E-learning service in Brazilian public organizations

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Abstract
This study investigated the constructs that influence satisfaction and continuous use intention in e-learning services through a sample of 343 employees of two Brazilian public organizations. The main contribution of this study is the delivery of an assessment tool for performance oriented training courses at distance in public organizations.

Keywords: E-learning, Satisfaction, Continuance Intention

Introduction

The expansion of the Internet has contributed in popularizing various virtual platforms implemented in electronic services. One such these services, is e-learning.

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 (Chiu et al. 2005).

However, few studies focus on the evaluation of online training for employees of public organizations (Langford and Seaborne 2008, Erdogmus and Esen 2011, Lin and Hsieh 2007, Rhee et al. 2007, Hess, 2012). Under Brazilian studies, the pattern is repeated, and there are few studies using this approach (Carvalho and Abbad 2006, Klering and Schroeder 2011).

In Brazil, the increasing of distance courses has shown to be significant since the year 2000. From 2000 to 2009, the number of distance courses rose from 13 to 844. It is estimated that there is involvement of more than three million users (Abraead 2008).

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, Lai 2008, Summak et al. 2010, Erdogmus and Esen 2011). The DEDT assesses the expectations and performance, in context of e-learning (Chiu et al. 2005, Chiu et al. 2011). Such models allow the user to assess their own performance in the use of Virtual Learning Environments - VLE, and encourage public
employees to use technological tools of strategic potential, contributing to increased productivity and modernization of public organizations (Carvalho and Abbad 2006, Fontes 2006, Langford and Seaborne 2008, Saha et al. 2010).

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.

Literature Review

This topic addresses the theories that underpin research model, and considerations about the presence of e-learning in public organizations.

Technology Readiness Index (TRI)
Developed by Parasuraman (2000), TRI serves as an instrument to measure consumer technology readiness, therefore, is the provision that the consumer has to use certain technology (Hu et al. 2010). This theory was developed in order to verify the behavior of consumers facing technology-based services (Summak et al. 2010). However, the tool has gained notoriety with the possibility of applications in different contexts, including, technological services in education area and public organizations (Rhee et al. 2007, Nascimento et al. 2011).

In the context of e-learning, TRI has been gaining ground, especially by its scope, have constructs that seek to understand possible resistance to the use of technologies by different classes of users (Rhee et al. 2007, Ismail et al. 2011).

Decomposed Expectancy Disconfirmation Theory (DEDT)
The DEDT was conceived from the Expectancy Disconfirmation Theory – EDT (Oliver 1980). It is a model of consumer behavior where customer satisfaction is co-determined by the expectation disconfirmation (Roca et al. 2006). In the model adapted to e-learning services, titled DEDT (Chiu et al. 2005), disconfirmation can influence the immediate satisfaction of the user. The disconfirmation is the degree to which performance meets or not the individual expectations (Oliver and Swan 1989, Liao et al. 2007).

A series of previous studies confirms the predictive ability of EDT in the context of continuance intention in technology-based services (Chou et al. 2010, Chou et al. 2012). The individual’s satisfaction with the product or service is the condition for repurchase. This in turn, is related to the degree of the expectations that the individual has, at the beginning of the consumption process. Thus, the expectation is configured as an additional determinant of satisfaction (Bhattacherjee 2001a).

E-learning in public organizations
Access to web-based learning has become a key factor in retaining quality to public sector employees (Langford and Seaborne 2008). The e-learning when inserted in public organizations
contributes to be a vehicle to meet organizational objectives, to encourage the use of new technologies and to improve the service provided to citizens (Langford and Seaborne 2008, Saha et al. 2010).

The TRI has been used as a measure of scale of technological readiness, including studies about e-learning (Lai 2008, Ling and Moi 2007, Summak et al. 2010, Rhee et al. 2007). Studies in Brazilian public organizations such as Nascimento et al. (2011) and Fontes (2006) contributed to enlarge the TRI applications in the context of e-learning. Likewise, the model EDT has demonstrated efficacy in evaluating systems on the internet and consequently in VLEs (Chiu et al. 2005, Chiu et al. 2011). The EDT model also demonstrates utility when applied to public organizations under the perception of citizens about government performance (Gregg 2006, Oliver 2009).

Several researches adapted for new models presented an approach that related the constructs or combined tested models, as in the study to Erdogmus and Esen (2011), joining Technology Acceptance Model –TAM and TRI, Roca et al. (2006) and Lin (2011), using EDT and TAM, Liao et al. (2007), using EDT and Theory of Planning Behavior (TPB). However, EDT and TRI have no applications together in the context of e-learning in public organizations.

Hypotheses and Research Model
The hypotheses selected for the composition of the components of the survey were based on Bhattacherjee (2001b), Chiu et al. (2005), Erdogmus and Esen (2011), among others.

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 (Lai 2008). Innovativeness dimension gives an idea of an individual who believes to be in the vanguard of trying new products and have new experiences based on technology (Summak et al. 2010, Lai 2008, Hu et al. 2010). Discomfort refers to the perception of loss of autonomy in the face of technologies to be used in the organizational environment. (Parasuraman 2000, Rhee et al. 2007). Insecurity relates to skepticism and other cultural barriers that prevent the user to enable the use of certain technology (Lai 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 applied in studies of e-learning denotes the importance of having a VLE that meets the quality requirements that the user expects to get (Cheung and Lee 2011). Usability can be seen as the degree a person believes that using a VLE will be free of effort (Lin 2011). The value is an abstract concept that refers to the mode of conduct, personal preference or position forward the technology offered.
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. 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. Satisfaction is an individual feeling of pleasure resulting from the comparison of perceived performance relative to expectations (Chiu et al. 2005). There are numerous studies that establish the link between satisfaction and continuous use intention of an e-learning service (Lin and Hsieh 2007, Cheung and Lee 2011). The effects between constructs of e-learning are presented in Figure 1.

Figure 1: Research model

Methodological procedures

The study focuses on employees of two public organizations in the state of Rio Grande do Norte, located in Northeastern Brazil. They are the Universidade Federal do Rio Grande do Norte (UFRN) and the Ministério Público do Rio Grande do Norte (MPRN). 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.

Data collection was conducted in February 2013. Of the 3202 employees of UFRN, 273 completed the questionnaire, while in MPRN, of 816 servers, 70 valid responses were computed. Thus, the research sample corresponds to 343 cases.

The questionnaire was applied in the form of online survey. The survey instrument consists of 45 closed questions with 10 points metric scale, ranging from 1 - less agreement, of 10 - highest agreement assertive, plus five questions dedicated to the sample profile.

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 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 (Brei and Liberali 2006).

The assumptions that are determinant for analysis were verified. In the evaluation of assumptions, from 39 variables, 13 were disallowed in one or more tests and were excluded from the research model (Hair et al. 2009).

It was used exploratory factor analysis to refine the research model before the start of SEM in two steps. The Kayser-Meyer-Olkin (KMO) test obtained was 0.930, being considered suitable. The significance test of Bartlett Sphericity was 0.000, indicating significant correlations between the variables.

Analysis of Results

In this topic, the main results that contribute to fulfill the objectives of research are highlighted.

Sample profile
The survey sample shows that the workforce required in both organizations is predominantly composed of operational positions, but presents a significant portion of strategic levels. It was concluded that there is predominance of female respondents, aged between 18 and 25 years old, single, college-educated incomplete and family income between R$ 670 and R$ 1,920.

To identify possible differences in opinions by internal groups in organizations comparisons of means were performed of the dependent variables of satisfaction and continuous use intention along demographic variables. The results showed no significant differences.

Measurement model
Firstly, an adjustment 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.

Then, the goodness of fit was made according to the goodness of fit indices, as recommended by Maroco (2010). Thus, the indices were calculated, 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 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 above 0.5, 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). 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).

**Structural Model**
The model of satisfaction and continuous use intention of e-learning service was evaluated incorporating measurement model set and adding causal relationships. The goodness of fit indices were calculated again. The ratios showed adequate adjustments. 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. The adjusted final model is shown in Figure 2.

![Figure 2: Final model found by research](image)

Only optimism and innovativeness influence technology readiness. Only usability has no positive relationship with performance. In the structural model, both the performance as the technology readiness had positive relationship with satisfaction. The resulting continuity of use has a strong relationship with satisfaction and explanatory power of 84%.

**Discussions and implications**
This topic presents the main discussions and implications followed by limitations and suggestions of future studies.

**Discussions**

In study of exploratory factor analysis, the results found by Erdogmus and Esen (2011) and Darab and Montazer (2011) showed that the dimensions of optimism and innovativeness influence positively the determinant constructs. However, 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.

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 and Esen 2011, Summak et al. 2010, Pires and Costa 2008).

In the application of Confirmatory Factor Analysis (CFA), 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 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.

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 and Esen 2011, Cheung and Lee 2011, Lin 2011; Lin and Chen 2012, Pires and Costa 2008, Chou et al. 2010). In Table 1 the status of confirmatory testing of hypotheses are summarized.
Table 1: Test research hypotheses

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Direct effects</th>
<th>Trajectories of significance</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: Optimism is positively associated with user's Technological Readiness</td>
<td>0.990</td>
<td>1.463; S.E 0.096</td>
<td>H0 Rejected</td>
</tr>
<tr>
<td>H2: Innovativeness is positively associated with user’s Technological Readiness</td>
<td>0.841</td>
<td>1.446; S.E 0.102</td>
<td>H0 Rejected</td>
</tr>
<tr>
<td>H3: Discomfort is negatively associated with user’s Technological Readiness</td>
<td>---</td>
<td>---</td>
<td>H0 Confirmed</td>
</tr>
<tr>
<td>H4: Insecurity is negatively associated with user’s Technological Readiness</td>
<td>---</td>
<td>---</td>
<td>H0 Confirmed</td>
</tr>
<tr>
<td>H5A: Quality is positively associated with Perceived Performance</td>
<td>0.930</td>
<td>1.104; S.E 0.087</td>
<td>H0 Rejected</td>
</tr>
<tr>
<td>H5B: Quality Disconfirmation is positively associated with Perceived Performance</td>
<td>0.976</td>
<td>1.387; S.E 0.092</td>
<td>H0 Rejected</td>
</tr>
<tr>
<td>H6A: Usability is positively associated with Perceived Performance</td>
<td>---</td>
<td>---</td>
<td>H0 Confirmed</td>
</tr>
<tr>
<td>H6B: Usability Disconfirmation is positively associated with Perceived Performance</td>
<td>0.966</td>
<td>1.835; S.E 0.098</td>
<td>H0 Rejected</td>
</tr>
<tr>
<td>H7A: The Value is positively associated with Perceived Performance</td>
<td>0.907</td>
<td>2.013; S.E 0.110</td>
<td>H0 Rejected</td>
</tr>
<tr>
<td>H7B: The Value Disconfirmation is positively associated with Perceived Performance</td>
<td>0.912</td>
<td>1.793; S.E 0.101</td>
<td>H0 Rejected</td>
</tr>
<tr>
<td>H8: The Technological Readiness and Performance Perceived influence each other</td>
<td>0.894</td>
<td>Double arrow</td>
<td>H0 Rejected</td>
</tr>
<tr>
<td>H9: The Technology Readiness is positively associated with User Satisfaction</td>
<td>0.362</td>
<td>0.869; S.E 0.254</td>
<td>H0 Rejected</td>
</tr>
<tr>
<td>H10: The perceived performance is positively associated with User Satisfaction</td>
<td>0.522</td>
<td>1.252; S.E 0.250</td>
<td>H0 Rejected</td>
</tr>
<tr>
<td>H11: The User Satisfaction is positively associated with continuous use intention</td>
<td>0.917</td>
<td>0.958; S.E 0.034</td>
<td>H0 Rejected</td>
</tr>
</tbody>
</table>

Generally, the disconfirmatory constructs have high power to explain satisfaction and continuous use intention, concerning in other studies (Chiu et al. 2005, Chou et al. 2010, Chou et al. 2012).

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.

Implications

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 (Nascimento et al. 2011). 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.

Limitations and Future Studies
The research has some limitations. Firstly, it is noteworthy that the model is a simplification of reality and can present different results when applied to other units of analysis.

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).

Conducting longitudinal studies is recommended, because they generate more reliable results (Chiu et al. 2005).

References