The relationship between user types and story-based gamification: Analysis of preference and accom-plishment in educational context

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Abstract

Gamification has been discussed as a standout approach to improve experience (e.g., motivation, engagement and performance). However, little is known about the fit between users' types and types of gamification design. Therefore, in this study (N=331) we investigate how user types are associated with the preference and perceived accomplishment from different approaches of storifying. Beyond singular associations, the findings indicate that there were no consistent patterns of associations between user types and gamification designs. Based on the results, we provide recommendations on how to personalize gamified educational systems and a guideline for further research on gamification personalization.

1. Introduction

Gamification, the use of game design elements in non-game contexts [1], has been widely used in the recent years to increase users' motivation in different areas, such as health [2], virtual reality [3] and education [4, 5, 6]. One goal of the use of gamification in education is to lead students to desired psychological outcomes (*e.g.*, engagement, motivation, fun or autonomy [7]), and according to Koivisto and Hamari [8], the education/learning context is the most common in the studies about gamification and most of them reported positive results about the efficacy of gamification. However, some studies also reported that the gamification can bring negative effects on the students behavior [9, 10, 11].

One of the main hypotheses for these negative effects is that people have different gamer types, which leads to different perceptions regarding the gamification design [12, 13, 14], that can positively or negatively be affected by some games elements [15]. At the same time, most of the gamified educational systems (GES) are developed on a way called "one-size-fits-all", that means the students' preferences are ignored and normally

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the designers create a universal gamified environment to all the students [16, 17, 18], thus possibly negatively affecting their user experience [17, 12, 19].

Although in the past few years researchers conducted some studies about personal-ized gamification [20], they did not reach a consensus about which game elements would be the most suitable for each user type [13], used a small number of game elements [21] or analyzed the game elements individually [22]. Thus, one lack in the field of personalized gamification are studies about the preference for groups of game elements (gamification design) by each user type.

We tackle this challenge through a study with 331 participants, where we *i)* identified their user types, *ii)* analyzed their preferences regarding different gamification designs (represented in storyboards), *iii)* measured the participants' preference and accomplishment in each gamification design and *iv)* analyzed the participants' preference and accomplishment according to their user types, thus advancing towards answering the question: **How user types are associated with the preference and feeling of accomplishment from different gamification designs?** Our results allow us to move towards evidence-based gamification design, generating new insights for gamification designers to create more effective GES according to the users' preferences and experiences. We also provided a series of validated storyboards to represent personalized GES.

2. Background

This section aims to present our study background (*i.e.*, player/user types, gamification taxonomies, and gameful experience), as well as the main related work.

2.1. Player/User types

Throughout the years, researchers have worked in how certain characteristics could affect the user's engagement while using a gamified system [23] and how people could be grouped in player types [24, 25]. One of the first Player Type Model was presented by Bartle [24], which proposed a classification in four player types: *i)* achiever; *ii)* explorer; *iii)* killer; and *iv)* socialiser. Based on the Bartle's player types, Yee [25] proposed an empirical model of player motivations, from data collected of 3.000 Massive Multiplayer Online Role Playing Games (MMORPGs). In his analysis, Yee revealed ten motiva- tion sub-components (Advancement, Mechanics, Competition, Socializing, Relationship, Teamwork, Discovery, Role-Playing, Customization and Escapism) which he grouped into three overarching components (Achievement, Immersion and Social).

Another Player Type Model that has been used in researches is the BrainHex Model [26], which was based on neurobiological findings and has seven player types: *i)* Seeker; *ii)* Survivor; *iii)* Daredevil; *iv)* Mastermind; *v)* Conqueror; *vi)* Socialiser; and *vii)* Achiever. According to Nacke *et al*. [26], each category within BrainHex should be understood, not as a psychometric type, but as an archetype intended to typify a particular player experience.

To create a model designed specifically for gamification, Marczewski [27] proposed the Gamification User Types Hexad, with six user types motivated by intrinsic or extrinsic motivational factors. The user type division in intrinsic and extrinsic motivation

is based on the self-determination theory [28], that says that people are intrinsically motivated when the activity supports three basic human psychological needs (competence, autonomy and relatedness) or extrinsically motivated when the reason of doing something is not an interest in the activity itself [28]. According to Diamond *et al*. [29] and Ton-dello *et al*. [30], the user types motivated by intrinsic motivations are the *i)* Socialisers;
ii) Free Spirits; *iii)* Achievers; and *iv)* Philanthropists, while *v)* Players are the user types motivated by extrinsic motivations. The *vi)* Disruptors are not a user type derived from SDT, but from observation of user behavior within online systems [31].

The Hexad has been chosen for our study since it is considered the most appropriate user typology for tailoring gamification [13], it does not classify the user in one specific user type (the users can be classified in more than one user type, with a principal tendency followed by the others in some degree [30]), it is empirically validated, it was created especially for gamification, and it has been successfully used in other recent studies [32, 31, 33].

2.2. Gamification taxonomy

To help designers, teachers and instructors select and understand how game elements can be used in the educational context, Toda *et al*. [34] created a gamification taxonomy composed of twenty-one game elements that could be used in GES, organizing them in five dimensions: the **Performance/Measurement** dimension is related to the environment response and has the elements Point, Progression, Level, Stats and Acknowledgement; the **Ecological** dimension is related to the environment that the gamification is being implemented and it's formed by the elements Chance, Imposed Choice, Economy, Rarity and Time Pressure; the **Social** dimension is related to the interactions between the learners presented in the environment and has as elements: Competition, Cooperation, Reputation and Social Pressure; the **Personal** dimension is related to the learner that is using the environment and has the elements Sensation, Objective, Puzzle, Novelty and Renovation; and the **Fictional** dimension is the mixed dimension that is related to the user and the environment and has as elements Narrative and Storytelling.

As far as we know, this taxonomy is the only that was validated and developed for the educational context, explained a considerable number of game elements, and grouped them into five dimensions. For these reasons, we decided to use it to select the game elements for the gamification designs. For a further review on the taxonomy, see Toda *et al*. [34].

2.3. Gameful experience

The success of gamification depends on the gameful experience the service creates in the user [35]. According to Landers *et al*. [36], the gameful experience is a psychological state where the user perceives achievable goals and is voluntarily motivated to pursue them under behavioral rules. Also, new generations seem to be more susceptible to have gameful experiences [37], showing that its measurement can be an important part of the future design of gamified environments.

Ho¨gberg *et al*. [37] presented a validated instrument for measuring the gameful experience users can have while using a system or a service, that can be used for person-

alized gamification and user-modeling research. In this study, they define that the gameful experience is formed by seven dimensions (accomplishment, challenge, competition, guided, immersion, playfulness, and social experiences) and the instrument validated in their study is able to measure them.

The accomplishment dimension is defined as experiencing the demand for successful performance, goal achievement, and progress [37]. In our study, we focused on the measurement of this dimension because it can reflect the users' engagement and can be considered a long-term experience (it extends beyond the use of the service), what can be essential to the success of gamification [37].

2.4. Related work

In this section, we briefly discuss some recent studies about personalization based on user types and game elements. Oliveira and Bittencourt [38] conducted an empirical experiment with 121 elementary students to identify the students' preferences in terms of game elements (considering the ten most used game elements in the field of education) according to their player type (considering the BrainHex Player type). They identified that students had some different preferences for the game elements according to their player type. Despite they had suggested a guideline to design or adapt GES based on the player type, they just used ten game elements in the suggestion.

Mora *et al*. [22] explored different types of interaction with gameful digital applications, based on the user types described in the Hexad [27]. They conducted a study with 590 participants and their results showed that the participants' user types affected the preferences for game elements. Although their results allow advancing the literature, they focused only on six different game elements selecting one game element for each user type (based on the Hexad's game element recommendations).

Lopez and Tucker [33] conducted an empirical study with applications that promote physical activity to explore the effects of gamification in the performance of the participants. The authors explored the relationship between user types and individuals' performance in gamified applications and the participants could rank the game elements (as fun, useful, preferable, motivating, and frustrating). However, the authors only used three game elements and had 30 participants, of which 80% were classified as Philanthropists, Free Spirits, and Players. Thus, they could not gamified the application with a big group of elements and their respondents were not homogeneously distributed between the Hexad user types.

Altmeyer *et al*. [39] conducted a study with 237 participants, where they investigated the perceived persuasiveness of 12 game elements in the domain of healthy eating. They used the Hexad to provide the user types and storyboards to show the game elements to the respondents. They conducted a pre-study to test the storyboards' comprehensibility and although they got good results on tailoring gamification in healthy eating, they only showed one game element in each storyboard. This prevented them to get results about how groups of elements could be used to create a different experience for the user. In Ta-ble 2.1 we present a comparison between the related work. As far as we know, our study is the first to conduct an empirical study evaluating respondents' preference regarding different gamification designs (a group of game elements strategically organized) in ed-

ucational settings, considering a gamification-based user type and a validated taxonomy for the education domain.

Table 2.1. Related work comparison

Study	H	TGE	ST	GE	AP	DGE
[38]					•	
[22]	•				•	
[33]	•				•	
[39]	•		•		•	
Our study	•	•	•	•	•	•

Key: H: Uses Hexad to define the user type; TGE: Uses a taxonomy of game elements; ST: Uses storyboards to present the game elements; GE: Uses groups of elements; AP: Measured the preference regarding game elements; DGE: Measured a gameful experience dimension.

3. Study design

Our study aimed to identify if the user type affects the preference and the feeling of accomplishment for gamification designs in GES. Thus our research question is: "**How user types (Philanthropist, Achiever, Socialiser, Free Spirit, Player, and Disruptor) are associated with the preference and accomplishment from different gamification designs (Fictional, Personal, Performance, Social, and Ecological)?**". To answer our research question, we organized our study in five different steps: *i)* storyboards design; *ii)* survey design; *iii)* pilot study; *iv)* survey application; and *v)* data analysis. Figure 3.1 summarizes the study design.

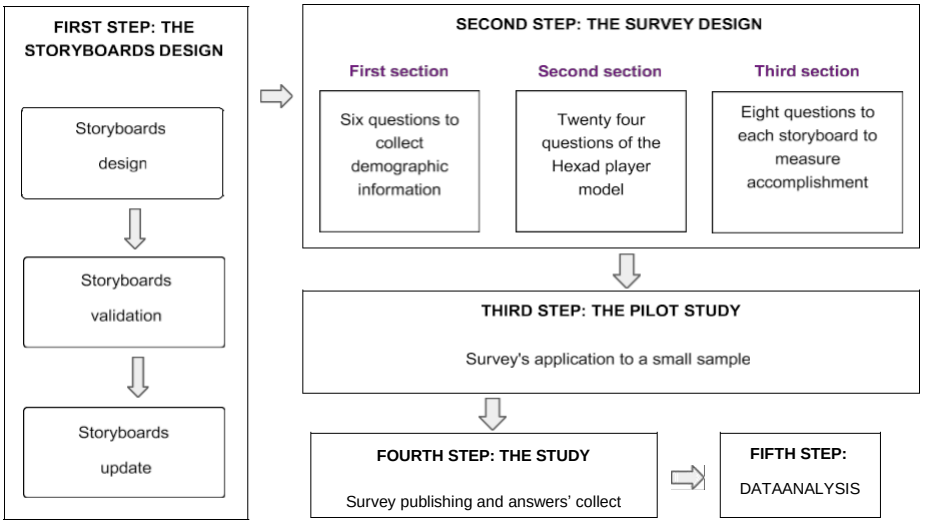

Figure 3.1. Study design

3.1. Materials and method

Before designing our survey, we needed to decide how to present the dimensions of the gamification taxonomy in a way people would imagine their implementation in a GES. As recommended in the recent literature in the field of human-computer interaction (HCI), a good strategy is the use of storyboards [40, 39, 41]. Storyboards are a short graphical depiction of a narrative [42] and a common technique in HCI and design for demonstrating system interfaces and contexts of use. Following these recommendations, we decided to implement five storyboards to represent each of the five dimensions proposed in Toda's taxonomy [34].

To design the storyboards[4], we followed the recommendations of Truong *et al*. [42], which have been successfully used in recent similar studies (*e.g.*, [43, 40, 44]). Truong *et al*. [42] determined five attributes to design a storyboard: *i)* Level of detail; *ii)* Inclusion of text; *iii)* Inclusion of people and emotions; *iv)* Number of frames; and *v)* Portrayal of time. Thus, we created five storyboards with six frames each, representing a fictional learning environment without defining a specific curricular component.

To ensure the storyboards' quality after its design, they were evaluated by three gamification experts with extensive experience in evaluating this type of technology. Two experts had six years researching gamification and one of them had nine years. To conduct the evaluation, we used a Likert scale [45] that goes from 1 (totally disagree) to 5 (totally agree), asking the experts about the storyboard and their textual description. They had to answer the following questions: *i)* "Does this storyboard represent the dimension?"; *ii)* "Does this text represent the dimension?"; and *iii)* "How can we improve this storyboard?" (this last was an open question, so they could give their impressions about the storyboard and tell us how to improve it).

Our main goal in this evaluation was to guarantee that the storyboards correctly represented the five dimensions proposed by Toda *et al*. [34]. In their evaluation, only one storyboard got an evaluation 1 (totally disagree) in the question "Does this storyboard represent the dimension?" by one of the experts. In the other storyboards, all of them evaluated as 5 (totally agreed) or 4 (partially agreed) the same question. Then, we updated the storyboards according to their feedback to the question "How can we improve this storyboard?". The gamification experts pointed some game elements that were present in more than one storyboard, that the use of some figures could cause a negative feeling about a prize, and how we could improve the use of the game element competition. The storyboards and the details about each one can be seen in the Appendix.

After the evaluation and improvement of the storyboards, we designed the survey. The survey was composed of 71 questions organized in three different sections. *i)* Demographic information: gender, age, education degree, and gaming habits; *ii)* user type identification: we used the Gamification User Types Hexad [30], thus the respondents were asked to rate how well the 24-items scale proposed by Tondello *et al*. [30] rep-resented them. We used a 7-point Likert scale [45], the questions were presented in a random order, and they could not identify the corresponding type, as recommended by Tondello *et al*. [30]. In this part of the survey, we used an "attention-check" question:

[4]The storyboards were designed at: https://www.storyboardthat.com/

"I like to be with my friends, but this question is just to evaluate your attention. Please, mark option number 3, to let us know that you are paying attention". This question was to ensure that the respondents were paying attention to the questionnaire.

Finally, the last section was the *iii)* accomplishment and preference measurement: in this step, we used the scale proposed by Ho¨gberg *et al*. [37]. To measure the Accom-plishment in our research, the respondents were also asked to rate, on a 7-point Likert scale [45], how well the eight questions of the dimension represented them in each story-board. Besides the measurement of the accomplishment dimension, the last question of the survey was "Which storyboard is your favorite?". Thus, we were able to compare the feeling of accomplishment with the preference for a storyboard.

Before launching the survey, as recommended by Connelly [46], we conducted a pilot study to assess whether the survey was being correctly understood by the respondents, as well as to assess whether the number of questions was adequate. This pilot group answered the survey before the application and with the question "Is this survey large?" at the end of the survey. The pilot study was conducted with a small sample composed of 10 participants, where 80% answered that the survey wasn't large, so we decided to not take away any question from it.

3.2. Participants

The final survey was released on March 26th, 2020 and it was spread by social networks and e-mail. The survey was open for thirty-eight days and we received 366 answers, from which 331 were valid according to our attention-check question. The respondents participated voluntarily since we did not offer any kind of remuneration or gifts to them.

The study sample size is adequate under different aspects considering this type of study. According to the definitions of Bentler and Chih-Ping [47] and Hair *et al*. [48], it is necessary to have at least five participants for each construct measured (our study had eight constructs). Loehlin [49] suggests a minimum sample of 100 participants for studies of this nature. Table 3.1 presents demographic information about the respondents.

Table 3.2 summarizes the participants distribution by the dominant user types (*i.e.*, the strongest tendency of the participants), the average scores, and standard deviation for each Hexad user type. Resembling the HEXAD results [50] our research identified that Philanthropist is the most common dominant user type and the Disruptor is the least common dominant user type. Comparing the female and male scores in each Hexad user type (*i.e.*, all the tendencies of the participants), it is possible to identify that the male scores were higher than female scores in all the Hexad user types.

4. Results

To ensure the instrument validation for our study, we first analysed the data normality (using the Shapiro-Wilk test as recommended by Wohlin *et al*. [51]), which showed that ourdata followed a non-normal distribution. Then, we measured the internal reliability for each Hexad sub-scale (user types in the survey), as well as for the accomplishment evaluation in each gamification design. Overall, the reliability was acceptable ($\alpha \geq 0.70$, RHOA $\geq$ 0.70, CR $\geq$ 0.70, AVE $\geq$ 0.50) for all gamification designs and user types, except for

Table 3.1. Demographic information

Variable		%	Variable		%
Gender	Female	52%	**Age**	10-14	0,30%
	Male	47%		15-19	9%
	Other	0,60%		20-24	12%
	Preferred not answer	0,60%		25-29	15%
Education Level	Basic School	2%		30-34	18%
	High School	9%		35-39	13%
	Bachelor	30%		40-44	12%
	Specialized Courses	21%		45-49	10%
	M.Sc.	25%		50-54	7%
	PhD	8%		55-59	4%
	PostDoc	4%		Over 60	1%
Gaming Habits	Play games	67%	**Frequency**	Every day	13%
				Every week	21%
				Rarely	47%
				I do not know	19%
	Do not play games	33%			

Table 3.2. Participants distribution, average scores and standard deviation

User Types	D	Mean score	S.D.	Female Mean Score	S.D.	Male Mean Score	S.D.
Philanthropist	35%	24.18	4.78	23.86	5.47	24.50	3.89
Achiever	30%	23.98	4.79	23.41	5.60	24.57	3.61
Free Spirit	12%	22.50	4.63	22.23	5.30	22.71	3.74
Player	12%	20.53	5.61	19.76	5.96	21.37	5.05
Socialiser	10%	20.42	5.7	20.49	6.03	20.51	5.22
Disruptor	1%	14.66	5.33	13.91	5.48	15.32	4.98

Key: D: Distribution of the dominant user types; S.D.: standard deviation

the Disruptors. We also measured the discriminant validity, finding acceptable values (the square root of the variables' AVE value was larger than the correlations that variable had with the other variables and all the variables presented correlations between them below 0.85 [52, 3]). The reliability results can be seen in Table 4.1 and the discriminant validity can be seen in Table 4.2.

Table 4.3 presents the preference and accomplishment means in general and by gender. It is possible to identify that the gamification design Performance is the most chose in terms of preference and accomplishment.

To answer our research question and measure the effects of the gamification designs in terms of accomplishment and preference, following other recent studies in personalized gamification [32, 13, 53], we employed the Partial Least Squares Path Modeling (PLS-PM) analysis [54]. We used the PLS-PM to identify the relation between the Hexad user types with the gamification designs (accomplishment and preference) since it is a reliable method for estimate cause-effect relationship models with latent variable [54]. Toperform the statistical analysis in our study, we used the software SPSS 26. Specially to

Table 4.1. Reliability results

Construct	α	RHO A	CR	AVE
Achiever	0.881	0.887	0.918	0.736
Disruptor	0.679	0.664	0.726	0.426
Free Spirit	0.755	0.768	0.845	0.578
Philanthropist	0.885	0.893	0.921	0.744
Player	0.880	0.886	0.918	0.737
Socialiser	0.808	0.818	0.874	0.635
Storyboard Ecological	0.973	0.974	0.977	0.842
Storyboard Fictional	0.962	0.964	0.968	0.791
Storyboard Performance	0.974	0.974	0.977	0.844
Storyboard Personal	0.967	0.969	0.972	0.812
Storyboard Social	0.977	0.978	0.980	0.859

Key: α : Cronbach's; RHO A: Jo¨reskog's rho; CR: Composite Reliability; AVE: Average Variance Extracted. Values in grey are α ≤ 0.70, RHO A ≤ 0.70, CR ≤ 0.70, AVE ≤ 0.50

Table 4.2. Discriminant Validity (complete bootstrapping, sample=5000)

	AccE	AccF	AccPF	AccP	AccS	A	D	F	P	R	PrE	PrF	PrPF	PrP	PrS	S
AccE	0.918															
AccF	0.474	0.889														
AccPF	0.614	0.550	0.919													
AccP	0.620	0.623	0.639	0.901												
AccS	0.652	0.545	0.638	0.574	0.927											
A	0.367	0.400	0.480	0.389	0.429	0.858										
D	0.209	0.246	0.255	0.262	0.254	0.499	0.653									
F	0.268	0.369	0.369	0.294	0.322	0.740	0.539	0.760								
P	0.353	0.385	0.441	0.385	0.386	0.771	0.398	0.696	0.862							
R	0.313	0.280	0.349	0.302	0.369	0.563	0.425	0.511	0.413	0.797						
PrE	0.054	-0.134	-0.134	-0.094	-0.045	-0.042	-0.078	0.015	0.002	-0.041	1.000					
PrF	-0.074	0.142	-0.130	0.017	-0.091	0.000	-0.079	-0.030	-0.021	0.010	-0.161	1.000				
PrPF	-0.003	-0.079	0.183	-0.070	-0.047	0.045	0.086	0.048	0.010	0.034	-0.343	-0.260	1.000			
PrP	0.030	0.037	0.030	0.135	-0.014	-0.008	-0.044	0.026	-0.025	0.096	-0.153	-0.116	-0.248	1.000		
PrS	-0.011	0.077	-0.011	0.053	0.165	-0.008	0.059	-0.061	0.019	-0.074	-0.273	-0.207	-0.441	-0.197	1.000	
S	0.306	0.444	0.364	0.356	0.451	0.559	0.310	0.541	0.665	0.393	-0.070	-0.024	-0.075	-0.048	0.192	0.858

Key: P: Philanthropist; A: Achiever; R: Player; F: Free Spirit; S: Socialiser; D: Disruptor; AccE: Accomplishment Ecological; AccF: Accomplishment Fictional; AccPF: Accomplishment Performance; AccP: Accomplishment Personal; AccS: Accomplishment Social; PrE: Preference Ecological; PrF: Preference Fictional; PrPF: Preference Performance; PrP: Preference Personal; PrS: Preference Social.

Table 4.3. Comparison between the favorite gamification design and the Accom-plishment's measurement

Storyboard	SP	ACC	FA	MA
Storyboard Fictional	11%	14%	15%	13%
Storyboard Personal	10%	12%	13%	11%
Storyboard Performance	36%	28%	27%	30%
Storyboard Ecological	18%	21%	20%	22%
Storyboard Social	26%	25%	25%	25%

Key: SP: Which storyboard did you prefer?; ACC: Accomplishment's Measurement; FA: Female Accomplishment; MA: Male Accomplishment.

conduct the PLS-PM, we used the software SmartPLS[5], that provides a graphical interface to calculate PLS-PM [55].

The research model of our study can be seen in Figure 4.1. The results indi- cated that **Achiever**-orientation is positively associated with perceived sense of accomplishment from the gamification designs Performance (β = 0.295***) and Social (β = 0.238*). **Player**-orientation is positively associated with perceived sense of accomplishment from the gamification designs Ecological (β = 0.162*) and Social (β = 0.161*); positively associated with preference of gamification design Personal (β = 0.165**) and negatively associated with preference of gamification design Social (β = -0.148*). **Free Spirit**-orientation is only negatively associated with preference of gamification design Social (β = 0.150*). **Socialiser**-orientation is positively associated with perceived sense of accomplishment from the gamification designs Fictional (β = 0.307***), Personal (β = 0.154*) and Social (β = 0.309***); positively associated with preference of gamification design Social (β = 0.370***) and negatively associated with preference of gamification design Performance (β = -0.165*). **Disruptor**-orientation is positively associated with preference of gamification design Social (β = 0.150*). **Philanthropists** did not presented any association. All the relations can be seen in Table 4.4.

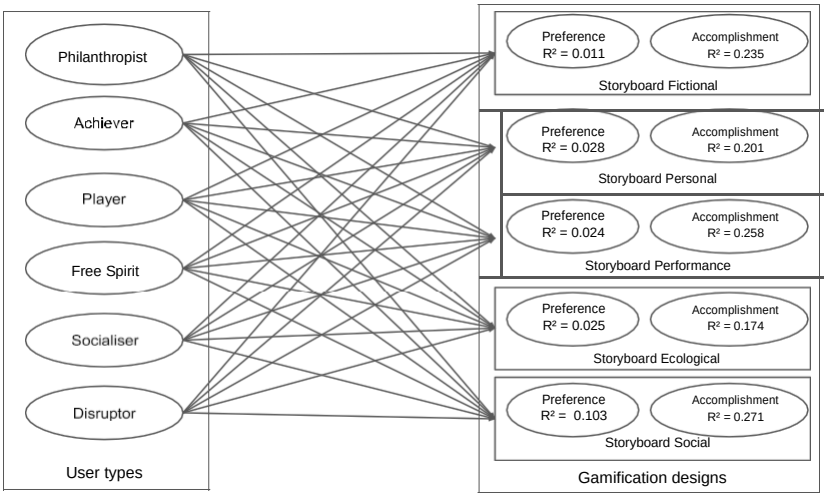

Figure 4.1. Research model

4.1. Discussions

The goal of this study was to understand the relationship between user orientations (Achiever, Disruptor, Free Spirit, Philanthropist, Player, and Socialiser) and gamification designs (Fictional, Personal, Performance, Ecological and Social). Overall, we identified differ-ent positive and negative associations between five of the six user orientations with the gamification designs. However, we identified that there is no consistent pattern of associa-tions between the users' orientation and gamification designs. We also provided mapping for the distribution of the user orientations into the six Hexad's user types.

In terms of distribution, our results (see tab:results) are similar with the results of

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

Table 4.4. PLS-PM matrix for participants' accomplishment and preference

	β	*P-value*	CI 2.5%	CI 97.5%				
PAcc → SF	-0.006	0.951	-0.176	0.198	AAcc → SF	0.157	0.110	-0.035	0.333
PPr → SF	-0.029	0.765	-0.214	0.172	APr → SF	0.080	0.444	-0.121	0.281
PAcc → SP	0.164	0.063	-0.029	0.342	AAcc → SP	0.168	0.066	-0.027	0.314
PPr → SP	-0.013	0.890	-0.209	0.171	APr → SP	-0.064	0.515	-0.234	0.105
PAcc → SPF	0.149	0.082	-0.028	0.304	AAcc → SPF	0.295***	0.001	0.119	0.456
PPr → SPF	0.020	0.852	-0.193	0.216	APr → SPF	0.047	0.667	-0.159	0.255
PAcc → SE	0.166	0.069	-0.004	0.338	AAcc → SE	0.174	0.075	-0.012	0.346
PPr→ SE	0.119	0.242	-0.086	0.317	APr→ SE	-0.113	0.315	-0.329	0.079
PAcc → SS	0.005	0.956	-0.146	0.176	AAcc → SS	0.238*	0.011	0.049	0.420
PPr → SS	-0.095	0.309	-0.261	0.056	APr → SS	0.034	0.724	-0.143	0.214
RAcc → SF	0.030	0.627	-0.095	0.154	FAcc → SF	0.058	0.429	-0.082	0.206
RPr → SF	0.042	0.613	-0.115	0.182	FPr → SF	-0.021	0.804	-0.210	0.133
RAcc → SP	0.109	0.101	-0.031	0.241	FAcc → SP	-0.132	0.127	-0.291	0.062
RPr → SP	0.165**	0.002	0.048	0.261	FPr → SP	0.104	0.261	-0.093	0.298
RAcc → SPF	0.117	0.062	-0.004	0.230	FAcc → SPF	-0.063	0.351	-0.193	0.081
RPr → SPF	0.009	0.892	-0.124	0.123	FPr → SPF	0.040	0.661	-0.139	0.244
RAcc → SE	0.162*	0.014	0.033	0.310	FAcc → SE	-0.124	0.142	-0.281	0.036
RPr→ SE	-0.005	0.946	-0.138	0.140	FPr→ SE	0.145	0.066	-0.032	0.276
RAcc → SS	0.161*	0.012	0.021	0.291	FAcc → SS	-0.128	0.154	-0.299	0.037
RPr → SS	-0.148*	0.031	-0.270	-0.008	FPr → SS	-0.226**	0.009	-0.386	-0.073
SAcc → SF	0.307***	0.000	0.171	0.437	DAcc → SF	0.031	0.644	-0.091	0.154
SPr → SF	-0.021	0.803	-0.190	0.127	DPr → SF	-0.108	0.189	-0.260	0.036
SAcc → SP	0.154*	0.036	0.004	0.297	DAcc → SP	0.090	0.231	-0.055	0.239
SPr → SP	-0.092	0.284	-0.259	0.083	DPr → SP	-0.104	0.166	-0.250	0.030
SAcc → SPF	0.087	0.204	-0.042	0.231	DAcc → SPF	0.006	0.916	-0.085	0.123
SPr → SPF	-0.165*	0.032	-0.305	-0.025	DPr → SPF	0.081	0.258	-0.072	0.223
SAcc → SE	0.094	0.186	-0.052	0.229	DAcc → SE	0.026	0.732	-0.115	0.174
SPr→ SE	-0.130	0.081	-0.270	0.005	DPr→ SE	-0.104	0.139	-0.222	0.025
SAcc → SS	0.309***	0.000	0.155	0.446	DAcc → SS	0.038	0.564	-0.077	0.165
SPr → SS	0.370***	0.000	0.259	0.467	DPr → SS	0.150*	0.017	0.023	0.254

Key: * p<0.1, ** p<0.05, *** p<0.01; β : Regression Coefficient; CI: Confidence Interval; PAcc: Philanthropist Accomplishment; PPr: Philanthropist Preference; AAcc: Achiever Accomplishment; APr: Achiever Preference; RAcc: Player Accomplishment; RPr: Player Preference; FAcc: Free Spirit Accomplishment; FPr: Free Spirit Preference; SAcc: Socialiser Accomplishment; SPr: Socialiser Preference; DAcc: Disruptor Accomplishment; DPr: Disruptor Preference; SF: gamification design Fictional; SP: gamification design Personal; SPF: gamification design Performance; SE: gamification design Ecological; SS: gamification design Social.

[50], with Philanthropist as the most common dominant user type and Disruptor as the least common dominant user type. Also, our results are similar to the results found by [31], where they identified that Philanthropist and Achiever are the prevalent user types and the Disruptor were the one that scored lower. According to [31] women tend to score higher than men in all the intrinsic motivations (*i.e.*Philanthropist, Socialiser, Free Spirit, and Achiever) and, even though in our results men scored higher than women in all the user types, the difference was shorter in the Philanthropist, Socialiser, Free Spirit, and Achiever user types (*i.e.* the user types that are motivated intrinsically).

Starting to answer our research question, considering the effects of personalized gamification designs on user types accomplishment and preference (see 4.4), similarly with the results found by Hallifax *et al*. [13], our results showed that **Philanthropists** did not present a significant association with any gamification design (Hallifax *et al*. [13]

CAE-ICMC-USP v.1 - 2020

measured the motivational impact of game elements also using storyboards). Moreover, our results showed that Philanthropists presented a negative association with the gamification design Fictional in terms of accomplishment and preference, the only gamification design that did not present the "assistant" that explain the activities of the storyboard. Since the Philanthropists are motivated by interaction [30], we believe the lack of the "assistant" presence can be understood by Philanthropists as a lack of interaction.

Analyzing our results in comparison with other studies [30, 56], we believe that **Achievers** had a strong significant association with the gamification design Performance especially because of the game elements Level, Point, and Acknowledgment since these game elements might show their competence, which intrinsically motivates this user type [30]. We believe that they also presented a significant association with the gamification design Social because of the game elements Competition, Social Pressure and Social status (Reputation), related to this user type in other studies [56, 30].

Since **Players** are motivated by extrinsic rewards [30], we believe that the significant associations with the gamification design Ecological were related to the game elements Rarity and Economy. Orji *et al*. [32] found out that Players tend to be motivated by Competition and Cooperation, which can explain the positive significant association with the gamification design Social in terms of accomplishment. At the same time, Play-ers presented a slightly and negative association with the gamification design Social in terms of preference. Thus, even though the gamification design Social brought feelings of accomplishment to the Players, this gamification design was not preferred by them. Players also presented a positive significant association with the gamification design Per-sonal, probably because of the game element Puzzle (Challenge), related to this user type in other studies [56, 30].

Free Spirits only presented one significant association with the gamification de-sign Social, however, it was negative. This user type was the one that presented more negative associations since, depending on preference or accomplishment, we were able to identify that Free Spirits presented a negative association with all gamification designs. This was unexpected considering we presented in the gamification designs game elements that were related to this user type in other researches (*e.g.* Puzzle [56, 30] and Level [56]).

Socialisers were the user type that presented more significant associations, in-cluding strong significant associations with the gamification designs Fictional and Social. The elements present in the gamification design Social are important to ensure interac-tions between the learners [34] and can be related directly with the Socialisers that are intrinsically motivated by relatedness [31]. In the Periodic Table of Gamification Ele-ments proposed by Marczenwski [57], the game elements Social Pressure, Competition, and Social Status (Reputation) are also related to the Socialisers. Probably, the strong significant association with the gamification design Fictional occurred because the game element Narrative is related to the learner's interaction with the system [34], and the slight significant association with the gamification design Personal because of the game element Puzzle (Challenge), related with this user type before [30]. They also presented a slightly and negative significant association with the gamification design Performance, probably because of the game elements showing progress in this gamification design, considering that similar results were presented by Hallifax *et al*. [13].

We believe **Disruptors** presented a significant association with the gamification design Social especially because of the game element Competition. Tondello *et al*. [30] identified that competition is a game element that can be related with this user type and Orji *et al*. [32] showed that competition would motivate people with high disruptor tendencies. Also, since the gamification design Social is the one that shows interactions with other students and Disruptors need interactions to influence other users to try to change the system [27], this can be another reason for this significant association.

Our results show that accomplishment's measurement has more homogeneous re-sults than the preference's (see Table 4.3). This indicates that only measuring the pref-erence for game elements might not be sufficient to understand the effects of the game elements on users. For instance, some user types presented a significant association with a gamification design in terms of accomplishment, meanwhile, this not happened in terms of preference with the same gamification design. Considering that the feeling of accom-plishment drives the user to complete tasks or goals and reflects the user's engagement [37], we believe the user types that presented a significant association with a gamification design in terms of accomplishment, can present better progress using GES that have that group of game elements.

When we do not consider the user type, the game elements of the gamification designs Performance and Social can be used for all the students since these two designs showed a predominance in the preference and accomplishment results (see Table 4.3). Thus, GES must present the group of game elements that create interactions between the students and the group of game elements that provide feedback to them.

Our results corroborate other studies [22, 13, 56] showing that users have different preferences based on their user types: considering only preference by user type, the gam-ification design Social is strongly related with Socialisers and also can be used with the Disruptors, while the gamification design Personal can be indicated for Players. Further-more, the user type is a factor that affects how the users feel accomplishment. Considering accomplishment and user type, the gamification designs Social and Performance are the most related to Achievers; Socialisers seems to be strongly affected by the gamification designs Social and Fictional; Philanthropists seems to not be affected by the game ele-ments represented in this study and Free Spirits might be not positively affected by most of the game elements.

In Table 4.5 we give recommendations of which gamification designs can be used to personalize GES based on our results.

4.2. Limitations

Some limitations have emerged during the study and they need to be considered. Al-though the internal reliability for the Disruptors was below the acceptable, we were able to identify that for this user type exists a kind of predominance: all the Disruptors, except one, presented only this user type as dominant user type. Also, even though we useda validated scale to measure the perceived accomplishment, its measurement might not represent the real feeling of accomplishment. Finally, the use of gamification designs can bring different results from the use of a real gamified educational system.

We also have sought to mitigate some limitations during the conduction of the

Table 4.5. Recommendations to personalize gamification

	Preference	Accomplishment
Philanthropist	0/	0/
Achiever	0/	+ SPF and + SS
Player	- SS and + SP	+ SE and + SS
Free Spirit	-SS	0/
Socialiser	- SPF and + SS	+ SF, + SP and + SS
Disruptor	+ SS	0/

Key: 0/ : Without significant association; +: Significant positive association; -: Significant negative association; SF: gamification design Fictional; SP: gamification design Personal; SPF: gamification design Per-formance; SE: gamification design Ecological; SS: gamification design Social.

study: to mitigate the possibility of the storyboards do not represent the dimensions proposed by [34], we validated the storyboards with three gamification experts before using them in the survey. The size of the survey could lead people to answer without paying attention and to mitigate this threat, we used an "attention-check" question in the survey and eliminated subjects that did not pass in this question. Since the Hexad scale proposed by [31] and the Gameful Experience Questionnaire proposed by [37] were not empiri-cally validated in Brazilian Portuguese, we conducted statistical analysis to validate the answers obtained in our study to mitigate this threat.

4.3. Recommendations for future studies

Based on the results obtained in our studies, as well as based on the limitations of our study, it is possible to propose a series of new studies to deepen this research domain. Therefore, in this section, we also propose some research that can be conducted based on our results. Initially, our study focused on answering research questions in the field of education (*i.e.*, using gamification designs representing an educational setting). At the same time, the effects of gamification may vary according to the field of application (*e.g.*, marketing, health, addictions, and others). Thus we believe that **future studies should be conducted in different areas (*i.e.*, replicating our study in different domains) ex-panding our results by using specifics gamification designs to the context**.

In our study we chose to conduct an exploratory study, which allowed us to have a broad view of the subjects without exercising control over them. However, now that our results allow us to know an overview of the subject, further studies must deepen the results through experimental studies in controlled environments, for example, directly compar-ing two gamification designs (personalized vs. non-personalized) in terms of users' ex-periences. Therefore, we recommend that **future studies should conduct experiments comparing the effects of personalized gamification designs with non-personalized gamification designs with different user types**.

In our study, we measured one dimension of the gameful experience (*i.e.*, Accomplishment) and according to Ho¨gberg *et al*. [37] the dimension Immersion also seems to reflect user's engagement, thus future studies can be done to measure this dimension. This

decision was important to obtain a reliable result on a specific dimension of the gameful experience. Now that we have these results, it may be necessary to assess the effects on other gameful experience dimensions (*e.g.*, Challenge, Competition, and Playfulness). Thus, we recommend that **future studies should investigate other gameful experience dimensions**.

Our results allowed us to identify different significant (positive and negative) relationships between different user types and gamification styles. This means that future studies on personalization of gamification can use the results as a basis for personalizing educational environments. At the same time, it is also important to investigate whether the results obtained in this study are maintained in ecological environments (*i.e.*, online educational systems). Thus, we recommend that **future studies can implement the gamification designs proposed and validated in our study in gamified educational systems and evaluate the effects of different versions of the system on the users' experience**.

5. Concluding Remarks

In this study, we presented how the six Hexad user types prefer five different gamification designs in the educational context. To avoid the use of only the game elements that are considered the most used in research (*e.g.*, points and badges), the game elements used in these designs were chosen from an empirically validated gamification taxonomy that groups twenty-one game elements in five dimensions. We used validated gamification designs to show these dimensions to the respondents, to help people visualize how each dimension could be represented in GES, instead of only asking about the preference for a dimension. Furthermore, we compared the preference with the Accomplishment (a di-mension of the gameful experience). Our results corroborate other researches when iden-tifying that the game elements presented in the gamification design Performance (Point, Progression, Level, Stats, and Acknowledgment) can be considered the most adequate to all students. Also, our results showed that the game elements presented in the gamification designs Fictional and Personal (Narrative, Storytelling, Objective, Puzzle, Novelty, Sen-sation, and Renovation) were the least preferred by all respondents. Our findings showed how some gamification designs can be used according to the user type, helping designers to design personalized gamified systems in the educational context. As future studies, we intend to focus on the measurement of the other dimensions of the gameful experience and how users that present more than one user type are affected by the gamification designs.

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A. Appendix

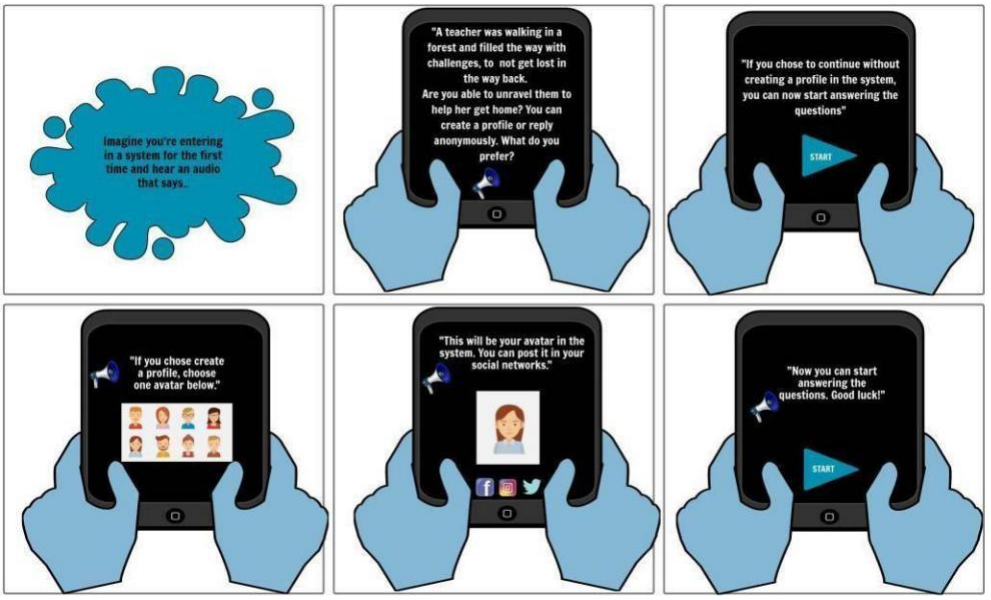

Figure A.1. Storyboard Fictional

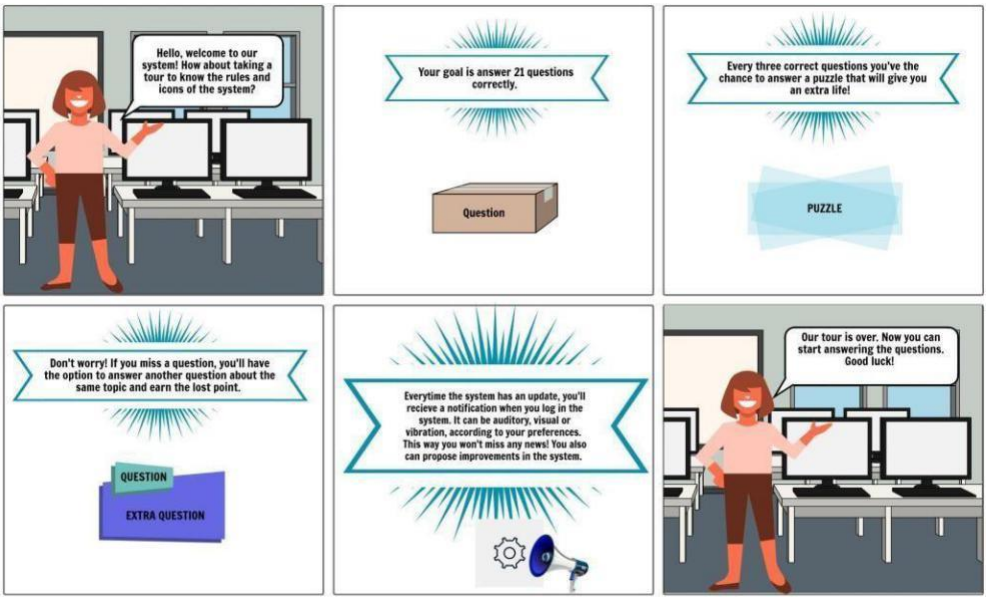

Figure A.2. Storyboard Personal

Figure A.3. Storyboard Performance

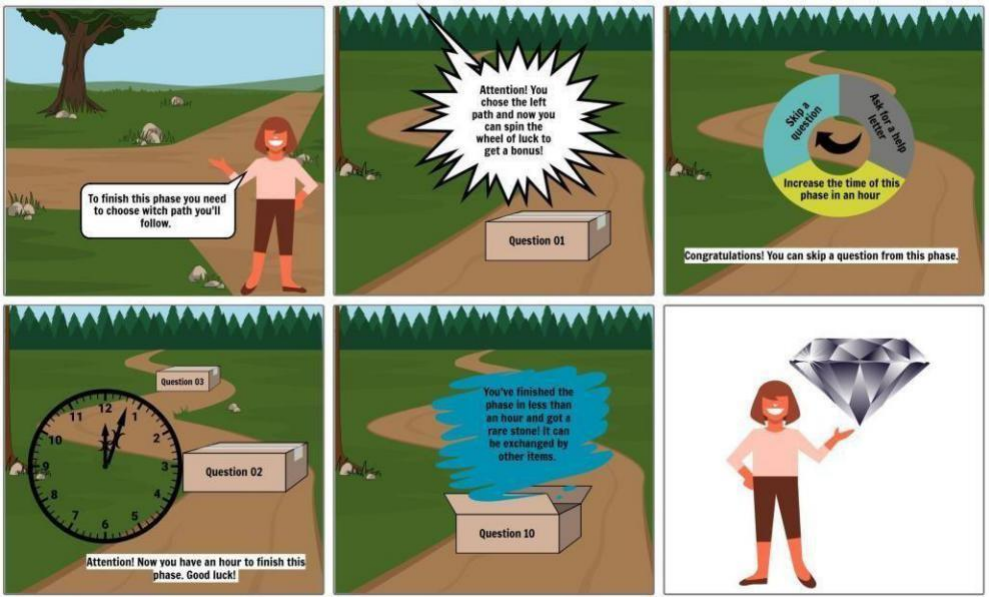

Figure A.4. Storyboard Ecological

Figure A.5. Storyboard Social

Table A.1. Storyboards description

Dimension	Description
Fictional (SF)	The system starts with an audio message explaining that a teacher spread questions along a path in a forest to not get lost **(game element Storytelling)**. If the student chooses to create a profile in the system, he/she will have the opportunity to create an avatar and share it in social networks. If the student chooses not to create the profile, he/she will have access to the questions, without access to any bonus **(game element Narrative)**.
Personal (SP)	The student's goal is to properly answer twenty-one questions about certain content. This goal is shown on the system's ini- tial screen **(game element Objective)**. The student, when miss a question about a certain subject, will have the option to do another question about the same subject and earn the lost point of the wrong question **(game element Renovation)**. After three correct questions, the student has the chance to answer a puzzle that will give he/she an extra life in the game **(game element Puzzle)**. Every time the environment has an update **(game element Novelty)**, the user receives an audible, visual or vibration notification when logging into the system, according to the configuration he/she chooses **(game element Sensation)**.
Performance (SPF)	The student needs to answer seven questions correctly to level up in the system and be a Beginner, Apprentice or Master **(game element Level)**. When the student answers the questions cor-rectly, he/she will receive Xp's **(game element Point)** and ad-vance in the progression bar, represented by stars **(game element Progression)**. When the student answers more than ten questions correctly, he/she will receive a recognition trophy **(game element Acknowledgement)**. All this information can be seen on the page called "My progress" in the system **(game element Stats)**.
Ecological (SE)	The student will have to choose a specific path to follow in the sys-tem **(game element Imposed Choice)**. After choosing the path, the student will spin a "wheel of luck" to earn a bonus, which canbe "Skip a question", "Request a help letter" or "Increase the levelof the phase by one hour" **(game element Chance)**. From that, he/she will have a limited time to finish the phase **(game element Pressure Time)**, where, if he/she finishes in the proposed time, will earn a rare stone **(game element Rarity)**. The student will have the opportunity to exchange the item for more lives or items **(game element Economy)**.
Social (SS)	The student needs to join other students on a group mission and they can help each other in order to everybody reach the end **(game element Cooperation)**. The team that finishes first in the class **(game element Competition)**, wins the title "Pathfinders" **(game element Reputation)**. Participants will be notified whenever other teams are almost reaching them **(game element Social Pressure)**.