

Understanding the effects of gender, age, and cultural orientation on users' flow experience during the use of a gameful educational system

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Abstract—Gameful approaches (*e.g.*, gamification, games, and alternate reality games) have been widely used in education in recent years. However, the results are still contradictory and generated different challenges. One of the main challenges is to understand how different individual aspects affect the users' experience in gameful educational systems. To face this challenge, in this paper, we present a study ($N = 205$) analyzing the effects of demographic aspects (*i.e.*, age, gender, and cultural orientation) on users' flow experience (*i.e.*, challenge-skill balance, action-awareness merging, clear goals, unambiguous feedback, concentration, sense of control, loss of self-consciousness, transformation of time, and *autotelic* experience) during the use of a gamified educational system. The main results indicated that age positively affected the overall flow experience while individualism negatively affected the overall flow experience. Our results contribute to the fields of educational technologies and gamification, providing insights into how different demographic aspects can affect the user flow experience in gamified educational systems.

Index Terms—gameful approaches, gamified education, flow experience, demographic aspects, user study

I. INTRODUCTION

Gameful approaches, especially gamification (*i.e.*, the design of systems, services, and activities to provide motivational benefits similar to those usually used in games [1], [2]) are used on a large scale in different spheres [2]. The clarity of defined goals, rules, visual techniques, and mechanisms of gamification can make the learning process pleasant and exciting [3]. As a result, gamified learning can improve students' performance, thus increasing the student's progress and assimilation of information [4].

An important experience that gameful systems aim to affect is the flow experience [5]. The flow experience can allow for unlocking the potential of the student, making them more mature and successful [6]. However, despite the potential positive effects of gamification, the results obtained are still contradictory [2]. Experimental studies have revealed that people are differently affected by gamification designs, depending

on their user traits [7]–[9]. Such analyses help to identify weak and strong points of the gamified educational systems and develop a system that adapts individually [7]–[9].

At the same time, in the last few years, different studies have been carried out to create better gamified educational systems where many different types of people are covered and all unique interests and aspects are considered [10], [11]. Studies have sought to analyze how different personal aspects (*e.g.*, user types/ player types) affect the flow experience (and other experiences) in gamified educational systems [12], [13]. However, there is still not enough knowledge to help clearly identify how demographic aspects affect students' flow experience [14], [15]. Demographic knowledge can help adapt gamification systems around the world and make global changes as well [16]–[18].

Stepping towards solving the lack of knowledge about demographic aspects, we conducted a quantitative study ($N = 205$), aiming to answer the following research question: how demographic aspects (*i.e.*, age, gender, individualism/collectivism, and masculinity/femininity) affect students' flow experience (*i.e.*, challenge-skill balance, action-awareness merging, clear goals, unambiguous feedback, concentration, sense of control, loss of self-consciousness, transformation of time, and *autotelic* experience) in a gamified educational system?

The main results indicate that *i*) age positively affected the overall flow experience, *ii*) individualism negatively affected the overall flow experience, and *iii*) age, degree, individualism, and masculinity affected some specific flow experience dimensions. The results contribute to fields of educational technologies and gamification, through insights into how demographic aspects affect the users' flow experience in gamified educational systems.

II. STUDY DESIGN

The main aim of this study is to understand the effects of demographic aspects on students' flow experience in a gamified educational system. To achieve this goal, we conducted a quantitative study based on statistical analysis.

A. Materials and method

To conduct the study, we used a gamified educational system called “Quick Detector on Gender Flow”. In this system, students should answer a logic reasoning quiz (containing 20 questions), and, by doing so, earn points, and trophies, and appear in a ranking. The system was chosen because it provides the most used gamification elements in education [2].

To access the student’s flow experience, the short flow state scale (short-FSS) developed by Jackson and Eklund [19] was used. The scale was chosen because of its psychometric properties were analyzed in the field of gamification by Hamari and Koivisto [20]. Also, according to Oliveira *et al.* [21], is one of the most popular scales in studies in the area of educational technologies. We analyzed the data using the software SmartPLS 3¹, a software for variance-based structural equation modeling (SEM), using the partial least squares path modeling (PLS-PM) [22]. The cultural demographic aspects were collected using the platform Hofstede Insights Culture Compass², a platform based on Hofstede’s cultural dimensions theory and widely used to understand cultural value preferences of people from selected countries [23].

In our study, we considered the following demographic aspects: age, degree, gender, individualism/collectivism, and masculinity/femininity. Especially, individualism is the degree of interdependence a society maintains among its members. In individualist societies, members of the community are supposed to look after themselves and their direct family only, while in collectivist societies, members of the community take care of them in exchange for loyalty [24]. Masculinity is what motivates people, to want to be the best (masculine) or like what they do (feminine). A high score (masculine) on this dimension indicates that society will be driven by competition, achievement, and success, with success being defined by the winner in the field. A low score (feminine) on the dimension means that the dominant values in society are caring for others and quality of life [24].

The study was organized into four different steps: *i*) participants’ invitation, *ii*) demographic data collection, *iii*) system usage and *iv*) flow experience identification. In the *first step*, participants were invited through online platforms. In the *second step*, participants fill out a form for collecting demographic data. In the *third step*, participants used the system to answer 20 logical reasoning questions. In the *fourth step*, participants answered the short FSS.

B. Participants description and data analysis

The initial database was composed of 209 participants. One participant was removed from the analysis because the country of origin was not analyzed by the Hofstede Insights Culture Compass platform (with the country only as an estimate). Another participant was removed because the country does not have the data available on the Hofstede Insights Culture Compass platform. Two participants were removed for not

informing gender. Thus, our final sample is composed of 205 participants (123 self-declared as male and 82 self-declared as female). The average age of participants is 24 years old (SD = 3.215 | Var = 10.287). Average individualism 61 (SD = 24.983 | Var = 621.099). Average masculinity 56 (SD = 12.268 | Var = 150.492). Participants were invited from Amazon Mechanical Turk (MTurk)³ (each participant received 25 cents for their participation) and Prolific platform⁴ (each participant received 0.63 £ for their participation). On the Prolific platform, the cost was suggested automatically according to the time of the experiment. To analyze the effects of demographic aspects on users’ flow experience, we used Partial Least Squares Structural Equation Modeling (PLS-SEM), which allows us to model and analyze complex relationships [25].

III. RESULTS

PLS-SEM works in the same way regardless of data normality assumptions [25]. Thus, we initially calculated the models’ composite reliability (CR) and discriminant validity (DV). As the flow experience dimensions (individually) are composed of only one item, it is necessary to calculate only the values related to the flow experience itself. We then calculated the effects of demographic data on the participants’ flow experience and internal predictive power (in the appendix, is possible to access all the tables). According to the path coefficients matrix (see the appendix) results indicate that age positively affects *autotelic* experience ($\beta = 0.240$ | $p = 0.005$). Degree negatively affected *unambiguous feedback* ($\beta = -0.183$ | $p = 0.046$). Gender did not affect any of the flow experience dimensions. Individualism negatively affects *autotelic* experience ($\beta = -0.186$ | $p = 0.027$), challenge-skill balance ($\beta = -0.201$ | $p = 0.031$), clear goal ($\beta = -0.210$ | $p = 0.018$), action-awareness merging ($\beta = -0.367$ | $p = 0.000$) and transformation of time ($\beta = -0.265$ | $p = 0.003$). Masculinity positively affected transformation in time ($\beta = 0.159$ | $p = 0.048$). Also, age has a positive effect on the flow ($\beta = 0.304$ | $p = 0.002$), while individualism, on the contrary, negatively affects the flow ($\beta = -0.390$ | $p = 0.000$).

Overall R^2 values indicate a low internal predictive power (see appendix). *Autotelic* experience ($R^2 = 0.057$ | *Adjusted* $R^2 = 0.033$). Total concentration on the task at hand ($R^2 = 0.019$ | *Adjusted* $R^2 = -0.005$). The challenge-skill balance ($R^2 = 0.036$ | *Adjusted* $R^2 = 0.012$). The sense of control ($R^2 = 0.008$ | *Adjusted* $R^2 = -0.017$). The unambiguous feedback ($R^2 = 0.040$ | *Adjusted* $R^2 = 0.016$). The clear goals ($R^2 = 0.046$ | *Adjusted* $R^2 = 0.022$). The loss of self-consciousness ($R^2 = 0.035$ | *Adjusted* $R^2 = 0.010$). The action-awareness merging ($R^2 = 0.0123$ | *Adjusted* $R^2 = 0.101$). The transformation of time ($R^2 = 0.0071$ | *Adjusted* $R^2 = 0.048$). And the flow ($R^2 = 0.0128$ | *Adjusted* $R^2 = 0.106$).

A. Limitations

We collected data from people from different countries, however, different cultures were not considered in the study.

¹<https://www.smartpls.com/>

²<https://www.hofstede-insights.com/product/culture-compass/>

³<https://www.mturk.com/>

⁴<https://prolific.co/>

Also, we did not consider all possible cultural orientations in the analysis. Thus, other demographic factors not analyzed in our study may affect the participants' flow experience. We asked participants to inform their country of origin, however, we cannot guarantee whether these participants still reside in their country of origin or how long ago they left their country of origin. Depending on these factors, the behavior of these users may already have been affected by other cultures. Our data were collected using crowdsourcing platforms, which may yield different results from a study conducted in a real (ecological) environment. Finally, although our sample is large, it does not meet all the criteria for identifying effects. Therefore, our results may not be generalizable to other contexts.

B. Insights for the future

Our results showed that some demographic factors affected some specific flow experience dimensions (or the overall flow experience itself). However, the flow experience is one of many other experiences associated with learning. Thus, **we suggest that future studies can analyze how demographic factors affect other human experiences when using educational systems.** Likewise, the culture of a country is formed by several demographic aspects (which go beyond those analyzed in this study). Thus, **we suggest that future studies consider other demographic aspects.** Our study models the relationship between demographics and the users' flow experience in a gamified educational system. However, it is not within the scope of this study to recommend personalization alternatives. Thus, **we suggest that future studies may generate personalization recommendations based on our results.**

IV. CONCLUDING REMARKS

In our study, we faced the challenge of understanding the effects of demographic aspects on the users' flow experience in a gamified educational system. The main results of our study indicated that age positively affected the overall flow experience while individualism negatively affected the overall flow experience. We also identified that demographic aspects affected different flow experience dimensions. In future studies, we aim to replicate the study with a larger sample size, also collecting data from participants from new different countries. We also aim to include new demographic aspects in the analysis.

APPENDIX

To access all supplementary material for this paper, visit the following link or request the authors: <https://osf.io/m8x4q>.

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