Public Corporate e-Learning: Antecedents and Results

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On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Abstract
This study investigates the relationship between technology, content, responsiveness, usability, and outcomes of public corporate asynchronous e-learning. PLS-SEM was used to analyze the data of 1097 valid questionnaires collected electronically. Results indicate that positive student perceptions on (1) technology can positively influence their perceptions about the constructs and on (2) content, responsiveness and usability can positively and directly impact the perception of results. These impacts may increase the willingness to reuse the system, thus helping to reduce evasion. The new model deepens the understanding of the factors linked to inefficiency and helps in pointing directions for improving e-learning courses and environments.
Keywords: Adult learning; Distance education; Online learning; Learning strategies; Public organizations

1 Introduction

Which components of asynchronous e-learning without tutoring relate to the expected results of a learning system? Understanding this phenomenon may contribute to reduce dropout rates in courses taught in a corporate setting, including in the context of public service (Agrifoglio, Metallo, & Di Nauta, 2021). In asynchronous mode, the process of knowledge transmission does not occur in real time, allowing the course to be created in a standardized way and reproduced unlimitedly and without tutoring (virtual teacher), leading to a high degree of scalability, due to a marginal cost of almost zero.

This learning mode could be useful for institutions and countries which have low investment capacity. Emerging countries, in general, have in common the fact that they have inferior infrastructure and a population with high growth rates, which can make it difficult to use classroom education (Sinha & Bagarukayo, 2019). To bridge this gap, online education can be an important tool in meeting this growing demand for quality education in emerging economies. In India, one of the BRICS countries, the online education market is expected to reach the value of USD 1.96 billion by the year 2021 (KPMG, 2017). According to the Global E-Learning Market Size by Technology 2019-2025 report (Global Market Insights, 2019), the value of the online education market in Latin America (Colombia, Chile, Argentina, Mexico, and Brazil) will exceed USD 10 billion by 2025. Only in 2018 the Brazilian government announced investments of USD 270 million for the use of e-learning systems to training teachers throughout the country.

However, asynchronous e-learning without tutoring, which is widely adopted in the corporate world for advantages such as convenience and scalability, faces high dropout rates. In South Korea, for example, government-run online courses have experienced dropout rates

of nearly 97% (Jung & Lee, 2018). In Brazil, the 2017 Brazilian Census for distance learning (Brazilian Association of Distance Learning, 2018) points to dropout rates of up to 20% in corporate online courses. Studies show that the presence of a tutor helps to improve the learners' engagement and also the retention rate of e-learning courses (Paepe et al., 2018). Therefore, asynchronous e-learning without tutoring suffers from this lack having drop-out issues.

Analyzing e-learning in public organizations from emerging markets, this educational mode is used as a training tool to improve public servant performance and the quality of public services provided (Jung & Lee, 2018; Pereira et al., 2015). Government schools, a type of corporate public organization, also use e-learning to empower any interested citizen, to stimulate the exercise of social control of public spending (Heath, 2018). However, online courses with high dropout rates do not achieve the goal of disseminating the knowledge needed to the final recipient (Jacobsen, 2018). Thus, public resources used in the creation and management of these inefficient courses end up being wasted. Furthermore, the 2017 Brazilian Census for distance learning (Brazilian Association of Distance Learning, 2018) highlights that half of the institutions surveyed in Brazil, including public ones, are unaware of the causes of dropout in their courses. Therefore, better understanding the relationship between quality and results in asynchronous public corporate e-learning becomes relevant.

The literature indicates that the system quality (Cidral et al., 2018; DeLone & McLean, 2003) precedes results. Some research on e-learning quality (Ayuni & Mulyana, 2019; Cheng, 2012; Pereira et al., 2015) consider tutoring as a component of quality, a non-existent feature in the asynchronous modality without tutoring. For the case of asynchronous e-learning with tutoring, Sugant (2014) developed a proprietary scale to measure quality based on its components (technology, content, usability and responsiveness) and validated that in an emerging market. However, Sugant's research (2014) was not applied to the public corporate environment, nor did it investigate possible mediating roles in the relationships between its components.

Other studies investigated e-learning systems results considering factors such as satisfaction, the willingness to reuse the system (loyalty) and the perception of the usefulness of knowledge, in isolation, not jointly (Ayuni & Mulyana, 2019; Shee & Wang, 2008; Wang, 2003). In addition, few studies have investigated the public corporate environment outside major economic centers like the United States and European countries (Pereira et al., 2015).

To fulfil this gap, this paper aims to identify the relationship between technology, content, responsiveness, usability, and results of asynchronous e-learning without tutoring in

the public environment. To this end, the framework of this study is formed by the asynchronous e-learning dimensions (Sugant, 2014; Sugant & Srilakshminarayana, 2018) and e-learning results constructs, such as satisfaction, utility, and loyalty. A survey was applied which obtained 1097 e-learning users and analyze the results using partial least squares structural equation modeling.

This study makes theoretical contributions by expanding the previous model which investigate the dimensions of asynchronous e-learning without tutoring (Sugant, 2014), connecting it with other studies that investigated the results of e-learning systems (Al-Rahmi et al., 2018; Bonatto, Motoki, Bezerra Filho, & Mainardes, 2021; Cidral et al., 2018; Gameel, 2017; Liaw & Huang, 2013; Shee & Wang, 2008). The present study also allows a better understanding of the relationships between the constructs by verifying the existence of indirect effects. Finally, as a practical contribution, this model can help public corporations to understand the factors that can influence the inefficiency of their courses. This knowledge can assist in the development of alternatives to improve the quality and efficiency of courses and e-learning environments, reducing waste of public resources and losses due to evasion.

2 Theoretical Framework

The model proposed by DeLone and McLean (2003) for the evaluation of Information Systems (IS) identifies quality of the system as an antecedent of the perception of satisfaction with the use and will to reuse it (loyalty). Consequently, quality leads to benefits generated by the impacts on the individual and the organization (Cidral et al., 2018). One of the generated benefits is the perception of the usefulness of the knowledge acquired for personal and professional life (Cidral et al., 2018). Therefore, results of an e-learning system can be measured by the variables satisfaction, usefulness, and loyalty.

E-learning student satisfaction is defined as an emotional response which varies in intensity and occurs after e-learning activities (Wang, 2003). Wang (2003) states that satisfied students lead to high levels of intention to reuse the e-learning service. This intention of reuse can be conceptualized as loyalty (Ayuni & Mulyana, 2019). System quality, functionality, design and responsiveness have significant effects on perceived usefulness (Cheng, 2012). The perception of usefulness is defined as the belief that a certain knowledge learned will bring about a future improvement in their job performance (Cheng, 2012; Joo et al., 2018). Therefore, satisfaction, usefulness and loyalty are the antecedents of the results of an e-learning system (Cheng, 2012).

For the specific case of asynchronous e-learning without tutoring, Sugant (2014) created a more appropriate model for measuring the quality of the components that form an e-learning course: content, ease of use (usability), technology used and system responsiveness. To measure content, the Sugant (2014) model investigates 3 aspects: whether the design and presentation of the e-learning course are appropriate; whether it is well structured; and whether the information presented is understandable and complete. The virtual characteristics of the course, which include its presentation form, positively affect student satisfaction and intention to continue using online learning (Sun et al., 2008).

The perception of the usefulness of knowledge learned depends on the correct understanding of the information presented, implying that content influences the perception of the usefulness of knowledge (Cheng, 2012). Similarly, studies state that the quality of the content positively affects the satisfaction and willingness to reuse, or loyalty, of the e-learning system (Cheng, 2012; Shee & Wang, 2008). Thus, considering that the observed variables satisfaction, utility and loyalty, all of them affected by course content, form the construct results (Ayuni & Mulyana, 2019; Cheng, 2012; Cidral et al., 2018; DeLone & McLean, 2003; Joo et al., 2018; Shee & Wang, 2008; Wang, 2003). Thus, the first model hypothesis is:

H1. Course content positively influences the e-learning system results

As defined by Parasuraman, Zeithaml, and Malhotra (2005), responsiveness is the ability to assist customers – in this case, learners – in other words, the willingness to provide service. In the asynchronous and without tutoring e-learning mode, feedback is automatic and provided by the virtual learning environment itself (Krause et al., 2009). Feedback compensates for a series of shortcomings in an e-learning system and has the effect of boosting the achievement of positive results (Cheng, 2012; Krause et al., 2009; Wang, 2003).

According to Cheng (2012), the quality of the feedback and be willing to listen to students' opinions have positive impact on the perception of the usefulness of the knowledge acquired and also on satisfaction, which consequently affects the willingness to reuse the system, or loyalty (Wang, 2003). Considering that the variable loyalty composes the construct results (Ayuni & Mulyana, 2019; Cheng, 2012; Cidral et al., 2018; DeLone & McLean, 2003; Joo et al., 2018; Shee & Wang, 2008). Thus:

H2. The responsiveness of the e-learning system positively influences its results.

Usability is also considered as one of the essential factors for the success of learning systems (Cheng, 2012; Liaw & Huang, 2013). This is because the perception of the ease of use

of an e-learning system is an important antecedent of satisfaction with the course (Sun et al., 2008), which is one of the determinants of results, alongside loyalty and usefulness.

According to Cheng (2012), usability also positively influences the perception of the usefulness of the acquired knowledge and the satisfaction with the e-learning system, provoking the intention of reuse, or loyalty. Since that the variables satisfaction, utility and loyalty form the construct results (Ayuni & Mulyana, 2019; Cheng, 2012; Cidral et al., 2018; DeLone & McLean, 2003; Joo et al., 2018; Shee & Wang, 2008; Wang, 2003). Thus:

H3. The usability of the e-learning system positively influences its results.

The literature emphasizes that one aspect of feedback (responsiveness) involves pointing the correct answers of the assessments to the users (Attali & van der Kleij, 2017; Krause et al., 2009). Consequently, feedback is provided by comparing the correct answers to the ones provided by the student based on the knowledge (content) conveyed by the course (Attali & van der Kleij, 2017). Therefore, there should be a relationship between content and responsiveness (feedback), leading to the fourth hypothesis:

H4. The course content provided by the e-learning system positively influences the responsiveness of the e-learning system.

The ease of use of an e-learning system (usability) is a critical factor to its success (Almeida et al., 2017; Choi et al., 2007). An easy-to-operate interface makes it easy for the student to use all parts of the system (Choi et al., 2007). From the moment that users are more able to use the system, new suggestions will emerge and the relationship with service providers becomes more intense. Based on that, there is more need for responsiveness. Thus:

H5. The usability of e-learning system positively influences its responsiveness.

Several studies (e.g. Chang, 2016; Cheng, 2012; Krause et al., 2009; Wang, 2003) have already discussed the positive effects of responsiveness on e-learning student performance and learning outcomes. The literature points out that content directly influences results (Sun et al., 2008), while also directly influencing responsiveness (Krause et al., 2009). Likewise, usability directly influences results (Cheng, 2012) and impacts responsiveness (Sun et al., 2008).

The literature also indicates that usability facilitates access to responsiveness (Choi et al., 2007; McIntyre & Wolff, 1998). Based on this and previous arguments it is clear that content directly influences the results (Sun et al., 2008) and responsiveness (Krause et al., 2009). On the other hand, responsiveness influences the e-learning results (Cheng, 2012;

Krause et al., 2009; Wang, 2003) and it can assume the role of a mediating variable (Cho et al., 2009). Considering that the literature emphasizes that responsiveness can assume mediating roles (Cho et al., 2009), it is argued that responsiveness may mediate the relationship between results and usability. Thus, it suggests that:

H6. Responsiveness of the e-learning system plays a mediating role in the relationship between course content and e-learning system results (H6a) and between e-learning system usability and e-learning system results (H6b).

The literature identifies that technology has relevance to the functioning of learning systems by facilitating interaction between students and course content (Wong & Huang, 2011) significantly affects user satisfaction (Sun et al., 2008). In an asynchronous e-learning system, an information system where human participation in the process of knowledge transmission is minimal or practically non-existent (tutoring courses), system technology plays a key role (Wong & Huang, 2011). Thus, content depends on the proper functioning of the technology (Choi et al., 2007; Martins et al., 2018; Xu et al., 2013). Consequently, the following hypothesis was constructed:

H7. E-learning system technology positively influences course content.

In the asynchronous e-learning system without tutoring, the responsiveness (feedback) happens automatically (Krause et al., 2009). Therefore, it depends on the correct functioning of the system. Thus, problems in the quality of system technology also affect the quality of the generated responsiveness (Attali & van der Kleij, 2017; Xu et al., 2013). Based on this, it was argued that:

H8. E-learning system technology positively influences e-learning system responsiveness.

Similarly, usability - which measures the ease of operating the system - is affected by the correct functioning of the technology (Cho et al., 2009; Xu et al., 2013). A system with deficient technology becomes difficult to operate, affecting the perception about its usability. Therefore, it was assumed that:

H9. E-learning system technology positively influences e-learning system usability.

Sugant (2014) evaluates the construct technology through questions that ask if the e-learning system works correctly and accurately, without presenting crashes. Technology malfunctions affect other constructs (Xu et al., 2013), among them content and responsiveness.

In Sugant's (2014) model, one of the dimensions regarding responsiveness relates to the student's perception that the applied assessments are appropriate and consistent with the content taught. In fact, responsiveness uses course content as a basis of comparison (Attali & van der Kleij, 2017), showing that there is a relationship between responsiveness and content.

Allied to this, it is the correct functioning of the system (technology) that allows access to the course content and also to feedback (Xu et al., 2013). Therefore, it is evident that technology has effects on the content and the responsiveness (feedback). If technology has direct effects on both content and responsiveness (Attali & van der Kleij, 2017); and if content has direct effects on the relationship with responsiveness and also suffers from the effects of technology (Xu et al., 2013), it is likely to exist a mediating effect of content on the relationship between technology and responsiveness. Thus, it is argued that content can act as a mediator in the relationship between technology and responsiveness:

H10. Course content plays a mediating role in the relationship between e-learning system technology and e-learning responsiveness.

Previous studies point out that (a) technology influences responsiveness and usability (Attali & van der Kleij, 2017; Xu et al., 2013); (b) technology significantly influences usability (Attali & van der Kleij, 2017; Martins et al., 2018); (c) usability influences responsiveness (Choi et al., 2007); and that (d) usability can play a mediating role (Cho et al., 2009). Based on this, the following hypothesis was elaborated:

H11. Usability of the e-learning system plays a mediating role in the relationship between technology and responsiveness of the e-learning system.

3 Data and Methods

For the present study, a quantitative cross-sectional survey was elaborated to collect primary data. The minimum sample defined by G*Power software is 472 respondents. The object of study is the virtual learning environment (VLE) of the Brazilian Government School of the Espírito Santo State's Court of Accounts, which had 33,895 students attending their virtual courses in 2017. The choice is justified because all its courses are taught in asynchronous mode, without tutoring and monitoring in e-learning format, and it has high dropout rates.

Any citizen who has attended the e-learning courses offered by the Government School composed the target population of the study, in addition to public servants of other institutions supervised or not by the Espírito Santo State's Court of Accounts. This is because the virtual

courses offered by the Government School to the external public are open for anyone interested, free of charge. The government school's virtual learning environment is based on Moodle and offered 43 distance learning courses in 2017.

The data collection instrument was a questionnaire based on previous studies (Sugant, 2014; Sugant & Srilakshminarayana, 2018; Wang, 2003) and composed of 5 parts. The questionnaire begins with an invitation for respondents to express themselves by identifying their perception of the courses they attended at the Government School.

The research was sent to all participants of the Government School's courses, including people that may have attended presential classroom courses. Therefore, there is a control question to identify the type of course attended by the respondent that admits 4 answers: (1) Only online; (2) Only presential; (3) Both presential and online; (4) Did not attend any courses. If the respondent checks option (4), his/her answers are excluded from the final sample.

The first part of the questionnaire has three statements to measure the construct "content"; the second part has 4 statements linked to the 'usability' construct; the third part has 3 statements involving the construct 'technology'; and the fourth part contains 2 statements linked to the construct 'responsiveness'. These first 4 parts were translated and adapted from Sugant (2014).

The fifth and last part of the questionnaire involves 3 statements aimed at evaluating the 'results' construct, which is composed by satisfaction (Wang, 2003), perception of usefulness of the acquired knowledge (Cheng, 2012; Cidral et al., 2018; Joo et al., 2018) and the intention to attend other online learning courses (Ayuni & Mulyana, 2019; Shee & Wang, 2008). Responses to statements on the form ate 5-point Likert scale-based alternatives ranging from strongly disagree to strongly agree.

Prior to distribution the questionnaires were validated through a semantic pre-test sent to 19 respondents. No issues were identified neither in the understanding of the text nor in the online access to the questionnaire. Thus, the questionnaire was sent to the entire research target audience by email containing the link to the electronic form.

From the 1747 answers obtained, 23% of the respondents (404 answers) attended only presential courses; 14% of respondents (246 replies) attended both types of courses, presential and online; and 63% of respondents (1097 replies) attended only online courses. Thus, for the purpose of this study, only 1097 answers are considered valid because they reflect the perception of participants who attended only the e-learning courses offered by the Government School.

Regarding the socio-demographic profile, the respondents are mostly male (53.2%), with the predominant age ranges being 31 to 40 years old (31.7%), 41 to 50 years old (28.5%) and over 50 years old (23.6%). Also note that 47.4% of the sample has a postgraduate education level and 37.4%, a graduate level. Finally, 67.7% of respondents are connected to the public sector.

To test the hypotheses the collected data is analyzed by applying partial least squares structural equation modeling (PLS-SEM) to validate the measurement and structural model. This statistical technique allows the analysis of several dependency relationships between variables simultaneously. The steps are based on Hair, Hult, Ringle, and Sarstedt (2017), who establish criteria to analyze collinearity, internal consistency, discriminant and convergent validity.

4 Analysis and Results

4.1 Model validation

To validate the model, convergent validity tests were performed by analyzing the factor loadings, the average variance extracted (AVE) and the composite reliability (CR). The findings shows that all factor loadings are greater than 0.70 (Table 1) and that the constructs presented average variance extracted (AVE) greater than 0.50 (Table 2), meeting the criteria established by Hair et al. (2017). Thus, no variables are excluded.

Table 1 – Factor Loadings Matrix

The values of composite reliability (CR) are higher than 0.881 for all constructs, exceeding the recommended value of 0.70 and indicating the existence of internal consistency (Hair et al., 2017). Thus, there is evidence of convergent validity in all constructs of the model. Results also indicate discriminant validity because the square roots of the AVE are higher than the values of the correlations of the other constructs (Table 2) and there is no indication of cross loadings.

Table 2 – Construct validity

4.2 Model results

The structural model (Figure 1) was analyzed. It conceptually represents the relationships between the constructs involved by means of a path diagram. This structural model is evaluated by analyzing the construct path coefficients and their significance and by calculating the determination coefficients (R2), to measure how much of the variance of endogenous variables are explained by the model (Hair et al., 2017).

Figure 1. Structural model

Results indicate that both direct and indirect effects hypotheses are supported. The presentation of the results is divided into two parts. First, the results related to the hypotheses with direct effects (H1, H2, H3, H4, H5, H7, H8, H9). Then, the results of the hypotheses regarding indirect effects (H6a, H6b, H10, H11).

Table 3 displays the results of the direct effects. The path coefficient of each hypothesis was analyzed. Then, it was highlighted which previous studies relate to the results. In the last column of the table, it was presented the interpretation of the hypothesis result. The results show that all hypotheses with direct effects are supported.

Table 3 - Results of hypotheses with direct effects

To test the hypotheses related to the mediating effect of certain constructs, the literature (Hair et al., 2017) indicates the following procedure. First, analyze the significance of all the relationship paths between the 3 constructs, that is, the path significance with possible indirect effects (paths B and C of Figure 2 containing the mediator construct) and the path with possible direct effects (path A of Figure 2). If the paths representing the indirect effect linking the first construct C1 to the mediating construct CM (path B of Figure 2) and linking this to the last construct C3 (path C of Figure 2) are both significant, it can be said that there is the indirect mediating effect.

Figure 2: Illustration of mediating effects

If there is a mediating effect, the next step involves identifying what kind of effect it is. Check the significance of the direct effect of the relationship between the first construct C1 and the third construct C3 (path A of Figure 2). If this direct effect is not significant, then there is only mediation (indirect effect). On the other hand, if the direct effect is significant, it indicates that partial mediation exists, and it may be complementary or concurrent. If the multiplication of the direct path coefficient (A) by the indirect path coefficients (B and C) is positive, it means that the mediation is complementary. If the result is negative, then mediation is of the concurrent type (Hair et al., 2017).

Table 4 shows results from indirect effects, following the protocol just described. Therefore, it presents (a) the analysis of path significance with possible indirect effects and direct effects and the type of mediation and (b) the interpretation of the results of each hypothesis (conclusion column). All hypotheses were supported as of the complementary partial mediation type.

Table 4 – Results of hypotheses with indirect effects of mediation

5 Discussion

Results indicate that technology precedes content and usability of the system. Moreover, 35.4% of the perception of the course content and 49.1% of the variation in the perception of system usability are due to the influence of technology perception of the e-learning system. Thus, a sizable part of the user's perceptions of system usability and course content can be explained by their initial perception of the system's technology. This can be explained by the fact that in asynchronous courses human influence is reduced, which provides a greater importance of technology (Wong & Huang, 2011).

Results also indicate that perceptions about course content, technology, and system usability are related to responsiveness, and this relationship explains 60.7% of the variation in the perception of e-learning responsiveness. The findings suggest that both content and usability act as mediators in the relationship between technology and responsiveness. This means that both content and usability can intervene in the relationship between technology and responsiveness. Thus, part of the user's perceptions of the responsiveness of the system can be explained by their initial perception of the course contents, e-learning system technology, and usability.

Finally, the model results shows that the relations with course content, responsiveness, and system usability explain 57.9% of the e-learning system results variation. The findings also indicate that responsiveness acts as a mediator in the relationship between content and results, and in the relationship between usability and results. Thus, positive perceptions about the 3 constructs –content, responsiveness, and usability – are responsible for part of the impact on the perception of system results. In addition, positive perceptions about system content and usability can also have positive impacts on results indirectly, through responsiveness. It explains the fact that aspects inherent to the system, (in this case, usability and content) will impact the institution's ability to provide a service. Unlike other sectors in which technology is not a central point, for responsiveness to generate results, aspects related to the system need to work well.

Given these results, it is possible to suggest that it is not enough just improve the system technology, the courses content, and the usability of the system, as defended by Parasuraman et al. (2005). As the responsiveness mediated the relationship of the other constructs with the result construction (formed by the variable satisfaction, loyalty, utility), negative perception about the responsiveness affects any improvements in the other constructs that could have a

positive impact on results. Therefore, organizations should improve system responsiveness to leverage any gains in technology, content, and usability.

As previously stated, one aspect of responsiveness (feedback) involves knowing the correct answers of the assessments (Attali & van der Kleij, 2017; Krause et al., 2009), by comparing the correct answers to the ones provided by the student based on the knowledge (content) conveyed by the course (Attali & van der Kleij, 2017). Therefore, the e-learning system manager needs to be concerned with the development of consistent evaluations, possessing a logical correlation with the content, that allow the student to easily know the result of their assessments and to what part of the content each question refers to.

6 Conclusions

This study proposes a model to investigate antecedents and results of online e-learning systems. The model was applied in a public corporate environment. The results indicate that a positive perception of technology, usability, responsiveness, and content of the course will contribute to the increased satisfaction and perceived utility, as well as desire to reuse the system (loyalty). Based on these findings, it is possible to argue that this increase in the desire for system reuse, in turn, can help decrease dropout rates.

The present study brings both theoretical and practical contributions. As a theoretical contribution, this study expands the model previously proposed by Sugant (2014) in two ways. First, by connecting it with other studies that investigated the results of e-learning systems (Al-Rahmi et al., 2018; Cidral et al., 2018; Gameel, 2017; Liaw & Huang, 2013; Shee & Wang, 2008). Second, by verifying the existence of mediation effects on the relationships between the constructs, in all the cases in complementary form, allowing a better understanding of the relationships.

The work also fills gaps in the literature (Pereira et al., 2015; Sugant, 2014; Sugant & Srilakshminarayana, 2018; Wang, 2003). Sugant (2014) investigated the use of asynchronous e-learning without tutoring only in a higher educational environment. The present study expands the research into a scenario of a public corporate environment. In turn, Wang (2003) considers tutoring in the process of knowledge transmission. This study takes part of Wang's (2003) research and applies it to an e-learning environment without tutoring. Finally, Pereira et al. (2015) did not consider the perception of the usefulness of the knowledge as an antecedent to the results of the e-learning system. This research considered this variable, along with the variables satisfaction and loyalty, as variables that precede the results of an e-learning system.

In practical terms, this study can help entities in creating ways to improve the efficiency of e-learning courses. It can lead to a reduction of public resources waste in the creation of these courses. In addition, by identifying system components and their effects, managers may improve system efficiency and enable better results. These strategies could increase the consumer satisfaction and quality perception to reduce the high dropout rates of asynchronous e-learning.

This study has limitations that enable some challenges and opportunities for future research. First, model uses a non-probabilistic sampling and cross-sectional data. This limits the conclusions about the phenomenon for other contexts. Given that, further studies could replicate this model in different emerging countries' public organizations. One possibility is applying this in Asian countries which have different cultural aspects in relation to South America. Thus, it will be possible to compare the results and analyze the effect between the variables in other contexts. Second, the framework uses only five constructs: technology, content, responsiveness, usability, and results, to test mediating effects between them. Studies could go further by adding new components (such as possible moderators) to the model to increase the understanding of what drives good results in online e-learning systems.

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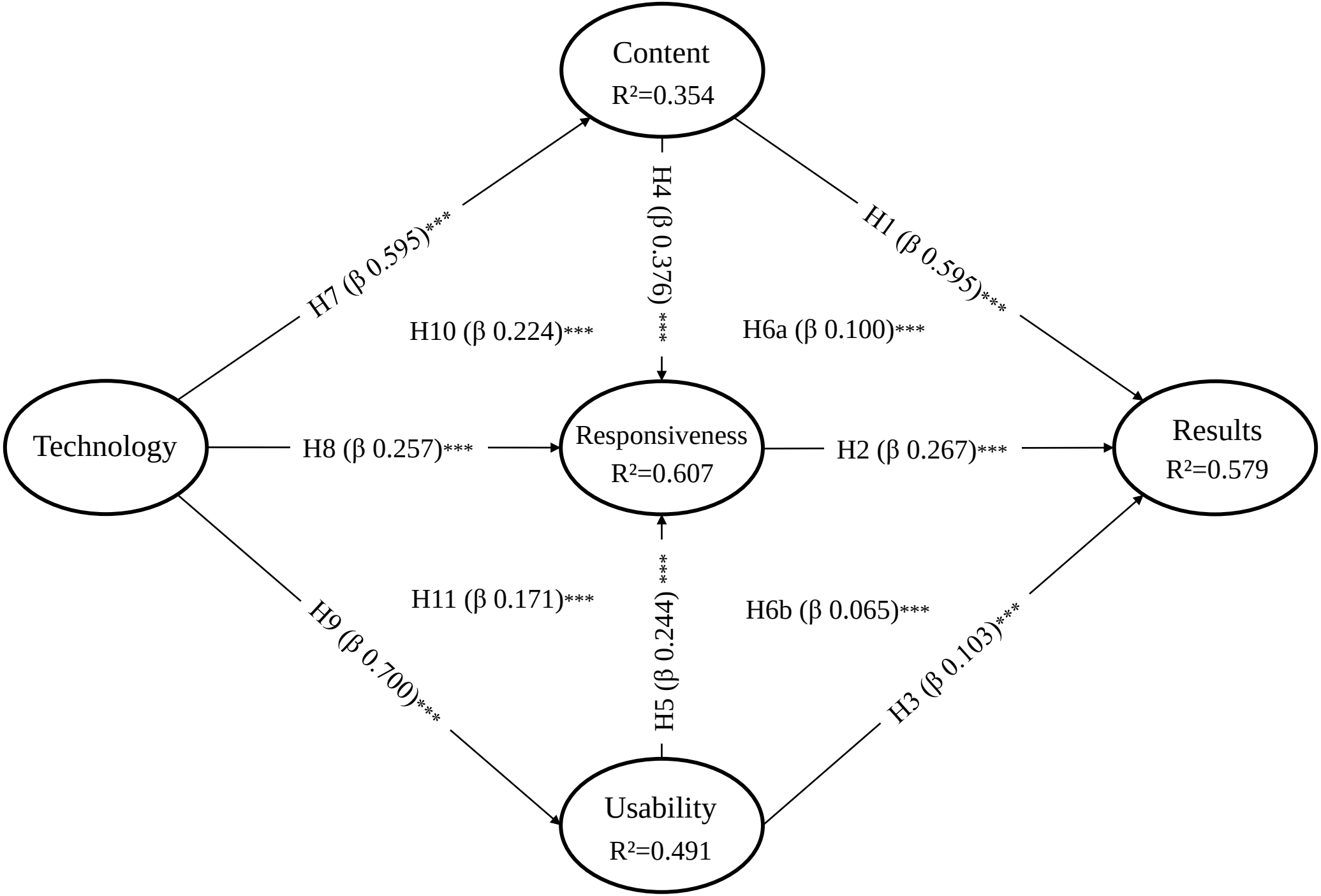
Figure


Content
R²=0.354
H7 (β 0.595)***
H4 (β 0.376) ***
H1 (β 0.595)***
H10 (β 0.224)***
H6a (β 0.100)***
Technology
H8 (β 0.257)***
Responsiveness
R²=0.607
H2 (β 0.267)***
Results
R²=0.579
H11 (β 0.171)***
H5 (β 0.244) ***
H6b (β 0.065)***
H9 (β 0.700)***
H3 (β 0.103)***
Usability
R²=0.491

Table

Tables

Table 1 – Factor Loadings Matrix

Constructs	Code	Item	Factor Loadings
Content	C1	The structure and presentation of the course(s) is(are) appropriate.	0.881
	C2	The content is well structured with appropriate text, videos, animations, exercises, etc.	0.918
	C3	The course(s) you have taken is(are) comprehensive and complete.	0.889
Usability	U1	The interface is attractive, user friendly and clutter free.	0.817
	U2	The course(s) is(are) interactive, encouraging active learning.	0.850
	U3	The school portal is easy to navigate, and students can easily access the modules they need and easily move between pages.	0.773
	U4	The school portal tracks your progress by registering completed modules and tells you where you left off before returning.	0.806
Technology	T1	The portal is fast and does not crash.	0.888
	T2	The portal works correctly and accurately.	0.908
	T3	The school provides adequate support in the event of any failure, providing prompt feedback.	0.805
Responsiveness	R1	Evaluations are appropriate and consistent.	0.905
	R2	The school considers students' opinions and consequently implements changes for a better learning experience.	0.869
Results	RE1	I am satisfied with the course(s) I attended.	0.924
	RE2	The acquired knowledge is useful/beneficial in my life.	0.916
	RE3	I intend to participate in other online course(s) through the school portal.	0.843

Table 2 – Construct validity

Latent Constructs	AVE	CR	C	T	U	R	RE
C – Content	0.803	0.924	0.896				
T – Technology	0.753	0.901	0.595	0.868			
U – Usability	0.659	0.886	0.752	0.700	0.812		
R – Responsiveness	0.787	0.881	0.712	0.651	0.706	0.887	
RE- Results	0.801	0.923	0.728	0.538	0.638	0.667	0.895

Notes: AVE is average variance extracted, CR is Composite reliability, C is Content, T is Technology, U is Usability, R is Responsiveness, and RE is Results. The highlighted values on the main diagonal represent the square roots of the AVEs of each construct.

Table 3 - Results of hypotheses with direct effects

Hypotheses	Previous studies corroborated	Conclusion
H1 (β = + 0.460 and p-value< 0.01)	Sun et al. (2008); Cheng (2012); Shee & Wang (2008)	Course content positively affects e-learning results.
H2 (β = + 0.267 and p-value < 0.01)	Delone & McLean (2003); Cidral et al. (2018); Chang (2016); Cheng (2012); Joo et al. (2018); Ayuni & Mulyana (2019); Shee & Wang (2008); Tolentino et al. (2013); Wang (2003)	If an e-learning system is responsive by providing positive student feedback, there is a positive stimulus in the perception of the results
H3 (β = + 0.103 and p-value < 0.01)	Liaw & Huang (2013); Cheng (2011); Sun et al. (2008)	If the student perceives the usability positively, there may be a positive reflection on the perception of the usefulness of the transmitted knowledge.

H4 (β = + 0.376 and p-value < 0.01)	(Attali & Van der Kleij (2017); Brown & Voltz (2005); Krause et al. (2009)	If the student perceives that the course content is well-structured and has consistent assessments, there is a positive stimulus in their perception of the feedback (responsiveness) provided by the system.
H5 (β = + 0.244 and p-value < 0,01)	Choi et al. (2007); Krause et al. (2009)	If the operation (use) of the system interface is perceived by the student as easy to operate and navigable, there is a positive stimulus in the perception of system responsiveness.
H7 (β = + 0.595 and p-value < 0.01)	Choi et al. (2007); Volery & Lord, (2000); Pituch & Lee (2006); Wong & Huang (2011); Xu et al. (2013)	If e-learning system technology is perceived positively by the system user, there is a positive effect on the perception of course content.
H8 (β = + 0.257 and p-value < 0.01)	Attali & Van der Kleij (2017); Krause et al. (2009); Volery & Lord (2000); Pituch & Lee (2006); Xu et al. (2003)	A properly functioning e-learning system has a positive effect on the user's perception of system responsiveness.
H9 (β = + 0.700 and p-value < 0.01)	Cho et al. (2009); Xu et al. (2013); Volery & Lord (2000); Pituch & Lee, (2006)	If the technology of an e-learning system works properly, this positive perception will also have positive effects on the user's perception of the usability of the system.

Table 4 – Results of hypotheses with indirect effects of mediation

Hypotheses	Analyses	Conclusions
H6a	The relationship (content and results), mediated by the responsiveness construct is significant (p <0.01 and p <0.01). The relationship (content and results) is significant (p <0.01), indicating partial mediation. Path coefficient product (0.460, 0.376 and 0.267) has positive sign (complementary partial mediation).	Part of the effects of the content construct on the results construct can be explained through the responsiveness construct.
H6b	The relationship (usability with results), mediated by the responsiveness construct is significant (p <0.01 and p <0.01). The relationship (usability with results) is significant (p <0.01), leading to partial mediation. The product of the path coefficient (0.103, 0.244 and 0.267) shows positive sign (complementary partial mediation).	Part of the effects of the usability construct on the results construct can be explained through the construct responsiveness.
H10	The relationship between the technology construct and the responsiveness construct, mediated by the content construct is significant (p <0.01 and p <0.01). The relationship between the technology construct and the responsiveness construct is significant (p <0.01), evidencing partial mediation. The product of the path coefficients (0.257, 0.595 and 0.376) shows positive sign (complementary partial mediation).	Part of the effects of the technology construct on the responsiveness construct can be explained through the content construct.
H11	The relationship between the technology construct and the responsiveness construct, mediated by the usability construct, is significant (p <0.01 and p <0.01). The relationship between the technology construct and the responsiveness construct is significant (p <0.01), evidencing partial mediation. The product of the path coefficient (0.257, 0.700 and 0.244) has a positive sign (complementary partial mediation).	Part of the effects of the technology construct on the responsiveness construct can be explained through the usability construct.

Figures

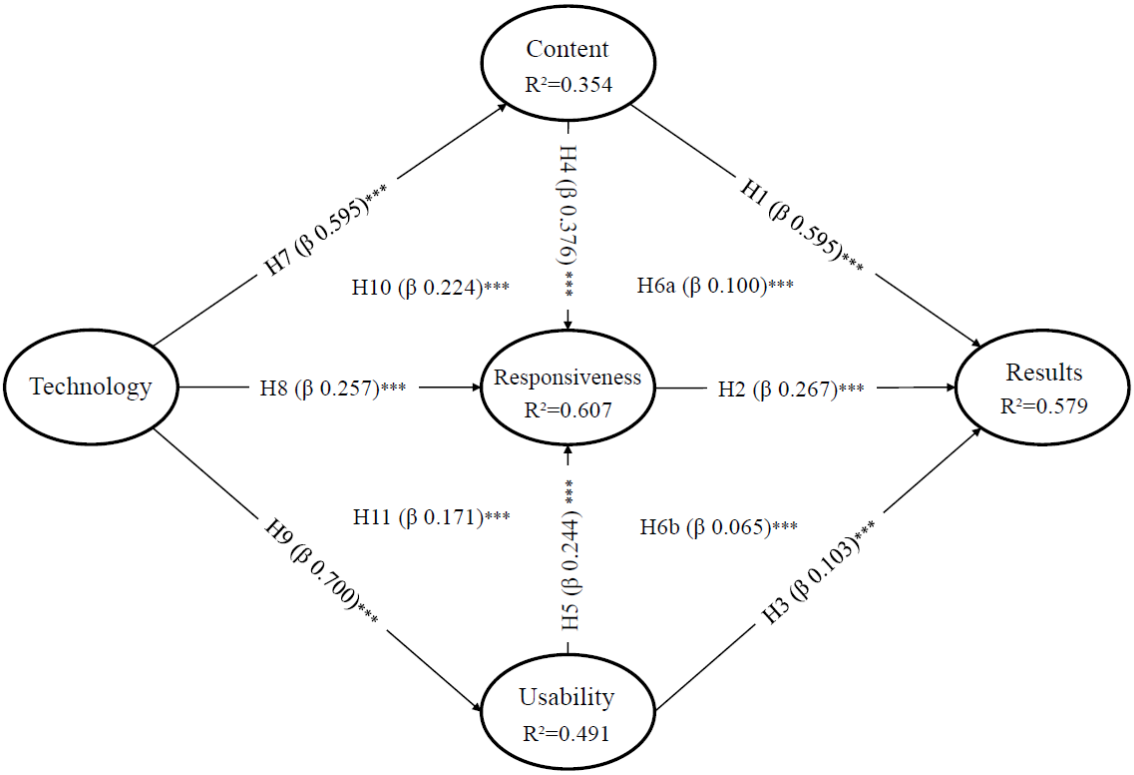


Figure 1. Structural model
Note$_1$: *** significant at 0.01
Note$_2$: Hypotheses H6a, H6b, H10 and H11 investigate indirect effects of mediation.

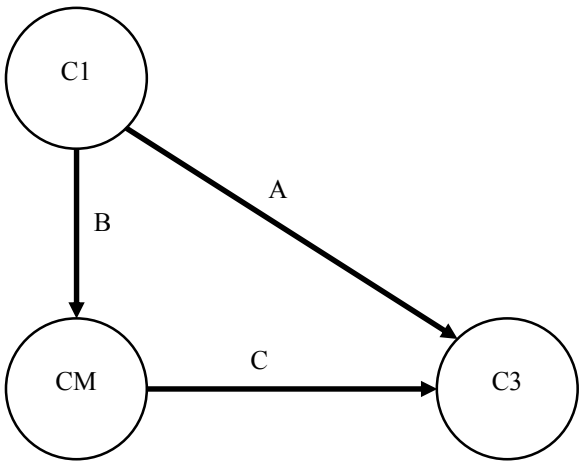


Figure 2: Illustration of mediating effects
Note: C1 has both a direct effect and an indirect effect, through CM, on C3.