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STUDY ON THE INFLUENCE OF SAFETY EDUCATION ON THE WILLINGNESS OF CONSTRUCTION WORKERS TO HABITUAL SAFETY BEHAVIOUR

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ABSTRACT

In order to explore the impact of safety education on the willingness of construction workers to habitual safety behaviours, the relevant literatures are analysed, relevant research hypotheses are proposed, and the theoretical model of habitual safety behaviour willingness influencing factors is established, and the verification and analysis are carried out by means of inter-group experiments. The results show that different types of safety education have different influences on the willingness of construction workers to habitual safety behaviours under the mediating role of time scale adjustment and perceptual behaviour control.

KEYWORDS

Safety education, Willingness to ac, Perceptual behaviour control, Time scale

INTRODUCTION

The construction industry plays a very important role in China's economic development and it is a pillar industry of China's national economy. However, construction safety accidents occur frequently, causing heavy losses in casualties. The Heinrich accident survey pointed out that the direct cause of a security incident is human unsafe behaviour. The unsafe behaviour of human beings is the result of the combined effects of various factors. Most of the construction workers have not received safety education, lack basic safety knowledge and construction skills, and are vulnerable to safety accidents [1]. Therefore, the implementation of safety behaviour of construction workers depends to a large extent on safety education.

The concept of willingness first came from the field of psychology research, and Fishbein (1975) defined willingness as the subjective probability that individuals engage in specific behaviours [2]. Ajzen (1991) defines the willingness to act as the degree to which an individual voluntarily performs a particular act and the level of effort that is intended to be done [3]. At present, there are few related studies on the impact of behavioural willingness and safety education. The root cause of unsafe behaviour of construction workers is their lack of safety awareness and lack of relevant safety knowledge [4]. Safety awareness must be gradually established through long-term, long-lasting and effective safety education [5], while workers have Safety knowledge affects their cognitive attitudes [6], and cognitive attitudes have a certain impact on behavioral willingness [7]. Therefore, it is of great significance to study the relationship between safety education and behavioural willingness and improve the quality of safety education, which is to improve the safety management effect of construction enterprises and reduce the accident rate of construction work.

THEORY AND ASSUMPTIONS

Safety education is an important measure to prevent unsafe behaviour of construction workers. The so-called safety is not to eliminate all potential accidents, but to make the system not exceed the allowable range [8]. Navidian pointed out that safety education plays a positive role in strengthening the knowledge and attitudes of workers, especially the implementation of safe behaviour [9]. Sun Jun pointed out that the safety awareness of workers has a direct and significant positive impact on construction safety behaviour [10]. The habitual safety behaviour of this paper refers to the daily repetitive construction behaviour, which needs to adjust the construction method and daily habit construction behaviour. The habitual safety behaviour will refer to the psychological tendency and behaviour motive of the individual before engaging in the habitual safety behaviour. Yang Gaosheng pointed out that the development of safe behaviour habits requires knowledge learning and experience accumulation [11]. Different types of safety education methods have different effects on the willingness to act. Starting from Maslow's "demand level theory", according to the most basic physiological needs, security needs, belonging and love needs, respect for needs, As well as self-fulfilling needs, the way of education is corresponding to economic education, social education influenced by others, social education and safety education that affect others. Yang Zhenhong pointed out that the influence degree of influencing factors of unsafe behaviour from large to small is individual susceptibility, safety atmosphere, communication behaviour characteristics, reward or punishment, and rewards safety modellers or members who punish unsafe behaviour, can suppress insecurity to some extent. The spread of behaviour [12]. Based on the above analysis, the following assumptions are made:

H1: Safety education has a significant positive impact on the willingness to habitual safety behaviour. Non-economic education is more likely to promote habitual safety behaviour than economic education. That is, the positive impact of economic education, social education influenced by others, social education and safety education affecting others on the willingness to habitual safety behaviours has increased in turn.

American scholar Ajzen (1985) first proposed the theory of planned behaviour, introducing the concept of perceptual behaviour control into the theory, and believed that perceptual behaviour control is an important factor affecting behavioural will [13]. Klöckner used a structural equation model to compare 56 data sets and found that perceptual behavioural control can predict behavioural will [14]. Xu Lizhong pointed out that people's knowledge base and understanding of things significantly affect the control of perceived behaviour [15]. Yuan Hongping [16] based on the theory of planned behaviour, found that the perceptual behaviour control has a significant impact on the willingness of architectural behaviour. Based on the above analysis, the following assumptions are made:

H2: Safety education has a positive impact on perceived behavioural control.

H3: Perceptual behavioural control has a positive impact on the willingness to habitual safety behaviour, and together with hypothesis H2, perceptual behavioural control plays a mediating role in the impact of safety education on the willingness to habitual safety behaviour.

Time scales are widely used in geography, atmospheric science, biological oceanography, physics, fractal geometry, and ecology. In the field of building safety education, there has not been any in-depth study on the regulation of time scales. However, in the field of propaganda, the propaganda content of different time scales has already appeared, such as "1 yuan per day, one year for broadband" and "broadband package". 350 yuan a year." The results show that people's perceptions of different units of measurement are different, and the information demands of

different units of measurement may have different effects. This paper argues that different time scales will regulate the process of safety education affecting the willingness of habitual safety behaviour, and divide the time scale into small scale (one day) and large scale (one year). Combined with the hypothesis H2 of the impact of safety education on perceived behavioural control, the following hypotheses are proposed:

H4: Time scales regulate the impact of safety education on the willingness to habitual safety behaviour.

H5: The time scale regulates the impact of safety education on perceived behavioural control, which in turn affects the willingness to habitual safety behaviour.

Based on the above analysis, the following research framework is established:

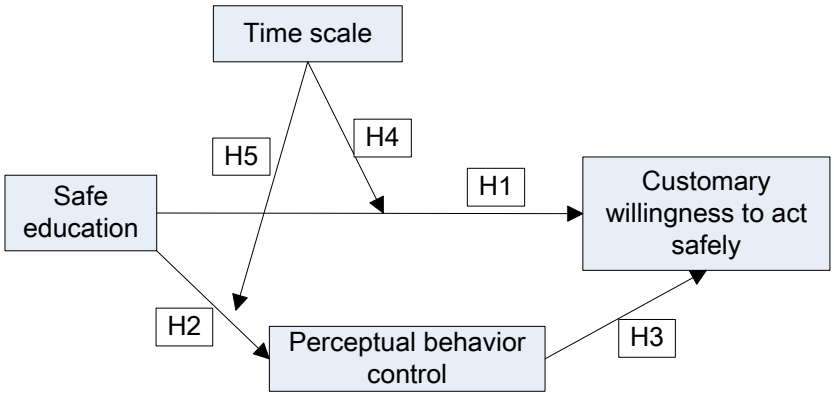

Fig.1 - Theoretical model of the influencing factors of habitual safety behaviour

RESERCH ESIGN AND EXPERIMENTAL ANALYSIS

Experimental design

The experimental method adopts 4 (safety education: economic education VS social education influenced by others VS social education affecting others VS safe education) × 2 (time scale: small scale VS large scale) inter-group factor design. Among them, Perceptual Behaviour Control Measurement Scale draws on the research results of Perujini [17], Taylor [18], etc., and divides perceptual behaviour control into control degree and difficulty level, and develops into willingness for habitual safety behaviour. Perceived Behaviour Control Scale. The research results of Shirley [19] and János [20], which are based on the habitual safety behaviour willingness measurement scale, are developed into a habitual safety behaviour willingness measurement scale by combining forward question and reverse question. A total of 216 valid data was collected from the experiment. The construction workers were randomly divided into 8 groups, and the number of participants in each experimental group was 27.

Experimental results and analysis

The reliability and validity of the scale are tested accordingly. In the reliability, the Cronbach's α value of the Perceived Behaviour Control Scale is 0. 711, and the Cronbach's α value of the Habitual Safety Behaviour Scale is 0. 762, both exceeding the standard of 0.7. In terms of validity, the confirmatory factor analysis showed that the factor load of the variable exceeded 0.5, the average variance of the variable (AVE) was close to 0.5, and the variable convergence efficiency was good, indicating the reliability and validity of the scale used in the study better.

Firstly, it analyzes the direct impact of safety education on the willingness of construction workers to conduct safe behavior. Using one-way analysis of variance, the results show that the average value of economic education, social education influenced by others, social education and safety education affecting others' habitual safety behaviors are 5.086, 5.107, 5.132, 5.141, indicating that the positive effects of the four educations on the willingness to habitual safety behavior increased in turn, but the analysis of variance showed that the four did not have statistically significant differences ($p>0.05$), indicating that the safety education is willing to the habit of customary safety behaviors. The effect is not significant, so assume that H1 is not verified.

Two-factor ANOVA is used to analyze the main effects of safety education and time scale and the interaction between them. The output results are shown in Table 1.

Tab. 1 - Regulatory effects of time scales on the impact of safety education on habitual safety behaviors

Category	Type III square sum SS	Degree of freedom df	Mean square MS	Statistic F	Significance P
Safe education	0.221	3，317	0.067	0.208	0.743
Time Scale	0.201	1，317	0.201	0.507	0.299
Safety education × time scale	9.038	3，317	3.006	8.485	0.000

The results showed that the interaction between safety education and time scale was significant ($F(3,317)=8.485$, $p<0.05$), indicating how one factor works and is affected by another. Therefore, after the interaction is significant, a simple effect test should be carried out to explore how the time scale affects the role of safety education in the willingness to habitual safety behavior. The results of the MANOVA simple effect test for safety education are shown in Table 2.

Tab. 2 - Simple effects of safety education

	Type III square sum SS	Degree of freedom df	Mean square MS	Statistic F	Significance P
Safety education (small scale)	6.01	3	2.01	5.62	0.001
Safety education (large scale)	3.31	3	1.04	3.17	0.022

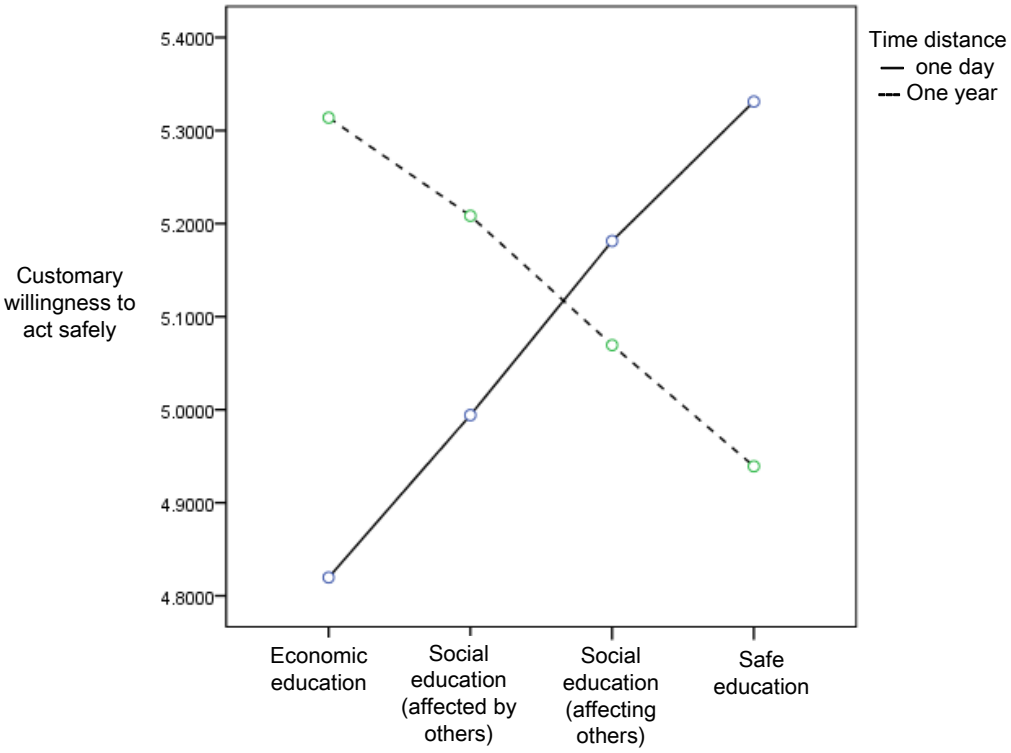

Fig. 2 - Simple effect of safety education

The simple effect results showed that there were significant differences in safety education at small scales (F=5.62, p=0.001<0.05) and large scales (F=3.17, p=0.022<0.05) (as shown in Figure 2). At a small time scale (one day), the willingness of the habitual safety behaviors of the four educations increased in turn; on the large time scale (one year), the willingness of the four types of education to habitually safe behavior decreased in turn. Among them, the safety information has a good matching effect with the small scale, and the economic information has a good matching effect with the large scale. The mean value of the habitual safety behavior will be 5.322 and 5.305 respectively. Assume that H4 is supported. When using small-scale safety education, safety education can promote the willingness of construction workers to generate habitual safety behaviors compared with economic education (see Figure 2); when using large-scale safety education, economic education is more important than safety education. It can

promote the willingness of construction workers to generate habitual safety behaviors (see Figure 2), assuming that H1 does not hold.

Using the mediation effect test procedure proposed by Zhao [21], based on the adjusted mediation analysis model proposed by Hayes [22], Bootstrap test is used to mediate the perceptual behavior control, with perceptual behavior control as the mediator variable and time scale as the regulatory variable. To test the mediating effect of the independent variable safety education on the perceptual behavioral control of the dependent variable habitual safety behavior and the time-scale adjustment effect (Table 3). The sample size is chosen to be 5000, in the 95% confidence interval.

Tab. 3 - Mediating effect of perceived behavioral control on the willingness of safety education to influence habitual safety behaviors

						95% confidence interval	
Input variable	Output variable	Effect size coeff	Standard error SE	Statistic T	Signific -ant P	Lower limit LLCI	Upper limit ULCI
safe education	Perceptual behavior control	0.2848	0.1148	2.4865	0.0134	0.0587	0.5109
Time Scale	Perceptual behavior control	0.5435	0.1923	2.8300	0.0049	0.1650	0.9220
Safety education × time scale	Perceptual behavior control	-0.2052	0.0722	-2.8508	0.0046	-0.3476	-0.0629
safe education	Customary willingness to act safely	0.3433	0.0785	4.3813	0.0000	0.1887	0.4979
Time Scale	Customary willingness to act safely	0.5549	0.1318	4.2139	0.0000	0.2953	0.8144
Perceptual behavior control	Customary willingness to act safely	0.4411	0.0377	11.6947	0.0000	1.7181	2.7048
Safety education × time scale	Customary willingness to act safely	-0.2061	0.0495	-4.1735	0.0000	-0.3030	-0.1085

Safety education has a positive impact on perceived behavioral control (LLCI=0.0587, ULCI=0.5109, coeff =0.2848), and this interval does not contain 0, assuming H2 is established. Perceptual behavior control has a significant positive impact on habitual behavioral willingness (LLCI=1.7181, ULCI=2.7048, coeff=0.4411), which does not include 0, assuming H3 is established.

The influence of time scale on the willingness of habitual safety behavior (LLCI=0.2953, ULCI=0.8144), the interval does not contain 0, and the interaction between safety education and time scale has a significant impact on the willingness of habitual safety behavior (LLCI=-0.3030, ULCI = -0.1085), assuming H4 is established, that is, the time scale adjusts the impact of safety education on the willingness to habitual safety behavior. The influence of time scale on perceptual behavior control (LLCI=0.1650, ULCI=0.9220), the interval does not contain 0, and the cross-terms of safety education and time scale have significant influence on perceptual behavior control (LLCI=-0.3476, ULCI=-0.0629), assuming that H5 is established, that is, the time scale regulates the impact of safety education on perceived behavioral control. In summary, safety education has a mediating effect on the willingness to habitual safety behavior.

Tab. 4 - Mediating effect of perceptual behavior control on the influence of safety education on habitual safety behavioral behavior at different time scales

Regulating variable state	Mediation effect type	Effect size coeff	Standard error SE	Statistic T	Significant P	95% confidence interval Lower limit LLCI	95% confidence interval Upper limit ULCI
Small scale	Direct effect	0.1362	0.0350	3.9156	0.0001	0.0673	0.2052
	Mediation effect	0.0342	0.0266*	—	Contains 0	-0.0148	0.0883
Large scale	Direct effect	-0.0688	0.0347	-2.0121	0.0450	-0.1371	-0.0006
	Mediation effect	-0.0550	0.0231*	—	Does not contain 0	-0.1004	-0.0107
Interaction	Mediation effect	-0.0902	0.0365*	—	Does not contain 0	-0.1671	-0.0220

Table 4 analyzes the mediating effects of safety education on the behavioral control of habitual safety behaviors in different time scales. The mediating effect of perceptual behavioral control on the willingness of safety education and time-scale interactions to influence habitual safety behaviors is negative (LLCI=-0.1671, ULCI=-0.0220, coeff=-0.0902). The impact of safety education on the willingness to habitual safety behavior on a time scale of one day (LLCI = 0.0673, ULCI = 0.2052), this interval does not include 0; the impact of safety education on the willingness to habitual safety behavior on a time scale of one year (LLCI=-0.1371, ULCI=-0.0006), this interval does not contain 0, that is, safety education has a significant impact on the willingness to habitual safety behavior. When the time scale is one day, the influence coefficient of safety education is 0.1362>0, that is, the higher the level of demand corresponding to the content of safety education, the better the influence on the willingness of habitual safety behavior, the willingness of perceptual behavior control to influence the habitual safety behavior of safety education. There is a mediating effect (LLCI=-0.0148, ULCI=0.0883); when the time scale is one year, the impact coefficient of safety education is -0.0688<0, that is, the higher the level of demand corresponding to the content of safety education, the lower the willingness to habitual safety behavior. Perceptual behavior

control has a negative mediating effect on the willingness of safety education to influence habitual safety behavior (LLCI=-0.1004, ULCI=-0.0107, coeff=-0.0550).

CONCLUSION

(1) Different types of safety education have different degrees of influence on the willingness of construction workers to habitual safety behaviors under the adjustment of time scale. When the safety education method adopts a small scale, the higher the level of demand corresponding to the safety education method, the stronger the influence on the willingness of the habitual safety behavior; when the safety education method adopts the large scale, the lower the level of demand corresponding to the safety education method, the habit The stronger the will of sexual safety behavioral willingness. Safety education has a positive influence on the control of perceived behavior. Perceptual behavior control has a significant positive impact on the willingness of habitual safety behavior. The mediating effect of perceptual behavior control is significant, and the time scale affects the customary safety behavior of perceptual behavior control intermediary safety education. There is a regulatory role in willingness.

(2) Divide safety education into four ways, and explore the influence of different modes of safety education on the time-scale adjustment and the intermediary role of perceptual behavior control on the willingness of construction workers to habitual safety behaviors, and make enterprises more in-depth. It is learned that what kind of education method can enhance the willingness of construction workers to safely behave, improve the quality of safety education, and provide reference for construction enterprises to carry out safety education for construction workers.

(3) There are certain deficiencies in the research: 1. There is no in-depth study of the impact of the basic information of the experimental object on the research results. 2.There are many factors and mechanisms that affect the willingness of construction workers to habitual safety behaviors. This paper only studies the direct effects of safety education, the mediating effects of perceived behavioral control, and the adjustment effects of time scales. It is impossible to deeply understand all the influences of habitual safety behaviors.

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