Conditioning factors pertaining to putting training into practice

Factores condicionantes de la transferencia de la formación y la probabilidad de transferencia

Fatores Condicionantes da Transferência da Formação e da Probabilidade de Transferência

培训迁移的条件因素及迁移概率

Pamies-Berenguer, Marcial (iD) **, Cascales-Martínez, A.** (iD) **, Gomáriz-Vicente, Mª. Ángeles** (iD)

University of Murcia, Spain.

Abstract

The effects of in-service teacher training on the improvement of educational quality should be considered when rolling out professional development policies. To this end, important information can be gathered by examining the most relevant conditioning factors regarding the likelihood that teachers will successfully transfer learning into teaching practice. Knowledge of the effects of such transfer would also be useful. The aim of the present article is to analyse the existing associations between conditioning factors and the likelihood of transferring knowledge acquired via professional teacher training in non-university education classrooms. The present research was non-experimental and exploratory in nature, employing a survey in order to collect cross-sectional data. A total of 4769 teachers participated. A non-probabilistic convenience sample was recruited due to the accessibility and availability of participants. Obtained data enabled identification of predictive variables pertaining to the likelihood of transferring the knowledge attained through lifelong learning. A logistic regression model was developed to estimate transfer likelihood based on outcomes pertaining to the conditioning factors.

Keywords: Ongoing Training, Training Transfer, Training Effectiveness, Professional Development, Teachers.

Resumen

El efecto de la formación continua del profesorado sobre la mejora de la calidad educativa es un indicador a tener en cuenta en el despliegue de políticas de desarrollo profesional. En este sentido, estudiar los factores condicionantes de mayor impacto sobre la probabilidad de que un docente tenga éxito en el proceso de transferencia y conocer el efecto de dicha asociación proporciona una información relevante. El objetivo de este artículo es analizar las asociaciones existentes entre los factores condicionantes y la probabilidad de que se produzca la transferencia al puesto de trabajo de los programas formativos destinados al profesorado de enseñanzas no universitarias. La investigación se ha diseñado como no experimental, con carácter exploratorio y en el que se emplea un instrumento tipo encuesta para la recogida de datos de carácter transversal. Han participado 4769 docentes, siendo el muestreo no probabilístico por conveniencia siguiendo el criterio de accesibilidad y disponibilidad de los sujetos. Los datos obtenidos han permitido identificar las variables predictivas de la probabilidad de transferir los productos de la formación permanente y proponer un modelo de regresión logística que estime dicha probabilidad en función a las puntuaciones de los factores condicionantes.

Palabras clave: Formación Permanente, Transferencia de la Formación, Eficacia de la Formación, Desarrollo Profesional, Profesorado.

Corresponding author / Autor de contacto: Marcial Pamies Berenguer. Facultad de Informática, Universidad de Murcia. Campus Universitario de Espinardo, Edificio 32, C.P. 30100, Murcia, Spain. correo-e: marcial.pamies@um.es

Resumo

O efeito da formação contínua dos professores na melhoria da qualidade educativa é um indicador a ter em conta na implementação de políticas de desenvolvimento profissional. Neste sentido, estudar os fatores condicionantes com maior impacto na probabilidade de sucesso de um professor no processo de transferência e conhecer o efeito desta associação proporciona informações relevantes. O objetivo deste artigo é analisar as associações existentes entre os fatores condicionantes e a probabilidade de transferência para o local de trabalho dos programas de formação destinados a professores de ensino não universitário. A investigação foi concebida como não experimental, com caráter exploratório e utilizando um instrumento de tipo inquérito para a recolha de dados transversais. Participaram 4769 professores, sendo a amostragem não-probabilística por conveniência seguindo o critério de acessibilidade e disponibilidade dos sujeitos. Os dados obtidos permitiram identificar as variáveis preditivas da probabilidade de transferência dos produtos da aprendizagem ao longo da vida e propor um modelo de regressão logística que estime esta probabilidade em função das pontuações dos fatores condicionantes.

Palavras-chave: Aprendizagem ao longo da vida, Transferência da Formação, Eficácia da Formação, Desenvolvimento Profissional, Professores

摘要

为了提高教学质量而对教师进行的持续培训是职业发展政策部署时需要考虑在内的一项重要指标。因此，研究对教师培训迁移成功概率有重大影响的条件因素以及了解因素间的关联效果都可以为该课题提供宝贵的信息。本篇文章的主要目的既是分析条件因素间存在的关联，也是分析针对非大学教育阶段教师培训计划的职位迁移概率。该研究为非实验性的探索性研究，在研究中使用问卷类工具收集横截面数据。共有 4769 名教师参与，样本为非概率抽样，抽样过程中遵循对象的可及性和可用性标准。获得的数据允许我们确定了终身学习产品迁移概率的预测变量，同时也帮助我们提出了一个可以根据条件因素分值预估迁移概率的逻辑回归模型。

关键词: 终身学习、培训迁移、培训效率、职业发展、教师

Introduction

The acquisition and application of new abilities, skills and attitudes by teachers represents one of the factors to be taken into account when trying to meet the continuously changing demands of education at both an operational and infrastructural level (Escudero-Muñoz et al., 2018). The importance of this is reflected in the efforts made by educational administrations, or private organizations in the education sector, to offer professional teacher development plans (DPD, the acronym in Spanish for Desarrollo Profesional Docente). Such plans strive to be effective in providing teachers with lifelong training that is capable of responding to strategic objectives associated, amongst others things, with improvement of the quality of education, efficient performance of leadership functions, improvement of the work environment and providing quick responses to regulatory, methodological and technological changes (Aparicio-Molina et al., 2020;

Darling-Hammond et al., 2017; Yurtseven et al., 2020).

Despite a number of arguments in favour of the use of DPD plans as a vehicle for introducing initiatives to implement decisions made in terms of educational policy, questions remain around the design of strategies, evaluation of strategy effectiveness and evaluation of DPD plans (Erdas et al., 2019; Kelley et al., 2020; McChesney & Aldridge, 2018; Popova et al., 2021; Sims and Fletcher - Wood, 2021). In this sense, Darling-Hammond et al. (2017) have highlighted a number of characteristics that are inherent to successful DPD plans. These include the incorporation of active learning dynamics, use of collaborative learning models, provision of practical examples of success, advice and support mechanisms, feedback and reflection processes, and developing a suitable developmental timeline for learning actions, practice and reflection. Despite this, work conducted by Sims & Fletcher - Wood (2021)

raises serious doubts about the criteria used to identify these common characteristics and proposes a standpoint focused on the investigation of relationships between the process of acquiring skills and the information obtained after carrying out a rigorous evaluation process of DPD plans.

Generally speaking, Mizell (2010) points out that the concept of professional development is defined by different training actions (formal or informal) carried out by a professional in order to improve their job performance. The variety of such actions can range from a mere conversation with a colleague to participation in conferences, courses or seminars designed to target specific training needs. The present work focused on the formal component of professional development plans, identified here through the term continuous or ongoing training. Likewise, the study will seek to determine the limiting factors pertaining to the transfer of skills in order to predict the likelihood of success with regards to transferring training to the work environment.

Evaluation of professional development plans

Some of the issues that have been extensively studied in existing literature regarding professional development include the effectiveness of actions developed within the framework of training programs, models used to evaluate such programs and the factors that influence them (Alsalamah & Callinan, 2021; Heydari et al., 2019; Kirkpatrick & Kirkpatrick, 2006; Vizeshfar et al., 2018).

Figure 1. Kirkpatrick 's four-tier model for training evaluation
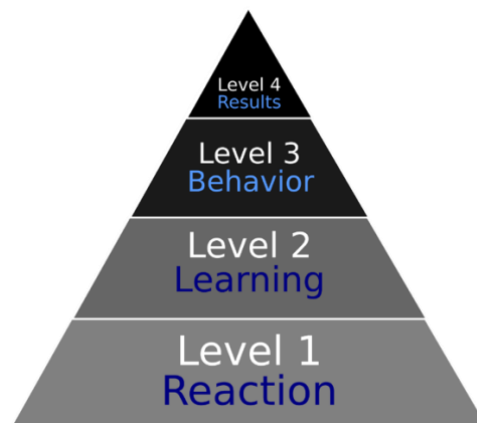
The model presented by Kirkpatrick and Kirkpatrick (2006) for the evaluation of training programmes proposes an ordered sequence of four levels of evaluation (see Figure 1): reaction, learning, behaviour and results. At the lower level, evaluation focuses on the response of participants towards the design and development of the training plan and provides important information on user satisfaction with the training carried out. Information obtained at the lower level is important for the interpretation of outcomes at the learning level. At the learning level, assessment is made of the extent to which users acquired the intended knowledge, attitudes or skills set in line with the goals set during the training process. At the behavioural level, an evaluate is conducted on the extent to which the training plan led to changes in the way participants act in the classroom. Analysis cannot proceed without obtaining outcomes at the learning level. Finally, at the results level, an evaluation is performed of training effectiveness in terms of its contribution towards achieving the objectives set by the organization. The interpretation of outcomes is based on the analysis conducted at the behavioural level.

The generalization underlying the different levels of Kirkpatrick's evaluation model

(Figure 1) means that, as one progresses upwards within the model, the object of evaluation is subject to fewer restrictions. This leads to an increase in the degree of freedom associated with the factors that affect the pertinent processes and, consequently, as demonstrated by empirical research on the model (Alexandaki et al., 2021; Jones et al., 2018; Mahmoodi et al ., 2019; Makumbe et al., 2018), leads to a more complex evaluation process.

In simple terms, training plan effectiveness is conditioned by, on the one hand, processes that allow the acquisition of learning during the training period and, on the other, more general processes in which trainees put learning into practice in the workplace (Tracey et al., 2001). Assuming that training effectiveness is related to achievements following the implementation of training outcomes in a professional context, processes pertaining to generalization play a crucial role as a precursor to conducting effectiveness evaluations (Baldwin et al., 2017; Botke et al., 2018; Brion, 2020; Ford et al., 2018).

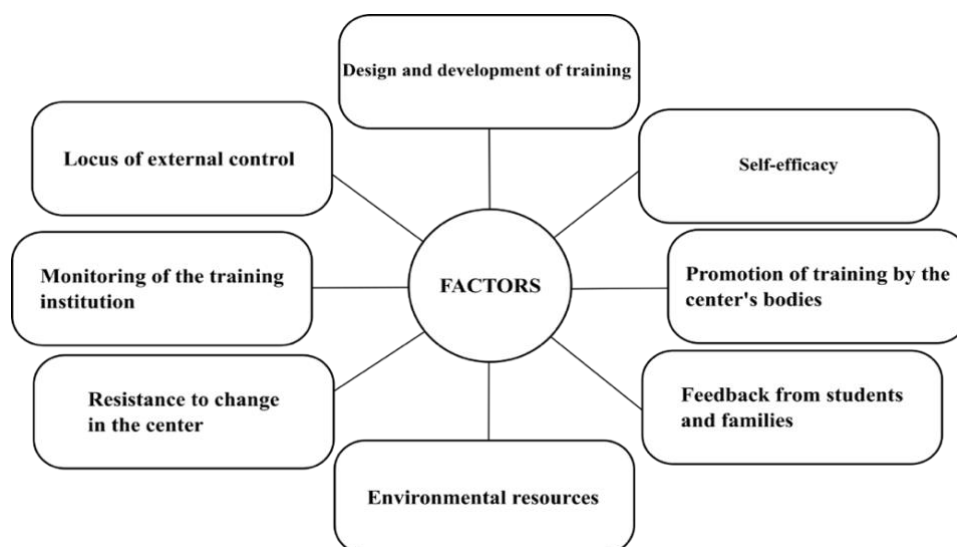### The transfer of teacher training

As can be deduced from the previous discussion, the evaluation process of the transfer of lifelong training, understood as the degree to which participants incorporate and maintain over time the learning, attitudes and skills acquired in the training context to the dynamics of their job (Baldwin & Ford, 1988), is located at the behavioural level of Kirckpratrick's evaluation model. This evaluation provides important information for decision making since, assuming that the capacity of the training to transform organizations depends on the extent to which participants put resultant skills into practice, it provides an overall glance at the effectiveness of training plans.

In general, transfer represents a complex process as it, on the one hand, is conditioned by a significant number of factors (Baldwin et al., 2017; Cano, 2016; Ford et al., 2018; Jackson et al., 2019; Richter & Kauffeld, 2020; Roig-Ester et al., 2021) and, on the other, follows a time-dependent evolution (Blume et al., 2019).

Within the contextual framework of education, Pamies Berenguer et al. (2022) have conceived an eight-factor model (see Figure 2) to identify the important aspects that regulate the transfer process. However, research has yet to examine the association of these factors with the success of transferring learned skills into the professional setting.

Figure 2. The eight conditioning factors of the transfer of ongoing training in non-university teachers identified in Pamies -Berenguer et al. (2022)

Identification of the factors with the greatest impact on the likelihood that teachers will successfully transfer training into practice and a better understanding of the outcomes of this would enable training programs to be designed that effectively target these factors. This would improve the transfer of learning and, consequently, enable training programs to have greater reach.

Research objectives

Based on the eight-factor model described by Pamies -Berenguer et al. (2022), the present research aimed to examine existing associations between conditioning factors and the likelihood of non-university teaching staff transferring training to the work setting. To this end, the following research questions were posed:

1. Do certain factors condition the likelihood of success when it comes to transferring learning to the work setting?
2. Should certain factors emerge in response to the previous research question, what is the nature of the relationship between these factors and how does this influence the likelihood of transferring training to the classroom?

Thus, the main aim of the present work was to determine to what extent training influences decision-making at both a strategic level, with regards to the development of DPD educational policies, and at an operational level, with regards to the design of ongoing training plans for teaching staff.

Method

Methodological approach

The present research design was cross-sectional, non-experimental and exploratory in nature. Surveys were issued and data was interpreted and analysed objectively according to the context of the underlying reality of interest (Cubo et al., 2018).

Variables

In order to address the proposed research questions, dependent variables were established according to the eight-factor model on which the present study is based. These factors are as follows: *Training design and development (F1), Self-efficacy (F2), Promotion of training by centre directors (F3), Feedback from students and families (F4), Environmental resources (F5), Resistance to change at the centre (F6), Monitoring of the training institution (F7)* and *Locus of external control (F8)*. These factors were examined according to their loadings. The likelihood of transferring learning acquired through training to the classroom (Tr) was included as an additional variable.

Sample and sampling

The sample consisted of a total of 4769 non-university teachers from the region of Murcia (Spain). All participants were selected using convenience sampling from a population of teachers who had been involved in training activities as part of the 2018/2019 and 2019/2020 Regional Training Plan courses. The population consisted of a total of 28,801 teachers, meaning that the present sample corresponded to 16.56% of the total population. In demographic terms, the present sample consisted of 77.4% women and 22.6% men, with an average of 16.17 years (SD = 9.11 years) professional experience in the non-university education sector. Table 1 presents descriptive data pertaining to the sociodemographic variables (age, educational stage in which they practice and type of educational centre at which they work).

Table 1. Descriptive data of the sample

Age	<30	30 - 40	40 - 50	50 ≤			
Frequency:	39	1 289	1 748	1 393			
Percentage:	7.1 %	27 %	36.7 %	29.2 %			
Education Stage	IECE	Primary	Inf./Prim.	ESO	ESO and Bach.	FP	SEND
Frequency	652	1 326	700	470	856	352	147
Percentage:	13.7 %	27.8 %	14.7 %	9.9 %	17.9 %	7.4 %	3.1 %
Type of centre	Public	Subsidised	Private				
Frequency	4 078	651	6				
Percentage:	85.5 %	13. 6 %	0.1 %				

Data collection instruments

A questionnaire was administered which comprised the following sections:

Welcome page: this page provides information on the research objectives and commitments assumed by researchers and participants. It explains that the research is conducted in line with ethical considerations of the Ethics Committee of the University of Murcia. Participants are also assured that all data is to be kept anonymous and informed about data handling procedures.

Sociodemographic data : this section comprises the items used for gathering data on sample characteristics, including age, sex, years of experience, educational stage in which the teacher practices and type of educational centre (public, subsidised, private) at which the participant works.

Transfer questionnaire: this section includes 43 ordered items regarding the transfer of ongoing training to the work setting of non-university teachers. This questionnaire has been validated by Pamies -Berenguer et al. (2022).

Transfer estimation: this section poses questions about the implementation of the learning, skills or attitudes acquired during the training phase according to the extent to which such opportunities have been capitalised on since training was completed. This section gathers the following information associated with the study dependent variable:

Estimation of the percentage of opportunities capitalised on to put the learning acquired through training into practice.

Measured on the following ordinal scale:

0% - 20%; 20% - 40%; 40% - 60%; 60% - 80%; 80% - 100%

At the end of the data collection period, a total of 4769 surveys had been received. Exploratory analysis of the data confirmed their suitability for statistical analysis.

Internal consistency analyses according to Cronbach 's alpha revealed good internal consistency between responses to the items that make up each of the considered factors (F1 .95; F2 .94; F3 .94; F4 .85; F5 .88; F6 .89; F7 .93; F8 .83).

Fieldwork

The study was approved by the General Secretariat of the Department of Education and Culture of the Autonomous Community of the Region of Murcia and carried out after the signing of a collaboration agreement. A questionnaire was made available to all teachers eligible for study participation. This was distributed using two methods. Firstly, mass mailing was used to send the questionnaire to all teachers who had already completed training activities. Secondly, it was attached to official evaluation questionnaires,

distributed two months following the training activity, used by the body responsible for ongoing teacher training (CPR region of Murcia).

Data analysis

Descriptive analysis of the factors, defined according to the reference eight-factor model framing the present research, was conducted according to means, standard deviations (SD), medians and percentiles (5th and 95th). In addition, dependent variable 2, describing the percentage of situations in which teachers put into practice the learning acquired from training (see Table 2), was analysed by assigning a positive transfer status to all cases in which this percentage exceeded 60%. This cut-point was adopted in order to mitigate effects associated with the positive bias resulting from subjective evaluation. Values for the primary variable (Table 2) show a positive bias towards values above 40% (2,864 cases) suggesting that the correct cut-point was selected.

Table 2. Descriptive data pertaining to dependent variable 2 describing the percentage of situations in which teachers put learning derived from training into practice

Variable	0-20 %	20 - 40 %	40 -60 %	60 -80 %	80 -100 %
Frequency	1 043	862	1 202	1 098	564

An adjusted logistic model describing the likelihood of transferring learning acquired through training was developed from data pertaining to the factors and the state variable. The stepwise method, followed by cross-validation, was used to determine the predictive variables. For this, the original sample was randomly divided into two data groups, with the first being used for the estimation process (GDE) and the second for confirmation (GDC). Selection was made using a 1:1 ratio. A multidimensional logistic model was then developed in order to evaluate associations between the factors and transfer likelihood.

Usefulness of the proposed model as a predictor of transfer was examined by analysing the confusion matrix associated with predicted and actual outcomes for the GDC sample. Measures of sensitivity, precision and accuracy were calculated.

R software (R Core Team, 2021) was used in its version 4.0.5 (03/31/2021) for data analysis. This ran on the macOS Sierra version 10.12.6 operating system installed on an iMac computer with a 2.8 GHz Intel Core i7 processor. The following packages were used during the analysis process: *car* (Fox & Weisberg, 2019), *caret* (Kuhn, 2021), *dplyr* (Wickham et al., 2021) and *mlogit* (Croissant, 2020).

Results

Outcomes will be discussed according to the objectives specified for the research. Firstly, outcomes pertaining to the identification of conditioning factors regarding transfer likelihood are considered (development of the logistic model by backward stepwise elimination and analysis of odds ratios). Examination of the parameters of the identified logistic model will follow, concluding with goodness of fit analysis. This will provide an evaluated model for estimating transfer likelihood.

Analysis of factor scores

During the data analysis process, the decision was made to define teachers who capitalised on at least 60% of opportunities presented to put learning into practice as successful transfer. Table 3 presents the distribution of factor scores for the sample both overall and as a function of successful transfer. Descriptive statistics reveal certain differences between average factor scores for teachers who reported successful transfer of training and those who did not. These differences were

statistically significant to the level of .05 according to Mann Whitney U test outcomes. In this sense, data confirm that factor scores differ in the sub-sample of individuals considered as examples of transfer to the classroom from those who were not successful at transferring training to the work setting. In consideration of the descriptive results, it is observed that scores associated with the factor *"Promotion of training by centre directors"* were lower in the set of individuals considered as examples of successful transfer, whilst scores in this group were higher in the case of all other factors.

Table 3. Descriptive data for factor scores and transfer likelihood. Mann-Whitney U test of differences in factor scores as a function of transfer success

Variable	Mean	SD	Median	Percentile (5th – 95th)
Factor 1. Training design and development	4.198	0.656	4.261	(3.000 – 5.000)
Factor 2. Self- efficacy	4.044	0.857	4.125	(2.375 – 5.000)
Factor 3. Promotion of training by the centre	3.217	1.253	3.250	(1.000 – 5.000)
Factor 4. Feedback from student and families	3.597	0.916	3.600	(2.000 – 5.000)
Factor 5. Environmental resources	3.807	0.649	3.667	(2.833 – 5.000)
Factor 6. Resistance to change in the workplace	3.766	0.837	3.667	(2.333 – 5.000)
Factor 7. Monitoring conducted by the institution delivering training	4.116	0.765	4.000	(2.667 – 5.000)
Factor 8. Locus of control	3.402	0.686	3.250	(2.500 – 4.750)

Transfer to job	No (65.15 %)	Yes (34.85 %)	p-value
Factor 1 Training design and development	Mean =4.048 SD=0.676	Mean=4.477 SD = 0.512	<.000
Factor 2 Self- efficacy	Mean =3.911 SD=0.874	Mean=4.293 SD = 0.763	<.000
Factor 3 Promotion of training by the centre	Mean =3.314 SD=1.159	Mean=3.037 SD = 1.396	<.000
Factor 4 Feedback de estudiantes y familias	Mean =3.450 SD=0.886	Mean=3.873 SD = 0.907	<.000
Factor 5 Environmental resources	Mean =3.738 SD=0.654	Mean=3.937 SD = 0.621	<.000
Factor 6 Resistance to change in the workplace	Mean =3.621 SD=0.820	Mean=4.037 SD = 0.801	<.000
Factor 7 Monitoring of the training institution	Mean =3.988 SD=0.779	Mean=4.357 SD = 0.677	<.000
Factor 8 Locus of control	Mean =3.347 SD=0.669	Mean=3.502 SD = 0.506	<.000

Note:
SD= Standard Deviation. P values calculated for the Mann-Whitney U test

Logistic regression

In view of the results obtained when comparing factor scores, an adjusted multidimensional logistic regression was performed to explore the association between factor scores and the probability of transferring training to the work setting.

The GDE group of sample data consisting of 2,294 individuals gathered in the model estimation phase was used to estimate the logistic model and evaluate its ability to predict training transfer based on factor scores. the GDC group, made up of 2475 individuals, was then used in the evaluation phase of the predictive model.

Table 4 presents data pertaining to the backward step elimination of variables, assuming a constant based on the hypothetical model and data collected for the final developed model.

Table 4. Outcomes of the multidimensional logistic model using the backward stepwise method. Model statistics

Step	Model	AIC	deviance		χ 2 p- value
			null	treatments	
1	Tr~F1+F2+F3+F4+F5+F6+F7+F8	2 673.8	2 934.4	2 655.8	278.64; df = 8 (p < .000)
2	Tr~F1+F2+F3+F4+F5+F7+F8	2 671.8	2 934.4	2 655.8	278.64; df = 7 (p < .000)
3	Tr~F1+F2+F3+F4+F7+F8	2 669.8	2 934.4	2 655.8	278.64; df = 6 (p < .000)
4	Tr~F1+F3+F4+F7+F8	2 668.3	2 934.4	2656.3	278.13; df = 5 (p < .000)
5	Tr~F1+F3+F7+F8	2666.9	2 934.4	2656.9	278.13; df = 4 (p < .000)

Factor	odds ratio	CI (95%)	p- value
Training design and development (F1)	2.58	2.06 - 3.20	<.000
Promotion of training by centre directors (F3)	0.83	0.77 - 0.90	<.000
Monitoring of the training institution (F7)	1.25	1.06 - 1.47	.0067
External locus of control (F8)	1.26	1.08 - 1.48	.0031

Note:

Tr : Transfer status variable (0; 1). F1 - F8 : = Factor 1 - Factor 8

With regards to relative goodness of fit between the proposed model and the saturated model (McCullagh & Nelder , 1983), the deviance statistic and the Akaike information criterion (AIC) statistic for the model comprising the explanatory factors (*"Training design and development", "Promotion of training by centre directors", "Monitoring carried out by the institution overseeing training"* and *"Locus of external control")* were lower than that of the saturated model. This indicates that the model provides information on the explained variable, whilst also showing that this model is more plausible and comprehensive than the rest of the analysed models.

Table 5. Logistic Regression Outcomes

predictor	β	SE(β)	W	df	p-value
Constant	-5.870	0.428	187.77	1	.000
Factor 1	0.948	0.108	76.71	1	.000
Factor 2	-0.188	0.040	21.45	1	.000
Factor 3	0.223	0.082	7.34	1	.007
Factor 4	0.234	0.079	8.77	1	.003
Model and goodness statistics			χ^{two}	df	p-val
Joint evaluation of the model					
likelihood ratio			277,590	4	.000
Wald test			367,222	5	.000
Goodness of fit					
Hosmer and Lomeshow			7,503	8	.483

Table 5 presents inference outcomes for individual coefficients (Wald test) pertaining to the selected model and goodness of fit outcomes according to Wald test and Hosmer and Lomeshow test outcomes and the likelihood ratio for evaluation of the joint model. Outcomes for all individual tests and those pertaining to overall model evaluation were statistically significant to the level of .05. Further, the Hosmer and Lomeshow statistic was not significant, providing some evidence that the model presents reasonable fit to the analysed data. Thus, it can be concluded that the selected model can be used effectively as a means to estimation the likelihood of training transfer.

Once the model was configured, the assumptions underlying multidimensional logistic models were evaluated. The assumption that a linear relationship exists between each explanatory variable and the logit of the response variable was evaluated using the obtained model, variable of interest, explanatory variables and the interactions of each of these with their natural logarithms. Outcomes relating model coefficients with interaction terms were non-significant to the level of .05. The multicollinearity assumption was evaluated by calculating the variance inflation factors (VIF) associated with the explanatory variables. Values lower than 2

were obtained, with the reference value being 10. Thus, it can be concluded that the effects of multicollinearity do not impede use of logistic regression techniques.

Analysis of the *odds ratios* associated with the explanatory variables included in the proposed model (Table 5) indicates that, when all other conditions are held the same, individuals recording high scores for the *training design and development factor* are more likely to successfully transfer training than those with low scores (OR = 2.58; 95% CI: 2.06 - 3.20; p <.000). The same relationship was found with the likelihood of transfer and scores pertaining to the factors "*monitoring conducted by the institution overseeing the training*" and "*external locus of control*". However, the factor "*promotion of training by centre directors*" was negatively related with the likelihood of transfer (OR = 0.83; 95% CI: 0.77 - 0.90, p <.000).

Analysis of the predictive power of the logistic model in order to estimate transfer

Examination of the characteristics related to the predictive power of the constructed logistic model was conducted using the GDC sub-sample (n GDC = 2475). The identified logistic model was used to estimate the likelihood of transfer based on the factor scores within the model. In order to estimate the likelihood of

transfer, a value of 0 was assigned when the estimated probability was less than 0.5, whilst a value of 1 was assigned when a higher probability was seen.

Table 6. Contingency and confusion matrix pertaining to the predictive model

Confusion matrix						
		Actual state			**Precision**	**Accuracy**
		0	1			
Estimated status	0	1407	616	2023	.695	ACC: .678
	1	181	271	452	.600	95% CI: (.659, .696) REL : 0.641
		1588	887	2475		p-value [ACC >NIR]: .000
Sensitivity	.886		.306			
Specificity	.306		.886			

Outcomes produced by the model developed for the GDC sub-sample were compared with the real values recorded in this sample. Table 6 presents data pertaining to the associated confusion matrix. Data indicate that the model identified 271 true positives, 1407 true negatives, 181 false positives and 661 false negatives. With regards to estimated values, the sensitivity value of the model for the negative state (probability of correctly predicting that individuals will not transfer training) was .886, whilst a sensitivity value of .306 was recorded for the positive state. Meanwhile, a precision value of .600 was produced for the positive state (probability of correctly predicting successful transfer) and .695 for the negative state. Overall, the model recorded an accuracy of .678, which was higher than the non-information quotient (outcomes when states are randomly assigned). This indicates that the model is built on relative information when it comes to classification. In view of these parameters, the model is observed to present with low-to-moderate precision in both states, whilst sensitivity data indicate that the model presents good characteristics for identifying individuals who are not likely to transfer training outcomes into practice.

Discussion and Conclusions

Examination of present outcomes makes it possible to conclude that the proposed logistic regression model is capable of estimating the likelihood of practicing non-university teachers transferring learning from teacher training to the workplace based on the scores of the examined conditioning factors (*training design and development, promotion of training by centre directors, monitoring of training overseen by the institution* and *external control locus*).

The developed model proposes a positive association between the factor *training design and development* and the likelihood of transferring training to the classroom. The characteristic elements of training design have been positively related to the transfer of training in different training or professional contexts (Cejas-León and Navío-Gámez, 2018; Espona-Barcons et al., 2017; Feixas et al., 2013 ; Wang et al., 2021). Thus, outcomes of the present study confirm that the elements inherent to training design are positively associated with transfer likelihood. Further, Yaghi and Bates (2020) explored the role played by support from supervisors and co-workers on the transfer of training, observing a positive impact of both types of support on the motivation to transfer, with the latter also

promoting actual transfer. The positive association between support and transference has been addressed by several studies in the field (Espona-Barcons et al., 2017; Freitas et al., 2019; Nazli & Khairudin , 2018), supporting present findings of a positive association between follow-up conducted by *the training institution* and transfer likelihood. In relation to the external locus of control, scientific literature in the field has focused on exploring motivation and specific aspects of the internal locus of control in training users. Thus, present findings regarding this factor are novel. This being said, this factor contributed little to model predictive power meaning that further research is required to confirm findings regarding this factor.

Another novel element of the present study was the emergence of a negative association between the *promotion of training work centre directors* and transfer likelihood. Although further study is required, this indicates that transfer to the classroom may be more likely in situations in which teachers act autonomously, without explicit mediation of the governing bodies of the educational centres at which they work. Although the aforementioned literature highlight the existence of a positive association regarding support from supervisors and peers, the negative association found in the present study indicates perceptions of promoting training may be different from actual support of support for putting it into practice. This requires further in-depth analysis to identify the function of this factor within the transfer process.

Finally, examination of the classification capacity of the established model to be able to identify transfer cases based on estimated probability shows that the model is capable of identifying cases in which transfer will not occur (correctly predict individuals who will fail to transfer training). However, the model had a low success rate in terms of precision and accuracy.

In view of the outcomes obtained and the interpretation made of findings, it is concluded from the present research that it is possible to identify predictive variables of the likelihood of training transfer in practicing teachers. This responds to the first research question posed at the beginning of the paper. Further, associations between explanatory variables and training transfer likelihood were studied, providing valuable information that will help at the time of proposing measures to improve the transfer of ongoing training into the workplace.

Study limitations and future work

Present findings must be interpreted within the limitations imposed by the methodological approach adopted for the research, which was designed to address a specific reality and context. Thus, the inferences made must be understood as relative and dependent on verification through further studies to provide them with greater validity. Nonetheless, outcomes are in accordance with those reported in previous academic literature on the issue of interest and, therefore, contribute towards a greater understanding of the transfer of training outcomes and its relationship with potential predictive variables.

In terms of the proposed inferential model, the factor denominated "external locus of control" was identified to have a weak association with transfer likelihood, according to the odds ratio produced. Due to this, the present study should be followed by other studies in order to establish the exact role of this factor in the estimation process. Finally, another limitation is that a differentiated analysis was not carried out in terms of education or professional experience of participating teachers. This means that outcomes do not allow the identified association to be examined according to different population groups.

In relation to future work, there is a need to provide mechanisms that will enable successful transfer cases to be differentiated from unsuccessful cases as a function of environmental, internal and, even, dynamic factors. The aim of this would be to provide a priori information on the degree of transfer of a training program or activity. On the other

hand, understanding the nature and extent of associations provides valuable information when designing the specific actions that may improve the overall process. This includes encouraging supervision, relativize the vision of the external locus of control or propose plans to promote training and transfer. Present findings in terms of classification require the exploration of other research designs in order to compare data with that gathered in the present work and explore different analytical techniques such as hierarchical regression, cluster classification or supervised learning.

Funding

References

Alexandraki, I., Rosasco, R. E., & Mooradian, A. D. (2021). An Evaluation of Faculty Development Programs for Clinician–Educators: A Scoping Review. *Academic Medicine*, *96*(4), 599-606. https://doi.org/10.1097/acm.0000000000003813

Alsalamah, A., & Callinan, C. (2021). Adaptation of Kirkpatrick's Four-Level Model of Training Criteria to Evaluate Training Programmes for Head Teachers. *Education Sciences*, *11*(3), 116. https://doi.org/10.3390/educsci11030116

Aparicio-Molina, C., Sepúlveda-López, F., Valverde-Huincatripay, X., Cárdenas-Merino, V., Contreras-Sanzana, G., & Valenzuela-Ravanal, M. (2020). Liderazgo directivo y cambio educativo: Análisis de una experiencia de colaboración Universidad-Escuela. *Páginas De Educación*, *13*(1), 19-41. https://doi.org/10.22235/pe.v13i1.1915

Baldwin, T. T., & Ford, J. K. (1988). Transfer of training: A review and directions for future research. *Personnel psychology*, *41*(1), 63-105. https://doi.org/10.1111/j.1744-6570.1988.tb00632.x

Baldwin, T. T., Ford, J. K., & Blume, B. D. (2017). The state of transfer of training research: Moving toward more consumer-centric inquiry. *Human Resource Development Quarterly*, *28*(1), 17-28. https://doi.org/10.1002/hrdq.21278

Blume, B. D., Ford, J. K., Surface, E. A., & Olenick, J. (2019). A dynamic model of training transfer. *Human Resource Management Review*, *29*(2), 270-283. https://doi.org/10.1016/j.hrmr.2017.11.004

Botke, J. A., Jansen, P. G., Khapova, S. N., & Tims, M. (2018). Work factors influencing the transfer stages of soft skills training: A literature review. *Educational Research Review*, *24*, 130-147. https://doi.org/10.1016/j.edurev.2018.04.001

Brion, C. (2020). The role of culture in the transfer of training. *International Journal of Training and Development*, *24*(4), 384-393. https://doi.org/10.1111/ijtd.12203

Cano, E. (2016). Factores Favorecedores y Obstaculizadores de la Transferencia de la Formación del Profesorado en Educación Superior. *REICE. Revista Iberoamericana Sobre Calidad, Eficacia Y Cambio En Educación,* 14(2). https://doi.org/10.15366/reice2016.14.2.008

Cejas-León, R., & Navío-Gámez, A. (2018). Formación en TIC del profesorado universitario. Factores que influyen en la transferencia a la función docente. *Profesorado. Revista de Currículum y Formación de Profesorado, 22*(3), 271-293. https://doi.org/10.30827/profesorado.v22i3.8002

Croissant, Y. (2020). Estimation of Random Utility Models in R: The mlogit Package. *Journal of Statistical Software, 95*(11), 1-41. https://doi.org/10.18637/jss.v095.i11

Cubo, S., Marín, B., & Ramos, J. L. (2018). *La investigación experimental. Métodos de investigación y análisis de datos en ciencias sociales y de la salud*. Editorial Picramide.

Darling-Hammond, L., Hyler, M.E., & Gardner, M. (2017). *Effective teacher professional development*. Palo Alto, CA: Learning Policy Institute. https://learningpolicyinstitute.org/product/teacher-prof-dev

Erdas, E., Dogan, N., Irez, S., Cakmakci, G., & Yalaki, Y. (2019). A five-level design for evaluating professional development programs: Teaching and learning about nature of science. *Issues in Educational Research*, *29*(2), 402-426. http://www.iier.org.au/iier29/erdas-kartal.pdf

Escudero-Muñoz, J. M., González-González, M. T., & Rodríguez-Entrena, M. J. (2018). Los contenidos de la formación continuada del profesorado: ¿Qué docentes se están formando? *Educación XX1*, *21*(1), 157-180. https://doi.org/10.5944/educXX1.15807

Espona-Barcons, B., Pineda-Herrero, P., Cirao-Calí, A., & Quesada-Pallarés, C. (2017). ¿Es eficaz la formación en la Administración Pública española? *QURRICULUM-Revista de Teoría, Investigación y Práctica Educativa*, (30), 31-48.

Feixas, M., Duran, M. D. M., Fernández, I., Fernández, A., García San Pedro, M. J., Márquez, M. D., ... & Lagos, P. (2013). ¿Cómo medir la transferencia de la formación en Educación Superior?: el Cuestionario de Factores de Transferencia. *REDU. Revista de Docencia Universitaria, 11*(3), 219-248.

Ford, J. K., Baldwin, T. T., & Prasad, J. (2018). Transfer of training: The known and the unknown. *Annual Review of Organizational Psychology and Organizational Behavior, 5*, 201-225.

Fox, J., & Weisberg, S. (2019). *An {R} Companion to Applied Regression*, Third Edition. Thousand Oaks CA: Sage. https://socialsciences.mcmaster.ca/jfox/Books/Companion/

Freitas, A. C., Silva, S. A., & Santos, C. M. (2019). Safety training transfer: The roles of coworkers, supervisors, safety professionals, and felt responsibility. *Journal of Occupational Health Psychology, 24*(1), 92–107. https://doi.org/10.1037/ocp0000125

Heydari, M.R., Taghva, F., & Amini, M. (2019). Using Kirkpatrick's model to measure the effect of a new teaching and learning methods workshop for health care staff. *BMC Res Notes 12*, 388. https://doi.org/10.1186/s13104-019-4421-y

Jackson, C. B., Brabson, L. A., Quetsch, L. B., & Herschell, A. D. (2019). Training transfer: A systematic review of the impact of inner setting factors. *Advances in Health Sciences Education*, *24*(1), 167-183. https://doi.org/10.1007/s10459-018-9837-y

Jones, C., Fraser, J., & Randall, S. (2018). The evaluation of a home-based pediatric nursing service: concept and design development using the Kirkpatrick model. *Journal of Research in Nursing*, *23*(6), 492-501. https://doi.org/10.1177%2F1744987118786019

Kelley, T. R., Knowles, J. G., Holland, J. D., & Han, J. (2020). Increasing high school teachers self-efficacy for integrated STEM instruction through a collaborative community of practice. *International Journal of STEM Education*, 7(1). https://doi.org/10.1186/s40594-020-00211-w

Kirkpatrick, D., & Kirkpatrick, J. (2006). *Evaluating training programs: The four levels*. Berrett-Koehler Publishers.

Kuhn, M. (2021). caret: Classification and Regression Training. R package version 6.0-88. https://CRAN.R-project.org/package=caret

Mahmoodi, M., Rashtchi, M., & Abbasian, G. R. (2019). Evaluation of in-service teacher training program in iran: Focus on the Kirkpatrick model. *Education and Self Development*, *14*(4), 20-38. https://doi.org/10.26907/esd14.4.03

Makumbe, S., Hattingh, T., Plint, N., & Esterhuizen, D. (2018). Effectiveness of using Learning Factories to impart Lean principles in mining employees. *Procedia manufacturing*, *23*, 69-74. https://doi.org/10.1016/j.promfg.2018.03.163

McChesney, K., & Aldridge, J. M. (2018). A new tool for practitioner-led evaluation of teacher professional development. *Teacher Development, 22*(3), 314–338. https://doi.org/10.1080/13664530.2017.1418418

McCullagh, P., & Nelder, J.A. (1983). *Generalized Linear Models* (2nd ed.). Routledge. https://doi.org/10.1201/9780203753736

Mizell, H. (2010). *Why Professional Development Matters*. Learning Forward. https://learningforward.org/wp-

content/uploads/2017/08/professional-development-matters.pdf

Nazli, N., & Khairudin, S. (2018). The factors that influence transfer of training and its effect on organizational citizenship behaviour: Evidence from Malaysia civil defence force. *Journal of Workplace Learning. 30*(2), 121-146. https://doi.org/10.1108/JWL-09-2017-0080

Pamies-Berenguer, M., Gomariz-Vicente, M.A., & Cascales-Martínez, A. (2022). Factores condicionantes de la transferencia de la formación permanente del profesorado no universitario. *Revista de Educación a Distancia (RED), 22(69).* https://doi.org/10.6018/red.486801

Popova, A., Evans, D. K., Breeding, M. E., & Arancibia, V. (2021). Teacher Professional Development around the World: The Gap between Evidence and Practice. *The World Bank Research Observer*. https://doi.org/10.1093/wbro/lkab006

R Core Team (2021). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/

Richter, S., & Kauffeld, S. (2020). Beyond supervisors' support: influencing (international) technical training transfer. *European Journal of Training and Development, 44*(4), 391-403. https://doi.org/10.1108/EJTD-08-2019-0141

Roig-Ester, H., Quesada-Pallarès, C., & Pineda-Herrero, P. (2021). Diseño y pilotaje del METEnf: Modelo de Evaluación de los factores de Transferencia de la formación de los nuevos profesionales en Enfermería. *Educación Médica, 22*, 346–351. https://doi.org/10.1016/j.edumed.2019.09.005

Sims, S., & Fletcher-Wood, H. (2021). Identifying the characteristics of effective teacher professional development: a critical review. *School effectiveness and school improvement*, *32*(1), 47-63. https://doi.org/10.1080/09243453.2020.1772841

Tracey, J. B., Hinkin, T. R., Tannenbaum, S., & Mathieu, J. E. (2001). The influence of individual characteristics and the work environment on varying levels of training outcomes. *Human resource development quarterly, 12*(1), 5-23. https://doi.org/10.1002/1532-1096(200101/02)12:1%3C5::aid-hrdq2%3E3.0.co;2-j

Vizeshfar, F., Momennasab, M., Yektatalab, S., & Iman, M. T. (2018). Evaluation of the effectiveness of a first aid health volunteers' training programme using Kirkpatrick's model: A pilot study. *Health Education Journal*, *77*(2), 190-197. https://doi.org/10.1177/0017896917741149

Wang, W., He, Z., Zhang, M., & Huo, B. (2021). Well begun is half done: Toward an understanding of predictors for initial training transfer. *European Management Journal*, *39*(6), https://doi.org/10.1016/j.emj.2021.04.002

Wickham, H., François, R., Henry, L., & Müller, K. (2021). dplyr: A Grammar of Data Manipulation. R package version 1.0.5. https://CRAN.R-project.org/package=dplyr

Yaghi, A., & Bates, R. (2020). The role of supervisor and peer support in training transfer in institutions of higher education. *International Journal of Training and Development, 24*(2), 89-104. https://doi.org/10.1111/ijtd.12173

Yurtseven, Z., O'Dwyer, L. M., & Lawson, J. (2020). Designing effective professional development for technology integration in schools. *Journal of Computer Assisted Learning*, *36*(2), 160-177. https://doi.org/10.1111/jcal.12394

Authors / Autores
Pamies-Berenguer, Marcial (marcial.pamies@um.es) 0000-0002-8556-5769   Degree in Mathematics at the University of Murcia. Associate Professor in the Department of Informatics and Systems at the University of Murcia. Member of the Research Group E074-10 We Share Education at the University of Murcia. He is currently developing his doctoral thesis project "Study of the transfer and the impact of permanent training of non-university teachers in the Autonomous Community of the Region of Murcia" under the direction of Ms. Mª Ángeles Gomariz Vicente and Ms. Antonia Cascales Martinez. His lines of work and research focus on permanent teacher training, transfer of training and study of the effectiveness of permanent training. On these topics he has various publications and participation in National and International Congresses.
Cascales-Martínez, Antonia (antonia.cascales@um.es) 0000-0002-8966-2558   PhD in Pedagogy at the University of Murcia since 2015. Associate Professor in the Department of Research Methods and Diagnosis in Education at the University of Murcia. She belongs to the Research Group E074-10 We Share Education at the University of Murcia. She has participated in various Research Projects funded within competitive National Plans. Her lines of work and research are focused on Educational Technology, Tutorial Action and Attention to diversity and educational technology. On these topics she has various publications and participation in National and International Congresses.
Gomáriz-Vicente, Mª Ángeles (magovi@um.es) 0000-0002-8308-0848   PhD in Pedagogy at the University of Murcia since 2005. Lecturer in Research Methods and Diagnosis in Education. She has participated in various Research Projects funded within competitive National Plans. She currently belongs to the Research Group E074-10 We Share Education at the University of Murcia. Her lines of work and research are focused on Educational Guidance, Tutorial Action, Diagnosis in Education and Family Participation in school education. On these topics she has various publications and participation in National and International Congresses. She has assumed positions of responsibility, such as the Vice-Dean for Students and Institutional Relations of the Faculty of Education (2009-2013), or the Coordination of the Degree in Pedagogy at the University of Murcia, as well as Coordinator of the Master's Degree in Education Teacher Training Compulsory Secondary, Baccalaureate, Vocational Training, Language Teaching and Artistic Teaching at the University of Murcia (2014-2017).

RELIEVE

Revista **EL**ectrónica de **I**nvestigación y **EV**aluación **E**ducativa

E-Journal of Educational Research, Assessment and Evaluation