

ORIGINAL RESEARCH PAPER

## The evaluation of the safety culture and the effect of educational intervention using the BASNEF model to promote the employees' health and safety of Persian Gulf Yadavaran Gas Refinery Co. (PGYGRC)

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### ABSTRACT

This research is in the applied research group based on its objective, and the data collection method is descriptive-correlational which evaluates the safety culture and the effect of educational intervention using the BASNEF model to promote the employees' health and safety of Persian Gulf Yadavaran Gas Refinery Co. (PGYGRC). The statistical population of this research is the employees of Persian Gulf Yadavaran Gas Refinery Co. (PGYGRC) who are 3000 people. The statistical sample was considered 340 people using Cochran's formula. To collect data, a personal information questionnaire, an educational intervention questionnaire using the BASNEF model, a safety culture questionnaire, and an employees' health and safety questionnaire were used. The total reliability of questionnaires was obtained at 0.83 using Cronbach's alpha. In addition, the validity of questionnaires was confirmed as face validity. The results of the research show that safety education is effective in promoting the employees' safety culture of Persian Gulf Yadavaran Gas Refinery Co. (PGYGRC). There is a relationship between the employees' health and safety culture of Persian Gulf Yadavaran Gas Refinery Co. (PGYGRC). In addition, the level of safety culture is not the same before and after the educational intervention at Persian Gulf Yadavaran Gas Refinery Co. (PGYGRC). The level of safety culture before the training intervention is not the same as after the training intervention in Yadavaran Persian Gulf Gas Refining Company. Therefore, regarding raising the level of educational intervention in order to improve the level of safety culture, it was suggested to the organization.

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## 1. Background

The safety principles and prevention of the caused diseases and accidents by working in the workshops should be mentioned with high priority in the industrial communities, particularly in our developing country (Sekhavati and Yengejeh, 2022; Acheampong and Kemp, 2022; Ahamad et al., 2022; Chatigny, 2022). Therefore, protecting the human force and the state material resources in addition to the health supply of workers, entrepreneurs, and employers are significantly important according to both the human capital and preventing material resources waste (Sekhavati and Yengejeh, 2021; Rafieyan et al., 2022; Acheampong et al., 2022; Sadeghi, 2022;). Today, many industries with high accident rates have found the vital role of human, managerial, and organizational factors in accidents (Nakhjavani et al., 2015; Soltanzadeh et al., 2022; Hajipour et al., 2021). Analyzing the great events during history shows that these accidents are not only caused by probable defects in equipment but are a combination of human and organizational factors. Meanwhile, the role of safety culture as a set of popular beliefs, attitudes, and behavioral principles about safety has been extremely significant in the occurrence of accidents (Ahamad et al., 2022; Ajayi et al., 2022). It is the most comprehensive model that is used to study behavior and identify behavior and create new behaviors in the society. This model is composed of the combination of the asked model and the behavioral intention model.

Today, it is believed that most events and accidents occur by the employee's ignorance and errors (Famakin et al., 2020). One of the definite methods to increase the safety performance of employees is increasing safety culture. Therefore, it seems that making a safety culture is proper to increase safety performance (de Andrade et al., 2020). The necessity of measuring the safety culture and doing the safety and health policies such as safety culture in the organization not only reduces the probability of accident but also has financial and economic benefits which show the return of capital to the organization in a long term (Antonsen, 2017).

The caused accidents by work in Iran harm employees while doing activities and impose total and partial damages to equipment and assets daily (Xue et al., 2021; Iaiani et al., 2021). Since human factors are the root of the occurrence of many events, attention to the promotion of employees' safety culture is significantly important. In addition, holding these courses to increase the employees' safety culture and to reduce the caused accidents seems wholly logical and correct according to the possibility of holding educational courses for all working and organizational levels (Petitta et al., 2017).

The workforce of each country, particularly in developing countries, is a very important part of the national capital and is considered the pillar of economic and social development. Undoubtedly, prosperity and self-sufficiency in the economy and industry will not be possible without having a healthy workforce (Aditiya et al., 2021). Thus, protecting the health of the workforce and

improving the workplace are significantly important. In a work environment, employees can face numerous health risks, including Biological Hazards (Mostofie et al., 2014; Jalilzadeh Yengejeh et al., 2014; Kazemi Noredinvand et al., 2016; Nikpour et al., 2020; Farsani et al., 2022), Chemical Hazards (Babaei et al., 2017; Derakhshan-Nejad et al., 2020; Kordestani et al., 2020; Gashtasbi et al., 2017; Masoumi and Yengejeh, 2020; Mehrdoost et al., 2021), Physical Hazards (Lavigne et al., 2023; Abd Wahab et al., 2023) and ergonomic hazards (Singh et al., 2023; Sekhavati and Yengejeh, 2022). Integrated HSE management deals with various fields of safety, personal and social health, equipment, and the environment with a systematic, very regular, and intertwined approach and health and knowledge basis (Fataei et al., 2013; Ahamad et al., 2022; Jalilzadeh Yengejeh and Sekhavati 2023). The published statistics by various international countries and communities show that millions of people die or become disabled or sick annually by the caused accidents in the workplace in the big and small industrial centers, and this bitter event is continuing (Rejda, 2015). Experience has shown that the existence of a strong safety culture in all working levels of society such as workers, employers and also governments is equally useful and necessary. Applying preventive methods in the field of safety has a significant effect in preventing accidents and it has been proven that one of the sure ways to reduce accidents is to promote safety culture. The arrival of such problems has intensified the need to learn and consider the working health and safety principles and has made people find scientific and fundamental solutions to protect human forces (Cosgrove and Loucks, 2015; Raazi Tabari et al., 2020; Hoseini et al., 2022). In this regard, the related issues to industrial safety, work safety systems, and various theories like domino theory, multiple fantafantamen theory, etc. were formed. The working health and safety units remove the health and safety problems of the workplace in the industrial communities and try to reduce the accidents (Fataei et al., 2020; Karanikas et al., 2020; Jalilzadeh Yengejeh and Sekhavati., 2023).

According to the announcement of the International Labor Organization, 250 million accidents occur by working every year, and if this number of accidents is converted into days, hours, minutes, and seconds, it should be stated that 8 accidents per second occur in the world. In addition, if the victim of the accident is considered only one person, it means the health of 8 people is in danger per second ((Burton, 2010). One accident may occur in many cases, but the losses are more than 1 person (Hollnagel, 2018). In addition, the registered statistics of the accidents are in the relevant organization, while many accidents occur that no authority has registered them (Brauer, 2022). The main objective of executing the HSE parameters is protecting and promoting human force health, removing or minimizing the effective factors of health, safety, and environmental accidents and dangers (Laal et al., 2019). However, it should be noticed that the accomplishment of HSE plans and designs becomes

actualized in the light of senior managers' leadership and commitment (Umble et al., 2003; Tabari et al., 2021). In today's advanced world where all affairs depend on complicated, dangerous, and advanced technology, it is always feared that irreparable damages will be imposed by the painful accident caused by work. Many direct and indirect costs are annually imposed on countries because of non-obeying safety principles (Bresnahan et al., 2001; Khajeh Hoseini et al., 2021). The common judgment is on human errors which are the main cause of accidents. In addition, based on the published statistics in Iran, the main cause of accidents is carelessness and unsafe work (Chan et al., 2022).

Safety culture in the organization is achievable in the proper management system where the management is committed to safety affairs and problems (Otitolaiye, 2016). Actually, safety culture is a part of an organization's culture which is impressed by the attitude and behavior of people in the health and safety performance. Reaching the safety culture in the organization is formed in the context of the safety management system where the organization is made (Choudhry et al., 2007). When the safety culture of an organization is strong, people would have fewer unsafe behaviors, and fewer accidents occur which reduce the damage in the organization (Reason, 1998; Fataei et al., 2013). Actually, recognizing the importance of safety culture to prevent occupational accidents leads to the detection and evaluation of safety culture in organizations. Therefore, investigating various components and aspects of safety culture should be indicated in the organizations, and each organization should execute the intervention plan to improve the safety culture according to its weaknesses (Antonsen, 2017). Various studies have been conducted to evaluate and monitor the safety culture. However, similar studies in various communities have not been generalizable to domestic companies. Thus, the evaluation of the safety culture and investigation of the effect of education on the safety culture, then promotion of the employees' safety level health of Gulf Yadavaran Gas Refinery Co. (PGYGRC) seems essential based on this research.

## 2. Materials and Methods

This is descriptive-surveying research that is applied based on its nature, and sectional based on time. The surveying method was used in this research to collect data. Hence, this method is in the group of surveying research. The statistical population of this research is the employees of Gulf Yadavaran Gas Refinery Co. (PGYGRC). The data collection method was librarian and surveying. The data collection tool was taking notes and a questionnaire. This research was conducted using the sampling method, and the sample volume was indicated by Cochran's formula. A simple random sampling method was used. In this research, 30 questionnaires were distributed among employees to calculate the questionnaires' reliability, then all questionnaires (standard) were distributed after confirming the reliability.

SPSS software was used in two descriptive and inferential statistics levels for statistical analysis after data collection. The frequency, percentage, and mean were used at the descriptive statistical level. In addition, the Kolmogorov-Smirnov test was used to compare the criteria distribution to the normal distribution. An Independent T-test was used to compare the means between two independent groups, and a one-way variance analysis test was used to compare the inter-group mean (more than 2 independent groups). Correlation test, regression test, and paired T-test were used to test the hypotheses.

The data analysis method was conducted in two descriptive and inferential levels. Parametric and non-parametric tests were used according to the level of data measurements.

## 3. Results

In a preliminary study, 30 questionnaires were distributed among the sample volume to measure the questionnaires' reliability. Finally, their value was calculated using Cronbach's alpha coefficient and SPSS software (16), and its total value was obtained at 0.83. This value shows the reliability of the questionnaires. The obtained results from the research variables are shown generally in Table 1.

**Table 1.** Cronbach's alpha coefficient

Variable	Reliability coefficient
Educational intervention questionnaire	0.84
Safety culture questionnaire	0.85
Employees' health and safety questionnaire	0.81

**Table 2.** comparing the scores distribution of research variables using the normal distribution based on participants' idea

Variables	Kolmogorov-Smirnov statistics	Sig. level
Safety trainings	0.986	0.09
Safety culture	1.010	0.12
Working health of employees	0.863	0.08

It should be indicated that the collected data has a normal or non-normal distribution before using the statistical technic. If the collected data distribution is normal, parametric tests can be used. Otherwise, non-parametric tests should be used. At this level, the obtained results from the mentioned test about all the dependent and independent variables are investigated. In addition, based on the obtained results, the proper test was selected to investigate the accuracy of the research hypotheses. Based on the findings of the Table, Kolmogorov-Smirnov statistics were not significant for all variables at  $P \geq 0.05$ . Therefore, the distribution of the research variables follows the normal distribution (Table 2).

**The relationship between the marital status and triple variables**

Based on T-test execution, and the given sig. level, the mean difference of groups' ideas with various marital statuses is not significant for all three variables (sig. level > 0.05). In other words, the independent T-test showed that the ideas of single and married people do not differ significantly (Table 3).

**The relationship between the age and triple variables**

Based on the execution of one-way variance analysis, and the given sig. level, the mean difference of groups' ideas with various age groups is not significant for all three variables (sig. level > 0.05). In other words, independent one-way variance analysis showed that the ideas of various age groups do not differ significantly (Table 4).

**The relationship between the educational level and triple variables**

Based on the execution of one-way variance analysis, and the given sig. level, the mean difference of groups' ideas with various educational levels is not significant for all three variables (sig. level > 0.05). In other words, independent one-way variance analysis showed that the ideas of various educational groups do not differ significantly (Table 5).

**The relationship between the work experience and triple variables**

Based on the execution of one-way variance analysis, and the given sig. level, the mean difference of groups' ideas with various work experiences is not significant for all three variables (sig. level > 0.05). In other words, independent one-way variance analysis showed that the ideas of various work experience groups do not differ significantly (Table 6).

In order to collect the required information, a personal information questionnaire, an educational intervention questionnaire using the Bezenf model, a safety culture questionnaire, and an employee health and safety questionnaire in order to evaluate the safety culture and the effect of educational intervention using the Bezenf model to improve the health and safety of the employees of the refining company. Gas reminders of the Persian Gulf were used.

**Table 3.** comparing the ideas' means about variables based on the marital status

	Mean	St. dev	T-test	Sig. level
Before and after educational intervention	0.01159	0.03816	5.600	0.001

**Table 4.** comparing the ideas' means about variables based on the age.

Variables	F-test	Sig. level
Safety trainings	0.104	0.958
Safety culture	0.550	0.649
Working health of employees	0.120	0.996

**Table 5.** comparing the ideas' means about variables based on educational level

Variables	F-test	Sig. level
Safety trainings	0.185	0.831
Safety culture	0.695	0.500
Working health of employees	0.104	0.901

**Table 6.** comparing the ideas' means about variables based on work experience

Variables	F-test	Sig. level
Safety trainings	1.228	0.294
Safety culture	1.312	0.271
Working health of employees	1.179	0.309

#### 4. Discussion

In a research, they determined the effect of educational and technical interventions on providing a work environment with a healthy safety culture and workers' understanding of the risk of dangerous work situations at height. The results of the research indicated the significant impact of safety training on all components of safety culture and empowering workers in relation to understanding the risk of dangerous work situations at height. The results of the above research are in line with the results of the present research.

First hypothesis: safety trainings are effective in promoting the employees' safety culture of Persian Gulf Yadavaran Gas Refinery Co. (PGYGRC)

To examine the effect of two variables on each other, first, the existence of a relationship was examined using Pearson correlational test. If the relationship exists, the effect is examined using a regression test.

$P=0$ ,  $H_0$ : there is no relationship between the safety trainings and the safety culture level of employees.

$P \neq 0$ ,  $H_1$ : there is a relationship between the safety trainings and the safety culture level of employees.

According to the results of Table 7, if the sig.level > 0.05,  $H_0$  is resulted, and if the sig. < 0.05,  $H_1$  is resulted (Table 7).

Pearson sig. test was used to test this hypothesis. The obtained results are as follows: there is a significant relationship between the safety trainings and the safety culture of employees, because the obtained sig. level

(sig. level=0.001) is less than the research alpha ( $\alpha=0.05$ ). Therefore, the general result is the significant relationship between the safety trainings and the safety culture level of employees in 99% sig. level. The correlation type between the two variables was direct and linear. It means both of them increase or decrease simultaneously. The intensity of the correlation between the two variables is relatively strong. Thus, the research's first hypothesis is confirmed. It means that changes in the safety trainings make fluctuation in the dependent variable (safety culture level of employees). In addition, the more the safety trainings are, the more the safety culture level of employees moves toward positive.

#### The fit of regression model

The fitted model is presented to investigate and present the safety trainings model (x) and the safety culture of employees (y) after examining the indexes of model adequacy which is shown in Table 8. The correlation coefficient between the independent and dependent variables is 0.617. The determination coefficient was obtained at 0.38, and this value shows that 38% of changes in the safety culture of employees are related to the safety trainings. Based on the stated indexes, the model has sufficient adequacy.

The regression significance was calculated by F-test in Table 9. Based on this Table, the calculated sig. level or this statistic was 0.001 which shows the significance of regression in the 0.99 level.

**Table 7.** correlation coefficient between the safety trainings and safety culture level of employees

Dependent variable		Safety culture level of employees	
Independent variable			
Safety trainings	Intensity	0.617	
	Sig. level	0.001	
	No.	340	

**Table 8.** adequacy index of the relationship between the safety trainings and safety culture level of employees

Correlation coefficient	Determination coefficient	Adjusted determination coefficient	Error st. dev
0.617	0.380	0.378	0.28975

**Table 9.** F-test for significance of safety trainings and safety culture of employees

Change resources		sum of squares	Degree of freedom	Mean of squares	F-value	Sig. level
Safety trainings	Regression	149.823	1	149.823	1784.540	0.001
	Residual value	28.377	338	0.084		
	Total	178.201	339			

**Table 10.** result of T-test for safety trainings and safety culture level of employees

Model	t-value	Standard coefficient	Non-standard coefficients		Sig. level
		beta	Standard error	B	
Constant value	1.807		0.079	0.142	0.014
Safety trainings	42.244	0.617	0.023	0.954	0.001



The inserted variable in the regression equation is the main core of regression which is shown in Table 10.

For the change of each safety training unit, 0.617 units of safety culture level of employees will change, which is along with the assumption of considering other variables constant. The relevant T-test to the regression coefficients is also shown in this Table for the independent variable. According to Table 10, the calculated sig. level for this statistic is 0.001. Therefore, safety trainings are effective in the safety culture of employees.

The equation of the regression line is as follows:

$$Y=0.954X+0.142$$

### Second hypothesis

The safety culture level before and after the educational intervention is the same in Persian Gulf Yadavaran Gas Refinery Co. (PGYGRC).

The paired test was used to test the above hypothesis.

**Table 11.** result of paired test of similar safety culture before and after the educational intervention

	Mean	St. dev	T-test	Sig. level
Before and after educational intervention	0.01159	0.03816	5.600	0.001

## 5. Conclusion

The obtained results from this research are as follows:

- 1.The obtained results from data analysis showed that the maxim frequency out of 340 people from the sample volume is related to single people at 63.5%, and the minimum frequency was for married people at 36.5%. The results of the independent T-test showed that the mean ideas of the single and married people do not have a significant difference.
  - 2.The obtained results from data analysis showed that 40.6%, the maximum frequency, out of 340 people from the sample volume are in the age group of 31-40 years, and 8.5%, the minimum frequency, is related to the age group of 50 years. The results of the one-way variance analysis showed that the mean ideas of various age groups do not have a significant difference.
  - 3.The obtained results from data analysis showed that the maximum sample people, 57.6%, out of 340 people from the sample volume have an associated degree and lower, and the minimum number of people have a master's degree and higher. The results of the one-way variance analysis showed that the mean ideas of various academic groups do not have a significant difference.
  - 4.The obtained results from data analysis showed that out of 340 people from the sample volume, the maximum frequency is related to work experience of less than 10 years with 53.5%, and the minimum frequency is related to work experience of higher than 20 years with 14.7%. The results of one-way variance analysis showed that the mean ideas of groups with various work experiences do not have a significant difference.
- Finally, if the management wants to increase the safety culture and decrease the accidents, diseases, damages, and

P=0, H0: the safety culture level before and after the educational intervention is the same in Persian Gulf Yadavaran Gas Refinery Co. (PGYGRC).

P=1, H1: the safety culture level before and after the educational intervention is not the same in Persian Gulf Yadavaran Gas Refinery Co. (PGYGRC).

### The results of the paired test are shown in Table 11

T coefficients higher than ±1.96 are significant in 0.05 sig. level, and are less than 0.05. If the sig. the level is > 0.05, H0 is confirmed, and if the sig. level <0.05, H1 is confirmed. Since the sig. level is 0.001, that is less than 0.05, and the T-value is 5.600, which is higher than 1.96, H0 is rejected and H1 is confirmed. Thus, the safety culture level before and after the educational intervention is not the same in Persian Gulf Yadavaran Gas Refinery Co. (PGYGRC).

other caused hidden costs by the accidents, he/she should emphasize the safety issues and the effective relationship with personnel the same as emphasizing the principal problems of management. The manager should state his/her policies transparently in a way that is perceivable for all personnel. He/she should inform the goals of system transparently and be an Officials and senior managers of the organization must prove their commitment to the employees of the organization regarding safety, health and environmental issues in various ways, such as allocating sufficient resources and participating in HSE-related programs, and also by considering the suggestions and ideas of the employees. In their decisions, they should encourage employees to provide new suggestions and ideas to improve HSE issues. They should be held accountable for providing a suitable environment for creative people, continuous training of employees, creating suitable platforms for cooperation and greater participation of employees in the organization's issues, and finally supporting the management of the organization's employees.

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