

DETERMINANTS OF SATISFACTION AND CONTINUOUS USE INTENTION OF E-LEARNING SERVICE APPLIED IN BRAZILIAN PUBLIC ORGANIZATIONS

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SUMMARY

The aim of this paper is to investigate the constructs of Technology Readiness Index (TRI) and the Decomposed Expectancy Disconfirmation Theory (DEDT) as determinants of satisfaction and continuous use intention in e-learning services applied in public organizations. The research was conducted by online survey in a sample of 343 employees of two public organizations in Brazil who have had e-learning experience. The results showed that quality, quality disconfirmation, value and value disconfirmation positively impact on satisfaction, as well as disconfirmation usability, innovativeness and optimism. Likewise, satisfaction proved to be decisive for the purpose of continuous use intention. In addition, technological readiness and performance are strongly related. The main contribution of this study is the delivery of an assessment tool for performance oriented to training courses at distance and applied in public organizations.

Key words: E-learning, Technology Readiness Index, Expectancy Disconfirmation Theory..

1. INTRODUCTION

The expansion of the Internet has contributed in popularizing various virtual platforms implemented in electronic services. One such these services, is e-learning. Kaplan and Leiserson (2012) introduce the concept of e-learning used by American Society for Training and Development's as a broad set of applications and processes, such as web based learning, using virtual learning environments (VLE). This definition is shared by others authors who research the topic (Nicholson, 2007; Klering, & Schroeder, 2011).

The e-learning finds applications in several areas, including distance education for primary and higher education, corporate training and training for government employees. Several models have been shown to be able to measure the satisfaction and continuous use intention of e-learning services. These aspects are essentials to determine the success of e-learning (Duque, & Weeks, 2010; Liao, Chuang,

Yu, Lai, & Wong, 2011).

However, few studies focus on the evaluation of online training for employees of public organizations (Erdogmus, & Esen, 2011). Under Brazilian studies, the pattern is repeated, and there are few studies using this approach (Riss, & Grohmann, 2011; Klering, & Schroeder, 2011).

In Brazil, the increasing of distance courses has shown to be significant since the year 2000. One of the causes for this increase was the institutionalization of the National Policy on Staff Development, established by Decree 5707 to February 23, 2006 (Brasília, 2006), which emphasizes distance learning with the use of VLEs for government employees.

Among the theoretical models that assess the users' perspective on distance learning courses, two of them have the potential to be applied in public organizations. One is the Technology Readiness Index (TRI), developed by Parasuraman (2000) and, the Decomposed Expectancy Disconfirmation Theory (DEDT), developed by Chiu et al. (2005). TRI consists of a tool that checks pre-disposition to use certain technology (Parasuraman, 2000). The DEDT assesses the expectations and performance, in context of e-learning (Chiu et al., 2005).

The objective of the research is to identify factors that influence satisfaction and continuous use intention of e-learning services. Additionally, a theoretical model through structural equation modeling that measures satisfaction and continuous use intention of e-learning services in Brazil will be validated. The theoretical model that will support this research uses TRI and DEDT together, being unprecedented in the literature. The main hypothesis of the study is that there are significant relationships between performance in e-learning course and satisfaction with it and between satisfaction and continuous use intention of this kind of service.

The presence of e-learning in public organizations is important to show the need for continued development of employees, dissemination and management of training activities, rationalization and effectiveness of spending on training, adequacy of skills of employees to goals of institutions and improvement in services for citizens (Brasília, 2006; Saha, Nath, & Sangari, 2010).

2. METHODOLOGICAL PROCEDURES

This topic presents details about the sampling method, the instrument of data collection, statistical techniques applied in data analysis and research model.

2.1 Sample and data analysis

The study focuses on employees of two public organizations in Brazil. The services of e-learning focus of this study are based on a system of synchronous and asynchronous learning via the web. Factors were observed for the units of analysis so that they could integrate a homogeneous sample. Firstly, organizations operate in the same geographic boundary. Secondly, there are a significant number of employees of both organizations acting in distance courses as organizational training with use of VLEs to support. Furthermore, in each unit of analysis, respondents in the sample attended at least one training course distance.

The research sample corresponds to 343 cases. For the sample composition the criteria of statistical power and size of explanatory effects of the independent variables on the dependent variables were considered. The statistical power is indispensable for the evaluation of statistical power decisions and to design trials (Mayr, Erdfelder, Buchner, & Faul, 2007). The power of a statistical test helps to avoid probability errors which lead to falsely accept research hypotheses (Faul, Erdfelder, Lang, & Buchner, 2007; Prajapati, Dunne, & Armstrong, 2010).

Hair, Anderson, Taham, & Black (2009) suggest a statistical power of 0.95 as great, and the effect

size at 0.15 as average, being the most usual configuration. The software G*Power v. 3.1.5 was used to calculate the minimum sample size required and to generate outcomes after sample collection. The G*Power has been designed as a general program of power analysis for statistical tests commonly used in science social researches (Faul *et al.*, 2007). Using an average effect of 0.15 a statistical power of 0.999 was obtained. On sensitivity exam an effect size of 0.07 was detected.

The questionnaire was applied in the form of online survey and the answers have been recorded completely. A pretest was conducted with seven managers of both organizations in order to avoid biases, fix bugs and to add or modify questions (Iraossi, 2006). After initial release, a pilot study was applied with 30 employees of both organizations.

This study uses a strategy two-step of structural equation modeling (SEM), using the method of maximum likelihood (ML), operationalized in software Analysis of Moment Structures (AMOS v. 18). The first step is a confirmatory factor analysis (CFA) and second step is the analysis of structural equations. The sample with the use of ML should be between 150 and 400 observations and has more than 200 observations, meeting the specifications suggested by Hair *et al.* (2009). Thus, it allows the estimates are closer to the value of the population parameter (Joreskog, & Sorbom, 2003).

2.2 Research model

The hypotheses selected for the composition of the components of the survey were based on Oliver (1980), Parasuraman (2000), Bhattacharjee (2001), Chiu *et al.* (2005), Erdogmus and Esen (2011), among others. The constructs that make up the TRI, act as drivers of technological readiness in relation to use of e-learning services. Two of them have positive relationship with satisfaction: optimism and innovativeness, and two others are inversely related to the satisfaction: discomfort and insecurity. The constructs that are part of the model DEDT are evaluated from the premise called expectancy disconfirmation (perception of time before and after the use of technology). Several studies have indicated that the disconfirmatory constructs have significant effects attributed to satisfaction (Bhattacharjee, 2001; Terzis, Moridis, & Economides, 2013).

H1: Optimism is positively associated with user's technology readiness.

H2: Innovativeness is positively associated with user's technology readiness

H3: Discomfort is negatively associated with user's technology readiness

H4: Insecurity is negatively associated with user's technology readiness

Optimism refers to a positive view of technology, with focus on benefits of it, which brings a sense of control, flexibility and efficiency (Parasuraman, 2000; Lai, 2008; Richey, & Autry, 2009). The innovativeness dimension gives an idea of an individual who believes to be a thought leader and to be in the vanguard of trying new products and have new experiences based on technology. This vision exacerbates the trend of pioneering the use of technology, as a motivational behavior (Lin, 2007; Summak *et al.*, 2010; Lai, 2008; Hu *et al.*, 2010). Discomfort refers to the perception of loss of technology control and sense of loss of autonomy in the face of technologies to be used in the organizational environment. It can also be characterized as a lack of confidence in using new technologies (Parasuraman, 2000; Lin, 2007; Rhee *et al.*, 2007). The insecurity relates to skepticism and other cultural and psychological barriers that prevent the user to enable the use of certain technology. It differs from discomfort because it focuses on specific aspects of technology transactions (Lin, 2007; Lai, 2008; Ling, & Moi, 2008).

H5A: Quality is positively associated with perceived performance

H5B: Quality disconfirmation is positively associated with perceived performance

- H6A: Usability is positively associated with perceived performance
- H6B: Usability disconfirmation is positively associated with perceived performance
- H7A: Value is positively associated with perceived performance
- H7B: Value disconfirmation is positively associated with perceived performance

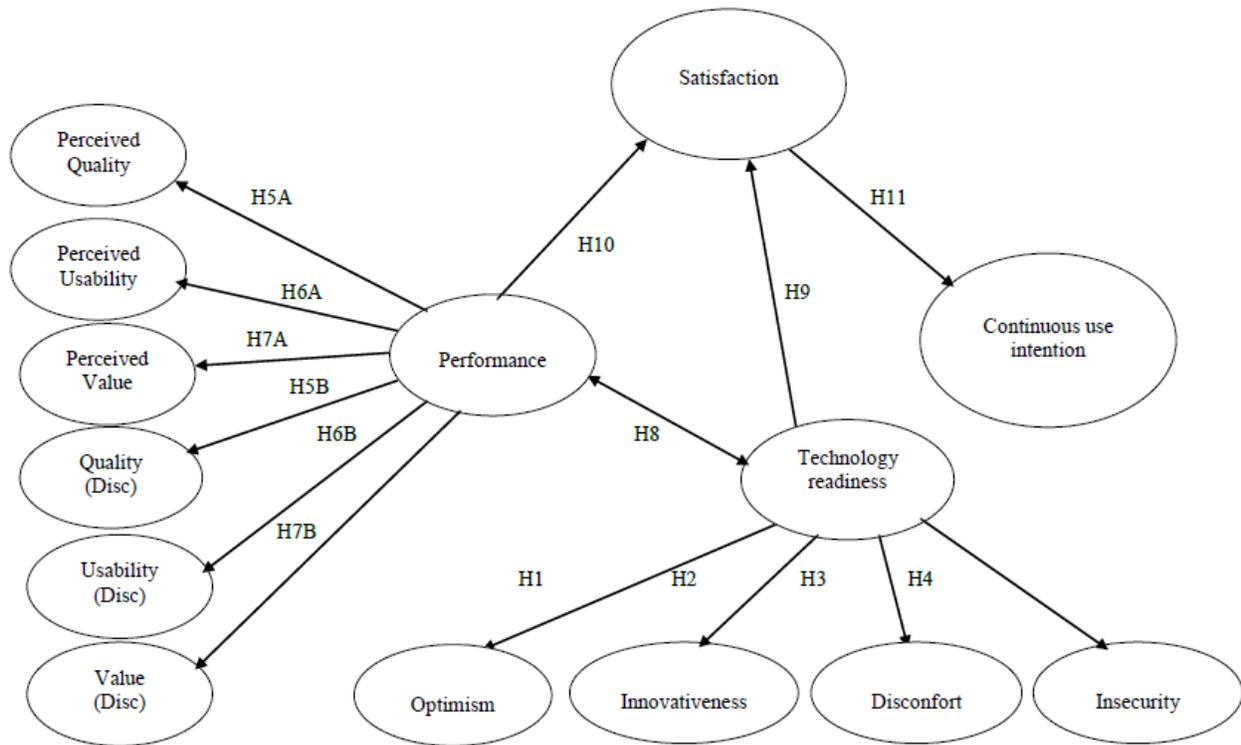
The quality involves variables related to response time, relevance, accuracy and completeness of the information generated by VLE. The quality applied in studies of e-learning denotes the importance of having a VLE that meets the quality requirements that the user expects to get (Paechter et al., 2010; Cheung, & Lee, 2011). Usability involves factors such as ease of use, familiarity with technology and attitude towards the use of computer systems. The usability also is used in model TAM and SERVQUAL to determine if performance is satisfactory through the ease of use (Devaraj et al., 2002). Usability can be seen, for example, as the degree a person believes that using a VLE will be free of effort (Premkumar, & Bhattacharjee, 2008; Lin, 2011). The value is an abstract concept that refers to the mode of conduct, personal preference or position forward the technology offered. Researchers suggest that high levels of value lead to high user satisfaction (Chou et al., 2010).

- H8: Technology readiness and perceived performance influence each other (they are interrelated)
- H9: Technology readiness is positively associated with user satisfaction
- H10: Perceived performance is positively associated with user satisfaction
- H11: Satisfaction is positively associated with continuous use intention

Users who have high TRI require more technical support (Parasuraman, 2000). The users that have greater understanding and appreciation of technology have a greater chance of obtaining a satisfactory performance. In the same way, individuals with high performances, tend to trust more in technology use (Rhee et al., 2007; Ismail et al., 2011; Erdogmus, & Esen, 2011). As there are no studies that consider performance and predisposition together, the relationship between these two constructs (H8) is formed by a double arrow, indicating a possible correlation. In surveys conducted, it was found that the level of willingness of individuals to adopt new technologies contributes to the analysis of factors that determine the satisfaction of e-learning service users (Marks, Sibley, & Arbaugh, 2005; Lin, & Hsieh, 2007; Ismail et al., 2011). In relation to performance, to develop constructs which could measure it in terms of usability, value or system quality, several studies have reshaped the perceived performance to define it as a contributing factor to the satisfaction (Davis, 1989; Spreng, Mackenzie, & Olshavsky, 1996; Chiu et al., 2005; Siritongthaworn, & Krairit, 2006).

Satisfaction is an individual feeling of pleasure resulting from the comparison of perceived performance relative to expectations (Chiu et al., 2005). Oliver (1980) theorizes that satisfaction is positively associated with a future intention. Liao et al. (2011) state that satisfaction with a product or service is the main motivation for its continued use. There are numerous studies in the literature that establish the link between satisfaction and continuous use intention of an e-learning service (Lin, & Hsieh, 2007; Liaw, 2008; Cheung, & Lee, 2011; Riss, & Grohmann, 2011). For this study, the effects between constructs of e-learning are presented in Figure 1.

Figure 1: Research model



3. DEVELOPMENT OF THE STUDY

Firstly, the Square Distance of Malahanobis (D^2) was performed to remove outliers, predicting exclusion of observations with the higher rates, beyond addition of correlations between errors of the variables, which substantially improves the model estimates (Maroco, 2010; Kline, 2005). Also an adjustment from the analysis of the factor loadings was made. The variable EDTV3 - Perform a distance course brings me a feeling of following a trend - showed low factor loading (0.49) and was excluded from the model. Correlations and factor loadings of the 26 variables that are contained in the measurement model are listed in the following table.

All documents must be sent in PDF format. Presentations will be written in Spanish, Portuguese or English in a formal and appropriate manner, with a maximum length of 15 pages (6,000 words) including the summary, text, references, tables, figures, photos and illustrations.

Table 1: Variables of measurement model

Cód.	Variable	Corr.	Factor Loadings
<i>Perceived Optimism AVE = 0.574 CR = 0.801 Alpha = 0,808</i>			
TROT2	New Technologies offered in the courses are convenient to use	0.591	0.65
TROT3	I like to study by computer	0.586	0.70
TROT4	Perform distance courses is mentally stimulating	0.667	0.65
<i>Perceived Innovativeness AVE = 0.569 CR = 0.867 Alpha = 0,889</i>			
TRIN1	In the workplace, I keep more updated than others in relation to technology	0.679	0.58
TRIN2	In general, I am one of the first at workplace to want to participate in the courses offered	0.554	0.60

TRIN3	Normally, I find new features in the technologies used during the courses	0.675	0.73
TRIN4	I appreciate the challenge of finding new ways of learning using technology	0.678	0.79
TRIN5	I have fewer problems than co-workers to learn using technology	0.679	0.66
<i>Perceived quality AVE = 0.622 CR = 0.866 Alpha = 0,866</i>			
EDTQ1	The layout and interface of the VLE are friendly	0.693	0.61
EDTQ2	I find it easy to navigate by the VLE used in the course	0.777	0.69
EDTQ3	I feel comfortable using an e-learning service in virtual platform	0.740	0.84
EDTQ4	The VLE offers complete information to users	0.629	0.66
<i>Perceived value AVE = 0.947 CR = 0.754 Alpha = 0,866</i>			
EDTV1	Perform a distance course brings me a sense of accomplishment	0.811	0.55
EDTV2	Perform a distance course brings me a feeling of supplying my needs	0.733	0.65
EDTV4	Perform a distance course brings me a sense of feeling smart	0.736	0.57
<i>Quality Disconfirmation AVE = 0.584 CR = 0.806 Alpha = 0,825</i>			
EDTQ1Dis	The layout and interface of the VLE are friendly (expectation)	0.628	0.61
EDTQ3Dis	I feel comfortable using an e-learning service in virtual platform (expectation)	0.740	0.79
EDTQ4Dis	The VLE offers complete information to users (expectation)	0.749	0.62
<i>Usability Disconfirmation AVE = 0.533 CR = 0.819 Alpha = 0,892</i>			
EDTU1Dis	Learning to work with a VLE is easy for me (expectation)	0.694	0.63
EDTU2Dis	It's easy for me become skillful in the use of VLE (expectation)	0.739	0.55
EDTU3Dis	The resources and activities offered by course are compatible with the way I learn (expectation)	0.721	0.66
EDTU4Dis	The tools used in the courses are satisfactory (expectation)	0.794	0.72
<i>Value Disconfirmation AVE = 0.519 CR = 0.810 Alpha = 0,825</i>			
EDTV1Dis	Perform a distance course brings me a sense of accomplishment (expectation)	0.590	0.71
EDTV2Dis	Perform a distance course brings me a feeling of supplying my needs (expectation)	0.761	0.69
EDTV3Dis	Perform a distance course brings me a feeling of following a trend (expectation)	0.777	0.56
EDTV4Dis	Perform a distance course brings me a sense of feeling smart (expectation)	0.581	0.55

After performing the first adjustment, the goodness of fit of factorial model was made according to the goodness of fit indices or modification indices, as recommended by Maroco (2010), Hair et al. (2009), Kline (2005) and Joreskog and Sorbom (2003). Thus, the indices were calculated for the measurement model set, featuring: $X^2/df = 1.160$; TLI = 0.861; CFI = 0.883; NFI = 0.853; PCFI = 0.747; PNFI = 0.722; RMSEA = 0.099; ECVI = 3.965 e MECVI = 4.006. The indices with their respective reference values demonstrate adequate goodness of fit.

To validate the measurement model, three types of validity were examined: factorial validity, convergent validity and discriminant validity. Factorial validity was confirmed with factor loadings, being above 0.5 for variables accepted in measurement model, as suggested by Hair et al. (2009). For convergent validity, it was used the average variance extracted (AVE) and composite reliability (CR) as suggested by Maroco (2010) and Kline (2005). The AVE results for each construct exceed 0.5 and CR exceeds the minimum of 0.7, confirming convergent validity. For discriminant validity, the square of the correlations was compared with the results of AVE. For values of AVE not above the square of correlations, the validity was confirmed, according to the method of Fornell and Larcker (1981).

This sub-topic is related to the second step of SEM, which presents the structural model as the product of this research. The model of satisfaction and continuous use intention of e-learning service was evaluated incorporating measurement model set and adding causal relationships. At

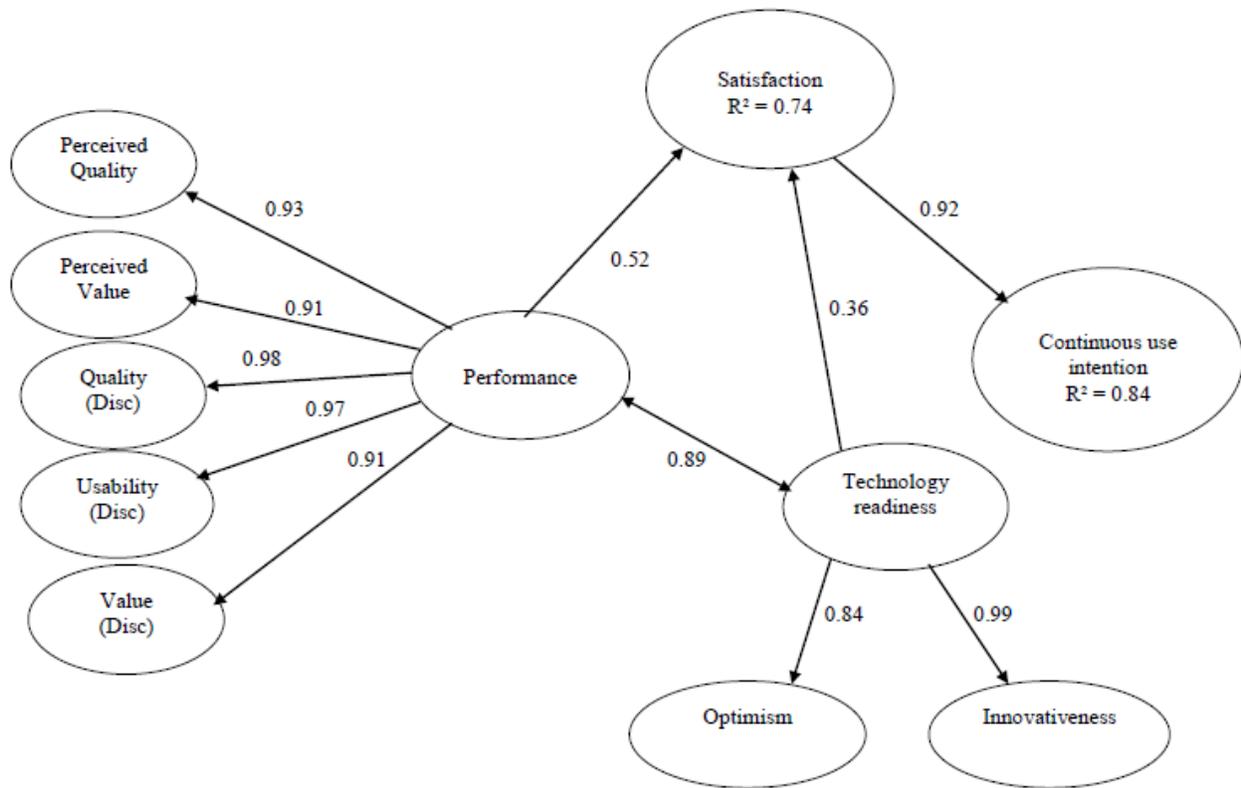
this stage, the goodness of fit indices were calculated again (Table 2), adding two indexes that measure the quality of the final adjustment of the structural model according to Mulaik et al. (1989) and Maroco (2010). They are: the relative normed-fit index (RNFI), adapted from NFI, which aims to counter the disproportionate number of parameters between the measurement model and structural model. The second index is the relative parsimony ratio (RPR), which measures the thrift degree of the model and assesses the degree of completeness of the model with fewer variables as possible.

Table 2: Goodness of fit indices of the structural model

Index	Results	Diagnosis
Statistic X ² /df	1.314] 1; 2 [- Good fit
TLI	0.911	>0.90 – Very good fit
CFI	0.920	> 0.90 – Very good fit
NFI	0.885] 0.8; 0.9 [– Acceptable fit
PCFI	0.822	> 0.8 – Very good fit
PNFI	0.790] 0.6; 0.8 [- Good fit
RMSEA	0.078] 0.05; 0.10 [- Very good fit
ECVI	4.567	Smaller is better...
MECVI	4.627	Smaller is better...
RNFI	0.974] 0.8; 1.0 [- Good fit
RPR	0.857] 0.8; 1.0 [- Good fit

According to Table 2, the ratios showed adequate adjustments, with a slight improvement compared to the indices of the measurement model, being ruled out the possibility of relationships that harm the fit of the model. With the refined model by modification indices and correlations that lead to considerable improvement of the adjustment, the estimates presented in AMOS Graphics were evaluated with a Z Test (Critical ratio and p value), considering significant relationships between parameters with $p < 0.05$, and the significance of the trajectories, considering relevant ones above 0.05. Also standardized direct effects in causal relationships were considered, and specifically to the constructs of second order, significant with mediation effect set to the path continuous use intention, as suggested by Kline (2005) and Hair et al. (2009). The adjusted final model with standardized regression weights are shown in Figure 2.

Figure 2: Final model found by research



In this study insecurity and discomfort showed no significant effects. It can be inferred that the negative aspects linked to the use of technology are presenting discredit in the composition of models that assess user satisfaction, as was pointed by Ismail et al. (2011) and Hu et al. (2010), being the discomfort invalidated by the reliability test. The insecurity items contained in the model TRI of Parasuraman (2000) showed the same behavior in the study of Richey and Autry (2009), also being invalidated.

In the present study, the factor loadings and no violation of assumptions for the constructs of quality, usability and value, including disconfirmation level are similar to those found by Cheung and Lee (2011) on the use of EDT. Similarly, optimism and innovativeness have high reliability and are significant in defining determinant constructs of satisfaction in e-learning services. Similar results were also found in other studies that approach attributes of the TRI (Erdogmus, & Esen, 2011; Summak et al., 2010; Pires, & Costa, 2008).

In the application of CFA, the results summarized in Table 1 show that the constructs that form the performance of the students were shown to be important for the teaching potential in distance learning, likewise the study developed by Biasutti (2011). The performance in studies of Hung and Cho (2008) and Chen (2011) also proved relevant to determine satisfaction and still had indirect effects in determining continuous use intention, corroborating the high factor loadings on manifest variables of EDT constructs.

The final model adjusted for a sample of 332 respondents, shown in Figure 2 provides an appropriate adjustment to the structure of variance and covariance of 26 determinant variables. The weights of the constructs that form the technology readiness were high (Innovativeness – 0.84 and

Optimism – 0.99). The standardized regression weight from technology readiness to satisfaction corresponds to $\beta=0.36$. The regression between perceived performance and satisfaction showed it a little higher ($\beta=0.52$).

All constructs of performance had weights above 0.9, including all constructs in disconfirmation level, emphasizing the importance of measuring user expectation as pointed out by Terzis et al. (2013). At the confirmation level, usability is the unique to not compose the final model of the study, invalidated in exploratory factor analysis, being only the disconfirmation usability validated. In the study by Chen (2011), the perceived performance also proved to be the most important factor to determine satisfaction an e-learning service.

An evaluation of non-causal relationship between the constructs of second order was made and it was found high and positive relationship (0.89) between performance that employees present in distance courses and pre-disposition of the employees to use technologies commonly used in the course, especially the VLE.

The direct effect from satisfaction to continuous use intention showed high rate of coefficient ($\beta=0.92$). The second order constructs together account for 0.74 of the total variance explained on satisfaction. About continuous use intention, the variance found was 0.84, which is the total variance explained in the final model set.

These results indicate that there is an individual sense of satisfaction by employees with the training courses using distance education, and this feeling is positively related to continuous use intention of e-learning service. These results are significant likewise other results found in the literature (Chiu et al., 2005; Erdogmus, & Esen, 2011; Liao et al., 2011; Kim et al., 2012; Cheung, & Lee, 2011; Hung, & Cho, 2008; Lin, 2011; Lin, & Chen, 2012; Pires, & Costa, 2008; Chou et al., 2010; Teo, 2010).

Generally, the disconfirmatory constructs have high power to explain satisfaction and continuous use intention, concerning in other studies (Chiu et al., 2005; Wu, Tennyson, & Hsia, 2010; Chou et al., 2010; Chou et al., 2012; Duque, & Weeks, 2010; Teo, 2010).

The model of EDT/TRI show significance by presenting similar results to other studies that test the satisfaction and continuous use intention as dependent variables in e-learning services (Cheung, & Lee, 2011; Chiu et al., 2005; Lee, Hsieh, & Hsu, 2011; Hung, & Cho, 2008; Liao et al., 2007; Godwin, Bagchi, & Kirs, 2011). The results indicate that indirectly the second order constructs (performance and readiness) have significant relationships of influence with the continuous use intention, showing indirect effects of 0.332 and 0.478 respectively.

4. CONCLUSIONS

The motivation of this study was to examine the effects of a theoretical model of satisfaction and continuous use intention in the context of e-learning in public organizations. The training of employees generates impacts on society, directly influencing the service provided to citizens. The final research model with the use of EDT / TRI in conjunction with the TRI demonstrates a high degree of compatibility when applied to users of distance training courses in public organizations.

The study presents as the main contribution the delivery of an assessment tool for performance oriented to training courses at distance and applied in public organizations. The study also contributes to strengthen the importance of VLEs in performance and predisposition of employees to take the courses, gives supports to decision making at the strategic level and provides subsidies that enhance the high capacity of civil servants.

In terms of theory building, Cheung and Lee (2011) point out that, such studies provide

researchers new insights about what should be speculated regarding satisfaction in the context of web-based applications. For the managers of e-learning services, such perceptions can be applied to targeting investments and better use of resources for implementing services.

This study sought to derive the EDT and the TRI applied to a new context and to specify an adapted model. Importantly, the adapted model comprises an initial effort to construct a theory focused on e-learning in public service organizations, focusing on user experience in skills training and practice of the knowledge generated. Moreover, a model with the EDT and the TRI together presents an original value because such a configuration was not found in important studies on the subject.

The research has some limitations. Firstly, validated and invalidated constructs should not have the results generalized because they need to be retested by the primary research model for future applications. It is noteworthy that the model is a simplification of reality and can present different results when applied to other units of analysis. Nonetheless, it is reinforced the premise that ensures reproducibility logic of the theoretical model found (Maroco, 2010).

By the reason that it is not practical to make a model too much complex, constructs equally significant in determining satisfaction in e-learning were not included, for example, subjective norms, present in the TPB model, validated by Lee (2010) and Raaij and Schepers (2008). Other limitation of this study is the same one pointed out by Lin (2011): external factors and possible effects derived by conditions facilitating or environmental influences were not included in the proposed theoretical model. These limitations encourage future studies that use such a construct.

This research suggests the way future works can continue to explore impacts of satisfaction and intention to continue the use in the context of e-learning or the use of other technologies (Cheung & Lee, 2011; Chiu et al, 2011; Lee, 2010). Conducting longitudinal studies is also recommended, because they generate more reliable results and allow an assessment of practical knowledge generated in the courses (Chiu et al., 2005).

The use of model EDT and TRI together reflects a significant link of influence between the perceived performance and readiness technology that can become the focus of further studies. Thus, it is possible to create a theory directed specifically to e-learning services aimed at training civil servants. Consequently, bringing the gap concerning theoretical models focusing on e-learning services in the public sector.

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