Idealogy Journal Vol. 10 No. 2, 2025, pp 138-147
DOI: https://doi.org/10.24191/idealogy.v10i2.836
Section: Original Article

Content Analysis of 3D Design Elements in GamifiedVirtual Reality for Viral Infection Prevention

Muhammad Farid Solihin Bin Ruslam[1], Nabila Aimi Mohamed Ghazali[2], SharkawiChe Din[3]

[1,2,3]College of Creative Arts, Universiti Teknologi MARA, Puncak Alam Campus, Selangor, Malaysia

[1]2023485262@student.uitm.edu.my, [2] nabilaiaimi@uitm.edu.my, [3] sharkawi237@uitm.edu.my

Corresponding author

Received: 30 June 2025; Accepted: 31 August 2025; Published: 1 September 2025

ABSTRACT

This study analyzes the content analysis of gamified virtual reality (VR) 3D design aspects for the prevention of viral infection. The primary goal is to study how some visual and interactive features of VR experiences influence the user and enhance learning outcomes in public health. The core issue under discussion is the lack of a clear understanding of which unique design factors influence the user's interaction and the effectiveness of education within gamified VR, particularly in public health education. Nine 3D components are examined in the examination: environment design, 3D models and assets, user interface and feedback systems, character design, physics and motion simulation, sound design, game mechanics, navigation and locomotion systems, and lighting and atmospheric effects. Findings attest that gamified VR applications are effective in public health education and strongly rely on the strategic incorporation of these 3D components. These elements are crucial in facilitating the change of behaviour during viral outbreaks. The research highlights that well-designed VR elements enhance students' immersion and are core in motivating preventive health practices. The study notes the significance of developers ensuring an egalitarian design strategy in aspects of visual realism, interaction dynamics, and user experience to maximize VR potential as a powerful learning interface in the event of an epidemic or pandemic. Future design should further support user agency, intuitive control, and realistic simulation to maximize the educational and behavioural effectiveness of gamified VR.

Keywords: *Elements of 3D design, Gamification of Virtual Reality, Application of gamification*

1 INTRODUCTION

The constant threat of viral illnesses, particularly those caused by Influenza A viruses, remains one of the hardest challenges for international public health systems. They are highly mutable and can producewidespread epidemics such as the H1N1 pandemic of 2009 (Taubenberger & Morens, 2008). As a means of responding to such threats, gamified virtual reality (VR) has emerged as a possible

medium that combines 3D immersive spaces and game principles to maximize user motivation, involvement, and learning.

In the setting of infectious disease prevention, VR offers the capacity to simulate virus spread and proper behaviour situations in a managed experiential setting. This allows learners to absorb abstract public health concepts such as contagion, immunity, and hygiene habits (Riva et al., 2016). Through the assistance of spatial realism, avatar interactions, feedback systems, and environmental contextual cues,VR is an education giant.

When used with gamification the deliberate use of game elements in non-game environments VR increases user engagement, motivation, and retention even more (Deterding et al., 2011; Johnson et al., 2020). Such environments transform health education into experiential learning that involves the emotional and intellectual investment of the user. Through it, gamified VR can simulate virus infection patterns and demonstrate the impact of protective against high-risk behaviours, thereby increasing users'awareness and intent to adopt safe behaviours (Lindgren et al., 2016).

Despite these advantages, the role of 3D design elements in the creation of such experiences is not yet understood. Learning success and immersion rely on high-quality visual material, approachable interaction models, and reactive feedback mechanisms (Makransky & Mayer, 2017). With additional health education software being developed within VR, a huge gap still exists to determine how these are put together and their single contribution towards behavioural change, particularly within gamified environments aiming to prevent viruses.

1.1 Research Objectives

The objective of the study was to identify the content analysis of 3D design elements in gamified virtualreality and analyze the gamified virtual reality of Virus infection prevention.

1.2 Problem Statement

Viruses continue to be a global public health threat, with global epidemics, high morbidity, and occasional pandemics (Paules & Subbarao, 2017). Although public health education campaigns and vaccinations are well heralded, preventive practices such as hand washing, mask wearing, and physical distancing continue to be inconsistent, particularly in youth and in poor or underserved communities (CDC, 2020; WHO, 2018). Gamified virtual reality (VR) has been proven to be an effective tool in health education since it enhances user engagement and raises the yield of behaviour change. However, there is limited information regarding how specific 3D design aspects of these gamified VR interventions affect their efficacy, particularly in preventing virus infection. While most of the earlier studies tend to highlight the outcomes of VR-based interventions, very little research has evaluated the structure, quality, and implementation of their design components (Johnson et al., 2016). More in-depth analysis of the 3D design features involved in gamified VR applications is needed to further improve future development and tap their full potential in educating people on virus prevention protocols.

2 LITERATURE REVIEW

This literature review explores the integration of 3D design elements within gamified virtual reality (VR) environments for virus infection prevention. VR offers a highly immersive platform with the capability of producing realistic settings, which can be used for infection prevention training (Lau et al., 2020). Coupled with gamification broadly defined as the use of game design elements in non-game contexts (Deterding et al., 2011), such technologies have demonstrated heightened engagement

and improved learning outcomes in health interventions. Gamified Virtual Reality (VR) integrates immersive technology with the incentivizing appeal of game mechanics to propel user engagement, emotional attachment, and learning retention. Gamification has been employed to refer to the use of game design elements such as points, leaderboards, rewards, and challenges in non-game contexts to change user behaviour and interaction (Deterding et al., 2011). Applied in VR, gamification leverages spatial immersion, interaction, and real-time feedback to replicate actual environments, and it is highly suitable for experiential learning (Lindgren et al., 2016).

2.1 Gamified virtual reality

Gamified Virtual Reality (VR) refers to the integration of game elements and mechanics within Virtual Reality environments to enhance user engagement, motivation, and learning. This combination leverages the immersive qualities of VR, such as 3D environments and interactive experiences, with the rewarding and goal-oriented dynamics of gamification, which includes elements like points, badges, leaderboards, and challenges (Deterding et al., 2011). Gamified virtual reality (VR) refers to the application of game mechanics, reward, challenge, and progression systems within immersive 3D spaces for increased motivation, engagement, and retention of knowledge. VR is particularly robust in its ability for experiential learning, whereby users are not just passive consumers but active agents (Makransky & Mayer, 2017).

2.2 Definition of 3D Design Elements

3D Design Elements refer to the visual and interactive components used in the creation of three-dimensional (3D) objects or environments in digital media, such as games, simulations, and virtual reality. These elements contribute to appearance, functionality, and user experience within a 3Dspace. Core 3D design components include environment design, 3D models and textures, character design, physics and motion systems, lighting and atmospheric effects, navigation techniques, sound design, and user feedback mechanisms. These elements work collectively to simulate real-world or imagined settings, making the virtual experience both believable and functionally useful (LaValle, 2016).

2.3 3D Design Elements in Gamified Virtual Reality

2.3.1 Environment Design

The virtual world must be realistic and interactive, complete with proper lighting, texture, and spatial architecture. Effective VR worlds utilise depth, scale, and perspective to draw in users and gameplay. (Jerald, J. 2015). Environment design in VR provides the spatial and atmospheric context that supports immersive learning. Realistic architecture, detailed textures, and appropriate lighting help simulate real-world environments to increase user presence and engagement (Jerald, 2015).

2.3.2 3D Models & Assets

These include all the characters, objects, and interactive items in the VR world. Excellent, optimized3D models with good textures and animations make experiences more realistic and keep the user engaged (LaValle, S. M. 2016). In virus prevention simulations, these models may include representations of viruses or protective tools like masks and sanitizers.

2.3.3 User Interaction and Feedback Mechanisms

User interactions (e.g., hand tracking, pointing, grabbing) combined with immediate feedback visual, auditory, or haptic foster active learning and engagement. gamified VR relies on intuitive interactions, such as grabbing, throwing, or pointing using VR controllers or hand tracking. Haptic feedback, visual cues, and sound provide essential user feedback
(Slater, M., & Sanchez-Vives, Sanchez-Vives, M. V. 2016).

2.3.4 Character Design

Character design in gamified virtual reality enhances user experience by facilitating emotional attachment and narrative immersion. Customizable avatars grant users a higher sense of agency, while expressive NPCs ensure realistic social interaction and behavioural guidance. In the prevention of viral infections, character design is essential in illustrating the impact of user behaviour, for example, mask- wearing or handwashing, within simulated environments. Effective character modelling enables learning through memorability and relatability of abstract health behaviours. Well-crafted characters are therefore key to user immersion and behaviour change in VR health education (Yee & Bailenson, 2007; Makransky & Mayer, 2017).

2.3.5 Physics and Motion Simulation

Accurate simulation of physical laws like gravity, object collisions, and fluid dynamics makes VR environments believable and avoids cognitive dissonance. Misaligned physical responses can disrupt immersion or cause motion sickness. In virus-related simulations, realistic movements such as sneezing particle trajectories or soap lathering are essential (Sherman & Craig, 2018).

2.3.6 Sound Design

In virtual reality (VR) is essential for creating a believable and emotionally engaging experience. In a gamified VR setting for virus infection prevention, spatialized audio helps users localize threats (like sneezing or coughing sounds) and respond appropriately. The three-dimensional nature of VR sound makes users feel embedded in the environment, with audio cues responding to head movement and body orientation (Larsson et al. 2001).

2.3.7 Game Mechanics

Refer to the rule-based systems that create structure, challenge, and rewards in a gamified application. In a VR context, mechanics must be integrated within the 3D space to promote learning through interaction. Effective mechanics can transform abstract virus prevention behaviours into active, goal- oriented tasks (Dixon et al. 2011).

2.3.8 Navigation and Locomotion Techniques

Navigation and locomotion are critical in VR to allow users to move through virtual spaces comfortably and safely. In the context of virus infection prevention, being able to navigate public spaces, avoid hotspots, and practice distancing is vital for experiential learning. In poorly designed systems, unnatural movement can result in cybersickness, interrupting the learning process (Boletsis, 2017).

2.3.9 Lighting and Atmospheric Effects

Lighting sets the tone and guides attention in a virtual space. Day-night cycles, shadows, and fog can be used to simulate real-life risks (e.g., entering dark, crowded rooms). This environmental storytelling improves both emotional engagement and knowledge retention (Bowman, 2006). help set the mood, emphasize spatial awareness, and direct user attention in virtual environments. In gamified VR, they do more than beautify scenes; they shape emotional responses and user behaviour. (Bowman, D. A., Kruijff, E., LaViola, J. J., & Poupyrev, I. 2006).

3 RESEARCH DESIGN

This research employed a qualitative content analysis to examine 3D design elements in gamified VRfor viral infection prevention. Key elements include environment design, 3D design & assets, user interaction and feedback mechanisms, character design, physics and motion simulation, sound design, game mechanics, navigation and locomotion techniques, lighting and atmospheric effects
(Jerald, 2015; Slater & Sanchez-Vives, 2016; Sherman & Craig, 2018).

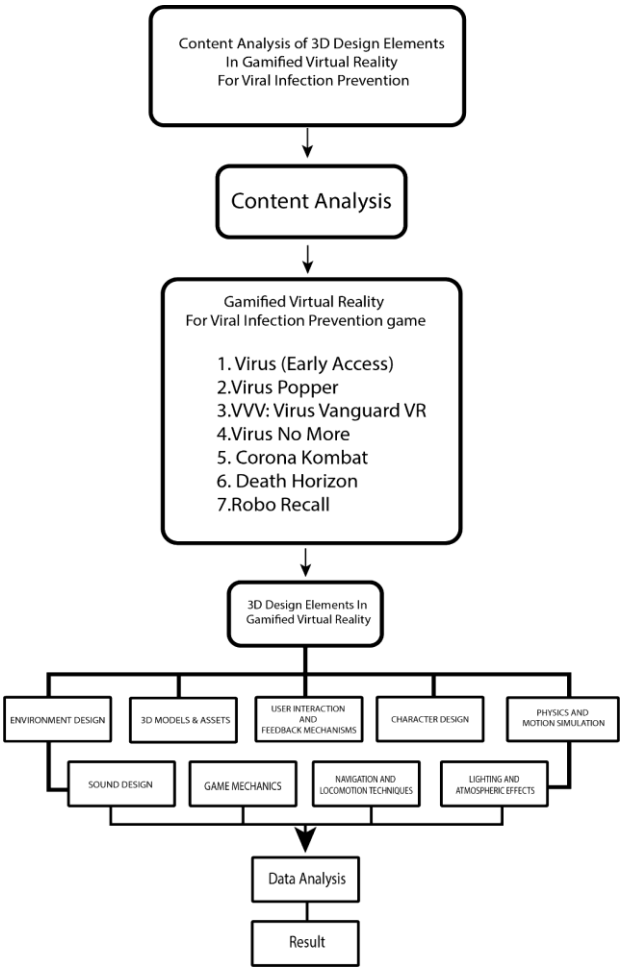

Figure 1 Framework of study

4 SELECTIONS OF SAMPLES

The selection criteria VR game of virus was based on the increasingly interesting games between 2017 and May 2023. The selection of the sample of Gamified Virtual Reality for ViralInfection Prevention in Table 1.

Table 1 sample of Gamified Virtual Reality for Viral Infection Prevention

Name VR Game of Virus	Label	Developer	Released
1. Virus (Early Access) 	VR1	Patrick Montiel	Released on 8 Jun 2018
2. Virus Popper 	VR2	Alexander Clark	Released on 9 April 2020
3. VVV: Virus Vanguard VR 	VR3	Clicked, Inc.	Released on 20 December 2023
4. Virus No More 	VR4	Foxy Banshee Productions	Released on 7 June 2021
5. Corona Kombat 	VR5	Reducept BV	Released on 25 July 2020
6. Death Horizon 	VR6	Dream Dev Studio LLP	Released on 26 September 2019
7. Robo Recall 	VR7	Epic Games	Released on 1 March2017

5 DATA ANALYSIS

To measure 3D design elements in gamified virtual reality, this study utilizes a rigorous 5-point ratingscheme: 1 Very Poor (not present or very poor), 2-Poor (weak or low quality and present but minimal), 3- Average (meets minimum standards), 4 Good (well designed and meaningful), and 5 Excellent.

Table 2 Data analysis of 3D design elements in gamified virtual reality

3D Design Elements in GamifiedVirtual Reality	VR1	VR2	VR3	VR4	VR5	VR6	VR7
Environment Design	3	2	4	3	4	5	5
3D Models & Assets	3	3	5	2	4	3	2
User Interaction and Feedback Mechanisms	1	3	5	3	2	2	3
Character Design	4	3	3	2	5	2	5
Physics And Motion Simulation	3	3	2	1	3	2	5
Sound Design	5	3	5	4	2	3	4
Game Mechanics	4	2	4	1	2	2	2
Navigation And Locomotion Techniques	2	3	2	2	1	2	3
Lighting And Atmospheric Effects	5	2	5	2	1	4	4

6 RESULT

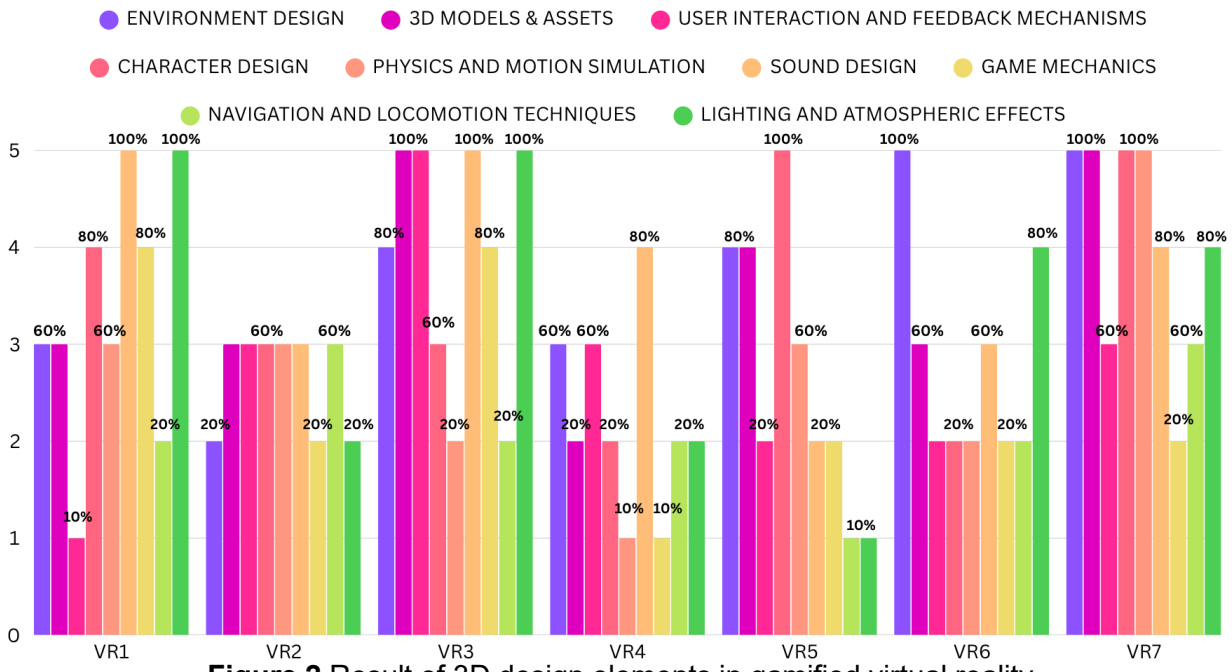

Figure 2 Result of 3D design elements in gamified virtual reality

7 FINDINGS

Several findings were obtained through this bar chart analysis concerning the 3D design elements in gamified virtual reality applications for viral infection prevention. Among the applications evaluated in this study, VR7, the Robo Recall, performed well in all aspects of the evaluation, with ratings in environment design, character design, sound and atmospheric effects, with 4 and 5 ratings. The. Similarly, VR5 (Corona Kombat) demonstrates strong design quality, particularly in character design, environment, and user interaction. Such titles can be termed well-rounded and immersive VR experiences that integrate technical quality with the user's engagement very effectively.

In contrast, some applications, such as VR4 (Virus No More) and VR6 (Death Horizon), reveal notable shortcomings. VR4 scored poorly in game mechanics, physics, and navigation techniques, suggesting a lack of polish in gameplay functionality and movement realism. VR6, while slightly better in environment design, received low scores in character design, feedback mechanisms, and locomotion, indicating limited interactivity and immersion.

One common trend across many of the applications is the relatively low performance in navigation and locomotion techniques. These elements are crucial for creating realistic simulations of viral transmission scenarios, such as navigating public spaces or practicing hygiene procedures. The lack of sophistication in movement systems may limit the educational potential of these VR tools. Additionally, game mechanics showed inconsistency; while some apps provided structured and meaningful gameplay (e.g., VR7 and VR1), others failed to deliver coherent game objectives or engaging systems.

Sound design and lighting, on the other hand, are generally stronger aspects in the higher-rated applications. These sensory elements contribute significantly to the mood and atmosphere of the simulation, enhancing emotional engagement and reinforcing the seriousness of infection control themes.

Furthermore, the analysis highlights a clear disparity between more advanced and underdeveloped VR applications. Effective virtual reality tools for viral infection prevention must balance immersive visual and audio elements with strong interaction design and user movement capabilities. Developers should prioritize improving navigation systems, feedback responsiveness, and game mechanics while drawing inspiration from successful titles like Robo Recall and Corona Kombat. These improvements can lead to more effective and engaging educational VR experiences in the context of public health.

8 CONCLUSION

This study has emphasized the significant role that 3D designs elements have to play in the efficacy of gamified virtual reality (VR) applications for viral infection containment. Following a qualitative content analysis of the selected VR games, interactive environmental design, high-fidelity assets, responsive interaction mechanics, and emotionally compelling sound and lighting are considerable contributors to user engagement and learning. Games such as Robo Recall and Corona Kombat demonstrate that solid design can truly amplify the learning potential of VR experiences.

However, the review also refers to ongoing weaknesses in navigation, locomotion, and game mechanics that remain central to creating realistic and educational simulations. These findings suggest that future health-focused VR development places greater emphasis on intuitive movement systems, real-time feedback, and cohesive gameplay structures to enable the medium to achieve its highest potential as an educational tool. By consolidating these elements, creators can create stronger virtual experiences that promote behavioural change and help public health officials combat viral outbreaks.

ACKNOWLEDGMENT

I am grateful to the Research Ethics Evaluation Committee of the Faculty of Arts and Design at Universiti Teknologi MARA (UiTM) for permitting me to conduct this study CCA/SRGK/2025 (EXM11). Furthermore, I would also want to thank Prof. Madya Dr. Sharkawi Che Din for his important expertise and help, as well as my supervisor, Nabila Aimi Binti Mohamed Ghazali, for being my supervisor throughout this journey. Additionally, I also wish to convey my heartfelt appreciation to my family and friends for their unwavering support and encouragement throughout this journey.

FUNDING

This research is self-funded.

AUTHOR CONTRIBUTIONS

All authors played equal contributions towards the production of this paper.

CONFLICT OF INTEREST

There is no conflict of interest.

REFERENCES

Alexander Clark. (2020). *Virus Popper*. Retrieved June 13, 2025, from https://www.uploadvr.com/virus-popper-hygiene-covid-19/

Boletsis, C. (2017). The new era of virtual reality locomotion: A systematic literature review of techniques and a proposed typology. *Multimodal Technologies and Interaction, 1*(4), 24. https://doi.org/10.3390/mti1040024

CDC (Centers for Disease Control and Prevention). https://www.cdc.gov

Clicked, Inc. (2023). *VVV: Virus Vanguard VR*. Retrieved June 13, 2025, from https://www.metacritic.com/game/vvv-virus-vanguard-vr/

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining gamification. *Proceedings of the 15th International Academic MindTrek Conference*, 9–15. https://doi.org/10.1145/2181037.2181040

Dream Dev Studio LLP. (2019). *Death Horizon*. Retrieved June 13, 2025, from https://en.wikipedia.org/wiki/Death_Horizon

Epic Games. (2017). *Robo Recall* Retrieved June 13, 2025, from https://en.wikipedia.org/wiki/Robo_Recall

Foxy Banshee Productions. (2021). *Virus No More*. Retrieved June 13, 2025, from https://vrdb.app/game/virus-no-more/3740630569307441

Gaver, W. W. (1993). What in the world do we hear? An ecological approach to auditory source perception. *Ecological Psychology, 5*(1), 1–29. https://doi.org/10.1207/s15326969eco0501_1

Hayati Mohd Rashdan, N., Aimi Mohamed Ghazali, N., Che Din, S., & Aniza Mohd Lazim, N. (2021). *Analysing the Elements of 3D Design in Semi-Immersive Virtual Reality Digital Learning*.LaValle, S. M. (2016). *Virtual reality*. Cambridge University Press. https://lavalle.pl/vr/ Meta for Developers (VR platforms). https://developer.oculus.com

Meta Platforms, Inc. (2020). *Virus Popper on Meta Quest*. Retrieved June 13, 2025, from https://www.meta.com/experiences/virus-popper/5333524253326127/

Patrick Montiel. (2018). *Virus (Early Access)*. Retrieved June 13, 2025, from https://store.steampowered.com/search/?developer=Patrick%20Montiel

Reducept BV. (2020). *Corona Kombat*. Retrieved June 13, 2025, from https://www.uploadvr.com/corona-kombat-pc-vr/

Reiners, T., & Wood, L. C. (2015). Immersive virtual environments to support authentic learning for students in finance and economics. *Journal of Educational Technology & Society, 18*(1), 17–29. https://www.jstor.org/stable/jeductechsoci.18.1.17