CONCEPTUAL DIMENSIONS IN TECHNOLOGY USE AND ACCEPTANCE MODELS

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Abstract

Advances in information and communication technologies, especially online digital applications, provide new experiences at a personal, community and even social level. To understand how digital technologies influence users' perceptions, what they value most and why they adopt them, conceptual models are developed – and tested – based on predicted causal relationships between latent dimensions, in each context. Digital games are used in the most diverse contexts and by all age groups. Given their relevance in terms of play, fun, or, eventually, in terms of learning or socialization, they have conquered a legion of fans. At the same time, and consequently, the characteristics of games, the role they play for users, and the influence they have on human behavior, are investigated by a growing number of authors, namely in topics, such as, cognition and learning, health and well-being, socialization, advantages, and disadvantages of its use. Digital games derive from the evolution of electronic games, incorporate new technologies and run-on game consoles, computers, cell phones, tablets, and other mobile devices. In this context, we emphasize the use of digital games in teaching and learning among adults.

The main objective of this work was to find out what are the more important dimensions in previous studies that analyzed the use of digital games by adults, in the context of teaching and learning. To achieve this goal, we analyzed the most relevant articles that propose and evaluate technology acceptance models in this research topic and were published in the last fifteen years - according to pre-defined inclusion criteria. In this systematic review, we had selected forty-eight scientific papers (indexed), from which the abstracts and keywords were analyzed with textual content analysis techniques, using the Iramuteq 0.7 alpha 2 software - through Descending Hierarchical Classification (DHC), Similitude Analysis and Correspondence Factor Analysis (CFA). We considered the following inclusion criteria: articles published in journals or proceedings of international conferences (indexed by Scopus or WoS), between 2006 and 2021, that have at least one significant keyword (serious games, social games, mobile games, or computer games), and are focused on the use and acceptance of digital games among adults – so, only studies that explore technology acceptance models in adults' samples were considered.

The results highlighted the dimensions that have been considered as most relevant in the use of digital games among adults, particularly in terms of teaching and learning. This is also an important contribution at an academic-scientific level, to propose a new conceptual model to explain the adoption of digital games among adults in a broader context – giving us suggestions for future work, such as the possibility of learning through socialization while using online digital games.

Keywords: Keywords: Conceptual dimensions; Technology adoption models; Digital games; Adults.

1 INTRODUCTION

The incorporation of new variables in existing models considering the necessary requirements for the verification and validation of models using mathematical methods, made possible to create extended models based on other models already popularized - duly proven. It's had happened with the Theory of Planned Behavior - TPB – [1] and with the Technology Acceptance Model -TAM – [2], [3], [4], which in the period from 2001 to 2018 were the most used for explain human interactions with the various existing technologies. In a percentage representation, considering a survey carried out through the Proquest platform, the TPB presented 26.5% of the records, the TAM 24.4% of the records, the Theory of Reasoned Action - TRA – [5], 17.6% of the records, the Social Cognitive Theory – SCT – [6], 17.3% of the records and the Unified Theory of Acceptance and Use of Technology – UTAUT – [7], 4.2% of the records [8].

As a technology, and subject to analysis in studies carried out through these models, there are digital games. Digital game is understood to be the technological evolution of electronic games, which, through the incorporation of new technologies, are currently games capable of providing digital sound and image. It is added that, when technologies were able to provide resources in digital technology to electronic video games, the technological evolution of these devices was allowed, including all the computer technology incorporated and that made possible the creation of the current consoles - which provide resources such as performing computer-like functions, acquiring games over the internet without the need for physical media, online multiplayer gameplay, internet browsing, among other functions [9], [10], [11], [12].

In the last fifteen years, studies that address the use and adoption of digital games, have been carried out in different contexts. In a broad sense, the use of these devices has been studied in contexts that involve cognition, namely education and learning [13], [14]; in health and well-being contexts [15], [16]; in contexts that depict interpersonal interaction [17], [18]; in contexts of recreational use and for leisure purposes [19], [20]; and, in contexts that portray the harm resulting from use [21].

In harmony with the research objective presented this study is part of an investigative work developed for a doctoral thesis on the acceptance of digital games by adults who, through a schematic structure that idealizes a conceptual map, created meanings through concepts. In a similar way, the concept map specially developed for the present academic work, with the help of a content analysis software, allowed the visualization of the different possible and representative relationships for the conceptual dimensions in teaching and learning contexts, and allowed that such conceptual dimensions were materialized without bias or biased interference from the researcher - a fact that is likely to occur when the researcher, when using qualitative methods, such as interviews, and, having already formed some opinion on the subject, tarnishes the results when interpreting the data [22], [23].

The results suggest that there is a limited number of publications on the use of digital games by adults who use models of use and acceptance of technologies to explain the phenomena surrounding the realities of teaching and learning practice. Yet, one of the recurring themes is related to the acceptance of educational practices in finance. The limitations of the present investigation work are presented as a possible suggestion for future work.

2 METHODOLOGY

This study considers publications of last fifteen years, considering the period from 2006 to 2021, on the use of digital games by adults, which, through models of technology adoption, contributed to a better understanding of the interaction of adults with digital games. The criteria of the systematic review considered the choice of platforms for the bibliographic survey, the use of articles published in indexed international journals and in conference proceedings, in a pre-defined period and, around the theme "the use and acceptance of digital games by the adult population." Google Scholar, Web of Science, EBSCOhost, and IEEE Xplore were used as platforms. The terms used for the research, on these platforms, considered the concept of digital games, using twelve terms, one at a time and, in association with the term "acceptance model" - Figure 1. The period for carrying out this action began on April 30th and extended to July 14th, 2021. This survey resulted in 4,943 articles.

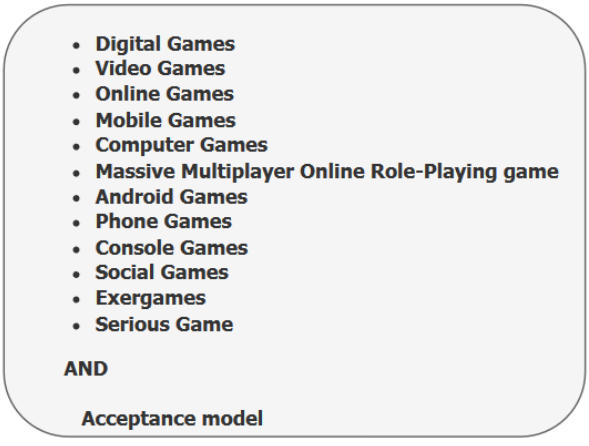

Figure 1. Research terms

In the selection of articles, the analysis of the abstract and keywords was considered, which resulted in the selection of 1480 articles. For the choice of articles, among those selected, the analysis of the introduction was considered, resulting in 183 articles. Of these, through the analysis of the methodologies, we used only the studies in which the adult population constituted the sample - students over eighteen and older adults, for example - and, which resulted in 48 articles - presented in Appendix 1.

The articles were organized in a Microsoft Excel file, by attributes, considering the introductions and conclusions. The organization of texts by attribute groups enabled the treatment necessary for textual mining, through the Free Software Iramuteq 0.7 alpha 2 – by using the DHC and the Similitude Analysis. The DHC allowed the idealization of conceptual dimensions, through the various connections between the words, concentrated in a class to produce meanings, which through the analysis of similitude it was possible to idealize and visually represent concept maps [23].

The criteria used to identify the conceptual dimensions consisted of the analysis of words that presented $p < 0.005$ of significance, of the word classes derived from the DHC and the elimination of words that did not allow the idealization of dimensions around the proposed theme (teaching and learning context). Only the words that presented representation equal to or greater than ten of the total text segments were selected.

3 RESULTS

The entire corpus consisted of forty-eight texts (48), separated into 1446 TS, with use of 1434 (99.17%). 52,148 occurrences emerged, of which 3,687 words, of which 3,158 are words that occur only once (3.92% of occurrences – 43.60% of forms) – Figure 2.

The DHC revealed eight classes originating from two main ramifications of the analyzed corpus, sub corpus A and sub corpus B – Figure 3. Sub corpus A is composed of Class 8, whose TS represent words used both in the introductions and in the conclusions of the articles. Sub corpus B is composed of Classes 1, 5, 4, 3, 2, 6 and 7, whose TS represent words used both in the introductions and in the conclusions of the articles.

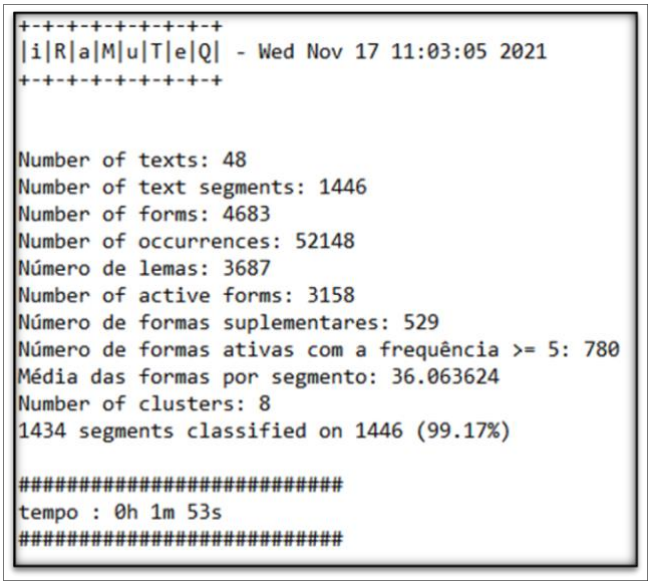

Figure 2. Corpus_Introductions_Conclusions

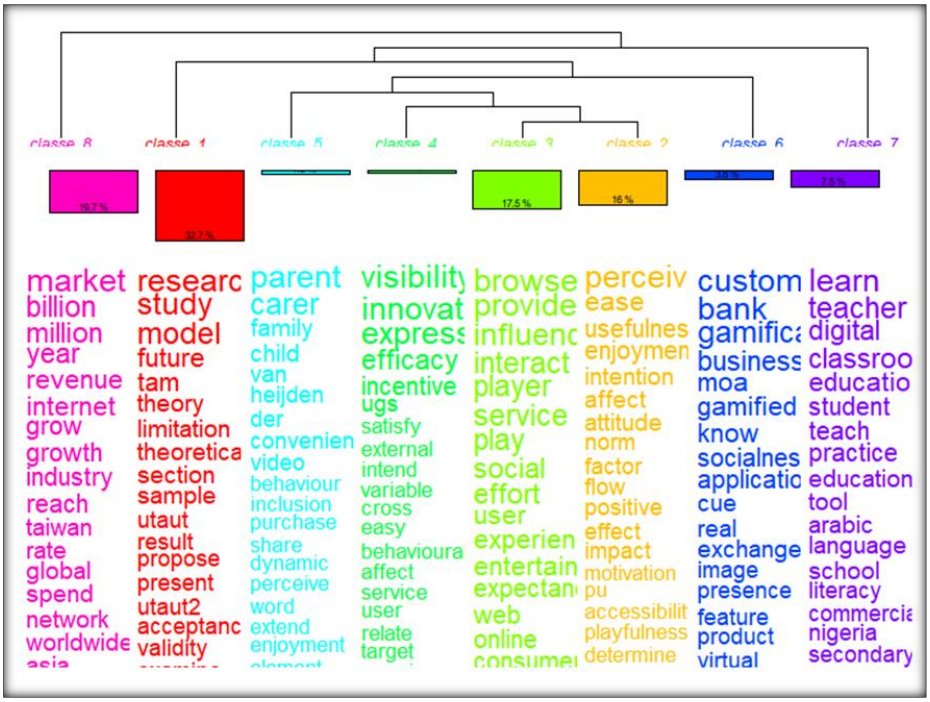

Figure 3. CHD_Introductions_Conclusions

The analysis of DHC data allowed identifying that Class 7 (7.53% of the total analyzed corpus) presented the set of words around the planned objective. For the choice of words capable of giving rise to conceptual dimensions, the words that appeared in ten or more TS were considered – shown in Table 1: by type, by number of text segments that contain the word in the class (eff. ts), by number of text segments in the corpus that contain the word at least once (total eff.), by the percentage of occurrence of text segments that contain the word in this class in relation to their occurrence in the corpus, by Chi2, and by the significance level.

Table 1. Class profile 7

Forme	Type	eff. s.t.	eff. total	pourcentage	chi2	p
learn	ver	45	57	78,95	434,72	< 0,0001
teacher	nom	32	37	86,49	339,97	< 0,0001
classroom	nom	21	21	100	261,67	< 0,0001
education	nom	26	33	78,79	246,27	< 0,0001
student	nom	23	34	67,65	180,72	< 0,0001
teach	ver	14	15	93,33	160,24	< 0,0001
educational	nr	16	23	69,57	129,16	< 0,0001
school	nom	9	10	90	98,34	< 0,0001

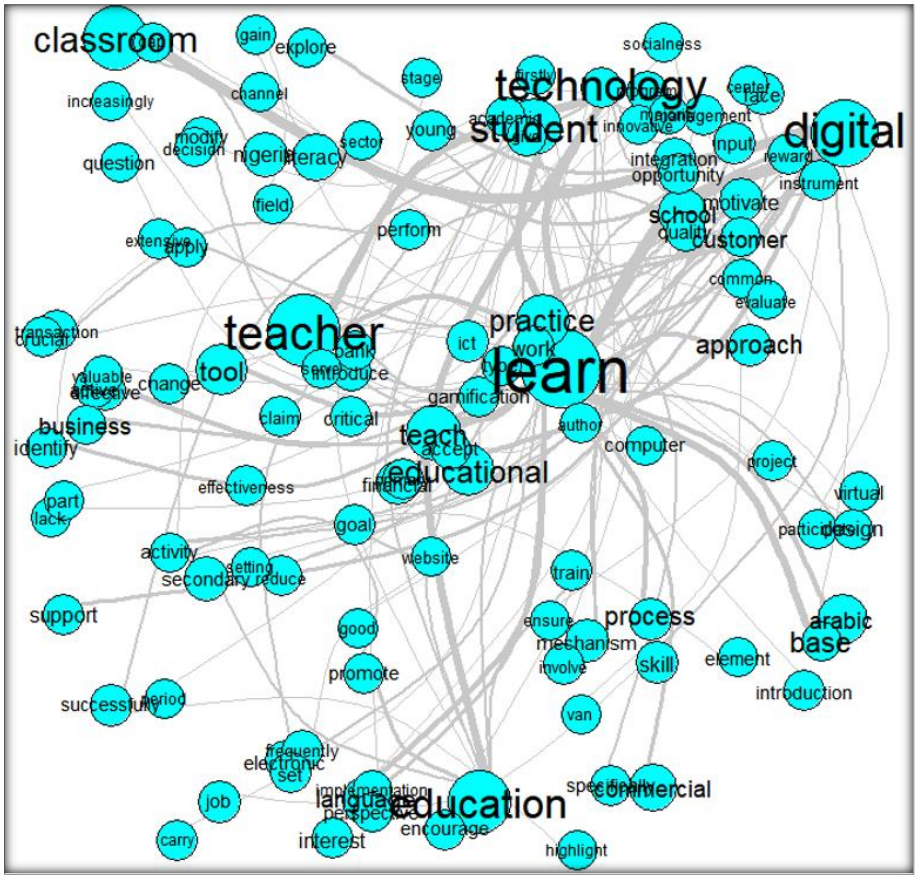

Figure 4. Similarity analysis

The similarity analysis of the words concentrated in Class 7 – Figure 4 – allows the idealization of some themes around the dimensions of teaching and learning:

- The word “learn” has relational proximity to other words (practice, work, process, skill, commercial, project, design, train, and language), suggesting that some recurring themes revolve around… “the creation or analysis of work practices, considering the design of projects to the improvement of process and commercial skills”; “of training related to the study of languages”.
- The word “teacher” has relational proximity to other words (technology, student, innovative, tool, change and valuable), suggesting that some recurring themes revolve around… “innovative technological tools that value the exchange between teacher and student”.
- The word “classroom” has relational proximity to other words (digital, integration, opportunity and channel), suggesting that some recurring themes revolve around… “the virtual classroom as a digital channel and as an opportunity for integration”.
- The word “education” has relational proximity to other words (website, encourage, teach, secondary), suggesting that some recurring themes revolve around… “encouraging secondary education with the help of a website”.
- The word “student” has relational proximity to other words (technology, teacher, learn and practice), suggesting that some recurring themes revolve around… “teaching and learning practices through technologies”.
- The words “teach” and “educational” have relational proximity to each other and to other words (accept and financial), suggesting that some recurring themes revolve around … “the acceptance of teach education practices in the finance”.
- The word “school” because it had a frequency lower than ten (eff. T.S. = 9), was not considered for the preparation of the concept map (prepared through similarity analysis).

4 CONCLUSIONS

The main objective of this work was to discover which are the most important dimensions in previous studies that analyzed the use of digital games by adults, in the context of teaching and learning. For

this purpose, data from a larger study were used, which considered the systematic analysis of 48 articles published in the last fifteen years, and which, through technology adoption models, contributed to a better understanding of the interaction of adults with the digital games.

Through the content analysis of the introductions and conclusions of 48 articles, it was possible to gather words in a cluster – Class 7 – that represent, in a broad way, the contextualized dimensions in the teaching and learning process. This cluster of words represented 7.53% of the total corpus analyzed (which was 1434 TS), suggesting the occurrence of few studies framed in the proposed theme.

The cluster analyzed through the DHC - Table 1 - made it possible to highlight three dimensions, namely: teaching (through the words "teacher" and "teach"), learning (through the words "learn", "student", "education" and "educational") and locus (through the word "classroom").

The analysis of similarity of the words of Class 7 allowed the creation of meanings for the dimensions highlighted, in the studies on the adoption of digital games by adults in the last fifteen years, namely: a) the dimension of teaching considered the themes around communication and the interaction between teachers and students through digital technologies; and around financial education training. b) the learning dimension considered the themes around training focused on business practices and language learning; around the use of digital tools complementary to the learning process; around the use of technologies; and, around the acceptance of technologies embedded in learning. c) the dimension of the locus considered the themes around e-learning.

As limitation this study did not allow us to present, in a broad way, the dimensions associated with teaching and learning practices around the adult audience, present in studies in recent years. to resolve this issue and as a suggestion for future work, we suggest the development of a similar study, with new terms and with the absence of the term "acceptance model", to allow a greater scope of publications and allow the production of new results around this theme.

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APENDIX 1

Global Youth and Mobile Games: Applying the Extended Technology Acceptance Model in the U.S.A., Japan, Spain, and The Czech Republic	*Okazaki, Skapa, e Grande, 2007*	*Business simulation games with and without supervision: An analysis based on the TAM model*	*Pando-Garcia, Periañez-Cañadillas e Charterina, 2016*
Consumer behavior in online game communities: A motivational factor perspective	*Hsu e Lu, 2007*	*Playing seriously e How gamification and social cues influence bank customers to use gamified e-business applications*	*Rodrigues, Oliveira e Costa, 2016*
Determinants of adoption of mobile games under mobile broadband wireless access environment	*Ha, Yoon, & Choi, 2007*	*The Effect of Flow Experience and Social Norms on the Adoption of Mobile Games in China*	*Gao, Krogstie e Zang, 2016*
Antecedents and outcomes of the flow experience: An empirical study in the context of online gaming	*Holsapple & Wu, 2008*	*Exploring the Hype: Investigating Technology Acceptance Factors of Pokémon Go*	*Harborth e Pape, 2017*
The Analysis of Service Acceptance Framework for Social Games Based on Extensive Technology Acceptance Model	*Chen e Chang, 2010*	*Understanding Behavioural Intention for Adoption of Mobile Games*	*Kumar e Acharjya, 2017*
What Drives People to Continue to Play Online Games? An Extension of Technology Model and Theory of Planned Behavior	*Lee e Tsai, 2010*	*Video Game Acceptance: A Meta-Analysis of the Extended Technology Acceptance Model*	*Wang e Goh, 2017*
Applicability of the UTAUT Model in Playing Online Game through Mobile Phones: Moderating Effects of User Experience	*L. S.-L. Chen et al., 2011*	*A Modified TAM for Predicting Acceptance of Digital Educational Games by Teachers*	*Dele-Ajayi, Strachan, Sanderson e Pickard, 2017*
Exploring the impact of use context on mobile hedonic services adoption: An empirical study on mobile gaming in China	*Yong Liu & Li, 2011*	*The Technology Acceptance Model for Playing Mobile Games in Indonesia*	*Kaltum, Rimadina e Zusnita, 2018*
Customer acceptance of playing online game on mobile phones	*L. S. Chen e Kuan, 2012*	*Analysis of critical factors for social games based on extended technology acceptance model: a DEMATEL approach*	*Chang e Chen, 2018*
How to attract Chinese online game users: An empirical study on the determinants affecting intention to use Chinese online games	*L. Fan et al., 2012*	*Examining situational continuous mobile game play behavior from the perspectives of diversion and flow experience*	*Liu et al., 2018*
Using the technology acceptance model to evaluate user attitude and intention of use for online games	*Zhu, Lin e Hsu, 2012*	*Analysing the acceptation of online games in mobile devices: An application of UTAUT2*	*Ramírez-Correa et al., 2019*
Analyzing Behaviors Influencing the Adoption of Online Games From the Perspective of Virtual Contact	*Lin e Chiang, 2013*	*The integration of video games in family-life dynamics: An adapted technology acceptance model of family intention to consume video games*	*Bassiouni, Hackley e Meshreki, 2019*
Gamers just want to have fun? Toward an understanding of the online game acceptance	*Yoon, Duff e Ryu, 2013*	*Online Video Games Adoption: Toward an Online Game Adoption Model*	*Hokroh e Green, 2019*
Understanding the effect of flow on user adoption of mobile games	*Zhou, 2013*	*User Continuance in Playing Mobile Online Games Analyzed by Using UTAUT and Game Design*	*Marham e Saputra, 2019*
Acceptance of game-based learning by secondary school teachers	*Bourgonjon et al., 2013*	*A questionnaire-based approach on technology acceptance model for mobile digital game-based learning*	*Ghani et al., 2019*
Factors affecting Chinese Ubiquitous Game Service usage intention	*S. Lee e Quan, 2013*	*Technology-Enhanced Teaching: A Technology Acceptance Model to Study Teachers' Intentions to Use Digital Games in the Classroom*	**Dele-Ajayi et al., 2019**
Understanding Users' Continued Use of Online Games: An Application of UTAUT2 in Social Network Games	*Xu, 2014*	*Using the Technology Acceptance Model to Evaluate Behavioural Intention to Use Mobile Games—A Case of Pokémon GO*	*Fan e Cheng, 2019*
Determinants of Acceptance of Mobile Games Through Structural Equation Modeling	*Gökalp, 2014*	*Factors Affecting Woman's Continuance Intention for Mobile Games*	*Ye, Liu, Gao, e Mei, 2020*
The Adoption of Mobile Games in China: An Empirical Study	*Gao, Zang e Krogstie, 2014*	*A Posteriori Segmentation of Personal Profiles of Online Video Games' Players*	*P. E. Ramírez-Correa, Rondán-Cataluna e Arenas-Gaitán, 2020*
Determinants of player acceptance of mobile social network games: An application of extended technology acceptance	*E. Park, Baek, Ohm e Chang, 2014*	*Adoption and Continuance Intention Model of Applying Telemedicine Technology in Digital Games Addiction*	*Aborujilah et al., 2020*
Exploring Key Determinants of Gamer Behavior for Somatosensory Video Games: An Application of the Extended Technology Acceptance Model and Game Flow Theory	*Ho, Chang e Lee, 2014*	*Proposing a TAM-SDT-Based Model to Examine the User Acceptance of Massively Multiplayer Online Games*	*Linares, Gallego e Bueno, 2021*
The Moderating Effect of Reference Group on Online Game Loyalty: Focused on Hedonic Information System	*Park et al., 2015*	*Exploring the Factors Influencing Consumer's Attitude Toward Using and Use Intention of Virtual Reality Games*	*Tsai, Chen e Peng, 2021*
Mobile Game Adoption in China: the Role of TAM and Perceived Entertainment, Cost, Similarity and Brand Trust	*Jiang, Peng, e Liu, 2015*	*Relationship between Perceived Ease of Use, Perceived Usefulness and Motivation Opportunity Ability Theory in Online Gamers Know-How Exchange*	*Foster, Reyta e Purnama, 2021*
A Study of Downloading Game Applications	*L.-S. Chen e Yen, 2015*	*Mobile games adoption: An extension of technology acceptance model and theory of reasoned action*	*Mulyawan e Rafdinal, 2021*