

Research on Cross-Cultural Emergency Education Based on an Editable VR Platform

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Abstract: Against the background of globalization, cross-border population mobility has become increasingly frequent. Differences in emergency responses among groups with diverse cultural backgrounds pose major challenges to traditional emergency education. Featuring customizable scenarios, iterative processes, and collaborative simulation, editable VR platforms provide a brand-new path for cross-cultural emergency education. Based on an analysis of practical dilemmas in cross-cultural emergency education, this paper elaborates on the core value empowered by editable VR platforms and emphasizes the closed-loop mechanism of “multi-player online experiment — data collection and analysis — educational content iteration.” Participants from diverse cultural backgrounds carry out synchronous simulation on the VR platform; behavior and decision-making data are collected, and continuous optimization of emergency educational content and strategies is driven by analysis of cultural differences. A systematic implementation path is designed accordingly.

Keywords: Editable VR platform; Cross-cultural emergency education; Multi-player online experiment; Data-driven iteration; Behavior analysis

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1. Introduction

The acceleration of globalization has boosted cross-border population mobility. According to United Nations statistics, the number of international migrants worldwide reached 281 million in 2024. At the same time, natural disasters, public health incidents, terrorist attacks, and other emergencies occur frequently. Differences in risk perception, information comprehension, and behavioral reactions of groups with different cultural backgrounds have become increasingly prominent. Studies have shown that cultural background significantly affects individuals' compliance with emergency instructions, trust in authoritative information, and time preference for evacuation decisions. Such differences may lead to chaos and efficiency loss in emergency responses. Nevertheless, traditional emergency education mainly imparts general knowledge

under a single cultural context, which cannot meet the differentiated demands of multicultural groups. The lack of cross-cultural emergency education capacity has become a weak link in global urban safety governance ^[1].

The rise of editable VR platforms offers a technical breakthrough to resolve the above predicaments. VR technology has demonstrated unique value in public first-aid emergency education, yet its customization potential in the cross-cultural dimension has not been fully tapped ^[2].

2. Practical dilemmas of cross-cultural emergency education

2.1. Prominent and neglected cultural differences in emergency scenarios

Numerous empirical studies have verified behavioral disparities of groups with diverse cultural backgrounds in emergencies. Hofstede's cultural dimension theory states that individualism-collectivism cultural orientations affect people's willingness to help others and tendency to wait in crises; the degree of uncertainty avoidance influences individuals' tolerance for ambiguous information and compliance with emergency instructions; power distance shapes people's trust in and obedience to authoritative information sources ^[3]. In specific emergency scenarios, individuals with Western cultural backgrounds tend to evacuate rapidly and independently, while those from East Asian cultures prefer waiting for collective instructions or reaching group consensus before taking action. If such differences are not incorporated into emergency education and plan design, delayed responses or inappropriate behaviors may occur among specific cultural groups. However, current emergency education generally adopts a culturally neutral general content framework, failing to effectively respond to these substantial differences ^[4].

2.2. Cultural blind spots in traditional emergency education

Traditional emergency education has three limitations in the cross-cultural dimension. First, homogeneous content: it ignores disparities in cognitive habits and behavioral patterns of different cultural groups and lacks culturally adaptive design. The language selection of evacuation signs, expression of emergency instructions, and presentation logic of risk information all take mainstream cultural context as the default setting, without considering comprehension barriers for non-native language and non-local cultural groups ^[5]. Second, simplistic scenarios: it cannot simulate coordination and conflicts among multicultural groups within the same emergency scene, nor demonstrate how cultural differences impact emergency response processes. Third, insufficient verification methods: the effectiveness of cross-cultural emergency education is usually verified via subjective questionnaires without objective behavioral data. Teachers can hardly figure out the real emergency cognition and behavioral patterns of students from various cultural backgrounds, let alone adjust teaching contents accordingly ^[6].

2.3. Insufficient cross-cultural experimental data restricts educational iteration

Continuous optimization of cross-cultural emergency education relies on empirical data. Information about how people of different cultures make decisions and react in emergencies, and how they understand instructions, can only be obtained through systematic experimental observation. Nevertheless, organizing real cross-border and cross-cultural experiments faces practical obstacles, including difficult participant recruitment, high costs, and complicated ethical approval. Traditional questionnaires fail to capture instant reactions and real behaviors under emergency conditions. The dual shortage of experimental data and

empirical methods confines cross-cultural emergency education to experience-based assumptions rather than evidence-driven approaches. Updates and optimization of educational content lack scientific grounds, making genuine iteration impossible ^[7].

3. Core value of editable VR platforms empowering cross-cultural emergency education

3.1. Editable scenarios: Realize cultural customization of emergency educational contents

The editable VR platform developed by the author's team empowers teachers to independently construct emergency scenarios, breaking the restriction of "one-size-fits-all" content in traditional emergency education. Teachers can customize scenario elements targeting cognitive characteristics and behavioral preferences of specific cultural groups: adjust languages and graphic symbols of sign systems, modify presentation modes and information density of emergency instructions, and adapt the presentation to culturally specific preferences for receiving information from authoritative sources. For example, more explicit procedures and definite information can be added for groups with high uncertainty avoidance; presentation of individual action plans can be emphasized for highly individualistic groups; multi-language switching signs and voice prompts can be deployed for multilingual communities. The capacity of "teaching according to cultural traits" transforms standardized emergency education into differentiated adaptation, greatly improving the acceptability and effectiveness of educational content for diverse cultural groups ^[8].

3.2. Multi-player online mode: Build a large-scale collection platform for cross-cultural behavioral data

The multi-player online function of editable VR platforms provides empirical research conditions that were hard to achieve in the past for cross-cultural emergency education. Participants in different regions with various cultural backgrounds can enter the same virtual emergency scene simultaneously to carry out synchronous simulation and collaborative responses. More importantly, the platform automatically records complete behavioral data of every participant with high precision (millisecond timestamps, sampling rate ≥ 5 Hz), including movement paths, staying duration, operation sequences, decision-making time, instruction response speed, and social interactions. Subjective experience data are also collected via built-in questionnaires and emotion feedback modules ^[9].

The core breakthrough of this mechanism lies in advancing cross-cultural research from the questionnaire era to the behavioral experiment era. Researchers no longer depend on participants' post-event recollection and self-reports, but obtain authentic, continuous, and quantifiable behavioral data under emergency conditions. Meanwhile, the high immersion created by VR generates psychological stress and behaviors close to real situations, ensuring high ecological validity of collected data. Studies prove that risk decision-making behaviors in VR are highly consistent with those in reality, laying a reliable methodological foundation for scientific research on cross-cultural emergency behaviors ^[10].

3.3. Data-driven iteration: Construct a closed-loop optimization mechanism for cross-cultural emergency education

The core value of editable VR platforms goes beyond one-time customized teaching; it lies in building a continuous optimization closed loop of "teaching — data — analysis — iteration." After analyzing cross-

cultural behavioral data collected by the platform, researchers can identify universal rules and differentiated features of emergency responses among cultural groups, such as cognitive biases of certain cultural groups in specific scenes, cross-cultural comprehension barriers of some emergency instructions, and ineffective guidance strategies for particular populations. Such findings are fed back to the scenario editing terminal to support targeted adjustment of teaching contents, guidance strategies, and interface design. New adjusted scenes are verified in the next multi-player online experiment, and newly generated data drive another round of iteration ^[11].

This closed-loop mechanism transforms cross-cultural emergency education from static knowledge transmission into dynamic cultural adaptation. Educational content is no longer fixed standardized outputs but evolves alongside a deeper understanding of the behavioral rules of diverse cultural groups. Each multi-player online experiment serves as both a teaching activity and a data collection and research process, realizing organic integration of teaching, scientific research, and content production on the platform ^[12].

4. Implementation path of cross-cultural emergency education empowered by editable VR platforms

4.1. Hierarchical design of teaching scenarios

Teachers shall design differentiated VR scenarios according to hierarchical teaching objectives. The basic layer targets all learners, covering general emergency knowledge and basic operational skills with multilingual interfaces and culturally neutral design. The advanced layer carries out cultural adaptation for specific cultural groups, adjusting scenario elements, instruction styles, and behavioral guidance strategies based on cognitive traits of target populations. The research layer serves cross-cultural data collection, with standardized experimental scenes, control variables, and data acquisition schemes to provide evidence for educational iteration.

4.2. Multi-player online experiment and data collection mechanism

Organization of multi-player online experiments shall follow standardized procedures. Before experiments, clarify research questions (e.g., response differences of various cultural groups to visual and voice emergency instructions), design experimental scenes and control conditions, and recruit participants with multicultural backgrounds. During experiments, all participants enter the virtual scene synchronously to complete response tasks independently or collaboratively under identical emergency conditions. The platform collects behavioral data (position, time, operations, etc.) and subjective feedback in standardized formats. After experiments, the system automatically generates individual and group behavioral analysis reports with cross-cultural comparison of key indicators.

4.3. Data analysis and educational iteration mechanism

Data analysis is the core link of the closed loop. Teachers and research teams shall adopt quantitative methods to systematically analyze multi-source collected data: identify evacuation path preferences and decision-making styles of cultural groups through behavioral trajectory analysis; evaluate comprehension speed and compliance of different populations toward various instructions via response time analysis; discover corresponding relations between cultural variables and behavioral performance by association rule mining.

4.4. Platform construction and teacher support

Schools and research teams shall jointly promote platform construction. First, the platform shall feature high-freedom scene editing, supporting independent adjustment of layout, facilities, emergency parameters, and role settings; embed multi-language switching, cultural symbol library, and cross-cultural communication auxiliary modules; and possess standardized data collection and automatic analysis report generation functions. Second, build a case and template library for cross-cultural emergency education to accumulate teaching designs and experimental data of various cultural scenes. Third, form interdisciplinary teaching teams integrating emergency management, cross-cultural communication, and educational technology specialists, and carry out special training on editable VR platform operation and cross-cultural curriculum design to provide manpower guarantee for sustainable curriculum iteration^[13].

5. Conclusion

The globalization era puts forward new cross-cultural adaptation requirements for emergency education, while traditional educational tools have prominent limitations in coping with this challenge. Equipped with the three-in-one technical architecture of customizable scenes, collectible behaviors, and iterable contents, editable VR platforms provide a systematic solution to dilemmas in cross-cultural emergency education. The multi-player online experiment mechanism enables large-scale, high-precision collection of cross-cultural behavioral data, and analytical results drive continuous optimization of educational content. This model transforms emergency education from an experience-based static process into a data-driven dynamic adaptation process, turning the concept of “teaching according to cultural traits” into operable practice. Future research shall further verify learning effect disparities of diverse cultural groups in VR, explore deep integration schemes of editable VR platforms with AI-based behavioral analysis and big data mining, and push cross-cultural emergency education toward higher accuracy and effectiveness^[14].

Disclosure statement

The author declares no conflict of interest.

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