

Exploring the Use of Virtual Gaming Platforms to Enhance Teaching Reform in Landscape Planning and Design

Xu Rui, Tang Hui, Zhang Yuzhu, Tao Bolan

South China Agricultural University, Guangzhou, Guangdong, 510642, China

Keywords: Minecraft Virtual Platform; Gamified Learning; Landscape Planning and Design; Spatial Expression; Teaching Reform

Abstract: Against the backdrop of the rapid development of the digital gaming industry, gamified learning has become a key direction for teaching reform in higher education. Taking the introductory foundation course ‘Spatial Expression’ in the landscape architecture programme as the research focus, this paper addresses the practical challenges of traditional landscape design classrooms—which place heavy emphasis on theory at the expense of practice—as well as the weaknesses in spatial cognition, insufficient three-dimensional visualisation, and low levels of active engagement among first-year students. To this end, the 3D sandbox construction game Minecraft has been integrated into the course's practical teaching. Students can independently construct landscape scenes and explore them immersively, gaining an intuitive understanding of spatial scale and landscape aesthetics, whilst identifying design flaws and iteratively optimising their proposals in real time. Teaching practice has demonstrated that the Minecraft virtual platform serves as an effective supplement to traditional landscape teaching, significantly enhancing students’ interest in learning, their level of spatial cognition and their ability to gauge scale. Based on the findings of these experiments, a digital teaching application framework for landscape design incorporating virtual reality technology has been developed. A new ‘three-in-one’ teaching model—comprising ‘Case-based teaching + Minecraft gamified scenario-based teaching + Minecraft digital construction practice’—has been proposed, providing practical guidance and fresh perspectives for the innovative reform of planning and design courses in landscape architecture programmes.

1. Introduction

Against the backdrop of the ongoing advancement of national ecological civilisation and the ‘Beautiful China’ initiative, the landscape architecture discipline plays a central role in creating green living environments and enhancing the quality of life for the public. As a core module within this discipline, landscape planning and design aims primarily to cultivate students’ spatial design thinking and practical implementation skills. Currently, this course in domestic higher education institutions generally suffers from weaknesses in practical teaching and a lag in the application of digital technologies. Advancing curriculum reform and strengthening practical training components are key

measures to enhance the core competitiveness of professionals in the landscape architecture field.

At present, video games have become deeply ingrained in youth culture, and gamified learning has emerged as a hot topic of research in the field of education. Video games possess characteristics such as high interactivity, immediate feedback and achievement-based incentives, which can fully mobilise learners' initiative. Research by the European School Alliance indicates that gamified teaching methods are widely accepted and can guide students to actively participate in classroom inquiry. Curriculum reforms in both basic and higher education in the new era have simultaneously set forth new requirements; teaching must focus on cultivating students' abilities in independent thinking, problem-based inquiry, teamwork and innovation, thereby providing policy and theoretical support for the implementation of gamified teaching methods in landscape architecture classrooms.

2. Existing Issues in Traditional Teaching of Landscape Planning and Design

Landscape architecture combines multiple disciplines, including art, engineering, and ecology. Planning and design thinking, spatial aesthetics, and the abstract perception of sites constitute key challenges in teaching. Traditional teaching models struggle to meet the demands of professional talent development, with prominent issues centring on three areas:

2.1 Teaching emphasises theoretical instruction, whilst practical training is severely lacking

The core task of foundational first-year courses such as 'Spatial Expression' and 'Fundamentals of Landscape Design' is to consolidate students' spatial modelling thinking and basic spatial skills, thereby laying the groundwork for specialist design courses in later years. At present, classroom teaching remains dominated by lecturers' theoretical explanations and the presentation of case studies through text and images, whilst the proportion of practical training hours remains disproportionately low. There is a disconnect between theoretical instruction and hands-on practice, resulting in a marked deficiency in students' practical skills. Consequently, they struggle to meet the industry's demand for professionals who possess both theoretical knowledge and the ability to apply it in practice.

During case-based teaching sessions, lecturers rely solely on drawings and photographs of actual sites for their explanations. As first-year students have not yet developed a comprehensive spatial logic and lack three-dimensional visualisation skills, they are unable to immerse themselves in the spatial layout of landscape sites or grasp the spatial logic underlying landscape design techniques; two-dimensional teaching materials are insufficient to meet the requirements of practical training in three-dimensional spatial design [1–2].

2.2 Monotonous and rigid teaching methods lead to low student engagement

As there are no standardised 'correct answers' in landscape architecture design, the core of teaching lies in training students' comprehensive planning thinking, requiring them to integrate knowledge, tools and design methods. The traditional, monotonous lecture-based model, compounded by the weak professional foundations of first-year students, easily leads to a lack of motivation and a loss of confidence in the discipline; as a result, some first-year students choose to switch to other degree programmes, leading to a loss of student enrolment in the landscape architecture programme [3].

2.3 Mismatch in the transmission of spatial cognitive information between teachers and students, limiting teaching effectiveness

Traditional teaching has long relied on two-dimensional CAD drawings and static images,

resulting in a prolonged lack of training in students' three-dimensional spatial perception and dynamic site simulation abilities. A natural disparity in spatial cognition exists between teachers and students, leading to discrepancies in the transmission of teaching content, as well as issues such as non-intuitive instructional delivery and high barriers to student comprehension. The talent development model is in urgent need of digital transformation [4].

3. Core Advantages of Applying the Minecraft Virtual Gaming Platform to Landscape Teaching

3.1 Stimulating students' enthusiasm for independent learning

Minecraft is a 3D sandbox construction game offering a high degree of freedom, with a broad audience reach and ample scope for creative expression. In 2016, Microsoft launched the Education Edition, introducing new features tailored to classroom teaching to create a standardised gamified teaching platform. Scholars abroad have already applied it to teaching and research across multiple disciplines, including biology, mathematics and ecology, confirming that the platform can establish an immersive classroom environment and promote students' deep engagement in practical classroom activities [5–7].

3.2 A low entry threshold and ease of use

Traditional landscape spatial training is divided into two approaches: physical modelling and professional 3D modelling, both of which have significant shortcomings: physical modelling involves high material costs, lengthy production cycles and considerable difficulty in making modifications; professional modelling software such as SketchUp and 3ds Max has complex operational logic, resulting in a high initial learning curve for students and stringent requirements for computer hardware; whilst VR virtual simulation technology offers an excellent spatial experience, the costs of equipment procurement and maintenance are prohibitively high, making large-scale adoption difficult [8]. Minecraft, as a low-specification sandbox game, can run on a standard laptop; its 'building-block' construction logic enables the rapid assembly of three-dimensional scenes and allows users to dynamically perceive space through virtual exploration. By utilising the various types of blocks in Minecraft, players can recreate famous landmarks or garden landscapes, or even reconstruct an entire city [9–10], which helps students to quickly and effectively grasp the principles and methods of landscape design, laying a solid foundation for their subsequent use of professional 3D modelling software.

3.3 Developing Students' Spatial Design Skills

Immersive spatial experience: Three-dimensional virtual environments and highly interactive spatial modules bridge the perceptual gap between people and space, providing a more authentic and direct experience. This helps to spark design inspiration and deepen understanding of the interplay between open and enclosed spaces, as well as the layering and sequencing of landscape spaces;

Two-way interactive iterative optimisation: Students can interact in real time with classic garden case studies and landscape spaces they have created themselves, repeatedly refining spatial layouts, identifying issues and making immediate optimisations and adjustments.

A shift in classroom focus from the teacher to the students: Breaking away from traditional, one-way, lecture-based teaching, students independently construct, create and share their design works, engaging with the lesson through multiple senses, which significantly enhances classroom participation;

Significant potential for pedagogical innovation: Whilst there is a wealth of research on

interdisciplinary teaching using Minecraft abroad, domestic applications have largely focused on programming education [11–13], and educational reform practices in the field of landscape architecture and spatial design remain in their infancy. This study aligns with trends in digital teaching and can enhance the practical framework of the curriculum.

4. Exploration of Landscape Teaching Reform Practices Based on the Minecraft Platform

4.1 Comparative Teaching Experiment

Supported by gamified learning theory and constructivist learning theory, this study conducted teaching practices for first-year landscape architecture students. The teaching content covered three major modules: landscape space types, fundamental elements of garden design, and the organisation of spatial sequences, and included practical tasks such as training in open, semi-enclosed, and enclosed spaces, terrain modelling, plant grouping, and the construction of garden architecture. A control experiment was conducted in parallel to compare the teaching outcomes of three practical training modes: physical block construction, professional modelling in SketchUp, and virtual construction in Minecraft (Figures 1–3).

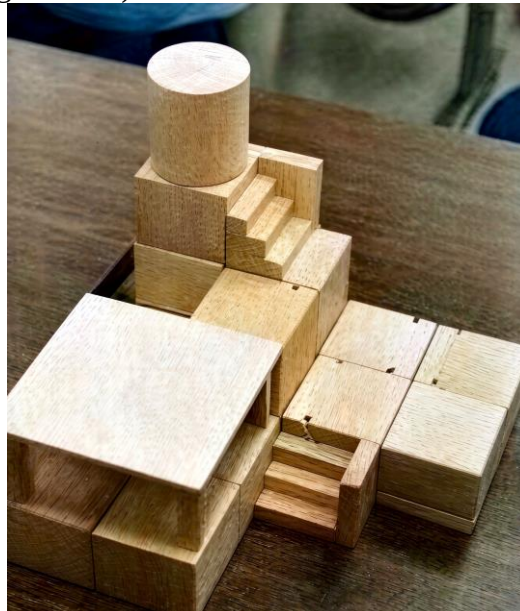


Figure 1: Spatial construction using blocks

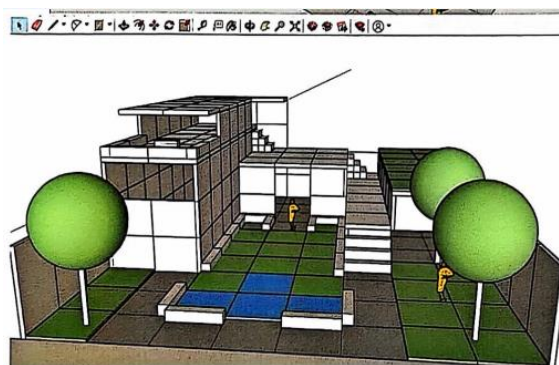


Figure 2: 3D modelling in SketchUp



Figures 3: Spatial construction on the and Minecraft platforms

Data from the teaching experiments show that 94.59 per cent of participating students believed that Minecraft could effectively enhance classroom engagement and stimulate design creativity; 86.49 per cent of students acknowledged that the platform's dynamic navigation function could strengthen their three-dimensional spatial perception; 83.3 per cent of students reported that the operation was straightforward and enabled them to quickly realise their design concepts; and all participating students were able to proficiently employ at least three spatial definition techniques to complete their landscape designs. The experiment confirmed that utilising Minecraft as a supplementary tool in traditional landscape design teaching is both feasible and effective.

4.2 Teaching Model Combining CBL (short for Case-Based Learning) , Gamified Contextual Teaching and Digital Construction Practice

Traditional linear 'lecture-reception' teaching is teacher-centred and overlooks students' initiative and the iterative nature of design proposals; current digital teaching in the discipline remains limited to CAD drafting and basic modelling in SketchUp, failing to establish a closed-loop teaching system comprising 'digital modelling – real-time feedback – collaborative optimisation'. This technological gap directly results in students requiring 6–8 months to adapt to mainstream industry working practices, such as BIM (short for Building Information Modeling) collaborative design, upon entering the workforce.

To address these challenges, this paper proposes a new 'trinity' teaching model (Figure 4), which utilises the MC (short for Minecraft) platform to stimulate students' initiative in learning and systematically enhance their spatial cognition and innovative design capabilities. The core logic of the model is as follows:

Core components: classic landscape architecture case studies (theoretical material) + the MC digital construction platform (practical tool);

Three-stage learning pathway: Analysing classics (theoretical study, case dissection) → Replicating classics (recreating landscape spatial structures in MC) → Reinventing classics (completing innovative spatial designs in MC);

Three-pronged teaching approach: CBL + gamified scenario-based tasks in MC + tiered, progressive construction tasks in MC;

Full-cycle closed-loop assessment: pre-course knowledge pre-test — in-class peer assessment and teacher feedback — post-course skills re-test + in-depth student interviews.

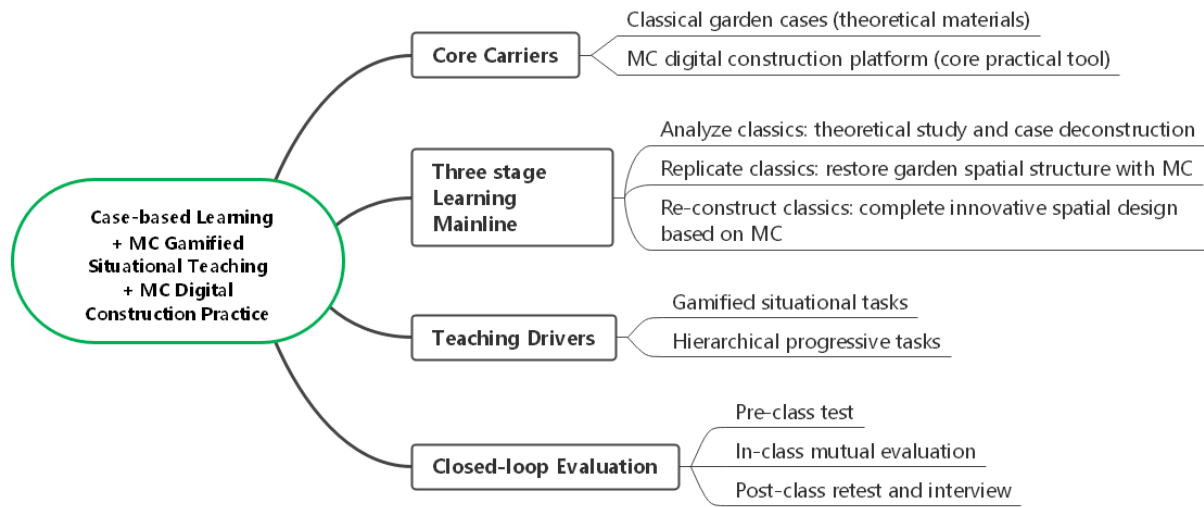


Figure 4: Teaching Model

Five key innovative features of this teaching model:

- ① Real-world landscape architecture case studies are integrated throughout the course, enabling students to complete the full training process of case analysis, replication, and innovation;
- ② Gamified task sequences drive classroom activities, emphasising the student's central role and sustaining long-term concentration;
- ③ It follows the cognitive progression of 'theoretical learning — spatial fundamentals training — case analysis — replication practice — innovative design', aligning with the logic of CBL teaching;
- ④ Minecraft lowers the barrier to 3D spatial expression, enabling students with no prior experience to rapidly visualise their design concepts;
- ⑤ A multi-faceted assessment process—comprising 'pre-test → in-process feedback → peer review of work → post-test'—is integrated throughout the course, forming a complete feedback loop for teaching outcomes.

5. Conclusions

The "CBL + MC gamified scenario-based teaching + MC digital construction practice" model represents an innovative attempt to integrate gamified learning with landscape architecture courses. By utilising a low-cost virtual sandbox tool, it effectively addresses the teaching challenge of spatial perception difficulties faced by first-year students, providing a new implementation pathway for the digital reform of landscape design education.

The application of Minecraft in professional teaching still has limitations: firstly, the pixelated graphics constrain the expression of detailed landscape effects; in future, rendering software such as Lumion could be integrated to enhance the quality of visual presentation; secondly, the platform lacks professional tools for the quantitative assessment of spatial cognition; current evaluations are primarily subjective and qualitative. In future, technologies such as eye-tracking and EEG (short for Electroencephalogram) monitoring could be introduced to quantitatively analyse improvements in students' spatial cognition abilities, thereby further refining the teaching evaluation system; thirdly, Minecraft's multiplayer functionality can be utilised for collaborative landscape design training in small groups; fourthly, by integrating real-world topics such as rural revitalisation and urban pocket parks, project-based gamified teaching can be implemented to enhance the integration of industry, academia and research within the curriculum.

Acknowledgement

This work was supported by the South China Agricultural University University-level Teaching Reform Research and Practice Project: “Teaching Reform and Practice of ‘Landscape Planning and Design’ Based on a Virtual Landscape Tour Platform” (JG22116).

This work was supported by the Guangdong Provincial Higher Education Society “14th Five-Year Plan” 2025 Higher Education Research Project: “Research on the Construction of a Curriculum System and Teaching Practice for Landscape Architecture Programmes Integrating the Concept of ‘Operational Pre-positioning’ in the Context of New Engineering Disciplines” (25GBY012).

References

- [1] Li Weiting. *Explorations in Landscape Design Teaching at Higher Education Institutions* [J]. *Xueyuan*, 2017 (08): 38.
- [2] Xu Fang, Sun Jinbo. *Strategies for Cultivating Landscape Architecture Talent Guided by Market Demand* [J]. *Modern Horticulture*, 2024, 47 (04): 193.
- [3] Gao Ying. *A Study on the Reform of Landscape Design Courses in Higher Education* [J]. *Industrial Design*, 2021 (07): 56–57.
- [4] Yao Hui. *Analysis of the Current State of Landscape Design Education and Recommendations for Development* [J]. *Times Education*, 2016 (13): 193–194.
- [5] Cipollone M, Schifter C C, Moffat A R. *Minecraft as a Creative Tool: A Case Study* [J]. *International Journal of Game-Based Learning (IJGBL)*, 2014, 4 (2): 1–14.
- [6] Petrov A. *Using Minecraft in Education: A Qualitative Study on the Benefits and Challenges of Game-Based Education* [D]. Toronto: University of Toronto, 2014: 27–76.
- [7] Nobel S, Schneider S, Schledjewski J, et al. *Goal-Setting in Educational Video Games: Comparing Goal-Setting Theory and the Goal-Free Effect* [J]. *Simulation & Gaming*, 2016: 98–130.
- [8] Li Hua. *The Application of Virtual Simulation Training Technology in Integrated Circuit Interdisciplinary Teaching* [J]. *Integrated Circuit Applications*, 2024, 41 (03): 335–337.
- [9] Xu Xiang. *A Study on the Design and Practice of Gamified Collaborative Learning Based on Minecraft* [D]. Xihua Normal University, 2017.
- [10] Qian Shengnan, Wang Yunfan, Peng Wen. *A Study on the Practicality of Using Minecraft to Construct a 3D Campus* [J]. *Fujian Computer*, 2016 (5): 56–57.
- [11] Hu Qiang. *A Practical Study on Online Python Language Teaching Based on Minecraft* [D]. Shanghai: Shanghai Normal University, 2021: 15–49.
- [12] Yu Yuewen. *Design and Implementation of Python Programming Teaching Activities Based on Minecraft* [D]. Hangzhou: Zhejiang University, 2019.
- [13] Qu Weizhi. *A Study on the Application of Minecraft-Based Gamified Programming Instruction in Cultivating Computational Thinking in Upper Secondary Schools* [D]. Mudanjiang: Mudanjiang Normal University, 2023: 21–51.