5th International Conference on Industrial Engineering and Industrial Management
XV Congreso de Ingeniería de Organización
Cartagena, 7 a 9 de Septiembre de 2011

The pedagogical importance of evacuation drills in schools as a means of increasing the preventive culture in Spain

Serafin Piñero Rodriguez[1], Antonio Juan Briones, Juan Lorente García

[1] Departamento de Economía de la Empresa, Facultad de Ciencias de la Empresa, Universidad Politécnica de Cartagena, C/. Real, nº 3, 30201 Cartagena (Murcia), Spain.
Aj.Briones@upct.es, serafinpr@gmail.com,

Key Words: Evacuation Drills, Self-Protection Plans, State Schools.

1. Introduction

Education centres in general represent one of the places in which safety becomes something totally essential, due to the special vulnerability of children. The normal day-to-day practice of a school, supposes a series of risks and therefore it is important for the Educational Community to work actively to ensure that the school environment is as safe as possible. Of all the possible risks, fire is perhaps one of the most feared by society, and it is also that which is most likely to occur.

The Educational Community in general, should be aware that the spreading of a correct preventive culture, has as its starting point the "Educational Centre" (Lewis, 2009), and it is of vital importance that this *prevention culture,* reaches all the pupils and teachers in order to be able to increase the level of prevention in schools and to achieve important progress in this matter at a social level.

The schools must be prepared to react correctly when faced with any emergency situation that may arise and thus, if it is important to carry out annual evacuation drills, it is even more determinant that the pupils receive adequate *prevention training*.

2. Review of the literature and the national laws

All schools must be ready to react well in the face of any emergency and to this end, it is necessary to carry out prior evacuation drills (Cote, 1988). School evacuation exercises must count on efficient organisation, and correct coordination between the teachers who intervene (Malcolm, 2002).

On the other hand, it is essential that the level of training in prevention of all the pupils is sufficient and adequate (Barry, 1996). The Organisation for Economic Cooperation and Development (OECD) in 2004, when talking about the organising of safety in schools placed special emphasis on the need to count on good action protocols during the event of a school emergency.

The following Spanish laws to a certain extent confirm the preoccupation of the public administrations to increase the awareness of centres in matters related to prevention and self-protection.

The Law 2/1985[1], on Civil Protection, specifies that: "*Teaching centres will carry out, among the pupils, activities to increase awareness regarding responsibilities in matters of protection. Said activities will not have the configuration of an area of knowledge, nor will they compute in academic evaluation*".

The Law 31/1995, for the Prevention of Labour Risks, notes that: "*The intention is to promote an authentic preventive culture, by means of the promotion of improvement in the education in said field, to involve society as a whole and constitutes one of the basic objectives and which has perhaps the most transcendental effects".* On the other hand, in its Article 20 it points out the obligation of workplaces (and this includes Schools) to have foreseen the actions to carry out in any emergency, and to train the workers (teachers) to ensure efficient action.

The Order of 13 November 1984[2], on "Evacuation of teaching centres for General Basic Education, High School Diplomas and for Professional Training", disposes in its 1st Article, that a practical evacuation drill shall be carried out in order to: teach the pupils to conduct themselves adequately in emergency situations, know the conditions of the buildings to achieve an orderly evacuation and to increase the pupils awareness as to the importance of the problems related to safety in the centres. The Order adds that the evacuation drills which are part of the Schools' Safety Plans must constitute a further aspect of the pupils' education.

The Basic Norm of Self-protection[3] of the centres, establishments and installations dedicated to activities which could lead to emergency situations, specifies that the owners of the affected activities, must Elaborate the Self-protection Plan, which anticipates the risks to the people and responds to the possible emergency situations in the area of the owner of the activity's responsibility. It also contemplates the actions which are needed to implant and maintain the Plan's efficacy, as well as to train the staff.

3. Hypothesis of the study

This research work seeks to demonstrate the following hypothesis: *"The pedagogical importance of Evacuation Drills in State Schools, presents influence on the Degree of General Efficacy achieved by this type of exercises"*

3.1 Study population

In order to be able to investigate the most significant aspects of evacuation drills in state schools, as well as the pedagogical importance they hold and the level of *training in prevention* of the pupils, an investigative questionnaire was sent to the 486 State Schools of the Autonomous Community of the Region of Murcia (CARM), requesting the evaluation of a series of items according to the Likert scale between 1 and 9 points. Responses were obtained from 148 state schools, which represent 30.4% of the total of the CARM.

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[1] The interest by the Government in promoting the concept of safety, as part of our culture right from the schools themselves should be highlighted.

Chapter II, article 4.3.

[2] BOE number 276 of 17 November 1984

[3] RD 393/2007 of 23 March. BOE number 072 of 24 March 2007

3.2. Results of the univariate analysis

From the study it was deduced that 98% of the State Schools in the CARM have on some occasion carried out an evacuation drill, which is a positive piece of data, although such drills are compulsory by law. The result is more significant if it is compared with that taken from a study by the Education, Science and Investigation Department of the Autonomous Community from 2006, on the carrying out of evacuation drills in these schools. In that study it can be appreciated that at that time 58% of the schools had never carried out an evacuation drill, thus there is a clear positive evolution in prevention is these centres during the last four years.

The study also shows that 90% of the schools do not dedicate any time to training in prevention. Of the remaining 10% of schools, only one hour is dedicated to this task per year, with a resulting mean evaluation of 4.93 points for the pupils in Safety training. With regard to the four factors which were considered as being able to influence the "General Efficacy of Evacuation Drills", their mean evaluations were:

1. Degree of teacher coordination during the drill 7.79 points
2. Efficacy of the organisation of these exercises 7.77 points.
3. Efficacy of the action protocols during the evacuation 7.70 points.
4. Importance of the Exercise from the pedagogical point of view 7.53 points.

3.3 Multivariate analysis

As a first step in this analysis, a lineal regression was carried out in order to check if the relation between the independent variable "General Efficacy of Evacuation Drills" and the four dependent variables considered is lineal and if the values this provides fit to a straight line. The simple lineal regression model tries to fit to the following equation: y = a + bx1+bx2+ bx3+bx4.

In this model, the Determination Coefficient (r^2), is defined from the multiple correlation coefficient (r) and measures the proportion of variability of the dependent variable explained for the independent variable introduced (Pardo and Ruiz, 2005). If the resultant value is multiplied by 100, the percentage of variability explained will be obtained. (Mora *et al.* 2009). This coefficient takes the value 1 when the fit is perfect, however it is not demarcated at the lower level, with it being possible to take negative values when the fit carried out is bad. From the non-standardised coefficients of the independent variables calculated, the following predictive equation was obtained:

[(EFICAC. SIM) = 0,120 + 0.168 (EFIC ORG) + 0.506 (EFIC PROTOC) + 0,181 (COORD PR) + 0,130 (IMP PEDAG)]

The regression model has a determination coefficient r^2 with a value of 0.490, with a standard error of the estimation of 0.853. The independent variables considered, explain 47.5% of the variability of the Grade of Efficacy of the Evacuation Drills of the State Schools. The most significant factor turned out to be "the efficacy of the Action Protocols" (0.506); followed by the teacher coordination (0.181); and the efficacy of the organisation of the exercise (0.168); but the variable "Pedagogical importance of the exercise", also presented influence (0.130).

In order to confirm the pedagogical importance of the drill, a reliability analysis will be carried out for the factors considered, which would serve to check the suitability of the scale; subsequently a factor analysis will be carried out to confirm if grouping exists between any of

the four factors considered. Finally, a lineal regression would be carried out with the new variables obtained. To measure the reliability of the scale, the coefficient denominated *Cronbach's alpha* (α) was taken into account, meaning that the nearer it is to one, which is its maximum value, so the greater the reliability of the scale would be.

Authors such as: Uriel and Aldás (2005); Newbold *et al* (2007) and Pérez López, C (2005), consider that values of the coefficient greater than 0.7 are sufficient to guarantee the reliability of the scale. In this case, the *Cronbach's alpha,* for the total scale, presents good internal cohesion as it reaches a value of 0.774 and therefore the scale on which the measure will be based is reliable. On occasions data bases are usually integrated by variables in which there is a great amount of redundant information; Poza (2008) comments that technically they are variables with a high level of intercorrelation, and this poses the problem of multi-colinearity, which makes the basis of the model useless. For Uriel and Aldás (2005), Factor Analysis (FA) is a technique that will serve to analyse the correlation structure between variables, by means of the definition of a series of "*Factors",* having as its first objective the identification and quantification of said factors. For Barrera (2006), one of the purposes of FA is to define the underlying structure in a matrix of data. Anyway, FA will permit the substitution of the original set of variables, for another with a lower number of non-observable variables with the object of reducing the data.

Álvarez (1995), affirms that to check if it is adequate to carry out FA with the data available, the results of the *Kaiser-Meyer-Olkin (KMO) Coefficient* and of *Bartlett's test of sphericity* must be taken into account. The *KMO,* takes values between 0 and 1, contrasting the magnitudes of the observed correlation coefficients, with the magnitudes of the partial correlation coefficients. This coefficient will indicate that FA is more adequate the higher its value is. In our case, as is shown in Table 1, its value is 0.772 and therefore the technique is suitable. According to Kaiser[4], this FA would present acceptable sample suitability. The Bartlett statistic is obtained from a chi-square transformation of the determinant of the correlation matrixes. For Álvarez (1995), the sphericity test contrasts the null hypothesis (Ho); that "*the correlations matrix is an identity matrix*[5]". In this case, the Ho hypothesis is rejected, since the Bartlett statistic presents significance of 0.000<0.05, therefore it is accepted that correlations between the variables and FA is pertinent[6].

Table 1

Measure of the Kaiser-Meyer-Olkin.(KMO) sample		0.772
Bartlett's test of sphericity	approximate Chi-square	234.337
	Significance	0.000

[4] Kaiser proposed the following criterion to decide on the adequacy of the Factor Analysis in 1974:

- 0.9 <KMO ≤1.0 = Excellent sample adequacy. .0.8 <KMO ≤0.9 = Good sample adequacy.
- 0.7 <KMO ≤0.8 = Acceptable sample adequacy 0.6 <KMO ≤0.7 = Regular sample adequacy
- 0.5 <KMO ≤0.6 = Bad sample adequacy 0.0 <KMO ≤0.5 = Unacceptable sample adequacy

[5] Or that the correlations between the variables are zero since, in an identity matrix the diagonal is formed by ones and the value of the determinant is also one.

[6] The determinant of the correlation matrix is significantly different to one.

When extracting the factors, the method of Principal Components Analysis (PCA) was employed. Table 2 shows the initial *communalities* of each factor and those obtained from the extracted factors. Table 3 shows the variance explained for the two factors. The first explains 55.7 % of the *common variance* and the second 27.4 %. The two factors explain 83.2 % of the *variance* which covers statistical information of over 83 %.

Table 2

Communalities	Initial	Extraction
Efficacy of the organisation	1.000	0.721
Efficacy of the action protocols	1.000	0.835
Degree of coordination between	1.000	0.778
Pedagogical importance of the drill	1.000	0.994

Table 3: Total variance explained

Component	Sum of the squared saturations rotation		
	Total	% of variance	% accummulated
1	2.232	55.793	55.793
2	1.096	27.409	83.202

Table 4 shows the matrix of the components extracted by the PCA method and subsequently the factors are rotated by the "Varimax" orthogonal rotation method, presenting the rotated components matrix.

Table 4

Matrix of components. Without rotation (PCA)			Matrix Comp. Rotated	
	1	2	1	2
Efficacy of the organisation	.840	-.125	**.804**	.274
Efficacy of the action protocols	.897	-.175	**.877**	.256
Degree of coordination between teachers	.838	-.275	**.871**	.140

Pedagogical importance of the drill	.657	.750	.240	**.968**

According to Poza (2008), to determine the number of factors to conserve, the Sedimentation Graphic is used; in our case, Graphic 1 suggests that the number of factors to be retained should be two. (Table 5)

Graphic 1

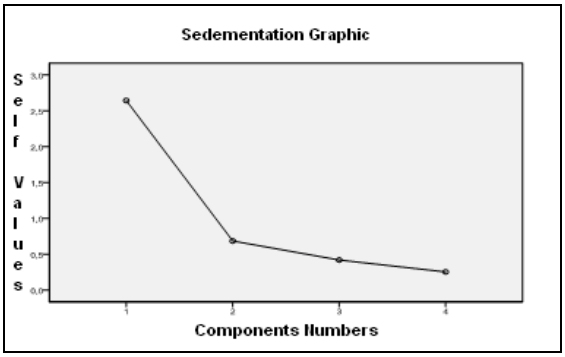

Table 5: New Factors

FACTOR 1: OPERATIVE ASPECTS DRILL	FACTOR 2: PEDAG IMPORTANCE DRILL
Efficacy of the organisation	Pedagogical Importance of the Drill
Efficacy of the action protocols	
Degree of coordination between teachers	

Therefore, the Efficacy of the Evacuation Drill (EED) is influenced by two new factors: the Operative Aspects of the Drill, and the Pedagogical Importance of the Exercise, presenting the following hypotheses H^{A1} and H^{A2}, with only the *Hypothesis* H^{A2} being of interest for the current article

- *Hypothesis* H^{A1}*: "An influence exists of the operative aspects of the evacuation drills in schools, on the Degree of General Efficacy they reach"*
- *Hypothesis* H^{A2}*: "An influence exists of the pedagogical importance of the drills, on the Degree of General Efficacy they reach"*

From the data of the non-standardised coefficients of the independent variables from Table 7, the predictive equation can be written:

[(EED) = 0,237 + 0.277 (OP ASPECTS DRILL) + 0.137 (PED IMPORTANCE DRILL)].

Table 7

DEGREE OF EFFCIACY OF THE EVACUATION DRILL (EED)						
Predictive Variables.	Non-standardised coefficients	T Test (Sig.)	Colinearity		Diagnostic Colinearity	
		(t)	T	VIF	A	CI
(Constant)	0,237					
OPERATIVE ASPECTS OF THE DRILL	0,277	8.759[a]	.775	1.295	0.017	13,316
PEDAGOGICAL IMPORTANCE OF THE DRILL	0,137	2.265[a]	.775	1.295	0.006	22,963
$R = 0.524$; $R^2 = 0.478$; R Adjusted = 0.471		Statistic Durbin-Watson (DW) = 2.242				
Standard error of the estimation = 0.856		ANOVA (F) = 64.983[a]				

Source: Own production. Where:

- Sig.: $p< 0.01^a$; $p<0.05^b$, $p<0.1^c$
- T (tolerance) VIF (variance inflation factor)
- A (self-values) CI (condition index)
- R (determination coefficients: R, R^2, and R corrected or adjusted)
- ANOVA (ANOVA table, F statistic and Sig.). Student T (t)

The regression model has a determination coefficient $r^2 = 0.478$, with a standard error of 0.856. It can be said that the two new variables explain 47.8% of the variability of the Degree of Efficacy of the Evacuation Drill. (Table 7).

The Snedecor F statistic permits us to contrast the hypothesis Ho and as it is seen with a level of significance $0.000 < 0.05$), it can be rejected and therefore, the regression equation offers a good fit, which leads us to consider a good lineal relation between the variables, with the simple lineal regression model being valid.

The T statistic allows us to check if the regression between the independent and dependent variables is significant. In our case, the significance of the statistic associated to the model generated with the two independent variables, is below 0.05, thus we can ratify the predictive character of said variables. The tolerance (T) of the two variables does not have values close to 0.00 so neither of them can be considered redundant in the estimation and therefore the information obtained is independent.

The index $1/(1-r^2)$[7] reaches a value of 1.91 and since the variance inflation factors (VIF) are close to 1, it can be affirmed that stability exists in the estimations of the regression coefficient. As can be appreciated from the table, the statistics and the diagnostics of colinearity are favourable, with the condition index (CI) being situated at the maximum threshold of 22.963, which is lower than 30, so this is considered an absence of colinearity. On the other hand, the distribution of the variable formed by the residuals is Normal.

[7] Coefficient r² as the coefficient which indicates the percentage of fit that has been achieved with the lineal model.

The statistic Durbin-Watson (DW)[8] takes the value of 2.242, indicating that no correlation exists between the residuals; therefore, the dependent variable is influenced by the independent variables considered, with it being proven that:

- *Hypothesis H^{A2}: "An influence exists of the pedagogical importance of the drills, on the Degree of General Efficacy they reach"*

4. Conclusions

Ninety-eight percent of the State Schools in the CARM, have carried out at least one evacuation drill, which is an excellent statistic for the Region's schools; although on the other hand, the mean score in the pupils' training in safety turns out to be in general rather low, with a valuation of 4.93 points.

The reliability analysis demonstrated the internal consistency and the suitability of the scale formed by the four factors considered as influencing the variable "General Efficacy of School Evacuation Drills":

1. Elaboration and suitability of the action protocols in the evacuation drill
2. Organisation of the personal deployed during the exercise
3. Coordination and collaboration by the teachers who intervene in the emergency
4. Pedagogical importance of the evacuation exercise

The factor analysis allowed these factors to be grouped into two new variables: "Operative Aspects of the Drill" (1 to 3) and "Pedagogical Importance of the Exercise". (4). The lineal regression demonstrated that the "Pedagogical Importance of the Exercise", presents a positive influence on the "Efficacy of the Evacuation Drill". (0.137).

Thus, emphasis must be placed on that specified by the Law 31/1995, for the Prevention of Labour Risks: "*The purpose of promoting an authentic preventive culture, by means of the promotion of improvement in education in said field, involves the society as a whole and constitutes a basic transcendental objective"*

This is also specified in the Order of 13 November 1984, when it states that:"*The evacuation drills that are part of the Safety Plans of the Schools must constitute a further component of the pupil's education"*.

The Educational Community must be aware that the extending of a correct *preventive culture*, has its starting point within the "School" and it is of vital importance that this *prevention culture,* reaches all the pupils in order to extend the level of self-protection in these state schools.

[8]For Pérez López, C (2005), the DW statistic, measures the degree of self-correction between the residual corresponding to each observation and the previous one.

- If the value is close to 2, the residuals will be interrelated or there is no self-correlation
- If it is close to 4, they will be negatively self-correlated. If it is close to 0, the will be positively self-correlated.

Although the State Schools value the pedagogical importance of the evacuation drills in their centres very positively (7.53 points), in reality very little importance is given to training the pupils in prevention; therefore it is essential that the heads of the schools reflect on this matter and take the necessary measures to increase the level of training of the pupils in safety, since it will definitely serve to improve self-protection in their schools and increase the preventive culture in Spain.

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