Original Article

Safety education and control: A tool to measure the safety locus of control

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ABSTRACT

Background: Effective safety education can prevent many occupational accidents. To educate the public about safety effectively, determinants of safe behavior must be addressed. Personality constructs are among the most important determinants of safe behavior. One of the personality constructs that has been studied recently in relation to accidents is locus of control. The main aim of this study was designing, validating, and determining the reliability of safety locus of control scale. **Materials and Methods:** This study was a descriptive, cross-sectional study. The "forward–backward" procedure was applied to translate safety locus of control scale (Jones and Becker 1985) from English to Persian. To determine the scientific validity of the scale , face validity and content validity by expert judgments were used. Internal consistency was determined using Cronbach's α-coefficient. Questionnaires were distributed to a group of 400 workers from different parts of Isfahan Steel Company. Finally, 317 workers completed the questionnaires. Exploratory factor analysis was performed with software SPSS13, and confirmatory factor analysis was performed with software LISREL8.8. **Results:** The exploratory factor analysis results revealed that the three components of the items can be extracted from the scale including internal control (4 questions), environmental and equipment control (4 questions), and chance and fate (4 questions). Confirmatory factor analysis using maximum likelihood estimation results indicated that the data had good fit with three-component scale and fit indices were acceptable: χ^2/df=3.96, df=41, χ^2=120.59, RMSIA=0.080, 95% Confidence Interval=0.64–0.097, CFI=0.96, GFI=0.94, AGFI=0.89. The internal control components and equipment and environmental control were negatively correlated with each other ($P \leq 0.05$, r=−0.41). Also, a weak correlation between chance and fate and environmental and equipment control was seen ($P \leq 0.05$, r=0.31). **Conclusion:** In most studies, designing a scale and determining its validity and reliability is costly and time consuming. The available reliable and valid scale leads to reduced costs and accelerated research. In other words, duplication will be avoided. The scale obtained in this study can be used in safety and industrial psychology research.

Key words: Reliability, safety locus of control, scale, validity

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Access this article online	
Quick Response Code:	Website: www.jehp.net
	DOI: 10.4103/2277-9531.99951

INTRODUCTION

Workplace fatal and nonfatal accidents and injuries result in a huge burden on workers, their families, and society.[1] Because the behavior of workers is involved in many accidents, proper training of workers could prevent many accidents.[2] Background studies in the field of safety education and safety training have shown that to promote safe behavior and effective training, in addition to knowledge and attitudes, other determinants of safe behavior need to be addressed.[3]

Personality constructs are among the most important

This article may be cited as:
Mazaheri MA, Hidarnia A, Ghofranipour F. Safety education and control: A tool to measure the safety locus of control. J Edu Health Promot 2012;1:21.

determinants of safe behavior. One of the personality constructs that has been studied recently in relation to accidents is locus of control. Previous studies have indicated that locus of control and self-efficacy have an important impact on whether individuals take on recommended safe behaviors. Previous studies have indicated that locus of control and self efficacy have an important impact on whether individuals take on recommended safe behaviors or abstain from behaviors not recommended.[4]

Locus of control refers to the degree to which an individual perceives that the outcomes of the situations they experience are under their personal control. Individuals with an internal locus of control orientation perceive that they can exert control over the outcome of the situation. They feel they have significant influence over the course of events; they are sure that their actions lead to predictable results.

Individuals with an external locus of control attribute outcomes to external factors such as luck, fate, and chance, actions of other persons, the weather, or other factors external to themselves.[5] Individuals with an external locus of control are nervous and full of hate, mistrust, and irritation accept, and their decision-making strategies are different from the individuals with an internal locus of control who tend to retain good strategies that lead to failure aside.

Overall, internally controlled individuals are healthier and more efficient and goal oriented; they are better both at acquiring new information and applying it effectively, while externally controlled individuals show signs of lethargy and inertia.[6] In addition, internally controlled individuals are more responsible to their duties than externally controlled individuals. There is evidence that also indicates internally controlled individuals have better mental health.[7]

Locus of control can be considered as an adjective associated with an intrinsic motivation of an individual to effort. Individuals with high perceived control over their behavior believe that their behaviors are effective to achieve desired goals or outcomes. Therefore, they will have more motivation and will take more efforts. Internal locus of control can be considered as a personality trait that can predict intrinsic motivation and belief in an individual's ability to gain desired goals and outcomes.[8]

While the scale of locus of control which has been developed by Rotter measures general control, scales have also been developed to assess the degree of perceived control over specific issues such as health,[9,10] driving locus of control.[11]

Some researchers believe that endeavors to relate internality externality to the outside criteria have been more successful when the measures of this construct were adapted more specifically to the target behavior rather than using the more general locus of control scale itself.[9]

Locus of control is important in the safety issue. The safety locus of control scale (SLOC) was developed and validated after deriving it from Rotter's LOC scale to predict workers' accidents and injuries.[12] The following years, these researchers found that there was only a moderate correlation between the general LOC scale and the SLOC.[13]

Hunter modified the Jones and Wuebker's SLOC to create an Aviation SLOC that would specifically address the construct of internality externality among pilots.[14]

In another study by Hansen, significant relationship between the locus of control and the rate of events was confirmed.[15]

Considering the importance of this variable in promoting safety and preventing accidents, designing an appropriate instrument to measure it is essential. The main aim of this study was designing, validating, and determining the reliability of SLOC.

MATERIALS AND METHODS

Design and participants

This study was a descriptive, cross-sectional study. The subjects in this study, 400 workers from different parts of Isfahan Steel Company, the oldest iron and steel maker of Iran and one of the three main sources of iron and steel in Iran, were randomly selected.

All subjects were males. Their mean±standard deviation of age was 37.56 ± 7.88 and the mean±standard deviation of work experience was 8.9 ± 6.2 years.

Ethical consideration

This study was approved by the Internal Review Board of the Isfahan Steel Company. The participants in the study were explained about the details of the study and were asked to read and sign a consent form, and were assured of the confidentiality. Participation in the study was voluntary.

Design of primary scale

SLOC was prepared by Jones and Becker (1985),[12] and in 2002, was reviewed and modified by Hunter.[14] In this study, the revised form by Hunter with 20 items (Likert range) was used.

Procedure

The "forward–backward" procedure was applied to translate SLOC from English to Persian. The original 20-item questionnaire was translated to Persian by the authors, and then was translated back to English by two bilinguals who were blinded to the original English version. The expert panel (majoring in psychology, specialized in Persian language and health sciences) reviewed our back translation and some corrections were made accordingly. After that, in a pilot study, the edited version of the questionnaire was submitted to a group of 30 workers. There were two purposes for this review: First, to ascertain whether the worker's

understanding of the questionnaire items was the same as that of the researcher, and second, to find if there was any disagreement among the workers regarding their understanding of the items. Then, the workers' comments were taken into account and some alterations were done where necessary. To determine the scientific validity of the scale , face validity and content validity by expert judgments were used. Internal consistency was determined using Cronbach's α-coefficient. The Cronbach's α-coefficient was equal to 0.85. Questionnaires were distributed to a group of 400 workers from different parts of Isfahan Steel Company. Finally, 317 workers completed the questionnaires. Exploratory factor analysis was performed with software SPSS13 and confirmatory factor analysis was performed with software LISREL8.8.

RESULTS

In order to check the main structure of questionnaire, exploratory factor analysis was performed. Eigen value greater than 1 and scree test were used to determine the dimensions. This test revealed that three components of the items can be extracted from the scale. This means that the three components had Eigen value greater than 1 and 63.5% of variance of the data was explained by these components. To measure the appropriateness of data, the Kaiser–Meyer–Olkin Measure of Sampling Adequacy index was used. It was equal to 0.77.

In order to identify the underlying dimensions of the scale, Orthogonal Rotation by varimax rotation with a minimum load factor of 0.5 was used. Principal component analysis after six iterations achieved to the best its factor structure.

Items with factor loading less than 0.5 were excluded. The three-component scale consists of 12 questions. According to the relevant literature, the obtained scale was structured. More information is presented in Table 1.

Table 1: Exploratory factor analysis coefficients of items

Number	Items	1	2	3
1	If workers follow all the rules and regulations, they can avoid many accidents	1.461		
2	Most accidents and incidents can be avoided	1.065		
3	People can avoid getting injured if they are careful and aware of potential dangers	0.83		
4	Accidents and injuries occur because workers do not take enough interest in safety	0.791		
5	Occupational accidents are mostly caused by lack of regulation and ineffective supervision		0.648	
6	Most injuries are caused by accidental happenings outside people's control		0.670	
7	Accidents are usually caused by unsafe equipment		0.564	
8	Accidents are usually caused by poor safety regulations		0.575	
9	Most accidents are unavoidable			0.725
10	Whether people get injured or not is a matter of fate, chance, or luck			0.616
11	Workers can do very little to avoid accidents and injuries			0.625
12	Avoiding accidents is a matter of luck			0.517

Explanation

First component: Internal control
Second component: Environmental and equipment control
Third component: Chance and fate

Confirmatory factor analysis using maximum likelihood estimation results indicated that the data had good fit with three-component scale and fit indices were acceptable.

χ^2/df=3.96, df=41, χ^2=120.59
RMSIA=0.080, 95% Confidence Interval=0.64–0.097
CFI=0.96, GFI=0.94, AGFI=0.89

Based on the three-component structure, the mean of scores of subjects in the three components was calculated separately.

The mean±standard deviation scores of the subjects in the internal control component (11.4 ± 4.63) for chance and fate (10.1 ± 2.78) and equipment and environmental control (13.19 ± 2.82) were obtained. Pearson correlation test revealed that the internal control components and equipment and environmental control were negatively correlated with each other ($P \leq 0.05$, r=−0.41).

Internal control component and of chance and fate were not well correlated (P=NS, r=0.18).

Also, a weak correlation between chance and fate and environmental and equipment control was seen ($P \leq 0.05$, r=0.31).

DISCUSSION

Locus of control is a very important variable in people's behavior and shows individual and public expectations about the rewards and punishment.[16] For accurate measurement of the variable, having proper tools is significant. Experts have noted several features for a proper tool, including objectivity, easily implementation, easy grading, feasible, easy interpretation, validity, and reliability.

The scale developed in this study is short and simple and has acceptable validity and reliability. The results of this study are consistent with the results of some studies in this field.[14]

One of the important issues raised in this structure is if it is one dimensional or multidimensional.

While many studies have demonstrated that locus of control has three components, a number of other studies suggest a two-component structure, internal versus external.[17]

In this study, exploratory factor analysis indicated that three components of this scale could be derived. 63.5% of the total variance of data was explained by these three components. In Hunter's study also, 50% of total variance of data was explained by the multidimensional structure.[14]

The confirmatory factor analysis also approved the structure of the three components and provided a good fit. These findings are in line with the results of other studies[18-20] and inconsistent with the findings in Ref.[21]. The present results indicate that the scale has good reliability and is consistent with the results of some studies.[14]

Cronbach's α-coefficient for the 12-item scale was 0.74. Because age and experience are the variables that influence the safety control; the correlation of these variables with locus of control was investigated. In line with Joseph's study,[5] there was no significant correlation of age and experience with locus of control. But in Hunter's study, the correlation between age and the internal control (0.237), and age and external control (−0.231) was significant.[14]

Study limitations

Greatest weakness of the study is that it is limited to male workers; further research must involve participants from women workers. Another limitation of this study is that validation of the scale was measured only with a questionnaire. It is recommended that in future research, the validity of the scale be measured more accurately and more extensively with other methods such as interviews.

It is also recommended that in future research, validity of this scale be measured and the scale correlation with general locus of control or health locus of control be investigated.

CONCLUSIONS

In most studies, designing a scale and determining its validity and reliability is costly and time consuming. The available reliable and valid scale leads to reduced costs and accelerated research. In other words, duplication will be avoided. The scale obtained in this study can be used in safety and industrial psychology research.

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Source of Support: Nil, **Conflict of Interest:** None declared