An early case study analyzing teachers' acceptance towards of the use of gameful approaches in education in Brazil

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***Abstract*—Studies on gameful approaches in education have constantly sought to identify users' motivation and experience. However, most of these studies have focused exclusively on students' perspectives without considering the teachers' motivational and affective issues. Thus, although the community already has considerable knowledge regarding motivational and affective issues related to students' experience, little is known about teachers' acceptance of using gameful approaches in education. starting to face this challenge, in this paper, we present a case study (N = 41) analyzing the teachers' acceptance of the use of a gamified educational system. The main results indicate that previous experience with distance education and gamification can positively affect the perceived ease of use of gamified educational systems. However, unlike expected, experience with educational technology can not significantly affect perceived ease of use. Our results contribute to the fields of educational technologies and gamification in education by presenting the teachers' perceptions regarding a gamified educational system in education.**

***Index Terms*—Gameful approaches, Gamified education, Teachers' acceptance, Teachers' perspective, Case study**

I. Introduction

Gamification (*i.e.*, the approach of transforming systems, services, and activities to afford similar motivational benefits as games better often do [1], [2]) became a gameful approach known worldwide [3] and used in different areas (*e.g.*, marketing [4], health [5], and education [6]). Especially, gamification has been widely used in education (becoming the area with the highest number of studies on gamification) [7], generating great interest from the educational technology community. The interest in using gamification in education has also led to the development of gameful approaches (*e.g.*, gamified educational systems), aimed at improving students' motivation during different types of academic tasks [8].

In the last few years, several studies have sought to analyze the effects of gamification on students' experiences (*e.g.*, learning outcomes [9], engagement [10], and flow state [8]). If on the one hand, it is positive to analyze the effects of gamification on the students' experience, on the other hand, there is a lack of studies investigating the acceptance of teachers regarding gamification [11], [12], thus, making the community's knowledge limited about how teachers accept gamification in education. At the same time, often, the teachers are the main ones responsible for deciding whether or not to use gamification in educational tasks [13]. Thus, without a clear understanding of teachers' perception of gamification in education, it becomes difficult to overcome this barrier and make gamification used in education effectively, reaching students broadly and positively [13], [14].

To start facing this challenge, we investigated the teachers' acceptance of the use of gamified educational systems. Thus, we used the technology acceptance model (TAM) [15] to analyze the perception of 41 teachers towards the use of a gamified educational system. The study was organized into two steps: **first**, the use of a gamified educational system (called Eagle-edu) and **second**, identification of teachers' perception towards the gamified educational system (*i.e.*, using the TAM).

The main results obtained indicate that *i)* the teachers' acceptance level of gamification (during the system usage) was positive, *ii)* previous experience with distance education and gamification positively affected the perceived ease of use of the gamified educational system, and *iii)* experience with educational technology did not significantly affect perceived ease of use. The results contribute to the fields of educational technologies and gamification in education, demonstrating how teachers perceive gamification while bringing new insights into how to treat the use of gamification in education considering the teachers' perception.

II. Research Design

In this study, we aimed to investigate teachers' acceptance of the use of gamified educational systems. We conducted a

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Wilk Oliveira is a managing partner of the company that commercializes the system Eagle-edu.

quantitative study following the TAM [15].

Following the general TAM's theory proposed by Davis [15], initially, we define the external variables that should relate to perceived ease of use. In our study, we investigated if previous experience with *i)* educational technology, *ii)* distance education and *iii)* gamification *affected* perceived ease-of-use.

For the rest, we follow the original hypothesis structure proposed by Davis [15], thus investigating if perceived ease-of-use *affected* perceived usefulness and attitude toward using; perceived usefulness *affected* attitude toward using and attitude toward using; attitude toward using *affected* behavioral intention to use; and behavioral intention to use *affected* actual system usage.

A. Materials and method

To provide teachers with a real experience with a gamified educational environment, we adopted the system Eagle-edu[1]. The gamification design of the educational system is composed of 21 gamification elements and organized in five dimensions (*i.e.*, performance/measurement, ecological, social, personal, and fictional gamification), as defined by Toda *et al.* [16], [17]. The system can be personalized in different ways. In this study, we used the system without any personalization (*i.e.*, using all gamification elements available). The system was chosen by convenience.

To analyze our hypothesis, we used the TAM, a model derived from the psychology-based theory of reasoned action and theory of planned behavior, proposed by Davis [15]. We chose TAM because it is a dominant model in investigating factors affecting users' acceptance of the technology [18]. The TAM presumes a mediating role of two variables called perceived ease of use and perceived usefulness in a complex relationship between system characteristics (external variables) and potential system usage [18], [19]. TAM is composed of 19 assertive questions. In addition, in our survey, we added six demographic questions (*i)* gender, *ii)* age, *iii)* degree, *iv)* experience with gamification, *v)* experience with distance education, and *vi)* experience with educational technologies). We also measured the users' system usage time. Also, based on examples from recent studies [20]–[22], we also included an "attention-check" statement (*i.e.*, "This is an attention-check question, if you have read this question, check option 2") to verify whether participants were paying attention when answering TAM questions. Responses from participants who mistake the "attention check" statement were excluded from the analysis.

To perform the analyses, we used the software Smart-PLS[2], which is a software with a graphical user interface for structural equation modeling (SEM) using the partial least squares (PLS) path modeling method [23]. In this study, we used SmartPLS software under a license provided by Tampere University.

The study was organized in three steps. In the *first step*, participants answered the study's demographic questions. In the *second step*, participants were asked to use the gamified educational system (*i.e.*, the system Eagle-edu) for at least 30 minutes. To make the participants have a real experience using a gamified system, the participants used the normal version of the system (*i.e.*, without any additional resources). In the *third step*, immediately after finishing using the system, participants were directed to the form where they could answer TAM.

B. Participants and data analysis

Our sample is composed exclusively of Brazilian Basic Education teachers. We received 43 responses from teachers working in different regions of the country. The participation of teachers in the study was free and voluntary. The study was disseminated and was available on the Internet through Google Forms. The participants in the research were predominantly female (32 self-declared females and 11 self-declared participants). Regarding the predominant area of background, most respondents are professionals working in the field of Exact Sciences (16 participants). Also, 11 participants are from areas related to Social Sciences and Humanities. 19 participants work predominantly in Basic Education.

To analyze the data, we used partial least squares structural equation modeling (PLS-SEM) [24], which is a well-established method for structural equation modeling, allowing estimation of cause-effect relationships between latent variables [24], [25]. PLS-SEM is also capable of producing reliable estimates, even analyzing data from a small sample size [26]. Despite this, our sample does not allow us to detect the effect, and, therefore, our results should not be generalized to other cases [26].

III. Results

Initially, given that PLS-SEM is non-parametric in nature [24], no need to analyze data distribution. To test the adequacy of the data regarding the instrument used in the research, we analyzed the reliability results for the TAM. All dimensions of the model showed highly adequate results (*i.e.*, Cronbach's Alpha $\geq$ .700; Jöreskog's rho $\geq$ .700, Composite Reliability $\geq$ .700, and Average Variance Extracted $\geq$ .500 [27]). Table I present the reliability results.

TABLE I
Reliability results for the technology acceptance model

	α	RHO A	CR	AVE
ATU	.950	.951	.964	.869
BIU	.925	.925	.952	.869
PEU	.949	.949	.959	.797
PU	.967	.968	.974	.860

Key: α: Cronbach's Alpha; RHO A: Jöreskog's rho; CR: Composite Reliability; AVE: Average Variance Extracted; ATU: Attitude toward using; BIU: Behavioral intention to use; PEU: Perceived ease-of-use; PU: Perceived usefulness.

To analyze our hypothesis, the relationships proposed in the model were analyzed using the PLS-SEM. The results indicate that experience with distance education (β = .367 | p = .018)

[1]https://eagle-edu.com.br/

[2]https://www.smartpls.com/

and gamification (β = .473 | p = .001) *positively affected* perceived ease of use. However, experience with educational technology *did not significantly affect* perceived ease of use (β = .225 | p = .111). At the same time, as expected by TAM, attitude toward using *positively affected* behavioral intention to use (β = .691 | p = .000). Behavioral intention to use has *positively affected* current system usage (β = .440 | p = .001). Perceived ease of use *positively affected* perceived usefulness (β = .927 | p = .000). Perceived usefulness *positively affected* attitude toward using (β = .645 | p = .000). Table II present the path model.

TABLE II
PATH MODEL

			CI	
	β	**P Values**	**2.5%**	**97.5%**
ATU → BIU	**.691*** **	.000	.438	1.012
BIU → ASU	**.440*** **	.001	.069	.638
EDE → PEU	**.367** **	.018	.067	.600
EET → PEU	.255	.111	-.086	.481
EG → PEU	**.473*** **	.001	.211	.700
PEU → ATU	.279	.129	-.162	.700
PEU → PU	**.927*** **	.000	.803	.977
PU → ATU	**.645*** **	.000	.231	1.061
PU → BIU	.274	.114	-.062	.563

Key: ** p≤.05; *** p≤.01. The statistically significant associations are in bold. β: Regression Coefficient; CI: Confidence interval (bias-corrected); ATU: Attitude toward using; BIU: Behavioral intention to use; ASU: Actual system usage; EDE: Experience with distance education; PEU: Perceived ease-of-use; EET: Experience with educational technology; EG: Experience with gamification; PU: Perceived usefulness.

IV. CONCLUDING REMARKS

In this paper, we presented the results of a study to analyze teachers' perceptions regarding gamification in the educational context. The results demonstrate that experience with distance education and gamification positively affected the ease of use of gamification. In future studies, we aim to analyze the moderating effects of the acceptance of gamification by teachers.

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