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# Metaverse Education: A Study on Multimodal Metaphor Scenarios in Roblox Education

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**Abstract:** Based on a novel digital curriculum system, this study focuses on the virtual education platform—Roblox Education, selecting 100 STEM-themed course game samples. Employing a mixed-method approach that integrates quantitative and qualitative analyses, this research utilizes NVivo 12 Plus to encode and analyze multimodal metaphor scenarios and their types in Roblox Education. We particularly focus on their construction methods and cognitive foundations and conduct specific case analyses of the two most prevalent metaphorical scenarios. This study aims to provide insights into the design of metaphor scenarios in virtual education platforms and promote multimodal integration and innovative learning approaches in Metaverse-based education.

**Keywords:** Metaverse Education; Multimodal Metaphor Scenarios; Metaphor Scenarios; Metaverse; AI

## I. Introduction

With the rapid advancement of artificial intelligence, Metaverse has gradually permeated the field of education, ushering in a new era of pedagogical innovation. Metaverse education refers to creating immersive and highly interactive virtual learning environments through technologies such as virtual reality, enabling students to engage with academic content in novel ways. Notably, platforms like Roblox Education have emerged as fertile ground for exploring new educational paradigms. In Metaverse-based education, learners do not merely process isolated linguistic or visual inputs but rather interact with a complex integration of multimodal resources, including language, sound, and imagery. Multimodal metaphors, as cognitive constructs emerging from the interplay of multiple semiotic systems in specific contexts, offer learners enriched perspectives and deeper conceptual understanding.

Against this backdrop, this study aims to investigate the types of multimodal metaphor scenarios in Roblox Education (hereafter "Roblox") and to uncover how these metaphor scenarios are constructed and cognitively processed in virtual educational settings. Therefore, this study contributes to the ongoing discourses on Metaverse-based education and expands the scope of multimodal metaphor research. This research boasts both theoretical and practical implications. Theoretically, while Metaverse education remains in its early stages and lacks a fully developed conceptual framework, this study integrates insights from Metaphor Scenario Theory to advance the semiotic interactions and meaning construction in virtual learning environments. It thus offers a fresh perspective on multimodal metaphor research and its theoretical applications. Practically, Metaverse education is still in the exploratory phase worldwide, particularly in China. This study provides valuable inspiration for educators, policymakers, and technology developers.

## II. Research Status

### A. The Metaverse and Metaverse-Based Education

The term "Metaverse" emerged in the late 20th century and refers to a persistent, multi-user, immersive interconnected network that integrates features such as social networking, immersive VR platforms, massively multiplayer online games, and AR collaborative spaces (Mystakidis, 2022). In other words, this virtual world is constructed through computer and network technologies, which allow users to enter and interact via virtual reality (VR), augmented reality (AR), and mixed reality (MR) technologies. Innovations in computing technology inevitably drive socio-economic development, and as an integral part of society and the economy, education is also transforming. The educational potential of the Metaverse is increasingly recognized by scholars, particularly as it builds on multimodal learning. With its immersive, interactive, and open characteristics, the Metaverse is gradually reshaping the landscape of teaching and learning.

The relationship between the Metaverse and education lies in how virtual technologies bring innovation and breakthroughs to educational settings. By leveraging the Metaverse, learning is no longer confined to traditional classroom models but enters a novel environment that blends the virtual and the real. Students can transcend time and space, immersing themselves in highly realistic virtual settings where they can conduct experiments that may be difficult to achieve in reality or relive historical events. Based on existing research, the characteristics of Metaverse-based education can be summarized as follows: (1) customization of learning pathways and content; (2) virtual practice and vocational training platforms; (3) cross-disciplinary and cross-regional communication; (4) equity in educational resources.

Metaverse-based teaching has become a hot research topic in China, yielding numerous studies. For instance, ChANG Qiaoli & HU Dexin (2024) examined the principles, pathways, and implementation mechanisms of immersive teaching in the Metaverse. LI Xianxiang et al. (2024) analyzed the values and challenges of Metaverse-enabled higher education and proposed strategies to address them. LU Yuzheng & ZENG Tianshan (2024) explored the impact of the Metaverse on the teaching environments in vocational education. Internationally, research on the educational applications of the Metaverse began earlier. Tlili et al. (2022) investigated the evolving trends of Metaverse learning environments. Suh & Ahn (2022) conducted an experimental study integrating the Metaverse into elementary education, analyzing learner-centered experiences and attitudes toward virtual learning. Alfaisal, Hashim, & Azizan (2024) applied Information Systems (IS) Theory to evaluate Metaverse education research, discussing how students adopt and accept its systems and technologies. Onu, Pradhan, & Mbohwa (2024) conducted a qualitative study and pointed out the Metaverse's immense potential in personalized and adaptive learning.

### B. Research on Multimodal Metaphor Scenarios

Metaphor research can be traced back to Aristotle, evolving through various theoretical stages, including the Comparison Theory, Substitution Theory, and Interaction Theory. These frameworks commonly define metaphor as a rhetorical device, emphasizing its role in enriching expression and persuasiveness. However, a paradigm shift occurred in 1980 when Lakoff & Johnson introduced Conceptual Metaphor Theory (CMT), marking a transition of metaphor studies from the realm of linguistics to cognitive science.

Traditional metaphor research has largely been confined to linguistic analysis, often overlooking the role of other modes (e.g., images, sound, video, and gestures) in metaphorical expression. In the 21st century, multimedia advances and earlier research methods proved insufficient in capturing metaphorical phenomena in multimodal texts. As theoretical and practical explorations expanded, metaphor studies gradually moved beyond verbal language to encompass multisensory systems, giving rise to Multimodal Metaphor Theory. The publication of *Multimodal Metaphor* in 2009 examined metaphor across various genres, including advertisements, political cartoons, animation, spoken and sign language, and music. It was considered a milestone in establishing the Multimodal Metaphor Theory (Feng & Deng, 2014). Eggertsson & Forceville (2009) proposed that multimodal metaphor should be discussed from both a narrow and broad perspective. In the narrow sense, a multimodal metaphor is a “pure” metaphor in which the source domain and target domain are represented by different modes. Nevertheless, ZHAO Xiufeng (2013) argued that Forceville’s definition lacked clarity and that multimodal metaphors should be defined more broadly—i.e., as metaphors constructed through two or more modes. Since most multimodal metaphors do not conform to the narrow definition and the latter has limited applicability in empirical research, this study adopts the broad definition of multimodal metaphor.

Multimodal metaphors are not only realized through the interplay of different modalities but are often dependent on specific scenarios, which can activate multiple layers and depths of metaphorical meaning. Musolff (2006) demonstrated that scenario analysis acts as a necessary complement to the study of source domains and mapping in metaphor research. Based on this, he introduced the concept of metaphor scenarios, which help explore the systematicity of conceptual metaphors in discourses and facilitate an understanding of how metaphors shape thought and behavior. Beyond textual themes, applying Metaphor Scenario Theory in multimodal discourse has received increasing attention, allowing us to grasp the collaborative functions of metaphors in communication. ZHAO Xiufeng (2022) explicitly defined multimodal metaphor scenarios as scenarios constructed through two or more modes, commonly serving as discourse-building strategies and cognitive tools in political cartoons. Recently, with the rise of corpus linguistics, researchers have begun compiling their cartoon corpora to analyze metaphor scenarios.

Research on multimodal metaphor scenarios in China is still in its early stages, with relatively limited findings. For example, CHEN Min & SUN Weiwei (2018) examined multimodal metaphor scenarios in advertisements for male and female skincare products and concluded that multimodal metaphors reinforce and shape audience consumption behavior in discourse communities. ZHAO Xiufeng & WU Yuxin (2024) integrated multimodal cognitive research and critical discourse analysis by investigating health and illness metaphor scenarios in energy crisis cartoons. Furthermore, WANG Jiayu & ZHAO Yaru (2024) developed a relevance analysis framework for multimodal deliberate metaphor scenarios, applying it to anti-fraud campaign cartoons. Internationally, research on metaphor scenarios has largely focused on the impact of political discourses on audience cognition and emotions, as well as its cultural connections (Musolff, 2017; Chaban & Velivchenko, 2021; Kolumban, 2023). What’s more, Sedeghati et al. (2019) conducted structured interviews to analyze various metaphor scenarios related to housing in new urban lifestyles.

## III. Research Design

### A. Research Questions and Framework

This study enriches the research on metaverse education and multimodal metaphor scenarios. However, existing studies primarily focus on macro-level aspects such as technological applications and educational paradigm shifts, while micro-level investigations into the construction and implementation of metaverse education remain scarce, particularly the exploration of metaphor scenarios in specific platforms. In response to this gap, this study employs the qualitative analysis software NVivo 12 Plus and adopts a mixed-methods approach that integrates both quantitative and qualitative analyses to examine the virtual educational gaming platform Roblox. By doing so, it seeks to contribute to the body of research from a Chinese perspective and expand the understanding of this domain while offering insights for future studies on metaverse education and multimodal metaphors (see Figure 1 for the research framework).

This study addresses the following two research questions: (1) What multimodal metaphor scenarios are constructed in the selected 100 game-based educational courses on Roblox, and how are they constructed? (2) What is the significance of these metaphor scenarios in metaverse education? How can their educational effectiveness be assessed?

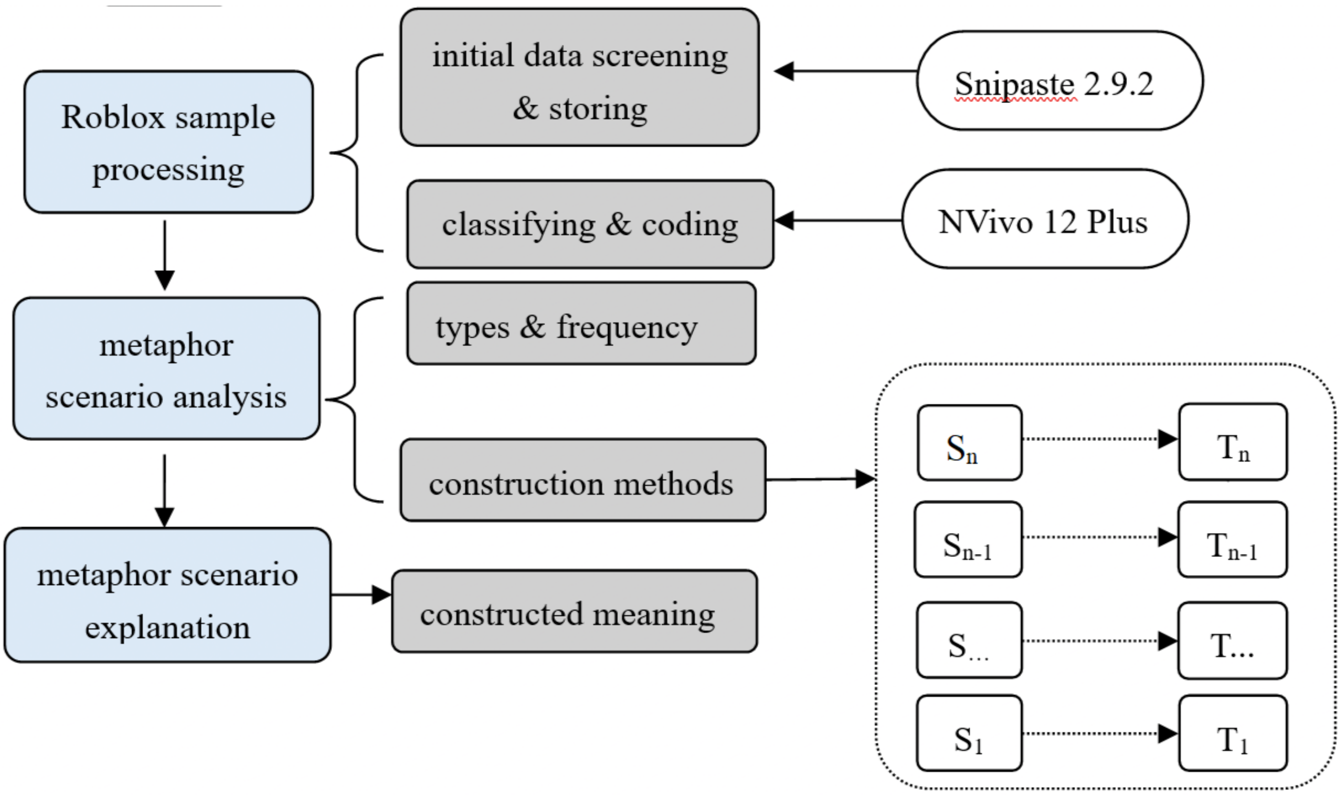


Figure 1 Research Framework for Multimodal Metaphor Scenarios in the Roblox Education

### B. Corpus Collection and Analytical Procedures

Roblox, as one of the world's largest online gaming platforms, has been widely integrated into educational curricula by various institutions and schools. Its extensive data provides a valuable foundation for research. Furthermore, the platform's wide applicability and research advantages make it a suitable subject for analysis.

This study collects corpus data from Roblox Education. It is worth noting that the research corpus in this study is strictly limited to video screenshots, images, and textual data, excluding audio, sign language, and other non-verbal texts. Research data are coded and analyzed using NVivo 12 Plus, following a structured process comprising corpus collection, classification standard development, coding, and data visualization. The specific steps are as follows:

(1) Defining the research sample. A total of 100 STEM-themed (Science, Technology, Engineering, and Mathematics) virtual games are selected from the Roblox. The selection criteria emphasize multimodal metaphorical content, including visual elements (e.g., characters and scene design) and textual or linguistic components (e.g., task instructions and course descriptions), since these multimodal elements can facilitate metaphor analysis.

(2) Capturing and storing data. Screenshots of relevant metaphor-rich images are taken using the Snipaste 2.9.2 tool. Corresponding textual information is collected as the core corpus for multimodal metaphor scenario analysis.

(3) Analyzing and categorizing metaphor scenarios. This study is based on Conceptual Metaphor Theory (CMT) and Musolff's (2006) Metaphor Scenario Theory, and classifies metaphor types according to the mapping relationships between source and target domains.

(4) Importing and coding data. Screenshots and textual data are imported into NVivo 12 Plus, where cases, attribute characteristics, and node codes are established through the predefined classification framework. Different metaphor types in each scenario are identified and annotated.

(5) Quantifying and visualizing data. The frequency of metaphor scenarios was calculated using NVivo 12 Plus's matrix coding query and reference point analysis tools. The results are then visualized through charts and tables, providing a clear representation of metaphor distribution across different scenarios.

C. Research Results

According to Table 1 and Figure 2, the "level-passing" and "experimental" scenarios account for the largest proportions in the sample, at 38% and 39%, respectively. This demonstrates their crucial role in virtual game design. Moreover, UP-DOWN metaphor (19%), COLOR metaphor (18%), and CONTAINER metaphor (14%) are the three most frequent metaphor types, and they are also dominant in "level-passing" and "experimental" scenarios.

These findings reflect common cognitive frameworks in virtual game design: UP-DOWN metaphors emphasize the natural principle of progression or regression in learning; COLOR metaphors highlight state variations and dynamic changes; CONTAINER metaphors relate to the storage of experimental data or the dissemination of knowledge. These high-frequency metaphors suggest that educational games favor intuitive visual and conceptual representations, allowing players to overcome challenges, conduct experiments, and grasp the hierarchical, dynamic, and operational nature of knowledge more effectively. In contrast, "engineering" scenarios and other categories involve fewer metaphorical elements, implying their lower cognitive complexity or more limited educational value.

Table 1 Metaphor Scenarios in Roblox (100 Samples)

| Metaphor Scenario Types | Metaphor Types | Number | Frequency |
|---|---|---|---|
| Level-passing scenario | UP-DOWN metaphor | 19 | 19% |
| | WAR metaphor | 8 | 8% |
| | JOURNEY metaphor | 11 | 11% |
| Experimental scenario | VIRUS metaphor | 7 | 7% |
| | CONTAINER metaphor | 14 | 14% |
| | COLOR metaphor | 18 | 18% |
| Engineer scenario | BUILDING metaphor | 9 | 9% |
| | TEAM metaphor | 6 | 6% |
| Others | CHESS metaphor | 8 | 8% |
| Total | | 100 | 100% |

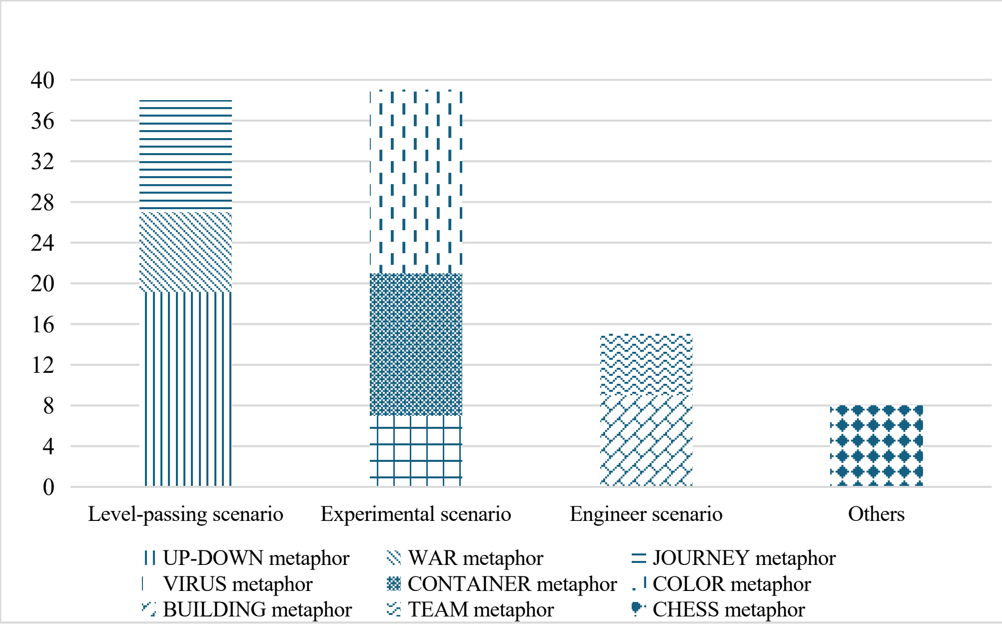


Figure 2 The Distribution of Metaphor Scenarios and Metaphors in Roblox Samples

## IV. Results and Discussion

The analysis of 100 game-based educational samples reveals that multimodal metaphor scenarios serve as concrete representational vehicles for abstract educational content, enabling learners to grasp complex and abstract knowledge through immersive experiences in virtual environments. This section will examine the construction mechanisms underlying the two most frequently occurring metaphor scenarios—the "level-passing" and the "experimental" scenarios.

### A. The "Level-Passing" Scenario

The "level-passing" scenario is particularly prevalent in mathematics education, where abstract problems are transformed into sequential challenges. Learners must solve problems to advance their characters, while errors result in regression or game termination. This scenario is primarily structured through three types of metaphors: the UP-DOWN metaphor, the WAR metaphor, and the JOURNEY metaphor, which shape the learning context and guide learners' cognitive and operational processes. The following section illustrates the most common UP-DOWN metaphor in this scenario.

The UP-DOWN metaphor is one of the most intuitive metaphors in game design, as it represents changes in knowledge or skills through the height of a character (ascending or descending). In tower-climbing games (see Figure 3), learners solve mathematical problems—such as arithmetic or logic puzzles—to ascend a tower, where each level symbolizes a distinct knowledge module. This progression moves from fundamental concepts to complex applications, mirroring a step-by-step mastery process. As learners advance, the difficulty increases until they reach the top, signifying successful completion. In contrast, incorrect answers result in a fall into lava, indicating failure. In this metaphor, the source domain is the spatial height (ascending, descending, reaching the peak), which maps onto the target domain, namely the learning progress (knowledge acquisition, skill improvement, identifying gaps, and completing learning tasks). The concrete experience of climbing allows learners to perceive their academic progress, where "changes in height" in the source domain are metaphorically mapped onto "knowledge growth" in the target domain.

Beyond individual learning progress, the UP-DOWN metaphor also incorporates a social reference frame. A leaderboard displayed in the upper-right corner ranks all players based on their achievements, reinforcing "height" as a competitive marker that highlights differences in progress among learners, thereby fostering a sense of competition. Furthermore, this metaphor is accompanied by auditory modes: uplifting music accompanies ascent, while error alerts signal descent, enhancing the multimodal learning experience.


Figure 3 Screenshot of the "Tower Challenge" Game

B. The "Experimental" Scenario

Similar to the "level-passing" scenario, the "experimental" scenario is commonly found in subjects such as chemistry and science, where abstract concepts are transformed into visualized experimental processes. Learners must apply their knowledge to conduct experiments and observe the outcomes in order to grasp key scientific principles. This scenario is mainly structured through VIRUS metaphors, CONTAINER metaphors, and COLOR metaphors. The following section focuses on the most typical metaphor—COLOR metaphors.

In the "experimental" scenario, COLOR metaphors use color transformations to indicate the success or failure of an experiment, enhancing learners' understanding of chemical reactions as dynamic processes. For instance, in "Chemistry Master" (see Figure 4), learners select experimental conditions—such as reagent types—based on their knowledge of chemistry and textual instructions. The green arrow, as a visual symbol, represents the correct course of action and implicitly signals the proper steps or directions in the experiment. This direct visual feedback helps learners make accurate procedural choices, reinforcing their understanding of experimental sequences.

Each action will trigger color changes in the solution, with different colors showing various stages or outcomes of the experiment. Green signifies a correct reaction, red indicates failure or danger, while blue or white represents the initial state. Additionally, the periodic table employs color coding to differentiate element properties, further embedding color as a cognitive tool in chemistry learning. In the COLOR metaphor, the source domain is color variation (e.g., red, white, blue), while the target domain corresponds to experimental states or reaction outcomes (e.g., success, explosion). By leveraging this mapping, learners can effortlessly associate experimental conditions with color cues, enabling them to monitor results in real-time, adjust strategies accordingly, and deepen their cognition of fundamental experimental principles.

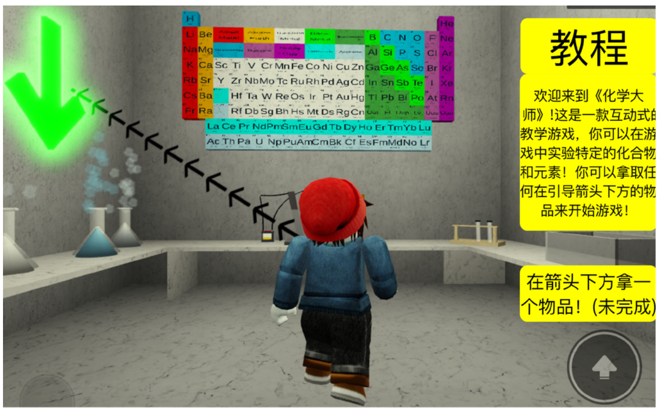


Figure 4 Screenshot of the "Chemistry Master" Game

## V. Conclusion

This study, based on the Roblox platform, analyzes multimodal metaphor scenarios in educational game samples, exploring how virtual learning environments construct learning experiences through metaphors and the cognitive mechanisms underlying these metaphor scenarios. The findings reveal that: (1) Among the 100 game-based educational samples selected from Roblox, three types of multimodal metaphor scenarios were identified, with “level-passing” and “experimental” scenarios being the most prominent; (2) These metaphor scenarios are structured through the mapping relationships between source and target domains in different types of metaphors (e.g., the COLOR metaphors, the UP-DOWN metaphors); (3) Unlike traditional curricula, the synergistic interplay of multimodal resources in these scenarios not only facilitates knowledge transfer and application but also enhances engagement and motivation, thereby improving educational value and effectiveness to a certain extent.

Future research could extend the scope to other virtual learning platforms, using pedagogical case studies to evaluate the educational effectiveness of metaphor scenarios across different disciplines. In addition, cross-cultural comparisons of multimodal metaphor construction could explore how these scenarios vary across cultural contexts, offering theoretical foundations and practical insights for the design and implementation of metaverse-based education.

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