

In the development phase, We Utilized CoSpaces for developing interactive and immersive learning materials in a VR virtual 3D environment to help students establish awareness of traffic safety and comprehend the severity of traffic

violations. Based on the structures of developed content, three challenging game levels were designed, as shown in Figure 1 to Figure 3. The third level simulates "car accidents". Players are asked to deal with and help others deal with car accidents, shown in Figure 3 .



Figure 1. Level 1: "Crossing the Road – Stop, Look, Listen!"



Figure 2. Level 2: "Traffic Signal Detective"



Figure 3. Level 3: "The Road, a Tiger's Mouth"

The implementation and evaluation stages will be conducted in the future. In addition, this study invited expert to test and evaluate this VR material through suitability-evaluation questionnaire.

3.2. Evaluation results

This study developed an evaluation questionnaire, and invited experts to evaluate our VR materials. One-sample t test was adopted for analyzing the collected data, and Cronbach's Alpha was used for showing its reliability instrument.

Table 1. Reliability coefficients and one-sample t test results (test value=3)

Facet	Number of questions	Cronbach's Alpha	M	SD	t (19)
Learning Value	5	.765	4.77	.338	23.358***
Course Inspiration	4	.795	4.73	.375	20.673***
Interface Operation	7	.927	4.48	.551	12.056***
Pre-assessment	3	.763	4.56	.519	13.479***
Post-assessment	8	.870	4.74	.383	20.328***

*** $p < .001$

The Cronbach's Alpha values for each dimension are all greater than 0.7. The overall Cronbach's Alpha value is .955, showing excellent reliability for the scale, making it suitable for expert evaluation. The one-sample t-test (with a critical value of 3) yields a p-value of < 0.001 , reaching a significant level, in Table 1, indicating that the experts showed significant and high appraisal towards our VR materials for each facet.

4. Conclusions

Through the adopting of the ADDIE instructional design model, this study has completed a comprehensive curriculum plan and analysis for developing a VR-based traffic safety learning module targeted at elementary school's students. According to the expert evaluation results, the developed VR material is found to be appealing to elementary school students, enhancing their motivation to learn, and is deemed suitable for integration into traffic safety education. The immersive experience provided by the VR module allows students to correct misconceptions about traffic rules and understand the consequences of their actions deeply.

References

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