Analysis of the Influence of Safety Education on Construction Safety Behavior

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Abstract

Safety accidents in the construction industry occur frequently, which threatens the safety of life and property of construction workers and affects the success or failure of construction projects. In order to reduce the probability of construction accidents, effectively solve the problem of safety production, further explore the mechanism of safety education on the safety behavior of employees, the questionnaire survey method was used to collect data from the construction site and use it as a sample to study the impact of safety education on the safety behavior of construction workers.Based on the theoretical analysis, AMOS software was used to collate and analyze the survey data, and the structural equation model was used for empirical testing. The results show that the safety atmosphere and safety awareness have a direct and significant positive impact on the safety behavior of construction personnel; and safety education acts on safety behavior of construction personnel through safety atmosphere and safety awareness. Research shows that safety education is conducive to the improvement of construction workers' safety behavior and improve safety production capacity.

Keywords

Safety education; safety behavior; safety atmosphere; safety awareness.

1. Introduction

Safety is the prerequisite for social harmony and the basic guarantee for the healthy development of the company. Building construction companies are directly engaged in construction operations, and their safety management is not only concerned by the public, but also serves as a vehicle for embodying corporate competitiveness. In recent years, major safety accidents such as the fall of elevators on construction sites in a certain district in Wuhan and the overturning of a residential building in Shanghai have caused more and more construction companies to pay more attention to safety.

At present, China is in the history of the world's largest basic construction, but also faced with a grim security situation [1]. In a construction company, the root cause of human unsafe behavior lies in its weak sense of safety, poor safety habits, lack of proper safety knowledge and skills, and how to eliminate unsafe behavior, largely depends on safety education [2]. Therefore, to explore the impact of safety education on safety behavior has significant implications for improving the safety behavior of construction workers and improving the safety management level of construction companies.

Safety education is an important way to prevent employees from creating unsafe behavior. The so-called security is not to eliminate all potential security risks, but to make the system not exceed the allowable limit [3]. Safe behavior refers to all behaviors in which people obey the operating procedures during work and can protect themselves and protect tools, equipment, and other materials in the event of a security accident [4].Based on the findings of Rasmussen [5], defining the safety behavior of construction workers refers to the goal behavior that can be safely completed during the construction process to avoid accidents.Improving the safety quality of construction workers is the foundation for safe production. Only through safety education can the safety awareness of construction workers be improved, the safety production knowledge can be mastered, the safety operation skills can be improved, the self-protection ability can be enhanced, and the number of

casualties can be reduced. With the deepening of the reform of the construction industry, the number of high-rise housing constructions has increased and become higher, and the degree of mechanization has increased. The structure of participating construction workers has undergone tremendous changes, and a large number of migrant workers have participated in the construction, which shows that the necessity and importance of strengthening education. Not only are special operators required to carry out safety education and training, they must hold certificates, and general workers, managers, commanders and leaders at all levels must undergo safety education and training, otherwise they cannot adapt to the development of the construction industry.

2. Research hypothesis

2.1 Security education

Safety education is an important way to prevent employees from creating unsafe behavior. Safety education plays an important role in the development of safety awareness for construction workers and improvement of the safety atmosphere at the construction site. Yi Du [6] pointed out that insecurity of safety awareness is the most direct cause of accidents, and safety awareness must be gradually established through long-term, long-lasting, and effective safety education. Jialei Cheng[7] pointed out that safety education has a significant impact on the safety atmosphere. Based on the above analysis, this paper proposes the following assumptions.

H 1 : Safety education has a positive impact on improving the safety atmosphere

H 2 : Safety education has a positive impact on the safety awareness of construction workers.

2.2 Safety atmosphere

The concept of a safety atmosphere was proposed by Zohar [8], which is defined as the common perception of employees within a company with a hazardous operating environment. Related studies have found that safety accidents have a lot to do with the safety atmosphere of the construction site where construction workers are located. Subsequently, many scholars conducted in-depth theoretical and empirical research on the safety atmosphere. Dedobbeleer et al. [9] conducted research on the safety atmosphere for the construction industry. Gaosheng Yang [10] verified that the construction site safety atmosphere has a significant positive impact on the safety behavior of construction workers. Yan Hu [11] pointed out that the better the safety atmosphere, the higher the employee's perception of the quality of work life, the more emphasis on safety behavior. Based on the above analysis, this paper proposes the following assumptions.

H 3 : A good safety atmosphere has a positive impact on the safety behavior of construction workers.

2.3 Safety awareness

The so-called safety awareness is the concept that production must be safe in people's minds, and it is a psychological state that people are alert to the external environmental conditions that may harm oneself or others in production activities. The accident was caused by human insecurity and the insecure state of things, while the insecurity was mostly caused by human unsafe behavior. The root cause of people’s unsafe behavior is that people’s safety awareness is not clear, that is, people are not alert to the objective things that may harm themselves or others in production and life. Based on the above analysis, this paper proposes the following assumptions.

H 4 : The higher safety awareness of construction workers has a positive effect on safety behavior.

After the above analysis, the conceptual model of the impact of safety education on safety behavior is presented in Fig.1.

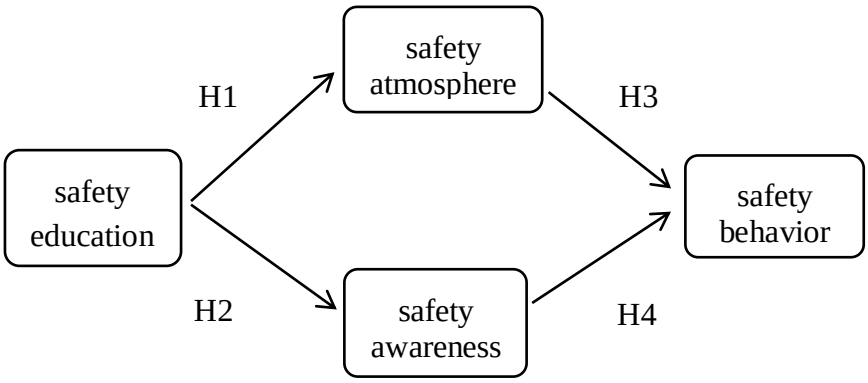


Fig.1 Effect model of safety education on safety behavior

3. Research methods

A questionnaire survey was conducted on employees of construction companies. A total of 200 questionnaires were sent out, 186 were recovered, excluding questionnaires filled with omissions and gaps, and questionnaires that were not earnest filled out.Finally, 153 valid questionnaires were obtained, and valid questionnaires accounted for 76.5% of the total questionnaires. Among the respondents, 78% were between 20 and 30 years old, 29% were between 30 and 40 years old, and 90% were college graduate or college degree or above.

4. Empirical analysis

4.1 Model Fitting

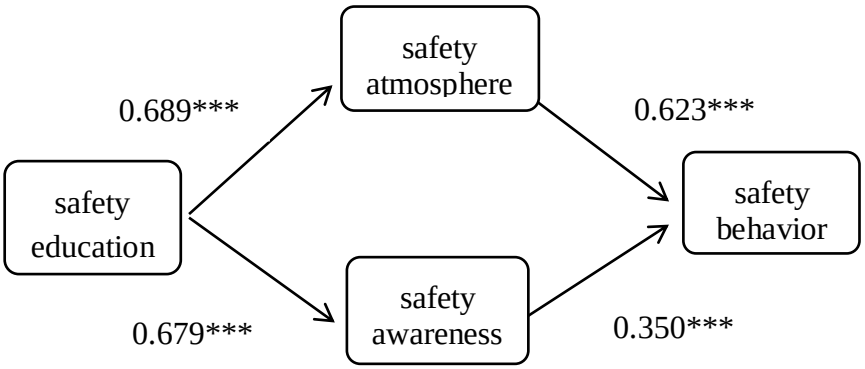
AMOS 17.0 software was used for analysis and it was found that the fit index of safety education on safety behavior impact model was up to standard. Among them, $\chi 2$ /df =1. 10, not only less than the maximum upper limit 5, but also less than the more rigorous indicator 3; RMSEA = 0.025, less than the upper limit requirement of 0.05; the values of GFI, AGFI, and IFI are respectively 0. 959,0. 920,0. 994, all greater than 0.9, up to standard. From the normalized path coefficients of each variable in Fig. 1, other hypotheses have been verified except that hypothesis H 4 has not been verified.

4.2 Cause and effect analysis

The main role of the structural equation model is to reveal the structural relationships among latent variables (or between latent variables and observed variables and between observed variables), and these relationships are represented in the model by path coefficients. For these coefficients, researchers can analyze the direct effect, the indirect effect, and the total effect.

4. 2. 1 Direct effect

The direct effect refers to the direct effect of the cause variable (exogenous or endogenous) to the outcome variable (endogenous), and the path coefficient of the common cause variable to the outcome variable.



*** indicates significant at the 0.001 level; ** indicates significant at the 0.01 level
Fig. 2 Path analysis of the impact of safety education on safety behavior

From Fig. 2, we can see that the standardized path coefficient of safety education to safety atmosphere is 0. 689, which means the direct effect of safety education to safety atmosphere is 0. 689, which indicates that when other conditions are not changed, the “safety education” latent variables are increased. In 1 unit, the “safety atmosphere” latent variable will directly increase by 0. 689 units. The direct effect of safety education to safety awareness is 0. 679, ie, when other conditions remain unchanged, “safety awareness” will increase by 0. 679 units for every 1 unit of “safety education”. The standardized path coefficient of security atmosphere to safety behavior is 0.623, ie, the direct effect of safety atmosphere to safety behavior is 0.623, which indicates that when other conditions are constant, the “safe atmosphere” latent variable is increased by 1 unit, “ The "safe behavior" latent variable will directly increase 0. 623 units. Safety awareness that the direct effect of safety behavior is 0.350, which indicates that when the other conditions remain the same, the “safety behavior” latent variable will increase by 0. 350 units for every 1 unit increase in “safety awareness” latent variables. The direct impact of safety education on safety behavior has not been verified.

4.2. 2 Mesomeric effect

The mesomeric effect refers to the influence relationship between variables (XY), which is not a direct causal chain relationship, but is produced through the indirect effects of one or more variables (called the mediator variable M), and the indirect effect of X on Y through M is called the mesomeric effect. The mesomeric effect is a kind of indirect effect. When the model has only one mediator variable, the mesomeric effect is equal to the indirect effect. When there is not only one mediator variable, the mesomeric effect is not equal to the indirect effect. In this case, the indirect effect is the sum of all mesomeric effects. There are two mediating variables in this model, namely the safety atmosphere and safety awareness, and they are tested for mediating effects respectively.

1) The mesomeric effect of safety atmosphere in the impact of safety education on safety behaviors.

Using SPSS 19.0 for analysis, the results show that the safety atmosphere plays a role of a complete intermediary in the impact of safety education on safety behavior (Table 3). The original coefficient of effect c was 0.671, and it was significant at the level of 1%, which indicated that the safety education had a positive impact on the promotion of employee safety behavior; the regression coefficients a and b were 0.689, 0.623, respectively. The 1% level was significant, indicating that the mesomeric effect was significant; the mesomeric effect value was 0.429, accounting for 63.93% of the total effect, suggesting that the safety atmosphere could explain the effect of safety education on safety behaviour by 63.93%.

2) The mesomeric effect of safety awareness in the impact of safety education on safety behaviors.

Safety awareness plays a role of a complete intermediary in the impact of safety education on safety behavior (Table 3). The original coefficient of effect c was 0.671, and it was significant at the level of 1%, which indicated that the safety education had a positive impact on the promotion of employee safety behavior; the regression coefficients a and b were 0. 679 and 0. 350, respectively.The 1% level was significant, indicating that the mesomeric effect was significant; the mesomeric effect value was 0.238, accounting for 35.42% of the total effect, suggesting that the safety awareness could explain the effect of safety education on safety behaviour by 35.42%.

From the above analysis, we can see that safety education influences safety behavior through two mediating variables: safety atmosphere and safety awareness. The indirect effect of safety education to safety behavior is 0. 689 × 0. 623 + 0. 679 × 0. 350 = 0 667. This shows that when the other conditions are not changed, every time the latent variable of safety education is increased by 1 unit, the latent variable of safety behavior will indirectly increase 0. 667 units.

Table 3 Intermediary effect test results of Safety atmosphere and safety awareness

Intermediary variable lnk	Original effect coefficient c	Mediation effect regression coefficient		Soble test Zab		
		a	b	Direct effect c'	Intermediary effect ab	Mediation/total effect (ab/c)
Safety atmosphere	0.671**	0.689**	0.623**	0.242**	0.429**	0.6393
Safety awareness	0.671**	0.679**	0.350**	0.433**	0.238**	0.3542

4.2. 3 Total effect

The total impact from the cause variable to the result variable is the sum of the direct and indirect effects. The above analysis shows that the total effect of safety education on the safety atmosphere is the highest, which is 0. 689; followed by the total effect of safety education on safety awareness, which is 0. 679. The highest overall effect on safety behavior was safety education, which was 0. 667; followed by the safety atmosphere, and its total effect on safety behavior was 0. 623.

5. Conclusion

Safety atmosphere and safety awareness all have a direct and significant impact on safety behavior. The standard path coefficient of safety atmosphere to safety behavior is 0. 623, and the standard path coefficient of safety awareness to safety behavior is 0. 350. It can be seen that the safety atmosphere has a greater impact on safety behavior than safety awareness. Although the direct impact of safety education on safety behavior is not very significant, the medium-effect coefficient of safety education through safety atmosphere and safety awareness on safety behavior has reached 0.667, which is higher than the direct effect coefficient of safety atmosphere and safety awareness on safety behavior. And the direct impact of safety education on safety atmosphere and safety awareness is significant.

Studies have shown that safety education at the construction site will help improve the safety atmosphere at the construction site and the construction staff's own safety awareness, and enhance the safety behavior of construction personnel, thus improving the safety production management level at the construction site.

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