

# Research on Innovation Path of Safety Information Dissemination Based on VR Technology

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**Abstract**— VR is an advanced digital technology rising in recent years, and has been widely used in games, education, media and other fields. VR technology is suitable for security information dissemination because of its unique characteristics. VR technology can greatly improve the liveliness and interactivity of security content, enhance the dissemination effect of safety information, and more effectively enhance the safety awareness of the audience. This paper focuses on the importance of safety information dissemination and safety awareness promotion, and analyzes the necessity of promoting safety information dissemination mode.

**Keywords**— VR; Safety information dissemination; Innovation path.

## I. INTRODUCTION

In many industries, it is necessary to strengthen safety education, enhance the safety awareness and ability of practitioners, and avoid all kinds of accidents and injuries in the work. Safety information dissemination plays an important role in improving safety awareness. Different technologies and methods play different roles in the process of safety dissemination. In order to improve the dissemination effect of safety information, we need to think about how to use more advanced digital technology, and explore effective ways of safety information dissemination according to the characteristics of technology. VR is an advanced digital technology rising in recent years, and has been widely used in games, education, media and other fields. VR technology is suitable for security information dissemination because of its unique characteristics. VR technology can greatly improve the liveliness and interactivity of security content, enhance the dissemination effect of safety information, and more effectively enhance the safety awareness of the audience.

"Safety education is related to personal life safety and the stable development of enterprises and countries. The effect of traditional paper and oral construction safety education is not obvious. However, VR technology can be used to simulate possible safety accidents in engineering and strengthen safety awareness, which can lay a foundation for avoiding safety production accidents in actual construction process"<sup>[1]</sup>. This paper focuses on the importance of safety information dissemination and safety awareness promotion, and analyzes the necessity of promoting safety information dissemination mode. This paper finds out the problems existing in the traditional way of safety information dissemination, introduces the characteristics and advantages of VR technology in safety information dissemination, and considers how to use VR

technology to realize the innovation of safety information dissemination mode.

## II. THE NECESSITY OF SAFETY INFORMATION DISSEMINATION

In recent years, the frequent occurrence of safety accidents has occurred in many industries. Many countries have gradually established various safety production responsibility systems and formulated safety laws and regulations for different industries to effectively alleviate production safety accidents. However, under the overall good safety situation, there are still some major production safety accidents from time to time. The safety awareness and safety knowledge of all walks of life need to be improved and updated, and the strength and effectiveness of safety education and training need to be strengthened.

Safety education is not a short-term work with good effect, but needs long-term persistence and continuous dissemination. Many industries have special needs for safety education. For example, in engineering construction, it has the characteristics of long construction period, large mobility of personnel, complex and diverse construction technology, many high-altitude operations, low level of mechanization, and dynamic process changes, resulting in frequent occurrence of safety accidents, even serious and extraordinary accidents. Therefore, safety education is particularly important. On the other hand, the education level of many engineering construction practitioners is not very high. For example, in China, many engineering personnel are migrant workers. These migrant workers generally accept the low level of education, lack of safety production knowledge, weak professional skills, weak safety awareness and strong fluke psychology, which make them operate against rules and violate labor discipline in the process of labor operation. The reason often causes all kinds of safety accidents. Strengthening the safety education of practitioners is the key to solve the frequent accidents in many industries and to do a good job in safety production management. Safety information dissemination plays a very important role in this process.

## III. PROBLEMS OF TRADITIONAL SECURITY INFORMATION DISSEMINATION

With the continuous development of safety education, the traditional way of safety information dissemination has been unable to meet the growing security needs of various

industries. The traditional security information dissemination mode has the following problems.

*1. The security information lacks pertinence and the content is repeated for a long time*

Traditional safety education and training usually adopts centralized training and large classroom learning, and the safety information of different industries is the same or similar, which lacks pertinence. It is difficult to improve the operation ability and safety awareness of engineering personnel, and the expected training effect cannot be achieved. The long-term repeated and gradually formalized safety education and training cannot meet the knowledge and skills needs of engineering personnel, which leads to the questioning of the necessity of safety education and training, resulting in numbness and conflict psychology.

*2. The dissemination method of safety information is single, and the interest of learners is not high*

Classroom teaching is an important method of safety information dissemination. This kind of safety education and training belongs to "cramming" teaching, which means that the engineers can remember the knowledge intact or slightly modified. Due to the lack of classroom interaction and atmosphere building, there is a pool of stagnant water in the classroom, so that the engineering personnel are not interested in the training content or even tired, so they start to sleep, distract or play with mobile phones, resulting in poor training effect.

*3. Lack of teachers and limited training scale*

The main reason is that the source of trainers is relatively single, which is usually undertaken by the corresponding construction project technical director or safety officer. Due to the high level of trainers and the mobility of engineering personnel, safety education and training cannot be carried out on a large scale. It is difficult to ensure that all engineering personnel can receive safety education and training regularly, which affects the training effect.

*4. Theoretical training is more than practical training*

The main performance is that most of the current safety education and training is theoretical teaching, which weakens or ignores the importance of practical operation, leading to the disconnection of theoretical knowledge and field practice. Especially in the aspects of risk analysis, hidden danger investigation, emergency treatment and accident investigation, it is necessary to pay great attention to the combination of theoretical knowledge and practical ability, improve the proportion of practical teaching in safety education and training, and closely fit with the site environment, so as to substantially improve the safety operation ability of engineering personnel.

Therefore, on the one hand, it is necessary to innovate the transmission form of safety information, seize the attention of engineering personnel, and improve their concentration; on the other hand, it is necessary to enrich safety information to cope with the new requirements of the changing environment of the times. In order to solve this problem, an immersive safety

information dissemination mode based on VR technology is proposed. Scene simulation teaching method and immersive learning are introduced. PPT, 3D projection, VR are used And practice teaching and other means to simulate the scene process of the operation site, give the engineering personnel immersion experience, improve their learning initiative, so as to improve the effect of safety education and training, and achieve the goal of improving the level of safety awareness and safety operation ability of engineering personnel, so as to reduce the occurrence of safety accidents.

#### IV. IMMERSIVE DISSEMINATION MODE BASED ON VR TECHNOLOGY

"In the face of online education supported by traditional technology, it has entered a stable period, Virtual reality technology will become the supporting technology to occupy the commanding heights of online education in the future"<sup>[2]</sup>. With the help of high-tech such as sensor, computer vision and artificial intelligence, VR technology combines with real-time interactive, diversified and immersive human-computer interaction experience environment, which has the main characteristics of immersion, interactivity and imagination. The VR technology is combined with the actual needs to create a multi-dimensional virtual information space, which can highly restore the real scene and increase the sense of presence of the experiencer; Using the perception control equipment such as head mounted VR glasses, control handle, stepper, etc., the interactive operation of the experiencer can be increased through the perception control; the subjective initiative of acquiring knowledge can be increased in the experience process by using the reasonable scene layout and gate design, and through the independent perception and cognition of the experiencer in the virtual space. Therefore, VR technology can better serve the dissemination of safety information, realize multi scene and multiapplication in limited space, highly simulate and restore the real accident scene that is difficult to reproduce in real life, effectively integrate teaching and interactive operation, and realize teaching and training design such as step-by-step teaching, detail demonstration and highlight. The immersion dissemination mode based on VR technology has the following characteristics and advantages.

*1. The viewing angle is from local to panoramic*

The production of security content from hand-painted to computer graphics, from two-dimensional to three-dimensional, regardless of the change, the visual presentation is "local". For example, traditional safety education movies, whether they are played on TV, monitor or mobile phone, always reserve a view for the audience to watch, just like giving the audience a "window" to watch the other world through the window. However, VR security information is quite different. Although there is also a "window" for the first time, this "window" is more like a "spectacle". The screen presentation is like bringing the audience into another world. The perspective is not limited, and the viewing content is no longer limited to the world displayed by the "window". The creators do not need to limit the content of safety information

to a single video frame. The whole content production stage can be expanded infinitely and can occur simultaneously. If the audience cannot see all the features of the safety education scene at one time, they can adjust the perspective and find new content through the second viewing, so as to stimulate the curiosity of the audience and realize the purpose of multiple learning.

## 2. Viewing mode from passive to active

The passive watching provided by the traditional safety education film has always been like a teacher telling a story. The disseminator has always expected to use some techniques to enhance the learners' sense of substitution. However, no matter how appealing, this passive viewing mode makes the audience always in the "absent" state. For the atmosphere of the rendering, there are always some people will feel that they are a "bystander", unable to integrate into this virtual sense of bringing in. VR security information transforms the audience as an object into a subject, endows the audience with a subjective way of watching, and obtains the initiative in watching content. Even if some audiences don't like watching the main plot, they can also turn the perspective actively. Watching VR content can mobilize the audience's sense of participation and make the audience have a sense of immersion and interactivity.

With the development of computer technology and the maturity of VR technology, more and more enterprises introduce VR virtual security experience hall into safety education and training. Based on the actual engineering situation, 3D model is constructed, rendering technology is used to present realistic virtual reality environment, and computer programming is used to simulate construction links with high risk. This kind of scene simulation based on VR technology can meet the personalized needs of different projects in scene restoration, meet the fine requirements of difficult projects in detail processing, and can give engineers a deeper sense of experience and more targeted special education.

"VR, as a new carrier and new media, brings new opportunities to the integration of embodied cognition and education" [3]. The application of VR technology is an important measure of safety information dissemination reform, which is of great significance to improve the quality of safety education and training. However, VR virtual security experience is still in the development stage. The development and construction of VR virtual scene and the purchase and maintenance of VR equipment are relatively high, which limits the practical application and development of virtual security experience museum to a certain extent. In addition, the human-computer interaction of engineers in the virtual scene is often limited by the computer program written in advance, so it is difficult to truly simulate the rapidly changing situation and flexible solutions when construction hazards occur.

## V. ADVANTAGES OF SAFETY INFORMATION DISSEMINATION BASED ON VR TECHNOLOGY

### 1. Give full play to the advantages of multimedia resources and enrich the content of safety teaching

The traditional safety education and training often stick to the stereotype, the form is rigid, and the teaching content is often simple and unchangeable. The safety education and training of immersive engineering personnel based on scenario simulation method fully integrates all kinds of multimedia resources, and uses the immersive scene simulation system including VR, AR, 3D images and VR technology to vividly display different scenes in life and engineering work in front of the engineers. By creating different virtual scenes, engineers can quickly experience a variety of different scenarios, feel the possible dangers in different scenarios from multiple perspectives, and learn coping methods and self-protection measures. Rich multimedia resources not only change the monotonous teaching form, but also broaden the source of knowledge, provide sensory conditions for the spread of knowledge, and make safety education and training change from "plane mode" to "three-dimensional mode".

### 2. Improve the enthusiasm and initiative of engineering personnel

"Using virtual reality technology to expand education content can lead students to actively participate in education"<sup>[4]</sup>. The best way of safety information dissemination pays attention to autonomy. The immersive safety information dissemination based on VR technology aims to enable engineers to independently integrate into the created situation, master safety knowledge and skills and learn to use them flexibly in the process of wholeheartedly engaging. In the "immersion" learning, engineers can choose the information they want to absorb to process and create, which has a great help to attract engineers' attention and cultivate their interest. Through role-playing, immersion learning improves the learning enthusiasm of engineering personnel, deepens their understanding of training knowledge, and guides engineers to discover problems spontaneously, raise problems, and finally solve problems through practice, thinking and dissemination. Once engineers are faced with the same or similar situation, they can easily choose to judge the situation, obtain effective information, and then quickly make effective response measures. It can be said that the use of immersive scene simulation teaching method can often make the safety education and training achieve twice the result with half the effort.

### 3. Break the limitation of teaching time and space and improve the scale of training

The traditional safety education and training needs trainers and engineers to live in the same room, so it is difficult to carry out large-scale safety education and training due to the limitation of the number of trainers and the scale of the site. With the development of Internet and virtual reality technology, safety education and training can break through the limitation of space and time. Through cloud classroom, we can break the space limit, and at the same time, we can carry

out safety education and training for a large number of engineering personnel. By storing the existing courses through the network database, we can break the time limit and let the engineering personnel study anytime and anywhere.

#### *4. Introduce experiential practice teaching to strengthen theoretical knowledge*

The traditional safety education and training is often led by trainers, and the trainees passively accept the contents. The experiential practice teaching takes the trainees as the center, takes the actual experience as the means, gives full play to the subjective initiative, and changes passive learning into active learning. Experiential practice teaching is carried out in real or simulated environment, and the uncertainty in the process of teaching can exercise the adaptability of engineers. Experiential practice teaching breaks the embarrassing situation of "outsider" identity and "paper soldier" of engineering personnel under the traditional mode, and promotes the improvement of safety awareness level and safety operation ability through practical operation and personal operation. Experiential practice teaching takes practice as a means, attaches importance to the thinking in the practice exercise; takes exchange and review as the guarantee, emphasizes the summary and reflection after the practice exercise, so as to improve the training quality and achieve the training purpose.

#### *5. Low cost and high benefit*

VR virtual experience does not need to repeatedly build the physical experience area, which greatly reduces the unnecessary construction cost and demolition cost, greatly reduces the setting up time, avoids the waste of construction period, can be reused, more efficient, green and environmental protection, and reduces the project cost. The traditional safety education and accident drill are limited by the site to a great extent, which not only covers a large area, but also has a lot of display equipment and manpower. The actual investment cost is large, and usually several accident drills need to spend a lot of expenses. The virtual security experience realized by VR can realize the scene maximization, which only needs to consider the hardware investment. In this way, a more reasonable resource allocation can be realized. The actual area of accident drill is relatively wide. According to the actual size of the project, not only the display equipment area but also the space occupied by the construction personnel during the disclosure should be considered. VR security experience hall only needs to consider the latter factor, customize the content of security experience according to the actual needs of the project, and realize the experience mode of virtual space by category and region according to the process of education disclosure. It greatly reduces the actual space occupied by the site, increases the space utilization rate of the experiential, and effectively realizes the rational allocation of resources. The cost of moving and reusing is low, and the physical security experience hall is complex to move and has low reuse rate. However, VR security experience hall has the characteristics of modular replication of project content, portable hardware equipment and high reuse rate in the transfer process, which

greatly reduces the risk of cost loss in the process of secondary transportation.

#### VI. PROBLEMS OF VR TECHNOLOGY APPLIED IN SECURITY INFORMATION DISSEMINATION

"In recent years, virtual reality technology is entering a new explosive growth stage, which is a new opportunity for safety education that introduces VR technology earlier"<sup>[5]</sup>. Compared with the physical experience area, virtual experience area can show more experience scenes, such as scenes that are difficult to build, scenes with high risk, etc. at the same time, VR scenes are more real and complete, the sense of experience is stronger, and the effect of safety education is more obvious. According to the actual construction project, the software carries out real scene virtual online, carries out safety simulation in a certain position of the current project, so that the personnel can directly carry out safety experience in the virtual project, and the effect of education experience is more direct. Therefore, I advocate that we can use VR technology to make us do better in safety education. But it is undeniable that VR technology still has some problems in the security information dissemination, we need to pay attention to these problems, in order to lay the foundation for finding a better application mode.

In scenario simulation, scenario design and case selection are the key factors affecting VR safety education and training, but how to design needs multi-party participation. In order to play its due effect and make the engineers enter the immersion state, it is necessary to design the plot, arrange the scene, set off the atmosphere and decorate the sound effect logically according to the actual situation of the project, so as to create a sense of immersion and ensure the smooth development of the immersion scene simulation teaching. This requires that the scene design is real and reasonable, PPT and film are closely linked, and case selection has typical educational significance. At the same time, it is particularly important for the lecturer to control and mobilize the scene atmosphere. By asking questions, engineers can be guided to think and explore, so as to change passive learning into active learning.

3D projection, VR and other technologies need professional equipment support, expensive equipment and less digital resources. Immersive virtual reality system has powerful functions, but at present, due to the maintenance and support of the system, the equipment is more expensive. Fortunately, with the rapid development of technology, the cost of immersive virtual reality system will be lower and lower. At present, 3D and VR application software and video format conversion software based on mobile phones have appeared. As long as they are equipped with special external devices such as glasses and handles, they can be good substitutes. At the same time, mobile phone has better flexibility and universality, which is conducive to the development of large-scale and multi population safety education and training. However, such portable terminals still cannot compare with large devices in terms of immersion effect. How to improve the universal application of VR technology is an important problem we are facing.

## VII. SUMMARY

Using VR technology to carry out safety education can form an immersive feeling in the dangerous scene, and can give strong psychological effect to the experimenter. Whenever dangerous operation or dangerous state is found, learners will think of the harm caused to themselves when the danger occurs in the virtual scene, so that they can pay more attention to safety awareness and safe operation in the future production.

Scene simulation teaching method and immersive learning based on VR technology have been widely used in safety information dissemination, but there are still some problems such as superficial form and low efficiency, which are also related to the characteristics of VR teaching, such as demanding scenario design requirements, expensive equipment prices, and fewer trainees. How to apply VR technology based security information dissemination mode more widely, give play to its strong immersion, high authenticity, interesting and other advantages, at the same

time, avoid or weaken its problems and defects, which should be considered and paid attention to at present. Many industries have been plagued by safety accidents for a long time. If we can start from the source of safety information dissemination and reduce the unsafe behaviors of engineering personnel, we can certainly get good results.

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