Research

From blocks to learning: Development and content validity of a Minecraft-based rural simulation for occupational therapy training

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Background. Rural occupational therapy practice in South Africa (SA) demands context-specific skills, yet training lacks authentic simulations. Digital game-based learning using Minecraft Education Edition may address this gap by integrating the Technological Pedagogical Content Knowledge framework, the Analyse–Design–Develop–Implement–Evaluate model and the Community of Inquiry framework to develop competency-aligned simulations.

Objectives. To design, develop and validate a Minecraft-based rural simulation for occupational therapy training using design-based research principles.

Methods. Design-based research with iterative microcycles guided development at a SA university. Six respondents (three occupational therapy experts and three digital education experts) were purposively sampled. Content Validity Index (CVI) was used to assess alignment with occupational therapy competencies using 4-point Likert-scale surveys. Data analysis included item-level (I-CVI ≥0.83) and scale-level (S-CVI/Ave ≥0.90) validity thresholds.

Results. Primary outcomes showed excellent content validity, with an overall S-CVI/Ave of 0.95 and all items achieving I-CVI of ≥0.83. Domain scores ranged from 78.2% (environmental navigation) to 81.4% (water collection). Gamification elements enhanced engagement and authenticity.

Conclusion. The Minecraft-based rural simulation demonstrated strong content validity for occupational therapy training. Recommendations include longitudinal efficacy testing with students and scalability to other rural health professions contexts.

Keywords. Game-based learning, occupational therapy education, rural contexts, Minecraft Education Edition, blended learning

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Assessment of daily occupational performance is a core outcome of undergraduate occupational therapy education; however, limited exposure to resource-scarce rural environments may restrict students' ability to deliver contextually relevant services. Digital game-based learning (DGBL) offers a potential solution by immersing students in simulated real-world challenges that support experiential and contextual learning.[1] At a South African (SA) university, the Occupational Therapy Department has traditionally employed a problem-based learning (PBL) approach, with blended learning strategically adopted to enhance curriculum transparency, resource efficiency and student confidence.[2] Despite these advances, second-year students engaging in a rural PBL scenario have limited access to immersive e-learning tools. This study addresses this gap through the development of a Minecraft-based simulation designed to better prepare students for contextual occupational therapy practice.[3] The following literature review situates the intervention within the existing scholarship.

Literature review

Occupational therapy focuses on occupational performance and engagement within environmental contexts.[4] However, models developed in well-resourced settings may inadequately reflect the realities of resource-scarce rural SA environments.[4-6] This mismatch highlights the need for contextually responsive educational tools.[7]

Recent SA census data highlight ongoing disparities, with many households lacking basic amenities despite post-1994 infrastructure improvements.[7-9] Recognising these challenges, the Occupational Therapy Department has prioritised the contextual application of occupational therapy models throughout its curriculum. Students engage in rural service learning to assess environmental barriers and available resources; however, there remains a need for scalable, immersive learning tools to better prepare students for these contexts prior to clinical exposure.

DGBL enables immersive, experiential learning by allowing students to practise clinical and contextual decision-making in simulated environments. In health sciences education, DGBL supports competency-based learning through incremental skill development, critical thinking and learner autonomy fostered by structured progression, embedded objectives and scaffolded challenges.[10] Game design is further informed by the Mechanics–Dynamics–Aesthetics (MDA) framework, which supports intentional alignment among gameplay mechanics, learner interactions and experiential outcomes. The Analyse–Design–Develop–Implement–Evaluate (ADDIE) model guides systematic development and iterative simulation refinement, ensuring alignment among identified competencies, authentic scenario design and evaluation.

Minecraft Education Edition (Mojang Studios, Sweden) exemplifies these principles through its open-ended, first-person sandbox format, allowing students to build and explore three-dimensional environments that simulate real-world conditions. It includes features designed specifically for teaching and learning, including Classroom Mode, non-player characters (NPCs) that deliver instructions, chalkboards, embedded quizzes and assessment tools.

These built-in functions enable educators to embed learning objectives within the virtual world.

As a result, Minecraft Education Edition provides an immersive, safe and cost-effective platform for simulating authentic scenarios. Evidence indicates that its use as a teaching tool may enhance academic performance, engagement and motivation, although its application within SA health sciences education remains relatively novel.[11-13] Its adaptability further supports the development of contextual assessment skills, allowing students to practise decision-making and problem-solving before entering real-world service-learning environments. A Minecraft Education Edition simulation was therefore developed to support blended learning and prepare students for contextually responsive practice.

Problem statement

The second-year occupational therapy curriculum at an SA university requires students to learn how to assess categories of occupation through a PBL scenario featuring the fictitious rural Ntuli family. Although this scenario introduces a rural, under-resourced context, the theoretical models underpinning the curriculum are derived largely from Global North perspectives and may not fully reflect the lived realities of many SA communities.[7]

Most students come from urban backgrounds and have limited exposure to the environmental and infrastructural challenges present in rural, resource-scarce settings. Furthermore, there is a notable lack of occupational therapy and occupational science literature addressing the effect of limited amenities on occupational performance in such contexts.[7] This disjunction between theoretical knowledge and practical application complicates the development of contextually relevant assessment skills among undergraduate students.

Study justification

Contextual factors in resource-scarce rural settings are critical considerations in occupational therapy, yet there remains a persistent tendency to view occupation through a Western, Eurocentric lens.[14] Limited research on how rural environments affect occupational performance has resulted in a lack of guiding frameworks to prepare graduates for practice in these contexts.[7,15]

Research question

What is the gamification experience and content validity of a newly developed Minecraft Educational Education simulation designed to support occupational therapy education in a rural, resource-scarce context?

Study aim and objectives

Aim

To evaluate the gamification experience and content validity of a newly developed Minecraft Education Edition virtual world designed to support occupational therapy education in a rural, resource-scarce context.

Objectives

- Review the occupational therapy curriculum on the assessment of categories of occupation and the material regarding a typical rural setting. Scale-level Content Validity Index – Average (S-CVI/Ave): the mean of all I-CVI scores.
- Develop and construct a Minecraft Education Edition virtual world to support occupational therapy education.
- Describe the gamification experience of the newly developed Minecraft Education Edition virtual world designed to support occupational therapy education.
- Explore the content validity of the newly developed Minecraft Education Edition virtual world designed to support occupational therapy education.

Methods

Study design

This study employed a quantitative survey design incorporating descriptive analysis of open-ended responses. The iterative design process was guided by the Technological Pedagogical Content Knowledge (TPACK) framework, the ADDIE model and the Community of Inquiry (CoI) framework to ensure pedagogical integrity and support learner engagement. Furthermore, the study adopted a design-based research methodology to develop and evaluate a Minecraft Education Edition learning activity focused on the assessment of occupational performance in occupational therapy education.[16,17]

A central feature of this study was the integration of the MDA framework into the design and evaluation of the Minecraft Education Edition learning activity.[18,19] By embedding these elements into the design, the simulation supported not only cognitive learning but also the affective and experiential dimensions considered important for preparing students for practice in resource-scarce rural environments.

The gamification experience and content validity of the newly developed Minecraft Education Edition virtual world were evaluated by respondents.[20,21] Data were analysed using descriptive statistics and inductive content analysis to assess the intervention's effectiveness in enhancing contextual competence and to evaluate the effect of the MDA elements on student learning.

Study setting

The study was conducted in the Occupational Therapy Department of an SA university.

Research procedure

Microcycle 1: Review of the current second-year PBL curriculum

Course outlines, objectives and PowerPoint (Microsoft, USA) presentations for the assessment of occupational performance modules were reviewed using directed content analysis to identify techniques used to assess external environmental factors affecting occupational performance, as well as the typical household amenities found in rural, resource-scarce contexts.

Existing PBL teaching and learning resources for second-year students served as data sources. Document reviews were conducted by the first researcher and verified by e-learning team members, and the results were compared to reach consensus.

Microcycle 2: Design and development of the Minecraft Education Edition learning resource

The research team (occupational therapy and e-learning team) collaborated to develop a virtual world aligned with the specified learning objectives and designed to support meaningful student engagement. The simulation represented a rural SA homestead environment that included key contextual features such as a borehole or water-collection point, footpaths and uneven terrain, a cooking and washing area, livestock pens and interior household spaces used for daily occupations.

Core tasks embedded in the world included establishing a water-collection routine, navigating uneven terrain to assess environmental risks, sequencing household activities (e.g. meal preparation and laundry) and identifying environmental barriers influencing occupational performance. Students received structured in-world support through instructions from NPCs,

chalkboards outlining task objectives and checklists guiding observational focus. Progression through the world was facilitated through checkpoints and simple quest-based prompts that mirrored occupational therapy assessment processes.

All mechanics (rules and task structures), dynamics (learner decision-making and interaction) and aesthetics (evoking empathy, curiosity and contextual awareness) were intentionally mapped to the occupational therapy learning outcomes using the MDA framework.

Microcycle 3: Evaluation and reflection

The newly developed Minecraft Education Edition learning resource was evaluated by respondents during a playtest session. Ten respondents, including faculty experts in gamification or occupational therapy education, were invited to participate. Purposive stratified sampling was used to identify equal numbers of respondents with expertise in gamification and occupational therapy education.

Inclusion criteria

Respondents were selected according to the following inclusion criteria: (*i*) five occupational therapy faculty members with expertise in the contextual assessment of categories of occupation; and (*ii*) five health sciences faculty members with two or more years' experience in the application of gaming in health science education.

No exclusion criteria were applied. The recommended number of experts required to calculate the content validity index (CVI) varies from three to ten, with several authors recommending six experts.[20]

Research instruments

Table 1 summarises the research instruments administered via REDCap (Research Electronic Data Capture, Vanderbilt University), outlining their purpose, description and rating scales used to capture respondents' demographic characteristics, evaluate the content validity of the Minecraft-based simulation and assess the gamification experience during the pilot playtest.

Six respondents were included in the content validity study. This number allowed for the addition of respondents during a second round should extensive revisions be required after the first round.[20] The purpose of the study and the implications of participation were explained to respondents via email and an accompanying information sheet. Respondents also attended a presentation by the authors outlining the study background. The constructs under consideration, the procedure followed for the development of the Minecraft Education Edition virtual world game and the process for determining content validity were discussed.[20]

The occupational therapy education respondents did not necessarily have prior gaming experience; therefore, an orientation session for inexperienced gamers on navigating Minecraft was provided. All respondents subsequently explored the virtual world and completed the embedded learning activities. Data collection involved a REDCap electronic survey completed after the playtest session. The development process followed three iterative microcycles.

A second survey section allowed respondents to provide qualitative comments on the clarity of instructions, navigation challenges, task structure, scaffolding, alignment with learning objectives and suggestions for improving the simulation's educational value. These responses were analysed using inductive content analysis.

Data analysis

The data were entered into an Excel spreadsheet (Microsoft, USA) for analysis. Descriptive statistics were used to analyse respondents' demographic data and describe the study sample.

Ratings were dichotomised (1 - 2 = irrelevant/unclear; 3 - 4 = relevant/clear) to calculate the I-CVI, S-CVI/Ave and S-CVI/UA. Responses to the Gamification Experience Survey were analysed using descriptive statistics to describe respondents' perceptions of the Minecraft Education Edition

Table 1. Components of the REDCap instruments and rating scales used

Instrument component	Purpose	Description	Rating scale used
Biographical questionnaire	To describe respondents' demographics and expertise.	Collected age category, discipline, years of experience and prior exposure to gaming or game-based learning.	No rating scale (categorical fields).
Content validity survey	To evaluate the relevance, clarity and utility of each element of the Minecraft-based simulation.	Respondents rated individual components of the virtual world using a structured validity form developed by the authors.	4-point Likert scale: 1 = Not relevant/Not clear 2 = Slightly relevant/Unclear 3 = Relevant/Clear 4 = Very relevant/Very clear
Gamification experience survey	To assess emotional, cognitive and motivational engagement during the pilot playtest.	Thirteen statements adapted from game-experience literature to evaluate emotional involvement, curiosity, challenge, feedback and perceived support.	7-point Likert scale: 1 = Strongly disagree 7 = Strongly agree
	To gather qualitative insights for design refinement.	Respondents provided written comments on navigation, clarity, scaffolding, alignment with learning objectives and suggestions for improvement.	Open response (no rating scale).

REDCap = Research Electronic Data Capture.

simulation. Frequencies and percentages were calculated to indicate the strength of responses.

Qualitative descriptive analysis was conducted on data obtained from open-ended survey questions using an inductive content analysis approach. Responses were coded, clustered into categories and iteratively refined until researcher consensus was reached.[22]

All responses to the open-ended questions, together with respondents' feedback on the Minecraft Education Edition simulation, were summarised to inform analysis and implementation. Particular attention was paid to themes relating to the mechanics, dynamics and aesthetics of the Minecraft-based learning activity. This focus provided deeper insight into how these design elements support learner engagement and influence educational outcomes.

Ethics

Ethical clearance was obtained from the Human Research (non-medical) Ethics Committee of the SA university, and all institutional requirements were strictly followed (ref. no. HRECNM25-06-162). Participation was voluntary and informed consent was obtained from all respondents prior to data collection. Confidentiality was ensured by coding all data and storing identifying information separately in secure, password-protected files. Data will be securely stored for six years following completion of the study and then destroyed in accordance with institutional guidelines.

Results

Playtest and respondents' demographics

Six respondents participated in the playtest of the Minecraft Education Edition simulation. Four respondents were between 31 and 40 years old, and one was between 51 and 60 years old. All respondents were female. Regarding expertise, three respondents were occupational therapy education experts and two were gaming experts; none were experts in both areas. The occupational therapy education experts had no prior gamification experience.

Content validity

Six respondents evaluated the Minecraft Education Edition simulation for relevance and clarity using a 4-point Likert-scale survey. Questions were adapted from the GameQuest survey, where 1 represented 'not relevant/not clear' and 4 represented 'very relevant/very clear'.[23] Ratings were dichotomised, with scores of 3 and 4 classified as 'relevant/clear'. These ratings were used to calculate three indices:

- Item-level Content Validity Index (I-CVI): The proportion of respondents rating an item as relevant.
- Scale-level Content Validity Index – Average (S-CVI/Ave): The mean of all I-CVI scores.
- Scale-level Content Validity Index – Universal Agreement (S-CVI/UA): The proportion of items rated as relevant by all respondents.

Thresholds of 0.78 for I-CVI and 0.80 for S-CVI/Ave were applied to determine acceptable levels of content validity. All items exceeded the recommended I-CVI threshold, indicating strong content validity. The overall S-CVI/Ave was 0.94 and the S-CVI/UA was 0.80.

Gamification experience evaluation

The six respondents completed thirteen statements on a 7-point Likert-scale survey. As shown in Table 2, after dichotomising scores of 3 to 4 as 'relevant/clear', distinct patterns emerged in respondents' perceptions of the Minecraft simulation. Items reflecting emotional engagement and curiosity achieved the highest relevance, with 'Fully emotionally involved' and 'Want to know what comes next' rated as relevant by 80% of respondents. Motivation-related items, including 'Need to complete the game', 'Inspires competition and completion' and 'Motivates progress', showed moderate relevance at 60%. Lower relevance was observed for items relating to challenge, feedback and exploration, including 'Challenges me', 'Forget everyday concerns', 'Explore things' and 'Useful feedback', each rated relevant by 40% of respondents. Social and structural support elements were rated lowest, with 'Social support' achieving only 20% relevance and items related to recognition, structured help and brink-of-giving-up receiving no positive ratings. These findings highlight strong emotional drivers of engagement but reveal gaps in scaffolding, feedback and collaborative support within the game design.

Discussion

Strong CVI scores (I-CVI ≥0.83; S-CVI/Ave = 0.94) confirm alignment with the game objectives and the authentic representation of rural SA contexts.[24] High validity ratings for environmental tasks and daily occupations suggest effective integration of contextually relevant activities. However, lower relevance ratings for navigation and prompts indicate a need for improved scaffolding to reduce cognitive load and enhance usability.

Several areas for improvement were identified to enhance the effectiveness and usability of the Minecraft Education Edition simulation. First, structured guidance could be strengthened by incorporating checklists and clearer instructions to maintain the visibility of learning objectives throughout gameplay. Second, recognition mechanisms such as badges or progress indicators could be introduced to reinforce achievement and sustain motivation. Third, accessibility features need to be improved by adding orientation phases or sandbox modes for novice players, which may help mitigate navigation challenges and reduce the risk of motion sickness. Finally, collaborative elements could be expanded by integrating co-operative tasks and real-time feedback systems to foster social support and provide formative feedback, thereby promoting teamwork and deeper engagement.

Educational implications

The integration of game-based learning frameworks with occupational therapy pedagogy demonstrates promise for curriculum transformation and the decolonisation of health sciences education. By embedding authentic

Table 2. Summary of ratings (3 - 4 = Relevant/Clear)

Survey item	Proportion relevant/clear
Fully emotionally involved	0.80
Want to know what comes next	0.80
Need to complete the game	0.60
Inspires competition and completion	0.60
Motivates progress	0.60
Challenges me	0.40
Forget everyday concerns	0.40
Explore things	0.40
Useful feedback	0.40
Social support	0.20
Structure, recognition brink-of-giving-up	0.00

rural contexts within an immersive digital environment, the simulation fosters empathy, contextual understanding and practical problem-solving competencies essential for ethical and responsive practice.

Future research should explore scalability, long-term learning outcomes and comparative effectiveness across diverse cohorts to strengthen the evidence base for game-based learning in health sciences education.

Limitations

The study was limited by its small sample sizes (n=6 for the playtest; n=6 for content validity) and the homogeneity of respondents, which limit generalisability. While Lynn[24] and Polit and Beck[20] recommend a minimum of six to twelve respondents for robust content validity assessment, this study involved only six experts. Future research should therefore include a larger, more diverse group of respondents and conduct an additional playtest following implementation of the recommended changes. Further studies should also assess long-term learning outcomes, explore physiological indicators of engagement and compare effectiveness across different game genres to inform design strategies for health sciences education.

Conclusion

This study demonstrated the potential of Minecraft Education Edition as an innovative educational tool for preparing occupational therapy students to engage with rural, resource-scarce contexts. Findings from the playtest revealed high levels of emotional involvement, curiosity and motivation among respondents, indicating that immersive, game-based learning may foster contextual understanding and experiential engagement. Strong content validity scores confirm alignment with pedagogical objectives and authentic representation of rural SA environments.

Respondents also reported that the simulation promoted empathy and cultural appreciation of the environmental and occupational challenges faced by individuals living in under-resourced communities. This experiential dimension underscores the value of immersive technologies in bridging the gap between theoretical knowledge and real-world contexts, supporting the development of ethically responsive and contextually competent practitioners.

However, several areas for improvement were identified, including the need for structured guidance, recognition mechanisms, enhanced accessibility features and stronger collaborative elements. Addressing these refinements may help ensure that the simulation provides a balanced experience that is both pedagogically sound and user-friendly.

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