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Learning transfer – validation of the learning transfer system inventory in Portugal

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Abstract

Purpose – The purpose of this paper is to analyze the construct validity of learning transfer system inventory (LTSI) for use in Portugal. Furthermore, it also aims to analyze whether LTSI dimensions differ across individual variables such as gender, age, educational level and job tenure.

Design/methodology/approach – After a rigorous translation process that included forward and backward translation, subjective evaluations of the translated items, and pilot testing, the Portuguese version of LTSI was completed by 484 trainees, who attended different kinds of training courses. Two separate exploratory factor analyses were run to analyze the specific and general domains covered by LTSI. An initial analysis with the validated items and a second one with the validated and research items were also completed.

Findings – The results of the initial factor analyses showed a 16-factor structure that accurately paralleled the 16-factor structure of the original English version and revealed that this one is the most parsimonious factor structure. Statistically significant differences in some LTSI dimensions were found across gender and education-level variables.

Research limitations/implications – Data were collected through self-reported measures using a single instrument applied immediately after the training, which might have affected the internal validity of the study. Although this study covered a wide variety of trainees' business areas and types of training, it might be possible that some types of organizations and training were not included in the analysis, thus limiting the generalization of the results to those contexts.

Practical implications – Based on the results of this study, Portuguese companies are now able to develop their training evaluation practices and to assess the training transfer factors through a valid and reliable instrument.

Originality/value – The paper expands LTSI validity in Europe, demonstrating that it has construct validity for use in Portugal.

Keywords Training evaluation, Learning, Cross-cultural studies, Portugal

Paper type Research paper

1. Introduction

The Lisbon Strategy proposed by the European Council in 2000 aims to make Europe the most dynamic and competitive knowledge-based economy in the world. Accordingly, it is crucial to create an environment in Portugal that stimulates the development and opening of innovative companies, especially the small and medium ones, in order to increase the levels of productivity, competitiveness and employment. This strategic imperative has made training in Portugal even more important as a critical vehicle of skills development and productivity improvement in organizations.

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Consequently, in recent years, investment on training activities in Portugal has greatly increased. The results of a report about professional training activity in Portugal involving 5,500 organizations, showed that, in 2004, more than 149,000 training courses were run in which over three-quarters of a million trainees participated. On average, the training cost per participant was €262,4, which represented a total annual training investment of over €200 million in Portugal (DGEEP, 2004).

Whether and to what extent this investment in training will have a payoff in improved productivity is a major question (Velada *et al.*, 2007). Caetano (2007) points out that, in Portugal, the analysis of the effective impact of training on individual and organizational development is almost non-existent. In those few cases where evaluation does occur, it tends to be superficial examining either trainee reactions to training or learning from training. Rarely do training evaluations examine change in job behaviour or performance resulting from training (i.e. learning transfer) or the factors that may facilitate or block such transfer. In the absence of more effective training evaluation practice it will be difficult to gauge the impact of training (Dionne, 1996).

There are at least two factors that underlie the lack of effective training evaluation practice. First, there is not a strong evaluation culture in Portuguese organizations: Fewer than 5 percent of private sector organizations are certified in training evaluation (IQF – Instituto para a Qualidade na Formação, 2006). Second, efforts at better evaluation are constrained by the limited availability of effective training evaluation measurement tools. Although many tools have been developed, such as those assessing the multidimensionality of participant reaction measures (Morgan and Casper, 2000; Velada and Caetano, 2007), key pre-training factors (Weinstein *et al.*, 1994), and factors affecting learning transfer (Alvarez *et al.*, 2004; Holton *et al.*, 2000), very few are available in languages other than English. This severely limits their use in other linguistic contexts.

A key step in expanding and advancing training evaluation in Portugal is promoting the integration of advanced, effective research tools and findings into current practice. To begin to address this challenge, this research seeks to translate into Portuguese and provide evidence for the construct validity of one such tool, the learning transfer system inventory (LTSI). The LTSI has value in the current Portuguese context from both a research and an applied perspective. From a research perspective, translating and adapting a valid existing instrument, rather than developing a new culture-specific one, represents a far more efficient use of research time and resources. The instrument could also provide a foundation for future cross-study comparisons of the learning transfer process. From a practical perspective, defining and accurately measuring factors affecting learning transfer moves training evaluation practice forward by providing a means to diagnose unknown and potential transfer problems, identify leverage points for change, and as a means for targeting interventions designed to enhance transfer (Holton *et al.*, 2000).

The purpose of this study is to translate and collect construct validity evidence for a Portuguese version of the LTSI (the PLTSI). The validation of the PLTSI will provide researchers and reflective practitioners with a tool that can improve training evaluation practice and advance knowledge about the system of variables, which influence training transfer from the training context to the work environment. This research will also increase the knowledge and practice in training research in countries with less developed HRD theory and practice, such as Portugal, and will provide

further evidence of the cross-cultural validity of the LTSI in a country with a management culture and work values different from the USA and from other European countries (e.g. Esmer and Pettersson, 2007; Hofstede and Hofstede, 2004) where this instrument has already been validated.

This study addresses the following research questions:

RQ1. Will exploratory factor analysis of the PLTSI version result in an interpretable factor structure consistent with the original LTSI factor structure?

RQ2. Will the addition of the 21 "research items" improve the factor structure or psychometric properties of the PLTSI scales?

RQ3. Will be found differences across individual-level variables, such as gender, age, level of education and job tenure, in the perception of the factors obtained in the PLTSI?

The investigation of these individual variables is relevant because it will increase our understanding of their importance in the training transfer process. If they have an important impact in training transfer, we should take them into account when designing new training programs. This issue is even more important because there is a gap in the literature regarding the analysis of the relationship between demographic variables and transfer-system variables (Chen *et al.*, 2006), as they are often used as control variables.

2. Method

2.1 Instrumentation

The LTSI has been through several developmental iterations over the last decade (e.g. see Holton *et al.*, 1997, 2000; Holton and Bates, 2002). The most recent version of the LTSI (Holton and Bates, 2002) was used in this study. This version includes 89 items measuring 16 factors influencing the training transfer process. This version contains 68 items validated in previous research (Holton *et al.*, 2000) along with 21 "research items" added by the instrument's authors (Holton and Bates, 2002) in an effort to improve the psychometric properties of several scales (positive personal outcomes, personal capacity for transfer, supervisor sanctions, opportunity to use learning, and performance coaching). The scales and items contained in the LTSI are grouped into two domains. The training-specific domain contains 63 items (45 validated items and 18 research items) assessing eleven factors influencing the transfer process related to a specific training program. The constructs in this section are program specific in that they are expected to vary depending on the training program. Respondents are directed "to think about this specific training program" when responding to these items. The second section of the LTSI contains 26 items (23 validated items and three research items) measuring five constructs that reference factors that reflect respondents' general experience with training in their organization. Respondents are directed to "think about training in general in your organization" when responding to these items (see Table I). All of the items used a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

A number of studies have provided evidence supporting the validity of the LTSI. For example, Bookter's (1999) study of sample of 204 US postal employees provided

Table I.
English LTSI scale definitions and sample items

Factor	Definition	Example item	Number of items (validated + research items)	α
Training specific scales				
Learner readiness	The extent to which individuals are prepared to enter and participate in training	Before the training, I had a good understanding of how it would fit my job-related development	4	0.73
Motivation to transfer	The direction, intensity, and persistence of effort toward utilizing in a work setting skills and knowledge learned	I get excited when I think about trying to use my new learning on my job	4	0.83
Positive personal outcomes	The degree to which applying training on the job leads to outcomes that are positive for the individual	Employees in this organization receive various "perks" when they utilize newly learned skills on the job	3 + 5	0.69
Negative personal outcomes	The extent to which individuals believe that not applying skills and knowledge learned in training will lead to outcomes that are negative	If I do not utilize my training I will be cautioned about it	4	0.76
Personal capacity for transfer	The extent to which individuals have the time, energy and mental space in their work lives to make changes required to transfer learning to the job	My workload allows me time to try the new things I have learned	4 + 3	0.68
Peer support	The extent to which peers reinforce and support use of learning on the job.	My colleagues encourage me to use the skills I have learned in training	4	0.83
Supervisor support	The extent to which supervisors-managers support and reinforce use of training on the job	My supervisor sets goals for me that encourage me to apply my training on the job	6	0.91
Supervisor sanctions	The extent to which individuals perceive negative responses from supervisors-managers when applying skills learned in training	My supervisor opposes the use of the techniques I learned in training	3 + 6	0.63
Perceived content validity	The extent to which, trainees judge training content to accurately reflect job requirements	What is taught in training closely matches my job requirements	5	0.84

(*continued*)

Factor	Definition	Example item	Number of items (validated + research items)	α
Transfer design	Degree to which: training has been designed and delivered to give trainees the ability to transfer learning to the job; and training instructions match job requirements	The activities and exercises the trainers used helped me know how to apply my learning on the job	4	0.85
Opportunity to use	The extent to which trainees are provided with or obtain resources and tasks on the job enabling them to use training on the job	The resources I need to use what I learned will be available to me after training	4 + 4 63	0.70
General scales				
Transfer effort-performance expectations	The expectation that effort devoted to transferring learning will lead to changes in job performance	My job performance improves when I use new things that I have learned	4	0.81
Performance-outcomes expectations	The expectation that changes in job performance will lead to valued outcomes	When I do things to improve my performance, good things happen to me	5	0.83
Resistance/openness to change	The extent to which prevailing group norms are perceived by individuals to resist or discourage the use of skills and knowledge acquired in training	People in my group are open to changing the way they do things	6	0.85
Performance self-efficacy	An individual's general belief that they are able to change their performance when they want to	I am confident in my ability to use new skills at work	4	0.76
Performance coaching	Formal and informal indicators from an organization about an individual's job performance	After training, I get feedback from people on how well I am applying what I learn	4 + 3 26	0.70
Items total			89	

Source: Adapted from Holton *et al.* (2000, pp. 344-6)

Table I.

strong evidence of the convergent and divergent validity of the LTSI scales. Other studies have provided evidence of strong relationships between LTSI scale scores and important outcome measures, such as individual performance, motivation to transfer and utility reactions (e.g. Bates *et al.*, 1997, 2000; Ruona *et al.*, 2002; Seyler *et al.*, 1998). Finally, a number of studies have examined and confirmed the cross-cultural construct validity of the LTSI in various cultural and linguistic contexts including Thailand (Yamnill, 2001), Taiwan (Chen *et al.*, 2005), Jordan (Khasawneh *et al.*, 2006), Belgium (Devos *et al.*, 2007), Germany (Bates *et al.*, 2007), and the Ukraine (Yamkovenko *et al.*, 2007). The present research seeks to extend this line of research by investigating the cross-cultural validity of the Portuguese version of the LTSI.

2.2 Instrument translation

To ensure equivalence of meaning of the items and constructs between the Portuguese and English versions of the LTSI, a rigorous translation process was used that included forward and backward translation, subjective evaluations of the translated items, and pilot testing. The goal of the translation process was to produce a Portuguese version of the LTSI with items that were equivalent in meaning to the original English version. Equivalent translations emphasize functional equivalence or the equivalence of meaning of items across the original and translated instruments rather than word-for-word duplication. Functional equivalence is seen as increasing the likelihood the instrument will operate in a new target culture much as it did in the original culture in which it was developed.

The translation process began with the translation of the English version of the LTSI into Portuguese by a translator bilingual in both English and Portuguese. The translator was instructed to retain both the form (language) and the meaning of the items as close to the original as possible but to give priority to meaning equivalence. After completing the forward translation two additional bilingual translators (one a native English speaker and the other a native Portuguese speaker) independently translated the LTSI back into English producing two back translations. The translators then compared the back translations to assess the item-by-item consistency. In the case of discrepancies or disagreements, the items were discussed and revised until consensus was reached. This sequential forward-back translation process was used because it involved direct translations and an evaluation process without making any changes in the underlying meaning of items taken from the original LTSI. The translation process ended with an examination of the final back translation by one of the LTSI authors. The purpose of this evaluation was to assure that the meaning of the back translated items were consistent with the meaning of the original items. Before the LTSI application, a pilot test was conducted with the PLTSI in order to gather feedback on the readability and content validity of the translated instrument. This instrument was applied at the end of a training session attended by ten trainees and no significant word changes were made.

2.3 Sample

In this study, both purposive and convenience sampling techniques were used. A number of organizations were contacted through personal and professional contacts of the first and second authors of this paper to determine their interest in participating in this study and seven of them agreed to participate. A total of 500 questionnaires were delivered immediately after the training sessions by the administrators of the training

programs to participants from those seven organizations. Participants were informed about the purpose of the study and instructed on how to complete the questionnaire. After completion, questionnaires were collected and returned to the first and second authors of this study. Of the 500 questionnaires that were delivered, 484 were returned for a response rate of 92.8 percent.

Regarding demographic characteristics, 55.8 percent respondents were male and 41.7 percent were female (2.5 percent non-responses). The mean age for the participants was 35 years and the average tenure was nine years and seven months. In terms of educational level, 20.5 percent had less than high-school level, 33.5 percent had a high-school degree, 33.1 percent had a university degree level and 5.6 percent had a master degree level (7.4 percent non-responses). These trainees were from different business areas (see Table II). The trainees also attended different kinds of training courses: technical training (77.7 percent), behavioural training (6.4 percent), and both technical and behavioural training (15.9 percent). We collected data from a sample as heterogeneous as possible in order to develop a generalized instrument that could be used across a wide range of training programs and organizations in Portugal.

2.4 Analysis

Factor analysis is a commonly used statistical technique in the instrument validation process. In this study, factor analysis was used to explore the extent to which the factor structure of the LTSI was similar across cultural-linguistic applications. In other words, our goal was to determine if the Portuguese version of the LTSI measured the same dimensions as the original English version in the same ways. Because of the exploratory nature of this study, common factor analysis with oblique rotation was selected as the most appropriate approach. Common factor analysis is more appropriate than principal component analysis when the objective is to identify latent structures, and oblique rotation is more appropriate when some correlation among latent variables is expected (Chen *et al.*, 2005).

Two sets of factor analyses were run in this study. First, a factor analysis was conducted on the 68 items validated in previous research (research question no. 1). A second factor analysis was conducted that included the 68 validated items plus 21 additional research items (*RQ2*). Within both of these analyses the two construct domains (specific and general) of items in the LTSI were factor analyzed separately (Chen *et al.*, 2005; Holton *et al.*, 2000). In all analyses, the eigenvalue greater than one criterion and the analysis of scree plot were used to make decisions about the number of factors to extract. Item retention used a 0.30 cut-off.

In order to analyze the mean differences in learning-transfer factors (dependent variables) across gender, age, level of education and job tenure (independent variables),

	Frequency	%
Industrial	99	20.5
Commercial	95	19.6
Services	114	23.5
Financial and insurance	133	27.5
Others	43	8.9
Total	484	100

Table II.
Sample description by business area

we performed a multivariate analysis of variance (MANOVA). The test of significance used in this study was Pillai's Trace, because it is not affected by violations of MANOVA assumptions, with the exception of gender (with only two levels), where we used the Hotelling's Trace test (Gardner, 2001). When MANOVA analysis showed statistically significant differences among levels of the independent variables, this analysis was followed by a Univariate Analysis of Variance (ANOVA) and Post hoc analysis (Tukey's at an alpha level of 0.05) to see which factors differed significantly across the individual variable and the levels of the individual variable that were statistically different.

3. Results

RQ1

Examination of the data showed Kaiser's measure of sampling adequacy was 0.85 for training in specific domain and 0.88 for the training in general domain, indicating the data were appropriate for factor analysis. The MSA values for individual items were also examined to identify potentially troublesome items and to exclude any that did not meet the minimum recommended value of 0.50 (Hair *et al.*, 1998). None fell below 0.60. The results of the factor analyses showed a 16-factor structure that accurately paralleled the 16-factor structure of the original English version. In the training in specific domain, 11 factors emerged, explaining 63 percent of the total variance. Except for items 1, 17, 58 and 60, all items loaded on their respective factors, (see Table III). In the training-general domain, five factors emerged that closely matched the original scales and items, and explained 58 percent of the total variance. One item (82) did not load on the respective dimension (see Table IV). Reliability estimates for 11 scales exceeded Nunnally and Bernstein's (1994) suggested threshold of 0.70 for new scales and other two scales (supervisor sanctions and performance self-efficacy) approached this level. The reliability estimates for the remaining three scales (learner readiness, positive personal outcomes and personal capacity for transfer) suggest we have to be more cautious regarding its psychometric properties. In sum, factor analysis of the two LTSI domains with data from the 68 validated items yielded an instrument with generally acceptable psychometric properties and a factor structure identical to the original English version. All 16 scales emerged with 63 of 68 (92.6 percent) items loading on their respective scale at 0.30 or greater.

RQ2

This analysis added the 21 research items to the 68 original items in an effort to examine the how the addition of these factors affected the factor structure and psychometric properties of the scales.

In the training in specific domain, 64 items were used (45 validated items and 19 research items). Kaiser's measure of sampling adequacy in this analysis was 0.87. None of the MSA values for individual items fell below 0.60. The results of this EFA showed a 14-factor structure explaining 65 percent of total variance. One factor was dropped because it contained only two items that loaded below 0.40 and that lacked conceptual coherence. With relatively minor differences, the remaining 13 factors largely paralleled those in the original English LTSI: 11 factors matched very closely the factors found in the original LTSI with all but three items (1, 17, and 27) loading above 0.30 on their respective factors (see Table V).

Question	Factor 1	2	3	4	5	6	7	8	9	10	11
Q33	0.96										
Q32	0.91										
Q43	0.48										
Q40	0.47										
Q37	0.46										
Q39	0.45										
Q48		0.92									
Q47		0.72									
Q49		0.58									
Q59		0.39									
Q4			0.70								
Q2			0.68								
Q3			0.63								
Q5			0.63								
Q1[b]			0.41								
Q21				0.82							
Q23				0.67							
Q14				0.59							
Q24				0.57							
Q17[b]				0.52							
Q29					− 0.80						
Q30					− 0.74						
Q28					− 0.72						
Q31					− 0.57						
Q61[a]						− 0.72					
Q63[a]						− 0.70					
Q56						− 0.53					
Q54							0.79				
Q55							0.67				
Q53							0.66				
Q52							0.46				
Q6								− 0.47			
Q16								− 0.43			
Q58[b]								0.30			
Q10									0.68		
Q13									0.56		
Q9									0.52		
Q19										0.51	
Q26[a]										0.48	
Q25										0.44	
Q27[a]										0.40	
Q60[b]										0.36	
Q38											0.60
Q45											0.48
Q44											0.31

Note: [a]Represents reverse-scored items; [b]represents items that did not load on the respective dimension

Table III.
Factor loadings for training in specific domain of the validated items

Question	Factor 1	2	3	4	5
Q66	0.75				
Q65	0.67				
Q69	0.61				
Q71	0.55				
Q82[b]	0.39				
Q77[a]		0.76			
Q76[a]		0.71			
Q74[a]		0.67			
Q78		0.56			
Q75		0.55			
Q73[a]		0.53			
Q67			−0.71		
Q72			−0.63		
Q68			−0.62		
Q64[a]			−0.49		
Q70			−0.48		
Q86				0.74	
Q87				0.66	
Q89				0.51	
Q79				0.45	
Q84					0.65
Q85					0.54
Q83					0.39

Note: [a]Represents reverse-scored items; and [b]represents items that did not load on the respective dimension

Table IV.
Factor loadings for training in general domain of the validated items

However, the addition of the research items did produce two factor structure differences. First, the supervisor sanctions scale do split into two separate factors. One factor (items 34, 35, 36, 38, and 41) largely concerned supervisors' active opposition to the use of new learning. The other factor (items 46, 45, 42, and 44) addressed trainees' perception that supervisors' believe the use of new learning will not improve work performance. Second, a new factor emerged with that contained five items from three scales (content validity, transfer design and opportunity to use learning). Conceptually, these items dealt with the extent to which trainees perceive that the design and delivery of training will enable them to find opportunities to transfer what they have learned (transferability of training). Reliability estimates for 12 scales exceeded Nunnally and Bernstein's (1994) suggested threshold of 0.70, with the exception of learner readiness (0.57).

In the training-general domain, 26 items were used (23 validated items and three research items). Kaiser's measure of sampling adequacy in this analysis was 0.89. None of the MSA values for individual items fell below 0.60. The results of this EFA showed the same original structure of five, explaining 57 percent of total variance. All items except one (item 82) loaded on their respective scales (see Table VI). Reliability estimates for four scales exceeded the threshold of 0.70 and performance self-efficacy scale approached this level. Performance Coaching was composed with all the validated and research items and its internal reliability increased.

Question	Factor 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Q57	0.74													
Q51	0.70													
Q58	0.52													
Q52	0.42													
Q59	0.34													
Q33		0.98												
Q32		0.89												
Q37		0.43												
Q40		0.42												
Q43		0.41												
Q39		0.38												
Q34			0.94											
Q35			0.91											
Q36			0.65											
Q38			0.62											
Q41			0.40											
Q6				0.78										
Q7				0.78										
Q22				0.54										
Q16				0.46										
Q18				0.45										
Q8				0.41										
Q15				0.30										
Q29					−0.80									
Q30					−0.73									
Q28					−0.71									
Q31					−0.57									
Q21						−0.76								
Q23						−0.69								
Q14						−0.57								
Q24						−0.53								
Q17[b]						−0.43								
Q48							−0.92							
Q47							−0.69							
Q49							−0.57							
Q54								0.72						
Q53								0.66						
Q55								0.64						
Q11[a]									0.71					
Q12[a]									0.63					
Q20[a]									0.47					
Q19									0.39					
Q26[a]									0.30					
Q46										0.77				
Q45										0.66				
Q42										0.42				
Q44										0.30				
Q61[a]											0.66			
Q56											0.58			

(*continued*)

Table V.
Factor loadings for training in specific domain of the validated and the research items

Question	Factor 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Q63[a]											0.57			
Q60											0.36			
Q50											0.32			
Q27[b]											0.23			
Q4												0.62		
Q3												0.62		
Q2												0.60		
Q5												0.59		
Q1[b]												0.41		
Q10													0.67	
Q9													0.52	
Q13													0.52	
Q25														0.38
Q62														0.36

Note: [a]Represents reverse-scored items; and [b]represents items that did not load on the respective dimension

Table V.

In summary, although the addition of 21 research items improved the psychometric properties of some scales, in the training-specific domain, factor analysis of the 68-item version produced a more parsimonious factor structure and a cleaner loading pattern than did the analysis of the 89-item version and, in the training-general domain there was no substantive difference between the two analyses (see Table VII). Accordingly, it was decided to consider the 68-item version for further analysis.

RQ3

To address research question three regarding differences across individual level variables, such as gender, age, level of education and job tenure on the perception of the factors obtained in the Portuguese version of LTSI, we conducted a separate analysis for each of the independent variables. Table VIII shows interfactor and independent variables correlations.

Gender. With regard to the set of dependent variables (LTSI factors), MANOVA analysis revealed significant differences across levels of gender: male versus female. A Hotteling's Trace of 0.14 ($F = 2.73, \mathrm{df} = 16, p = 0.00$), indicated that differences existed for male and female respondents. ANOVA analysis showed that statistical differences existed in five of the 16 factors across male and female respondents. Results revealed that male respondents have higher perceptions of positive personal outcomes, transfer effort – performance expectations, performance – outcomes expectations, openness to change and personal capacity for transfer than have female respondents (see Table IX).

Age. The age of the participants was another independent variable considered in these analyses. Age categories were as follows: 140 respondents within the 29-years-or-less age category, 195 respondents within the 30-39-years age category, 102 within the 40-49-years age category and 32 within the 50-years-or-above age category. MANOVA analysis revealed no statistically significant differences across the four age categories examined. The calculated value of Pillai's Trace was 0.19

Question	Factor 1	2	3	4	5
Q66	0.72				
Q69	0.65				
Q65	0.64				
Q71	0.59				
Q82[b]	0.47				
Q77[a]		0.77			
Q76[a]		0.71			
Q74[a]		0.66			
Q78		0.57			
Q75		0.54			
Q73[a]		0.54			
Q80			−0.77		
Q86			−0.71		
Q81			−0.70		
Q88			−0.59		
Q87			−0.55		
Q89			−0.52		
Q79			−0.52		
Q67				−0.71	
Q72				−0.64	
Q68				−0.62	
Q64[a]				−0.53	
Q70				−0.51	
Q85					0.63
Q84					0.62
Q83					0.32

Note: [a]Represents reverse-scored items; and [b]represents items that did not load on the respective dimension

Table VI. Factor loadings for training in general domain of the validated items and the research items

($F = 1.31, \mathrm{df} = 48, p = 0.08$), indicated that differences did not exist across these age categories.

Level of education. The trainee's level of education was operationalized through four categories as follows: 99 respondents within the less-than-high-school level, 162 within the high-school-level, 160 within the university degree level and 27 within the master degree level. MANOVA analysis showed statistically significant differences across the levels of education. The calculated value of Pillai's Trace was 0.26 ($F = 1.81, \mathrm{df} = 48, p = 0.01$), indicated that differences existed across levels of education. ANOVA analysis showed that statistical differences existed in four of the 16 factors across education levels. Post hoc analysis revealed significant differences in the positive personal outcomes, supervisor support, transfer design and performance – outcomes expectations. Respondents within the less-than-high-school level reported supervisor support, transfer design and performance – outcomes expectations higher than did respondents within the university degree level. These respondents within the less-than-high-school level also reported transfer design higher than did respondents within the high-school level, as well as respondents within the master degree level. Finally, respondents within the high-school level reported positive personal outcomes higher than did respondents within the university degree level (see Table X).

Table VII.
Factors, reliabilities, and items comparisons between LTSI and Portuguese LTSI version (PLTSI)

	LTSI (11 factors) Validated items	Research items	PLTSI (11 factors)	PLTSI (14 factors)
Training in specific				
Learner readiness	1, 9, 10, 13 (0.73)		9, 10, 13 (0.57)	9, 10, 13 (0.57)
Motivation to transfer	2, 3, 4, 5 (0.83)		2, 3, 4, 5 (0.78) *1*	2, 3, 4, 5 (0.78) *1*
Positive personal outcomes	6, 16, 17 (0.69)	7, 8, 15, 18, 22	6, 16 ($r = 0.41$) *58*	6, 16, 7, 8, 15, 18, 22 (0.82)
Negative personal outcomes	14, 21, 23, 24 (0.76)		14, 21, 23, 24 (0.80) *17*	14, 21, 23, 24 (0.80) *17*
Personal capacity for transfer	19, 25, 26[a], 27[a] (0.68)	11[a], 12[a], 20[a]	19, 25, 26[a], 27[a] (0.54) 60[b]	19, 26, 11[a], 12[a], 20[a] (0.71)
Peer support	28, 29, 30, 31 (0.83)		28, 29, 30, 31 (0.83)	28, 29, 30, 31 (0.83)
Supervisor support	32, 33, 37, 39, 40, 43 (0.91)		32, 33, 37, 39, 40, 43 (0.87)	32, 33, 37, 39, 40, 43 (0.87)
Supervisor sanction	38, 44, 45 (0.63)	34, 35, 36, 41, 42, 46	38, 44, 45 (0.63)	Behavioural dimension: 38, 34, 35, 36, 41 (0.87) Cognitive dimension: 44, 45, 42, 46 (0.76)
Perceived content validity	47, 48, 49, 58, 59 (0.84)		47, 48, 49, 59 (0.77)	47, 48, 49 (0.78)
Transfer design	52, 53, 54, 55 (0.85)		52, 53, 54, 55 (0.78)	53, 54, 55 (0.77)
Opportunity to use learning	56, 60, 61[a], 63[a] (0.70)	50, 51, 57, 62	56, 61[a], 63[a] (0.70)	56, 60, 61[a], 63[a], 50 (0.77)
Transferability				58, 59, 52, 51, 57 (0.84)
Training in general				
Transfer effort-performance expectations	65, 66, 69, 71 (0.81)		65, 66, 69, 71 (0.80) 82[b]	65, 66, 69, 71 (0.80) 82 [b]
Performance-outcome expectation	64[a], 67, 68, 70, 72 (0.83)		64[a], 67, 68, 70, 72 (0.79)	64[a], 67, 68, 70, 72 (0.79)
Openness to change	73[a], 74[a], 75, 76[a], 77[a], 78 (0.85)		73[a], 74[a], 75, 76[a], 77[a], 78 (0.82)	73[a], 74[a], 75, 76[a], 77[a], 78 (0.82)
Performance self-efficacy	82, 83, 84, 85 (0.76)		83, 84, 85 (0.65)	83, 84, 85 (0.65)
Performance coaching	79, 86, 87, 89 (0.70)	80, 81, 88	79, 86, 87, 89 (0.71)	79, 86, 87, 89, 80, 81, 88 (0.84)

Note: The numbers in the parentheses represent reliability. [a]Represents reverse-scored items; and [b]represents items that did not load on the respective dimension

Scales	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Learner readiness	3.38	0.63	–																			
Motivation to transfer	3.81	0.60	0.25**	–																		
Positive pers. Out.	2.78	0.83	0.09	0.35**	–																	
Negative pers. Out.	2.47	0.77	0.08	0.27**	0.38**	–																
Pers. Capacity transfer	3.27	0.58	0.03	0.11*	0.05	−0.00	–															
Peer support	3.33	0.65	0.21**	0.33**	0.24**	0.34**	0.05	–														
Supervisor support	3.10	0.75	0.14**	0.19**	0.28**	0.37**	0.21**	0.41**	–													
Supervisor sanction	2.14	0.62	−0.07**	−0.11*	0.07	0.08**	−0.26**	−0.10**	−0.24**	–												
Perc. content validity	3.11	0.72	0.22**	0.18**	0.01	0.18**	0.20**	0.19**	0.28**	−0.19**	–											
Transfer design	3.75	0.57	0.21**	0.34**	0.14**	0.14**	0.23**	0.23**	0.31**	−0.29**	0.42**	–										
Opportunity to use	3.58	0.67	0.13*	0.18**	−0.03	0.03	0.32**	0.10*	0.22**	−0.41**	0.30**	0.33**	–									
Transfer effort-p. ex.	3.94	0.52	0.22**	0.40**	0.17**	0.15**	0.22**	0.29**	0.31**	−0.21**	0.26**	0.38**	0.23**	–								
Performance-o. ex.	3.46	0.66	0.13*	0.27**	0.33**	0.20**	0.32**	0.20**	0.50**	−0.31**	−0.23**	0.32**	0.30**	0.47**	–							
Openness to change	3.53	0.63	0.05	0.09	0.03	0.09	0.26**	0.20**	0.35**	−0.45**	0.19**	0.21**	0.38**	0.31**	0.38**	–						
Perf. self-efficacy	3.82	0.51	0.15**	0.36**	0.20**	0.15**	0.17**	0.20**	0.22**	−0.21**	0.15**	0.28**	0.26**	0.48**	0.28**	0.24**	–					
Perf.coaching	3.42	0.57	0.17**	0.29**	0.26**	0.29**	.12*	0.35**	0.55**	−0.18**	0.19**	0.32**	0.21**	0.35**	0.44**	0.35**	0.33**	–				
Gender	–	–	0.02	0.04	−0.12*	−0.06	−0.10*	−0.02	−0.06	0.03	0.08*	−0.03	−0.05	−0.16**	−0.12*	−0.10*	−0.05	−0.07	–			
Age	35	8.51	0.06	−0.19**	−0.05	0.05	.06	0.01	0.06	−0.04	0.10*	0.09	0.00	0.10*	0.01	0.11*	0.02	0.02	−0.20**	–		
Level of education	–	–	0.00	−0.03	−0.13*	−0.09	-.02	0.05	−0.11*	0.08	−0.03	−0.18**	0.05	−0.01	−0.13*	−0.11*	−0.03	−0.11*	0.19**	−0.23**	–	
Job tenure	9.7	8.36	0.08	−0.07	−0.12*	0.02	−0.04	0.01	−0.04	−0.00	0.08	0.05	−0.08	0.05	−0.03	0.04	−0.04	0.01	−0.14*	0.64**	−0.26**	–

Note: *Significant at the 0.05 level; **significant at the 0.01 level

Table VIII.
Means, standard deviations and intercorrelations for the Portuguese LTSI factors and independent variables

Factor	Independent variable	Mean
Positive personal outcomes	Male	2.86
	Female	2.66
Transfer effort – performance expectations	Male	4.01
	Female	3.84
Performance – outcomes expectations	Male	3.52
	Female	3.36
Openness to change	Male	3.59
	Female	3.46
Personal capacity for transfer	Male	3.31
	Female	3.20

Table IX.
Mean differences across gender

Factor	Independent variable	Mean
Positive personal outcomes	Less than high school level	2.76
	High school level	2.99
	University degree level	2.54
	Master degree level	2.63
Supervisor support	Less than high school level	3.28
	High school level	3.07
	University degree level	2.97
	Master degree level	3.17
Transfer design	Less than high school level	3.93
	High school level	3.71
	University degree level	3.72
	Master degree level	3.42
Performance – outcomes expectations	Less than high school level	3.61
	High school level	3.43
	University degree level	3.35
	Master degree level	3.41

Table X.
Mean differences across level of education

Job tenure. This variable was grouped into four categories. In the category of four-or-less-years of work experience there were 161 respondents, 110 within the five to ten years category, 78 within the 11-17-years category, and 80 within the 18-years-or-more category. MANOVA analysis showed no statistical significant differences across respondents' job tenure. The calculated value of Pillai's Trace was 0.17 ($F = 1.07, \mathrm{df} = 48, p = 0.34$), indicating that differences did not exist for years of work experience across the dependent variables.

4. Discussion

The purpose of this study was to analyze the construct validity of the LTSI for use in Portugal, to examine how the addition of a set of research items affected the factor structure and psychometric properties of the scales, and to examine whether there were differences in the perceptions of PLTSI constructs across gender, age, level of education and job tenure.

Exploratory factor analysis of the PLTSI version resulted in an interpretable factor structure consistent with the original LTSI factor structure. Addressing the first

research question, initial analyses of the 68-item LTSI version (Holton *et al.*, 2000) showed a 16-factor structure that accurately paralleled the original English version, which gives evidence that this is an instrument valid for use in the Portuguese culture.

Research question two aimed to know if the addition of the 21 research items improved the factor structure or psychometric properties of the PLTSI scales. Results of this new analysis showed that the reliabilities of three scales were improved: positive personal outcomes, personal capacity for transfer and supervisor sanction. Nevertheless, in the present study two other constructs revealed not very high reliabilities: learning readiness and performance self-efficacy, suggesting the need to create new research items for these factors to provide them with higher consistency. Similar reliability values of these measures were found in the original English version, in the Chen *et al.* (2005) LTSI validation in Taiwan, and in the LTSI validation in the Ukraine (Yamkovenko *et al.*, 2007) regarding the learning readiness construct.

When the supplementary items were included in the analysis of training in specific domain, the same 11 factors were found, but three other new ones emerged. One of these factors was dropped. Another one emerged as a result of the combination of items from three factors: perceived content validity, transfer design, and opportunity to use learning. This factor was labelled Transferability of Training as the new factor that emerged in Chen *et al.*'s (2005) LTSI validation, because both were composed of items from the same three different factors, in which three of them were exactly the same (items 57, 58, 59). Based on this similar finding, we might be able to presume the presence of a new construct that was not considered in the LTSI framework. The cultural variation in training delivery method (Chen *et al.*, 2005) could also be an explanation for these findings because, as in Taiwan, few training courses in Portugal include a more practical orientation with clear examples on how to transfer the training material. In Portugal, until a few years ago, training was mostly perceived as a career progression vehicle instead of a personnel and organizational development mechanism. Only in recent years have Portuguese companies begun to face the challenge of improving training effectiveness and the need to evaluate it. Therefore, Portuguese trainees are now more aware of the importance of being prepared to transfer the training material when they are back in the work context. Thus, assuming that these cultural differences do exist, they should be considered in the LTSI in order to give the LTSI greater cross-cultural validation.

In the analysis of the extended version of the LTSI (Holton and Bates, 2002), the supervisor sanction factor emerged, divided into two separate factors: the behavioural one composed of items clearly orientated to the supervisor oppositional behaviours and the cognitive one more related to their opinion of the inefficacy of the training on the trainees' workplace. According to Chen *et al.* (2005), the differences between factor structures that emerged in different countries could be explained by cultural, instrument design or implementation differences, or by problems with the translation process. In our understanding, the differences in the supervisor sanction construct that occurred between Portugal and the USA could possibly be explained by cultural differences. Perhaps the Portuguese trainees may have been able to distinguish between the more behavioural items and the more general items. In spite of this cultural variation, the instrument design issue is probably the most adequate explanation for this result. The supervisor sanction construct was only divided when the research items were included in the analysis. In the extended analysis of the LTSI,

the reliability of this construct was improved but a new factor emerged, suggesting the presence of two different dimensions on the same construct.

There are no reasons to believe in other explanations, such as implementation differences or problems with the translation process. In fact, there were no differences in the timing of the LTSI administration to trainees. As in the USA, the survey was applied to the Portuguese trainees immediately after the training. The translation process of the English version to the Portuguese LTSI version was also very rigorous and with the participation of the original authors.

Overall, and addressing research question two, we can argue that it is not clear that the addition of the research items appreciably improved the factor structure of the PLTSI. There was no substantive difference in the factor structure in the training-general domain between the two analyses, although the three research items in this domain did load on the correct scale (performance coaching) and improved its reliability estimate.

Regarding in the training-specific domain, factor analysis of the 68-item version produced a more parsimonious factor structure and a cleaner loading pattern than did the analysis that included the research items. The 68-item version showed a factor structure identical to the original English version as all the 16 scales emerged with 63 of 68 (92.6 percent) items loading on their respective scale at 0.30 or greater. Both analyses produced scales with reliability estimates that were generally acceptable.

Research question three aimed to know whether there were statistical differences in the perception of some LTSI factors that emerged in the Portuguese validation across gender, age, education level and job tenure variables.

Results for gender showed that, for all factors with differences detected (positive personal outcomes, transfer effort – performance expectations, performance – outcomes expectations, openness to change and personal capacity for transfer) male respondents demonstrated significantly higher perceptions than female respondents. These results can be justified based on a more focused view of the male respondents, who are more often concerned with the specific results they can obtain with the training, as well as with the support they can obtain to reach those results. These results are consistent with the prevailing literature, which indicates that there are some gender differences in the perception of training outcomes. For example, Tziner and Falbe (1993) found a gender effect on motivation to transfer. Chen *et al.* (2006) conducted a study to examine situational and demographic influences on transfer-system characteristics and found significant differences in perceptions of those characteristics between trainees' genders in Taiwan.

Regarding education-level differences, it was found that the respondents with lower education levels always reported higher perceptions than did the respondents with higher education levels. In some sense, this may reveal a more critical view of higher educated employees regarding the training goals, design and content, as many times Portuguese organizations do not fit training courses to the needs of different groups. In their study, Chen *et al.* (2006) also found that transfer-system characteristics differ across levels of trainees' education.

In the present study, we did not find statistical differences in the perception of LTSI factors across respondents' age and job tenure.

Overall, and addressing research question three, results have shown that there are some important statistical differences in the perception of some LTSI factors that emerged in the Portuguese validation across gender and education-level variables.

4.1 Implications for research and practice

The present study validated the LTSI in Portugal, indicating that the main factors affecting training transfer in the United States are the same as in Portugal.

Regarding the implications to the research, results of this study have reinforced the cross-cultural evidence of the LTSI and expanded its horizons in Europe, providing a greater foundation for future cross-study comparisons of the learning transfer process. The present research has also expanded the work that has been done regarding training transfer and, specifically, the knowledge of the factors that affect the training material application in the workplace by demonstrating that not all the LTSI factors are perceived in the same way across male and female respondents and respondents with lower or with higher education levels.

This study also has practical implications because it provides a valid and reliable instrument for Portuguese human-resource managers who are interested in the maximization of their investment on training. At this moment, Portuguese companies are able to develop their training evaluation practices because they can identify the important factors that predict the training transfer to the work context and they are aware of the existence of an accurately measurement instrument to assess those factors, to diagnose unknown and potential transfer problems that allow them to identify leverage points for change and to target interventions designed to enhance transfer. In order to maximize the learning transfer to the workplace, this research has shown that managers they should not work on learning-transfer factors in the same way with all trainees. There are some individual characteristics, such as gender and education level that influence the perception of the learning-transfer constructs that emerged in this study. This suggests that HRD professionals should consider that diversity when designing training programs.

4.2 Limitations

In this study, data were collected through self-reported measures using a single instrument applied immediately after the training, which might have affected its internal validity. Regarding the external validity, we can argue that it is good because this study covered a wide variety of trainees' business areas and types of training. Still, it might be possible that some types of organizations and training were not included in the analysis, thus limiting the generalization of the results to those contexts.

4.3 Direction for future research

The LTSI is a valid and reliable instrument for assessing factors affecting training transfer and this study has reinforced its cross-cultural validity. However, we believe that future research should be conducted in order to explore some of the results found in this study.

In the present research, two new constructs emerged with not very high reliabilities: learner readiness and performance self-efficacy. Although they were not considered as having low reliabilities in the original version and in the Taiwan validation, a new development of the LTSI might include new research items on these constructs to

assure higher reliabilities in future validations. In addition, further efforts should be made in the improvement of the supervisor sanction scale. Finally, the validated LTSI may be an important instrument to be used in other studies aimed, for instance, to analyze the relationship between training transfer and other variables such as continuous learning culture (Tracey *et al.*, 1995) and individual attitudes at work (Holton, 2005).

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