The Impact of Information Graphics on Fire Evacuation of Chinese Students: A Case Study of Sichuan University of Light Industry and Chemical Technology

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Abstract

With the rapid advancement of technology, ensuring the safety of campus fire evacuations has become a significant focus. This empirical study was conducted at Sichuan University of Light Industry and Chemical Technology. The research aims to: 1. Explore the effectiveness of achievement scores after the use of information graphics for dormitory students. 2. Gather feedback on the use of these information graphics. The population for this study consisted of 50 dormitory students from Sichuan University of Light Industry and Chemical Technology. The research instruments included: 1. Information Graphics on fire evacuation 2. Achievement test papers 3. A questionnaire to assess students' satisfaction with the use of Information Graphics. The statistical methods used in this research included: 1. Mean ($\bar{X}$) 2. Standard deviation (S.D.) 3. Effectiveness index 4. Content analysis technique. The results indicate a comparison of students' pre- and post-test scores regarding fire safety awareness after using the Information Graphics for independent learning. The mean score on the pretest was 32.82, with a standard deviation of 2.26. After using the Information Graphics, students' performance significantly improved, achieving a mean score of 37.48 with a standard deviation of 2.23. The t-test results revealed a significant difference, showing a t-value of -32.229, which is statistically significant at the 0.05 level (t=-32.229, p=0.00). The effectiveness index was 0.38, indicating that students had a 38 percent improvement in their post-test scores. Feedback from students showed a high level of satisfaction with the use of Information Graphics for independent learning, which effectively enhanced their fire safety awareness.

Keywords: Information Graphics, Fire Evacuation, Dormitory Chinese Students, Training Effectiveness

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1. Introduction

1.1 Research Background

The training effectiveness of fire evacuation for Chinese students is directly related to their life safety and the quality of campus safety management. With the continuous development of technology, information graphics, as an intuitive and easy to understand tool for information transmission, are widely used in the field of safety, providing new possibilities for evacuation during disasters. The potential threat of fire to student accommodation has aroused deep concern from various sectors of society on how to improve the efficiency of fire evacuation. School administrators, fire departments, and students themselves need to take prompt and effective measures in the event of a fire to minimize potential risks. The application of information graphics as a visual means of conveying information in fire evacuation, especially in the environment of Chinese student dormitories, is a highly concerned topic.

1.2 Problem of Population

Currently, Chinese student fire evacuation faces a series of challenges, including a large number of personnel, complex evacuation routes, and uncertain student behavior. In this context, information graphics, as an intuitive and clear tool for information transmission, have the potential to play a positive role in improving the efficiency of student fire evacuation. However, in response to the actual situation of Chinese students, especially in large-scale student dormitories, there is still some uncertainty in the design and application of information graphics. Student accommodation safety has always been a concern for society and school administrators, especially in emergency situations such as fires, where rapid and orderly evacuation becomes crucial. Chinese universities, such as Sichuan University of Light Industry and Chemical Technology, not only have a large number of students but also complex and diverse student accommodation environments, including student dormitories, apartments, rental housing, etc. Therefore, improving the efficiency of student fire evacuation is crucial for ensuring student life safety.

1.3 Solution to Solve the Problems

Internationally, information graphics have been successfully applied to enhance public awareness and response capabilities in emergency situations. For example, in fire evacuation, clear information graphics can not only guide evacuation directions but also help students understand emergency situations more quickly. This intuitive way of information transmission is widely accepted internationally, providing new ideas and possibilities for improving the efficiency of student fire evacuation. Sichuan University of Light Industry and Chemical Technology, as a typical Chinese university, has a large student population and diverse accommodation environment. In this context, the issue of student fire evacuation is more complex and urgent. By taking Sichuan University of Light Industry and Chemical Technology as an example, we can gain a deeper understanding of the specific situation of fire evacuation among Chinese students, providing specific reference and inspiration for the design and implementation of information graphics. In the current context of student fire evacuation, this study focuses on the role of information graphics in Chinese student fire evacuation. Through a case study of Sichuan University of Light Industry and Chemical Technology, the aim is to explore the practical effects of information graphics on improving

students' fire safety awareness, guiding evacuation directions, and optimizing evacuation processes.

By comparing successful international experiences, feasible improvement suggestions are provided for the actual situation of fire evacuation among Chinese students in order to promote practice and research in the field of student fire evacuation. In this context, this study takes Sichuan University of Light Industry and Chemical Technology as an example to explore the practical impact of information graphics on the evacuation of Chinese student fires. As one of the most populous countries in the world, China has a huge student population. The safety of student accommodation has always been a concern of society, and fires, as a potential threat, pose serious safety hazards to student dormitories. Currently, schools and relevant management departments are committed to improving the safety evacuation ability of students in the event of a fire by establishing firefighting facilities and conducting regular drills. However, in emergency situations, the level of calmness and quick response of students remain key factors affecting evacuation training effectiveness.

1.4 Research Questions

(1) How is training effectiveness after use of the information graphics?
(2) What is the feedback of dormitory students for the next development on fire evacuation?

1.5 Research Objectives

(1) Explore of Training effectiveness after using the Information graphics of dormitory students.
(2) Explore the feedback of using the information graphics.

2. Research Methods

The research population were 50 students from the dormitories of Sichuan University of Light Industry and Chemical Technology. The training time was one month. A questionnaire survey was conducted to conduct pre-training and post-training tests.

2.1 Research Design

Selection of research methods: literature reference method, questionnaire survey method, learning process observation/interview, using independent training method. In the current era of continuous changes in education, independent learning has become an essential ability for students. It not only helps to improve students' comprehensive quality but also allows them to cultivate their innovative spirit in continuous exploration. As an efficient visual expression, information graphics can help students understand complex concepts more easily, thereby improving learning results. Therefore, it is of great significance to guide students to understand information graphics through independent learning.

Pre-test	Activities	Post-test
O_1	X	O_2

O1 Measurement of pre-test score
X   Self-learning and using information graphics
O2 Measurement of post-test score

Preliminary investigation Conduct an investigation into the current situation of school fire evacuation, including fire equipment, evacuation routes, and past fire drills. And conduct a questionnaire survey on students to understand their understanding and experience of fire evacuation.

The questionnaire survey is mainly based on multiple choice questions. There are 45 questions in total, most of which are Single choice question questions. A small number of questions are multiple choice questions, and each question has 1 point. It covers the knowledge of fire safety awareness, escape self-rescue ability, fire safety psychology, etc.

The survey results show that students have a generally good grasp of fire safety knowledge. Most respondents expressed familiarity with the use of basic firefighting facilities and equipment, such as fire extinguishers, fire hydrants, etc. However, the level of understanding of more professional fire safety knowledge and skills, such as the correct methods of evacuation and escape, and the maintenance of firefighting facilities, is relatively low. This indicates that schools should strengthen their efforts in fire safety education, enhance students' awareness of fire safety and their ability to self-rescue and mutual aid.

2.2 Information Graphics Design and Implementation

Based on the preliminary survey results, design information graphics that are in line with the actual situation of the school. Practical application in key areas such as student dormitories.

In the context of student fire evacuation, the design of information graphics can provide clear evacuation guidelines for emergency situations, enabling students to respond more quickly and orderly. Its visual characteristics enable students to quickly understand evacuation routes and the location of safety exits even under pressure in emergency situations such as fires, thereby improving evacuation efficiency. As shown in the Figure 1.
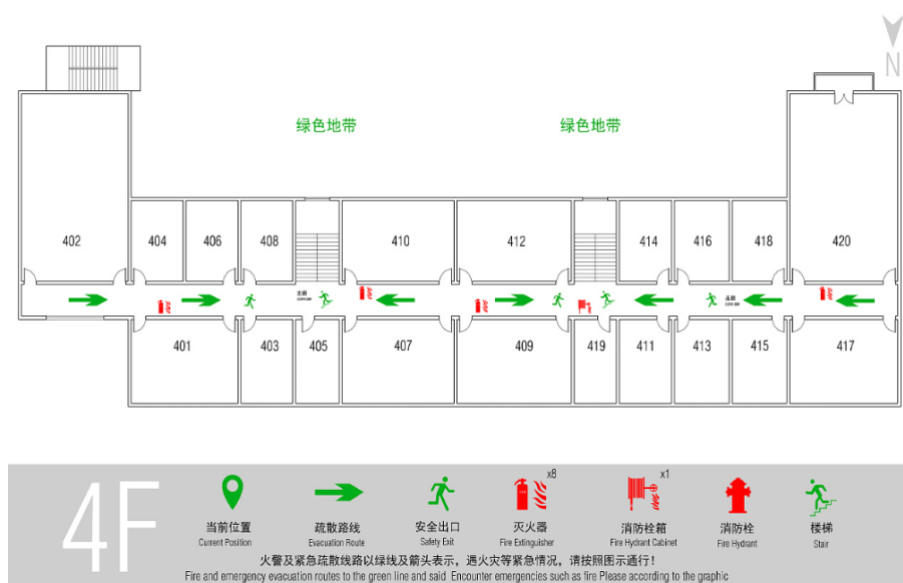

Figure 1: Evacuation Guidelines for Emergency Situations

The correct evacuation steps are crucial in the event of a fire. Here are some key evacuation steps:

- Stay calm: In the event of a fire, staying calm is the first step to successfully escaping. Don't panic, quickly analyze the situation on site and find the best escape route.
- Call the fire alarm number: Immediately call the fire alarm number 119 to report the location and situation of the fire, so that professionals can handle it in a timely manner.
- Determine the escape route: Determine the location of the fire point. If the fire is small, you can put out the fire yourself; if the fire is large, flee immediately.
- Use fire escape routes: Use fire elevators or stairs to escape and avoid using regular elevators as they may experience power outages or malfunctions during a fire.
- Cover your mouth and nose with a wet towel: Cover your mouth and nose with a wet towel, clothing, or other usable fabric to prevent inhaling toxic smoke.
- Low posture escape: Try to move forward in a low posture as smoke and toxic gases often accumulate in the upper part.
- Close the doors and windows that have not escaped: If it is not possible to escape immediately, the doors and windows should be closed, and wet towels, fabrics, etc. should be used to block the gaps between the doors and windows to prevent smoke from entering.
- Escape using ropes: If the escape route is blocked, homemade ropes such as bed sheets and curtains can be used to escape through windows.
- Don't be greedy for property: During the escape process, don't waste time trying to save property. Life safety is always the top priority.
- Seeking help: If unable to escape on your own, you should send out distress signals by tapping objects, waving clothes, etc., to attract the attention of rescue personnel.

2.3 Implementation Period

Conduct a period of practical application to monitor the performance of students during the fire evacuation process.

Through training observation, students are able to correctly use basic facilities such as fire hydrants and fire extinguishers, and their fire safety awareness and self-rescue and mutual aid abilities are gradually improving.

The steps for using a fire extinguisher are as follows:

- Lifting the fire extinguisher: Firstly, it is necessary to lift the fire extinguisher to ensure easy operation.
- Remove the safety pin: Find and remove the safety pin so that the fire extinguisher can be activated.
- Grasp the nozzle: Hold the nozzle with one hand and the handle with the other hand to ensure accurate spraying of the fire extinguishing agent.
- Aim at the root of the flame: Aim the nozzle at the root of the flame, which is the key position for extinguishing the fire and can more effectively extinguish the source of the fire.
- Press down the handle to spray: Finally, press down the handle to spray until the flame is completely extinguished. As shown in the Figure 2.

Figure 2: Using a Fire Extinguisher

2.4 Data Collection

Various methods are used for data collection, including observation records, student feedback, questionnaire surveys, etc., to obtain comprehensive research data.

2.5 Data Analysis Methods

Quantitative data analysis: Using statistical methods to analyze quantitative data on student evacuation efficiency. Qualitative data analysis: Conduct qualitative analysis on students' cognition and feedback on information graphics and explore deeper information through thematic analysis and other methods.

3. Research Results

3.1 Training Effectiveness After Using the Information Graphics of Dormitory Students

Achievement papers result as shown in Table 1.

Table 1: Shown the Pre-test and Post-test Scores of Using Information Graphics

Name	Pre-test (P1)	Post-test (P2)
Student 1	36	40
Student 2	30	37
Student 3	32	34
Student 4	29	35
Student 5	31	38
Student 6	33	36
Student 7	30	35
Student 8	35	41

Student 9	29	33
Student 10	30	35
Student 11	33	37
Student 12	32	37
Student 13	37	40
Student 14	33	37
Student 15	34	38
Student 16	32	36
Student 17	36	39
Student 18	30	34
Student 19	35	38
Student 20	32	36
Student 21	33	38
Student 22	32	35
Student 23	36	40
Student 24	29	35
Student 25	33	37
Student 26	32	38
Student 27	34	39
Student 28	34	40
Student 29	35	41
Student 30	30	35
Student 31	37	42
Student 32	33	37
Student 33	33	38
Student 34	34	39
Student 35	35	40
Student 36	30	35
Student 37	34	38
Student 38	36	41
Student 39	29	34
Student 40	32	36
Student 41	32	37
Student 42	35	40
Student 43	34	39
Student 44	33	37
Student 45	33	38
Student 46	32	37
Student 47	36	41
Student 48	31	36
Student 49	35	40
Student 50	30	35
sum	1641	1874

3.1.1 Effectiveness Scores

The calculation is as follows:

$$\frac{P2-P1}{Total-P1} = \frac{1874-1641}{(50\times45)-1641} = 0.38\times100\% = 38\%$$

P1= Pre-test
P2= Post-test

Total= Number of students × Total question score

The effectiveness index was .38 in other words, the students had higher post-test scores of 38 percent.

3.1.2 Comparison of Scores Before and After Testing

Comparison of scores before and after testing result as shown in Table 2.

Table 2: Comparison of Scores Before and After Testing

Items	n	$\overline{X}$	S.D.	t-Test	Sig.(2-tailed)
Pre-test	50	32.82	2.26	-32.229	0.00
Post-test	50	37.48	2.23		

P<0.05

Table 2 Show the comparison of students' fire safety awareness scores before and after test is displayed. The average score of the pre-test is 32.82, with a standard deviation (S.D.) score of 2.26. After using Information Graphics through self-directed learning, students' grades significantly improved, resulting in a high score of 37.48 and a standard deviation (S.D.) of 2.23. The t-test before and after the test showed a significant difference of -32.229, which is statistically significant at the 0.05 level.

3.2 The Feedback of Using the Information Graphics

The feedback of using the Information graphics as shown as Table 3.

Table 3: Satisfaction Assessment of Students Using Information Graphics Through Self-Directed Learning

Statement	Mean	S.D.	Result Interpretation
1. Are you satisfied with self-directed learning?	5.00	0.00	Very satisfaction
2. Are you satisfied with using fire evacuation information graphics?	4.96	0.20	Very satisfaction
3. Are you satisfied with the smooth flow of the safety exits?	4.96	0.20	Very satisfaction
4. Are you satisfied with fire safety awareness education?	4.94	0.24	Very satisfaction
5. Are you satisfied with the completeness of fire protection facilities?	4.92	0.27	Very satisfaction
6. Are you satisfied with the speed of fire response?	4.92	0.27	Very satisfaction
7. Are you satisfied with the school's fire safety management?	4.92	0.27	Very satisfaction
8. Are you satisfied with the effectiveness of the fire drill?	4.90	0.30	Very satisfaction
9. Are you satisfied with the lecture on fire safety knowledge?	4.90	0.30	Very satisfaction
10. Are you satisfied with the clarity of emergency evacuation signs?	4.88	0.33	Very satisfaction
Total	4.93	0.03	Very satisfaction

Table 3 the mean score ranged between 4.88 and 5.00, which was between averages to high levels. The highest mean score (5.00) was the item "Are you satisfied with self-directed learning?". The lowest mean score (4.88) was the item "Are you satisfied with the claim of emergency evacuation signs?". This indicates that students are very satisfied with the recognition of using Information Graphics through self-directed learning.

Conclusion

In the information age, Information Graphics, as an intuitive and efficient way of information transmission, have shown great potential in student fire evacuation. By comprehensively considering design principles, student feedback, and actual testing results, we can better apply information graphics to campus safety management, enhance students' self-rescue abilities in emergency situations, and thus better ensure campus safety.

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