Designing Embodied Learning Environments for First-Aid Education in Higher Education: A Practice-Based Study of a Public Emergency Response Course

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Abstract

First-aid education in universities often faces a gap between knowledge acquisition and practical action. Many students can explain emergency procedures but hesitate when responding to real situations. This study explores how embodied learning approaches can improve first-aid training in higher education. Based on embodied cognition theory, this study develops a four-environment learning model, including distributed learning, simulation-based practice, interactive scenario training, and community-based application. The model was implemented in a public emergency prevention and first-aid course. Through digital learning resources, simulation equipment, immersive scenarios, and authentic practice, students gradually moved from understanding procedures to performing skills confidently. Teaching outcomes indicate improvements in skill assessment and students' willingness to apply first-aid knowledge in real contexts. The study suggests that embodied learning environments can provide a practical framework for bridging the gap between knowing and doing in university first-aid education.

Keywords: First-Aid Education; Embodied Cognition; Learning Environments; Instructional Strategies; Skill Transfer

1. Introduction: the gap netween knowledge and action in university first-aid education

First-aid education has received increasing attention in public health and higher education. In China, the Healthy China 2030 Planning Outline highlights the importance of integrating first-aid knowledge into the national education system. However, public first-aid competence remains limited. A large proportion of out-of-hospital cardiac arrests occur outside medical facilities, while survival rates remain low, highlighting the need for broader first-aid training and effective skill transfer (Perkins et al., 2015; Greif et al., 2021). University students are an important group for improving public first-aid capacity because they generally have strong learning abilities and frequent opportunities for social interaction. However, completing a first-aid course does not necessarily mean that students can respond effectively in real emergencies. Many students can explain basic procedures or pass skill assessments, but they may hesitate when facing an actual emergency situation. This gap between knowing and acting has become a key challenge in university first-aid education.

Previous studies have described this problem as a gap between knowledge acquisition and practical performance. Students may understand the steps of cardiopulmonary resuscitation (CPR), including compression position, depth, and frequency, but theoretical understanding does not automatically lead to effective performance. Traditional first-aid courses often rely on classroom instruction and demonstration videos, while hands-on practice and realistic scenario training remain insufficient. As a result, students may become familiar with procedures in controlled classroom settings but feel uncertain when dealing with complex and stressful real-world situations. The underlying problem is related to the nature of first-aid skills. Unlike declarative knowledge, which can be acquired through reading and listening, first-aid competence is procedural knowledge that requires repeated physical practice and contextual experience. Learning how to perform CPR is not simply a process of memorizing instructions. It involves developing stable action patterns through continuous interaction between the body, the environment, and the task. Therefore, first-aid education should move beyond knowledge transmission and create learning experiences that support skill formation and action transfer.

2. Reconstructing first-aid teaching from an embodied cognition perspective

To overcome the gap between knowledge and action in first-aid education, it is necessary to reconsider how first-aid skills are learned. Embodied cognition provides a useful theoretical perspective for understanding this process. Unlike traditional views that treat learning as the acquisition and storage of abstract information, embodied cognition emphasizes the close relationship between cognition, bodily activity, and environmental interaction (Varela et al., 1991; Wilson, 2002). Learning is not only a mental process. It also involves physical experience and active engagement with the surrounding environment (Barsalou, 2008). This perspective is particularly relevant to first-aid education. First-aid skills cannot be developed through memorization alone. For example, students may remember the recommended depth and frequency of chest compressions, but effective CPR requires repeated practice to develop stable action patterns. Similar processes occur in other first-aid skills, such as locating the correct position for the Heimlich maneuver or controlling the pressure during wound dressing. Through repeated physical practice, learners gradually develop procedural knowledge that can be activated in emergency situations.

From an embodied cognition perspective, traditional first-aid teaching shows several limitations. Firstly, students often have limited opportunities for physical practice. Taking CPR training as an example, skill mastery requires sufficient repetition and feedback (Ericsson, 2008; Ericsson & Pool, 2016). However, in many conventional classrooms, students only perform a small number of practice cycles because of limited class time and teaching resources. Practicing a skill does not necessarily mean mastering it. Repeated exposure alone is insufficient unless learners receive targeted feedback and opportunities for correction (Ericsson, 2008). Second is that traditional training often lacks realistic contexts. Most practice activities take place in controlled classrooms with clear instructions and few external distractions. Students may not experience the pressure, uncertainty, or emotional responses that occur in real emergencies. This limitation is consistent with situated learning theory, which argues that knowledge and skills are developed through participation in meaningful contexts rather than isolated practice (Lave & Wenger, 1991). As a result, they may know how to perform a procedure but hesitate when they need to act in an unfamiliar situation. Third, feedback during training is often insufficient. Instructors usually rely on visual observation and general comments, such as “apply more force” or “adjust the speed.” However, learners may not accurately perceive whether their compression depth or frequency meets the required standard. Without precise feedback, it is difficult for students to identify and correct their own mistakes, just as mentioned by Hattie and Timperley (2007), effective feedback is particularly cruicial in skill-based learning because it helps learners compare current performance with expected standards and make timely adjustments. Figure 1 shows the framework.

Therefore, first-aid education needs to shift from knowledge transmission toward embodied skill development. Based on this understanding, this study proposes a three-stage embodied learning pathway: bodily engagement, contextual embedding, and action transfer.

The first stage is bodily engagement. Learners need sufficient hands-on practice to develop appropriate movement patterns. This idea is also consistent with experiential learning theory, which emphasizes that knowledge is created through concrete experience, reflection, and active experimentation (Kolb, 1984). Immediate feedback plays an important role in this process by connecting bodily experience with measurable performance indicators. Through the cycle of physical perception, feedback, and adjustment, learners gradually improve their operational accuracy. The second one is contextual embedding. Learners need opportunities to practice skills in realistic and complex situations. Virtual reality (VR) and augmented reality (AR) technologies provide new possibilities for creating emergency scenarios that are difficult to reproduce in traditional classrooms. Previous research has shown that simulation-based learning can provide learners with realistic practice environments while maintaining a safe space for error, reflection, and improvement (Lateef, 2010). Through simulated situations, students can experience decision-making pressure, uncertainty, and emotional responses in a safe learning environment. Reflection after simulation helps them recognize weaknesses and improve future performance. As for the last stage, it is action transfer. Learners need to apply their skills in authentic social contexts and gradually develop an identity as capable responders. External recognition, such as obtaining a certified first-aid qualification or participating in real emergency support activities, can strengthen students' self-efficacy. According to Bandura's self-efficacy theory, successful experiences are one of the most important sources of confidence in performing future behaviors (Bandura, 1997). When students successfully apply their skills in community activities or public events, their confidence is based on actual experience rather than personal belief alone.

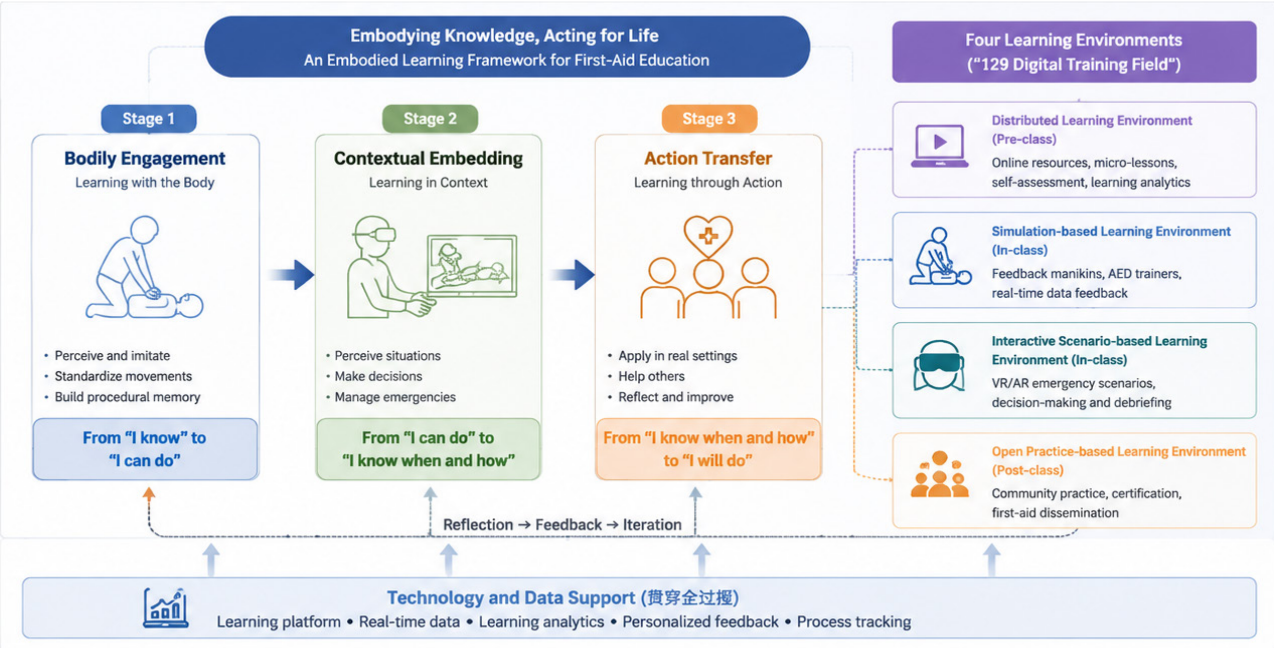

Figure 1. Embodied learning framework for first-aid education

The above mentioned three stages form the theoretical foundation of the proposed teaching strategy. They are not independent steps but interconnected processes. Without sufficient bodily engagement, stable skill patterns cannot be developed. Without contextual embedding, learned skills may not transfer to complex situations. Without action transfer, students may remain capable of performing skills in training environments but lack confidence in real emergencies.

3. Constructing four learning environments based on the "129 intelligent training model"

To translate the three-stage embodied learning pathway into practice, the course team developed the "129 intelligent training model", which consists of one curriculum development center, two online learning platforms, and nine offline training bases. Based on this model, four interconnected learning environments were established: distributed learning, simulation-based learning, interactive scenario-based learning, and open practice-based learning (see Table 1). These environments are not separate teaching components. Instead, they correspond to different stages of embodied learning and together form a continuous process from knowledge preparation to skill development and real-world application.

Table 1. The relationship between embodied learning processes and four learning environments

Embodied learning process	Embodied learning process	Embodied learning process	Embodied learning process
Bodily engagement	Simulation-based learning environment	Feedback-enabled CPR manikins, AED trainers, first-aid training equipment	Developing standardized procedures and procedural skills
Contextual embedding	Interactive scenario-based learning environment	VR/AR simulation systems and emergency scenarios	Improving decision-making and responses in complex situations
Action transfer	Open practice-based learning environment	Communities, sports events, and school-based activities	Applying skills in authentic contexts and strengthening self-efficacy
Throughout the learning process	Distributed learning environment	Online platforms, micro-courses, and self-assessment tasks	Supporting knowledge preparation, personalized learning, and learning analytics

3.1. Distributed learning environment: preparing cognition before practice

The distributed learning environment aims to move knowledge preparation beyond the classroom. Supported by online learning platforms, including the Chaoxing Learning Platform and a provincial intelligent first-aid education platform, students complete pre-class learning tasks before participating in hands-on training. These tasks include short case videos, micro-lessons, and self-assessment questions. The platform records students' learning behaviors and provides teachers with information about their prior knowledge and learning difficulties. The main function of this environment is to support cognitive preparation. Before performing physical operations, students first develop an initial understanding of procedures and key points through demonstrations and independent learning. This process is consistent with observational learning theory, which emphasizes that individuals can acquire new behaviors by observing others and mentally representing relevant actions before actual performance (Bandura, 1977). Research on multimedia learning also suggests that well-designed visual demonstrations can support learners' understanding of complex procedures by helping them organize and integrate new information (Clark & Lyons, 2011). More importantly, learning analytics allows instructors to identify specific problems before classroom practice and provide targeted instructional support (Siemens & Baker, 2012). For example, if students show weak understanding of compression positioning or defibrillation decisions in pre-class assessments, these issues can become the focus of subsequent instruction. In this way, classroom time can be used for solving practical difficulties rather than repeating basic information delivery.

3.2. Simulation-based learning environment: developing procedural skills through bodily engagement

The simulation-based learning environment represents the core component of bodily engagement. In the virtual simulation training room, students practice CPR, AED operation, and the Heimlich maneuver through specialized training equipment, such as feedback-enabled CPR manikins and AED trainers. These devices provide real-time information about compression depth, compression rate, chest recoil, and ventilation performance. The key mechanism of this environment is immediate and measurable feedback. Simulation-based learning has been widely applied in health professions education because it allows learners to practice technical skills in controlled environments while receiving timely feedback and opportunities for improvement (Issenberg et al., 2005). In conventional training, instructors often rely on general comments, such as asking students to "apply more force" or "adjust the speed." However, such instructions may not clearly indicate the degree of deviation. With digital feedback, students can directly observe whether their performance meets the required standards and make targeted adjustments during practice. Through repeated cycles of operation, feedback, and correction, learners gradually develop more stable procedural skills. This process reflects the central idea of embodied learning: knowledge is strengthened through continuous interaction between bodily experience, external feedback, and environmental conditions. Effective feedback is particularly important in skill-based learning because it helps learners compare their current performance with expected standards and make timely adjustments (Hattie & Timperley, 2007).

Rather than simply remembering CPR procedures, students gradually learn how to perform them accurately and consistently. Collaborative practice further strengthens this learning process. Students work in small groups, taking turns performing procedures, observing peers, and discussing performance data. Peer interaction encourages learners to explain, monitor, and reflect on their own performance, which can further support skill development and knowledge construction (Johnson & Johnson, 2009).

3.3. Interactive scenario-based learning environment: transferring skills through contextual practice

While simulation-based training helps students develop basic procedures, effective emergency response also requires the ability to make decisions under uncertain conditions. To address this need, the interactive scenario-based learning environment introduces VR and three-dimensional simulation systems to create complex emergency situations, including traffic accidents, earthquake responses, crowd-related incidents, and drowning rescue scenarios. The value of this environment lies not only in technological immersion but also in providing opportunities for safe practice and reflection. Simulation-based technologies, including virtual reality, have been increasingly used in medical and emergency education because they provide realistic environments for practicing decision-making and complex procedures without exposing learners to actual risks (Kyaw et al., 2019). In real emergencies, responders often face incomplete information, emotional pressure, and unexpected changes. Through simulated scenarios, students can experience these challenges while maintaining a safe learning environment.

When learners overlook important safety assessments or make inappropriate decisions, the system provides feedback that encourages them to review and improve their responses. This process supports the development of situational awareness, which is essential for effective decision-making in complex and dynamic environments (Endsley, 1995). Another important function of scenario-based training is psychological preparation. Traditional classroom practice often occurs in calm and predictable conditions, while emergency situations involve stress and uncertainty. By experiencing simulated pressure in advance, students can become more familiar with their own reactions and gradually improve their confidence in handling unexpected events. Such mastery experiences are important sources of self-efficacy and can influence individuals' willingness to perform future behaviors (Bandura, 1997). This process helps reduce the gap between "knowing how to do it" and "being willing to do it."

3.4. Open practice-based learning environment: moving from skill performance to real-world action

The open practice-based learning environment extends learning beyond the classroom and supports the final stage of action transfer. Through cooperation with organizations such as the Red Cross, sports event organizers, and community centers, students participate in first-aid certification programs, emergency drills, public education activities, and medical support services for large-scale events. This environment strengthens learning through two mechanisms. The first is external recognition of competence. Obtaining an officially recognized first-aid certificate provides students with evidence of their ability and helps increase their confidence in applying first-aid knowledge. In addition, introducing relevant legal knowledge, such as protections for good-faith rescuers, can reduce students' concerns about possible consequences when providing assistance. The second mechanism is authentic experience. Real practice situations allow students to understand how first-aid skills function outside controlled training environments. Experiential learning theory suggests that meaningful learning develops through direct experience, reflection, and active experimentation (Kolb, 1984). Supporting participants during sports events or providing emergency education in communities exposes students to situations that cannot be fully reproduced through classroom simulation. Such experiences contribute to the development of professional identity and self-efficacy. Ultimately, the purpose of this learning environment is not simply to make students complete a first-aid procedure correctly. It aims to help them become individuals who are prepared and confident enough to respond when emergencies occur.

4. Teaching implementation process

The four learning environments are integrated into three interconnected teaching stages: pre-class preparation, in-class practice, and post-class application, forming a complete learning cycle from knowledge acquisition to skill performance and transfer. This design is consistent with blended learning approaches, which emphasize the combination of online preparation and face-to-face interactive practice to improve learning effectiveness (Garrison & Kanuka, 2004; Graham, 2013). The following section uses the "CPR and AED operation" unit (two class hours) as an example.

4.1. Pre-class stage (distributed learning environment)

Before class, instructors release preparatory learning tasks through the Chaoxing Learning Platform. These tasks include a three-minute real-life case video, three to five micro-lessons (each lasting three to five minutes), and ten self-assessment questions. Students complete the learning activities independently, and the platform automatically generates learning reports for instructors. This stage aims to establish basic cognitive preparation before hands-on practice. The use of online resources allows students to review key procedures at their own pace, while learning data helps instructors identify common difficulties in advance. Such an approach reflects the principles of flipped learning, in which direct knowledge acquisition is moved outside the classroom so that classroom time can be devoted to active practice and problem-solving (Bishop & Verleger, 2013). For example, if the accuracy rate of identifying the correct compression position is only 45% or the accuracy rate of deciding whether defibrillation is required is 62%, these results become important references for classroom instruction. Instead of repeating basic knowledge, instructors can focus on the specific problems revealed through pre-class assessment.

4.2. In-class stage (simulation-based learning environment + interactive scenario-based learning environment)

The two-hour classroom session follows a sequence of demonstration, simulation practice, and scenario challenge. The first activity (approximately 15 minutes) focuses on targeted instruction. Based on common problems identified before class, instructors explain key procedures with the support of 3D animations and provide live demonstrations. The purpose of demonstration is not simply to repeat textbook knowledge but to highlight details that students commonly misunderstand, such as keeping the arms straight during compression and generating force through the upper body rather than relying only on wrist strength. Demonstration-based instruction can support skill acquisition by helping learners form accurate mental representations before practice (Bandura, 1977; Clark & Lyons, 2011).

The second one (approximately 35 minutes) involves hands-on simulation practice. Students work in groups and practice on feedback-enabled CPR manikins. Each student completes at least three complete practice cycles, with each cycle consisting of 30 compressions and two ventilations. Performance data are displayed in real time. Instructors provide guidance during practice and address common problems immediately. For example, if a group consistently shows insufficient compression depth, the instructor can provide targeted correction. This stage emphasizes repeated practice and immediate feedback. Deliberate practice theory suggests that the development of expert performance depends not only on repetition but also on focused practice with clear goals and timely feedback (Ericsson, 2008). Therefore, the purpose of simulation practice is not simply to increase practice time but to help students gradually improve the accuracy and stability of their actions.

The third and last activity (approximately 30 minutes) involves scenario-based VR training. Students enter the interactive simulation system with a scenario of "traffic accident scene—victim experiencing cardiac arrest." They are required to complete the full response process, including environmental assessment, self-protection, consciousness and breathing assessment, calling for emergency assistance, retrieving an AED, CPR performance, and AED analysis and defibrillation. The system automatically records key decision points, such as whether students assess environmental safety, assign someone to call emergency services, and ensure a clear area before defibrillation. After each group completes the task, instructors organize a brief debriefing session focusing on decision-making difficulties during the scenario. Debriefing is considered an important component of simulation-based education because it helps learners reflect on their actions and transform experience into improved future performance (Fanning & Gaba, 2007).

4.3. Post-class stage (open practice-based learning environment + distributed learning environment)

After class, learning activities are divided into required and optional tasks. Required tasks include an online theoretical assessment completed through the learning platform and additional skill practice in the open training room. Students can independently schedule practice sessions and strengthen their operational abilities in preparation for the practical assessment of the Red Cross first-aid certificate. Optional activities include joining campus first-aid volunteer teams, producing first-aid education videos, and participating in community outreach activities. These activities encourage students to apply their knowledge in authentic social contexts. This stage aims to extend learning beyond the classroom and promote skill transfer. Experiential learning theory suggests that meaningful learning develops through the continuous interaction between experience, reflection, and application (Kolb, 1984). By participating in real or community-based activities, students have opportunities to consolidate skills and gradually develop confidence in responding to emergency situations.

5. Implementation outcomes and discussion

After two years of systematic implementation, the course demonstrated measurable educational outcomes in students' skill development, behavioral transformation, and social engagement. The results suggest that the integration of embodied learning principles with digital and scenario-based training can effectively support the transition from knowledge acquisition to practical action. At the level of skill acquisition, the certification rate of Red Cross first-aid qualification increased from less than 10% before the reform to 100% after implementation. Paired-sample t-tests showed that students' post-test scores in CPR performance, including compression depth accuracy, compression frequency accuracy, and ventilation effectiveness, were significantly higher than their pre-test scores ($p < 0.001$). The detailed statistical results are presented in Table 2. These findings indicate that the design of the "bodily engagement" stage contributed to the development of standardized operational skills. The combination of sufficient practice opportunities and immediate feedback helped students gradually improve their performance through repeated action, correction, and refinement. This result is consistent with previous research emphasizing the importance of deliberate practice and feedback in the development of complex skills (Ericsson, 2008; Hattie & Timperley, 2007).

Table 2. Paired-sample t-test results of students' CPR skill assessment before and after the intervention (N = 86)

Assessment indicators	Pre-test (M±SD)	Post-test (M±SD)	t value	p value
Compression depth accuracy (%)	42.7±18.3	89.5±8.2	22.14	<0.001
Compression frequency accuracy (%)	58.4±15.6	92.3±6.5	19.87	<0.001
Ventilation effectiveness (%)	35.2±20.1	85.6±10.4	24.56	<0.001

At the level of behavioral transfer, dozens of students reported that they had applied first-aid skills in internship settings, family communities, or public places during the two-year implementation period. These situations included airway obstruction, sports injuries, and fainting events. In one case, a student successfully assisted with an AED intervention during an out-of-hospital cardiac arrest incident while participating in marathon volunteer services. These experiences suggest that the combination of contextual practice and authentic application may help students overcome the psychological barrier between "knowing how to perform a skill" and "being willing to act." Such findings are consistent with self-efficacy theory, which highlights the importance of successful experiences in strengthening individuals' confidence to perform future actions (Bandura, 1997).

At the level of social dissemination, 94% of students reported that they had taught basic first-aid skills to at least two people around them. The student-led “Little Rescuer” volunteer team conducted more than 1,000 first-aid education activities in communities and primary and secondary schools across several provinces. This diffusion effect indicates that embodied first-aid education may contribute not only to individual competence development but also to the formation of students’ identity as first-aid educators and community participants. From the perspective of experiential learning, applying knowledge in authentic social contexts enables learners to deepen understanding through experience and reflection (Kolb, 1984).

Reflecting on the implementation process, three design principles can be identified. First, sufficient practice intensity is the foundation for skill internalization. Traditional classroom training, in which each student may only practice a few times, is unlikely to support stable skill development. In this course, students completed at least three complete practice cycles in each session and more than 50 cycles throughout the semester, which provided the repetition necessary for procedural skill formation. Second, immediate feedback serves as a key mechanism for self-correction. Data-based feedback allows students to move from subjective judgment to objective evaluation and supports more accurate performance adjustment (Hattie & Timperley, 2007). Third, scenario-based training is essential for psychological preparation. Safe practice in VR environments enables students to experience uncertainty and pressure before facing real emergencies, which may reduce hesitation and improve confidence in future situations (Kyaw et al., 2019; Bandura, 1997).

6. Conclusions and recommendations

This study used embodied cognition theory as an analytical framework to examine the design logic and implementation pathway of the four learning environments in the course Public Emergency Prevention and First Aid. The findings suggest that one important challenge in current university first-aid education is the separation between knowledge acquisition and practical action. Addressing this challenge requires greater attention to the bodily nature of skill learning and the development of an embodied learning pathway consisting of bodily engagement, contextual embedding, and action transfer. The four learning environments correspond to different stages of this pathway and jointly form an interconnected learning system. Digital technologies, including real-time performance feedback, immersive VR training, and continuous learning records, provide important support for implementing this approach. Based on the findings of this study, three recommendations can be proposed for similar courses.

The first point is that teaching priorities should be adjusted. First-aid education should not focus solely on explaining principles and procedures but should emphasize the development of reliable practical abilities through sufficient hands-on experience. Therefore, practical training and scenario-based activities should occupy a substantial proportion of classroom time, allowing students to develop stable operational skills through repeated practice and feedback. Second, institutions should strengthen access to digital training resources. Although feedback-enabled simulation equipment and VR-based scenario systems require considerable initial investment, they provide valuable support for skill-based learning. Institutions with limited resources may explore alternative approaches, such as inter-institutional sharing or cooperation with external organizations. The key issue is not only the availability of advanced equipment but also the effective integration of digital resources into teaching processes. Third, connections between certification, curriculum learning, and social practice should be strengthened. Cooperation with organizations such as the Red Cross and community partners can provide students with opportunities to apply their skills in authentic contexts. Certification should not be regarded as the final goal of first-aid education; rather, it can serve as an external recognition mechanism that strengthens students’ confidence and willingness to act.

This study also has several limitations. First, the empirical evidence was collected from a single institution, and the generalizability of the findings requires further examination in different educational contexts. Second, although VR-based scenario training provided valuable learning experiences, the development of high-quality scenarios remains resource-intensive. In the current implementation, only six fixed scenarios were available, and repeated exposure may reduce the sense of novelty and challenge for learners over time. Future research can be extended in two directions. One possibility is to explore the application of emerging technologies, such as artificial intelligence and motion capture systems, to provide more precise assessment and feedback on first-aid performance. Another direction is to examine how this teaching model can be adapted across different educational levels, including universities, vocational institutions, and primary and secondary schools, in order to support a more integrated first-aid education system.

References

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84(2), 191–215.

Bandura, A. (1997). Self-efficacy: The exercise of control. W. H. Freeman.

Barsalou, L. W. (2008). Grounded cognition. Annual Review of Psychology, 59, 617–645.

Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. 2013 ASEE Annual Conference & Exposition Proceedings.

Clark, R. C., & Lyons, C. (2011). Graphics for learning: Proven guidelines for planning, designing, and evaluating visuals in training materials (2nd ed.). Pfeiffer.

Endsley, M. R. (1995). Toward a theory of situation awareness in dynamic systems. Human Factors, 37(1), 32–64.

Ericsson, K. A. (2008). Deliberate practice and acquisition of expert performance: A general overview. Academic Emergency Medicine, 15(11), 988–994.

Ericsson, K. A., & Pool, R. (2016). Peak: Secrets from the new science of expertise. Houghton Mifflin Harcourt.

Fanning, R. M., & Gaba, D. M. (2007). The role of debriefing in simulation-based learning. Simulation in Healthcare, 2(2), 115–125.

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. The Internet and Higher Education, 7(2), 95–105.

Graham, C. R. (2013). Emerging practice and research in blended learning. In M. G. Moore (Ed.), Handbook of distance education (3rd ed., pp. 333–350). Routledge.

Hattie, J., & Timperley, H. (2007). The power of feedback. Review of Educational Research, 77(1), 81–112.

Issenberg, S. B., McGaghie, W. C., Petrusa, E. R., Gordon, D. L., & Scalese, R. J. (2005). Features and uses of high-fidelity medical simulations that lead to effective learning: A BEME systematic review. Medical Teacher, 27(1), 10–28.

Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. Educational Researcher, 38(5), 365–379.

Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. Prentice Hall.

Kyaw, B. M., Saxena, N., Posadzki, P., Vseteckova, J., Nikolaou, C. K., George, P. P., Divakar, U., Masiello, I., Kononowicz, A. A., Zary, N., & Tudor Car, L. (2019). Virtual reality for health professions education: Systematic review and meta-analysis by the Digital Health Education Collaboration. Journal of Medical Internet Research, 21(1), e12959.

Lateef, F. (2010). Simulation-based learning: Just like the real thing. Journal of Emergencies, Trauma, and Shock, 3(4), 348–352.

Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge University Press.

Siemens, G., & Baker, R. S. J. d. (2012). Learning analytics and educational data mining: Towards communication and collaboration. In Proceedings of the 2nd International Conference on Learning Analytics and Knowledge (pp. 252–254). ACM.

Varela, F. J., Thompson, E., & Rosch, E. (1991). The embodied mind: Cognitive science and human experience. MIT Press.

Wilson, M. (2002). Six views of embodied cognition. Psychonomic Bulletin & Review, 9(4), 625–636.

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Acknowledgement

This research is supported by the General Project of the 2025 Special Research Project on Science Education Popularization and International Communication Application of the China Electronic Labor Association (Project No. CEA125B052): "Development and Cross-cultural Practice Research of Public Emergency First Aid Courses for International Students in China under the Belt and Road Initiative." (中国电子劳动学会 2025 年度科学教育普及与国际传播应用研究专项课题，一般项目，面向 " 一带一路 " 来华留学生的公众应急救护课程开发与跨文化实践研究，Cea125B052)