

ADAPTING TO THE DIGITAL AGE: GAMIFICATION'S ROLE IN REVOLUTIONIZING EDUCATION FOR YOUTH STUDENTS

Tamás Kovács

*Faculty of Economics and Business
Institute of Methodology and Business
Digitalization
University of Debrecen, Hungary
ORCID 0000-0001-5437-5009*

Sándor Kovács

*Faculty of Economics and Business
Coordination and Research Centre for Social
Sciences
University of Debrecen, Hungary
ORCID 0000-0002-1216-346X*

László Várallyai

*Faculty of Economics and Business,
Institute of Methodology and Business Digitalization
University of Debrecen, Hungary
ORCID 0000-0002-0795-9527*

Abstract: *Gamification, an educational strategy incorporating game-based elements, is gaining traction. Using the Unified Theory of Acceptance and Use of Technology model constructors, this study examines the adoption of gamification among 350 university students, which is representative of gender. The findings reveal a strong positive correlation between performance expectancy, and hedonic motivation, highlighting the role of gamification in fostering intrinsic motivation among learners. Most of all, the learning value influences behavioural intention directly in students thus consistently prioritising higher expected knowledge gains regarding performance, time invested, and energy expended. Overall, the study demonstrates the significance of several UTAUT constructs, including performance expectancy, effort expectancy, self-innovation, and hedonic motivation, in influencing the propensity to adopt gamification in educational settings. This research contributes to a deeper understanding of gamification's potential to enhance student engagement and learning outcomes, particularly among younger generations accustomed to interactive and engaging digital experiences.*

Keywords: *Gamification, higher education, CFA, intrinsic motivation, learning value*



INTRODUCTION

The rapid development of modern technology and the evolving learning preferences of new generations have brought about significant educational changes. Young people are now accustomed to digital technologies from an early age and use them naturally in their daily lives. There is an increasing demand to innovate traditional methods and effectively use technology to support learning in school and university environments (Groff, 2014; Moyle, 2010). Gamification offers a promising approach to enhance student engagement and motivation, often considered challenges in traditional education settings. Teachers increasingly explore gamification strategies to create more dynamic and interactive learning experiences. However, some teachers may have concerns about integrating gamification into their lessons, fearing that it may distract from the learning objectives or not be appropriate for all subjects (Alsawaier, 2018; Adams, Du Perez, 2022; Kim, 2015).

Gamification can bring several benefits to the learning process, including Increased student engagement and motivation, improved comprehension and knowledge acquisition, more straightforward understanding of complex concepts, and enhanced self-regulation skills. However, gamification has potential drawbacks, such as overemphasising game elements, potentially detracting from the learning goals and requirements for significant design and development resources. Due to various concerns, some teachers may hesitate to incorporate gamification into their teaching. These usually lack familiarity with gamification concepts and techniques and fear of compromising their lessons' rigour and academic quality (Chans, Portuguez Casto, 2021).

In higher education, several studies have reported on gamification's confusing or ineffective existence, and concerns about the areas in which it can be used are also mentioned. Gamification can be effectively applied in various areas of higher education. Supporting professional practice and project-based learning, teaching business and commercial subjects, and enhancing individual learning goals and objectives (Langendahl et al., 2016; Jääskä, Aaltonen, 2022). This research aims to explore the interrelationships between some of the constructs of the UTAUT technology adoption model, focusing on the elements of intrinsic motivation. The UTAUT model is a widely used framework for understanding the factors influencing technology adoption behaviour. The research seeks to answer the following research question (RQ):

- *RQ: How does hedonic motivation, expected learning, performance expectancy, and effort expectancy (the desire for enjoyment and engagement) affect the behavior intention to use gamification?*

This research aims to contribute to a deeper understanding of the relationship between gamification and intrinsic motivation, which can inform the effective implementation of gamification in educational settings. The findings of this research can help teachers and developers design and implement gamification strategies that effectively motivate students and enhance their learning experiences, primarily in higher education.

LITERATURE REVIEW

Definition and evolution of gamification

To understand the concept of gaming, it is important to understand the difference between the words "playing" and "gaming". The word "playing" refers primarily to a child's activity, which takes place in a spontaneous, self-indulgent state. The word "gaming", on the other hand, is more associated with games, which are usually governed by rules and objectives (Santayana, 1955; Caillois, 1961). The word "game" means a purposeful activity governed by rules, the outcome of which is determined by numerically determined points, such as winning or losing. Deterding et al. (2011a) have represented this in a two-by-two matrix, which illustrates how the application of each element affects the completeness of the game.

The concept of gamification emerged in the early 2000s and has been evolving ever since. The term was first coined in 2002 by the British game developer Nick Pelling, who defined it later in a 2011 article as the game-like user interface of electronic devices and the making of them more enjoyable and fast (Pelling, 2011).

However, the first real conceptualization was later, when in a conference presentation Deterding et al. (2011b) defined it as "the use of playful, game design elements in a non-game environment", i.e. the transposition of something into a different context.

Since Deterding's definition, a number of other experts have articulated the concept of gamification.

Some of the most common definitions are presented below:

- As stated by Sweetser & Wyeth (2005), gamification is *"the design process of applying elements and principles from games to other contexts"*.
- Deterding et al. (2011a) describe gamification as *"the application of the scientific study of playfulness to non-game environments"*.
- According to Kapp (2012), gamification is *"the transposition of game elements and mechanisms into non-game environments in order to motivate, engage and induce learning, performance or other desirable behaviours"*.

Zichermann & Cunningham (2011) wrote that the purpose of its application is to achieve some behavior. At the same time, it is emphasized that game design thinking and the use of certain game mechanisms can be successful in involving users. The definition of Werbach & Hunter (2020) does not differ much from the previous one, they also detail the game elements and their insertion into the context, but they emphasize that there will be no gamification by packing a few game elements one behind the other in a foreign environment. After that, Kapp examined its role in education. Based on his wording, the focus was on game-like, game design organization and implementation, where the goal was to motivate people, engage them and encourage them to take action, to overcome problems effectively (Kapp, 2012). When creating the term, Finnish researchers Kai & Juho (2016) focused on practical experiences, writing about processes where the individual gets a game-like experience when using certain services

(Kai & Juho, 2016). According to Pusztai (2020), gamification is a strategy where game elements are used in a non-gaming environment to move users' behavior in a positive direction.

The emergence of the concept of gamification has also varied in time and space. The concept has spread primarily in the United States and Europe but has gained popularity in other countries in recent years like in Latin America and the Caribbean (Dodi, 2020). Gamification is used in a wide range of fields, such as marketing, education, healthcare and corporate environments. The concept continues to evolve and is expected to play an increasing role in society in the future.

The development of the concept of gamification can be divided into the following stages:

- The beginning (2002-2011): During this period, the concept was not yet fully developed and was defined differently by different experts.
- The conceptual development (2011-2015): During this period, the definition of gamification by Deterding and his colleagues became the most widely accepted.
- The spread (2015-present): Since then, gamification has gained popularity and is being applied in a wide range of fields (Pelling, 2011).

The future of the concept of gamification is still uncertain but is expected to continue to evolve. The success of the concept may depend on some factors. The growing popularity of video games, coupled with a better understanding of game design elements and mechanisms, is driving the adoption of gamification. As technology continues to advance, gamification will become more accessible and effective, enabling its widespread implementation in various sectors like tracking human bio-physiological activities by Virtual Reality (VR) (Wojciechowski et al., 2021). With these factors in place, gamification is poised to play an increasingly significant role in shaping the future of human interaction and behavior.

Using gamification in higher education and elsewhere

Gamification is an increasingly popular method in marketing, human development and education (Brzozowska et al., 2024; Kapp et al., 2014; Kozová et al., 2024). The word is a combination of the English words “game” and “fiction” (Nakashima et al., 2017). While the concept is not yet fully defined, it is generally understood to involve the application of game elements in a non-game environment (Deterding et al., 2011b).

The aim of gamification is to motivate and engage people in a particular activity. Playful elements such as points, levels, tasks and rewards can make the activity more enjoyable and improve performance. Over the last fifteen years, gamification has enjoyed international success, particularly in marketing. Motivational theories and psychological tests demonstrate that individuals have diverse intrinsic needs. In order to satisfy these needs and motivate people, different incentives are required, such as rewards and recognition. Play and playfulness have been part of our lives since the dawn of mankind, and it is precisely because of their ancient nature that we can use them for both intrinsic and extrinsic motivation. Gamification uses these motivational factors to encourage the completion of specific tasks based on needs

and desires. The gamification of certain organisational tasks can also positively impact engagement and work morale (Hammedi et al., 2021). When people find a task exciting, they are eager to complete it, which positively affects productivity and teamwork (Kapp et al., 2014; Samoliuk et al., 2021; Vegt et al., 2018).

Gamification is used as an incentive at all levels of education and development. However, an article has already been published on the potential of using digital environments and game-based methods to support rehabilitation in ageing (Wojciechowski & Korjonen-Kuusipuro, 2022). Its use has been demonstrated from early childhood (Mikó 2018; Hossein-Mohand et al., 2021; Carvalho et al., 2015; Huizenga et al., 2009; Schwabe & Göth, 2005) through to secondary school, in areas such as reading and other skill development (Ronimus & Lyytinen, 2015; Njå, 2020), language learning (Gooch et al, 2016; Garcia, 2013; Huynh et al, 2016), and music and art education (Szabó, 2018).

Examples of gamification can also be found in higher education. In addition to the gamification of courses (Barabási, 2020; Pusztai, 2020; Bicen & Kocakoyun, 2017), a few case studies on the subject have been published. However, it is important to note that maintaining motivation is highly valued in higher education. Many lecturers belong to Generation X, while their students belong to Generation Z (Maczó, 2019). The differences in motivation and communication between these two groups can result in tensions, a topic previously explored by Prievara (2018). Kenéz (2016) points out this method can be applied in many areas of higher education, including during lessons, examinations and home learning, which can play a prominent role in the current online education context. The most commonly used game elements are point systems, teamwork, and quizzes and tests that measure classroom activity. Multimedia elements, bonus tasks, and avatars also take advantage of certain e-learning systems (Bernik et al., 2017; Kurucz & Gajzágó, 2019; Kiryakova et al., 2014). It is no coincidence that Kahoot!, Quizizz, Socrative or the flipped classroom approach have been incorporated into most digital learning tools (De La Cruz et al., 2023). Furthermore, the use of gamified applications has been studied in university settings, where researchers have obtained positive results in promoting deep learning. They have noted that such solutions are well received by students and can promote a student-centred approach, strengthening the university brand (Aguilar-Castillo et al., 2021).

The model constructors

Today's world is characterised by constant innovation, renewal and technological development, complemented by continuous improvement and accelerated data exchange (Bartuseviciene & Butkus, 2024; Bilan et al., 2023). Different technology acceptance models are a critical part of technological innovation, as testing the model can provide answers to the reception, perception and failures of your innovation. The justification of these models has been supported by a number of studies over the years (Blut et al., 2016; King & He, 2006; Korcsmáros et al., 2025; Jeroen & Wetzels, 2007). The following is a brief description of the model variables used. The research did not examine other potential moderating variables, such as religion, moral norms or culture.

Performance expectancy (PE)

In the UTAUT (Unified Theory of Acceptance and Use of Technology) model, performance expectancy refers to the expectation that the use of a technology will help the user achieve their goals. It is one of the four key constructs that influence an individual's intention to use technology, along with the expectation of effort, social influence and enabling conditions.

Performance expectancy is essentially an evaluation of the perceived usefulness of technology. A user with a high-performance expectancy believes that using technology will lead to positive outcomes, such as improved productivity, increased learning, or increased task satisfaction. This belief is influenced by several factors, including the user's previous experience with similar technologies, the perceived ease of use of the technology, and the availability of training and support (Venkatesh et al., 2003).

A strong expectation of performance is crucial in encouraging technology adoption. If users believe that technology can help them achieve their goals, they are more likely to be motivated to use it and to persevere despite any challenges they may encounter.

Performance expectancy can be influenced in the context of gamification by providing users with clear and achievable goals, timely and relevant feedback along with rewards for progress, and incorporating challenges and opportunities for skill development. By effectively addressing performance expectancy, gamification can significantly increase the likelihood of user adoption and engagement. By effectively addressing performance expectancy, gamification can significantly increase the likelihood of user adoption and engagement, as several studies have already pointed out (Ofosu-Ampong, 2019).

Effort expectancy (EE)

Effort expectancy is influenced by several factors, including the user's prior experience with similar technologies, the perceived complexity of the technology, and the availability of training and support (Venkatesh et al., 2003). A strong effort expectancy can lead to increased user adoption and engagement, as users are more likely to be willing to try out and use technology if they believe it will be easy to learn and use. A user with high effort expectancy believes that using the technology will not be difficult or time-consuming to learn and use. They may also believe that the technology is straightforward to navigate and that they will be able to find the information or support they need when they need it.

Gamification can effectively manage effort expectancy by employing an intuitive and user-friendly interface, meticulously crafted instructions and tutorials, and a comprehensive support system encompassing help guides, FAQs, and vibrant community forums. These measures collectively contribute to a gamified system that is readily accessible and less cognitively taxing, thereby fostering enhanced user engagement and satisfaction (Kyewski & Kramer, 2018).

Self-innovation (SIN)

Self-innovation is a relatively new construct that has been proposed as a potential fifth construct in the UTAUT model (Attié & Meyer-Waarden, 2022). Self-innovation refers to a person's tendency to embrace and adopt new technologies, even those that are perceived to be risky or challenging.

The inclusion of self-innovation in the UTAUT model suggests that a user's willingness to adopt a technology may also be influenced by their personal disposition towards innovation and risk-taking. A user with high self-innovation is more likely to be willing to try out new technologies, even if they are unsure of the benefits or potential drawbacks.

A study by Venkatesh et al. (2012) found that self-innovation was a significant predictor of user adoption of social media platforms. The study also found that self-innovation was positively correlated with other UTAUT constructs, such as performance expectancy and effort expectancy.

Learning value (LV)

The learning value item is a significant predictor of technology adoption in a variety of settings, including educational settings, corporate training programs, and online learning platforms. This suggests that the perceived usefulness of a technology for learning is an important factor in influencing user behaviour. High scores on the learning value item indicate that the user believes that the technology is useful for learning and skill development. This belief can then influence the user's intention to use the technology and their actual usage behaviour (Sitar-Taut & Mican, 2021).

Infusing learning with game-like elements, such as points, badges, and levels, can transform the learning process into an engaging and motivating experience. Secondly, establishing clear and achievable objectives can empower learners to stay focused and maintain direction throughout their learning journey.

Thirdly, timely and relevant feedback plays a crucial role in guiding learners, enabling them to identify areas for improvement and track their progress effectively. Finally fostering collaborative and competitive environments can transform the learning experience into an engaging and motivating environment, where the users collaborate to achieve shared goals and compete with peers to enhance their skills and knowledge.

Hedonic motivation (HM)

Hedonic motivation is essentially the intrinsic reward associated with using a technology. A user with high hedonic motivation find using the technology to be enjoyable and engaging, and they derive pleasure from interacting with the technology itself. This motivation is often driven by factors such as the aesthetic appeal of the technology, the sense of challenge and accomplishment, and the social interactions it facilitates.

Hedonic motivation is influenced by several factors, including the user's personality, their prior experiences with similar technologies, and the overall design and functionality of the technology. A strong hedonic motivation can lead to increased user adoption and engagement,

as users are more likely to be willing to use a technology if they believe it will provide them with enjoyment and satisfaction (Oluwajana et al., 2019).

Immersive design can transform gamified systems into captivating experiences that foster hedonic motivation. By creating a stimulating and engaging user interface, gamification can enhance user enjoyment and motivation (Shahzad et al., 2023). Game-like elements, such as points, badges, and levels, can provide users with a sense of progress and accomplishment, further fueling hedonic motivation. These rewards offer tangible and visible indicators of achievement, reinforcing engagement and satisfaction. Incorporating variety and challenge into gamified systems helps prevent boredom and disengagement, thereby keeping users actively engaged. Gamification caters to different interests and preferences by introducing a diverse range of tasks, challenges, and experiences, ensuring a continuously engaging experience. Gamification taps into the human desire for enjoyment and satisfaction by examining hedonic motivation. Gamification makes technology more attractive and usable by engaging the user and creating rewarding and intrinsically motivating experiences (Venkatesh, 2012).

METHODOLOGY

Data and Sampling

Altogether 350 responses were gathered using snowball sampling with the help of the student council of the Faculty of Business and Economics between 2021 and 2022. The sample can be considered representative concerning gender according to the results of Graduate Career Tracking System (GCTS, 2022) for full-time students (GCTS, 2022). The survey consisted of 8 blocks of indicators measuring the advantages (Pros), disadvantages (Cons), PE, EE, LV, SIN, HM, BM of using gaming in education.

Applied methods

At the first stage of the analysis and model construction, a Confirmatory Factor Analysis (CFA) was applied to test construct consistency with its indicators (how well were the indicators described by their constructs). During this process, some indicators were left out of the model due to the lower loadings (the threshold was 0.4). Originally, constructs „Pros” and „Cons” contained 7 indicators, respectively, while PE and EE contained 4 indicators, respectively. In the final theoretical model, each construct consisted of only 3 indicators. Factor reliability and inner consistency were measured through McDonald’s omega (McDonald, 1999) and Cronbach’s alpha. The reason for reporting even omega was that the (equal factor loadings, uncorrelated errors) of Cronbach’s alpha are very restrictive and often violated (Hayes & Coutts, 2020). On the other hand, the factorial scores were utilized in the present study and omega was specially developed for a factor model using the square of the sum of the factor loadings (McDonald, 1999). In the second stage of the model building, an Explanatory Factor Analysis (EFA) was employed to establish the appropriate latent constructs with the relevant indicators. For the factors score estimation, Thurstone’s regression (Thurstone, 1934) method was used. Factor extraction was performed by using the minimum residuals method.

In the final stage of the analysis, K-means (using Hartigan-Wong, MacQueen and Forgy algorithms) and hierarchical cluster analyses were performed on the CFA constructs. MacQueen's K-means clustering with 5 clusters was used to produce the final clustering. The optimal number of clusters was determined by using the so-called gap statistic. The cluster characteristics and differences then were examined using a Chi-squared test for gender, age and place of residence, presented in a bar chart.

The goodness of the CFA model fit was measured by Chi-squared test, Tucker-Lewis index (TLI) (Tucker & Lewis, 1973), comparative fit index (CFI) (Bentler, 1990) and the root mean squared error of approximation (RMSEA) (Stiger, 1990). The threshold for TLI and CFI was 0.9, higher values indicate a good model fit. On the other hand, a lower than 0.08 value for RMSEA indicates a proper model fit. Effect sizes were measured for chi-squared test with the effect size index (w), which is the square root of the quotient of chi-square value and the number of cells in the crosstable. Silhouette index (Rousseeuw, 1987) was used for measuring and comparing cluster quality. Jamovi 2.4.8. software (Jamovi project, 2023) was used to perform all analyses in the study. This software uses R statistical software (R Core Team, 2022) and its packages. The „lavaan” package (Rosseel, et al., 2023) was used to fit CFA, package „psych” (Revelle, 2023) was used for creating the factors and performing an EFA analysis, „snowCluster” package (Seol, 2023) was used to cluster data according to the established CFA construct. The authors also used the R script capabilities of Jamovi to calculate the Silhouette index using the „cluster” package.

EMPIRICAL RESULTS

Results

This study sought to ensure a representative sample with regards to gender distribution, aligning with the findings of the Global Citizenship Test Survey (GCTS, 2022). Their research on the entire University of Debrecen student population indicated a 62.5% composition of women. In mirroring this statistic, our sample achieved a comparable proportion of female participants, bolstering the overall representativeness in terms of gender composition.

Table 1. Distribution of the sample across gender, age and place of residence

Gender	Counts	% of Total
Male	137	39.1 %
Female	213	60.9 %
Age		
Under 20 Years	105	30.0 %
20, 21 Years	127	36.3 %
Over 21	118	33.7 %
Place of residence		
Village	90	25.7 %
City	159	45.4 %
County town	101	28.9 %

N=350

[Source: Authors' Calculation.]

*: all Z-statistics were statistically significant at 99.9% level of confidence ($p < 0.001$)

Furthermore, to guarantee approximate proportional representation across age groups, we meticulously constructed categories that encompassed similar student numbers within each respective range. This approach mitigates potential biases arising from overrepresentation or underrepresentation of specific age demographics, contributing to the robustness of our sample.

Finally, we acknowledged the potential impact of geographic origin on student characteristics and perspectives. Consequently, our sample aimed to reflect the distribution of urban, county town, and village residents within the broader student population. City residents constituted almost half of the sample, while approximately a quarter of students were from county towns and villages, respectively.

Table 2. Loadings and major descriptive statistics of the indicators used in the CFA model

Factor	Indicator description	Loadings**	Standard Error	Z-statistic*	McDonald's omega (Cronbach's alpha)	\bar{x}	Standard deviation
PROS	PRO1. arouses my interest	0.810	0.044	16.8	0.812 (0.808)	4.21	0.91
	PRO2. motivate	0.757	0.049	15.3		3.85	0.99
	PRO3. increase my activity in class	0.736	0.052	14.8		3.95	1.04
CONS	CON1. distracts me from the lesson	0.745	0.043	14.7	0.808 (0.795)	1.98	0.97
	CON2. I can't concentrate on the subject	0.717	0.058	13.5		1.77	0.85
	CON3. frivolous to me	0.828	0.048	16.5		1.96	1.08
PE	PE1. I find useful in higher education	0.871	0.040	20.2	0.873 (0.865)	4.07	0.93
	PE2. improves learning efficiency	0.896	0.038	21.1		4.08	0.90
	PE3. asks can be completed faster	0.733	0.047	15.6		3.90	1.01
EE	EE1. I see through the method	0.727	0.046	14.0	0.730 (0.722)	3.76	1.05
	EE2. no more difficult to master	0.783	0.044	15.3		4.17	0.90
	EE3. easy to use	0.703	0.055	13.4		4.16	0.85
SIN	SIN1. try new things immediately	0.711	0.064	13.6	0.769 (0.764)	3.56	1.22
	SIN2. be the first among my friends to try new technology	0.684	0.067	12.9		3.14	1.27
	SIN3. experimenting with new technologies	0.779	0.058	15.1		3.59	1.12
LV	LV1. control my learning time	0.764	0.056	16.3	0.844 (0.837)	3.39	1.19
	LV2. expand my knowledge and strive to succeed	0.842	0.045	18.9		3.77	1.02
	LV3. I learn the material immediately and easily	0.809	0.044	17.7		3.80	0.97
HM	HM1. fun and interesting	0.869	0.039	20.1	0.904 (0.896)	4.23	0.91
	HM2. happy to use	0.919	0.037	22.1		4.29	0.89
	HM3. greatly increases my motivation	0.831	0.047	18.7		4.01	1.05
BI	BI1. I intend to use gamification in the coming months	0.874	0.050	20.3	0.923 (0.922)	3.48	1.17
	BI2. I plan to use gamification in the near future	0.930	0.047	22.6		3.59	1.13
	BI3. I expect to use gamification in the next period	0.878	0.048	20.5		3.47	1.12

** : only those indicators were kept in the model whose loading was larger than the threshold of 0.6

Both McDonald's omega and Cronbach's alpha values suggested the highest reliability and factor consistency for BI and HM. In the case of PE, LV, PROS and CONS, the omega and alpha values were also excellent. All values were higher than the minimum of 0.7. Factor

loadings were also around or above the threshold of 0.7 and, therefore correlated well with the constructs. BI is described basically by B2, HM is represented the best with HM2, LV with LV2. The strongest indicator of PE was PE2 and EE2 in the case of EE. The main drawback of gamification was CON3 and the strongest advantage was PRO1.

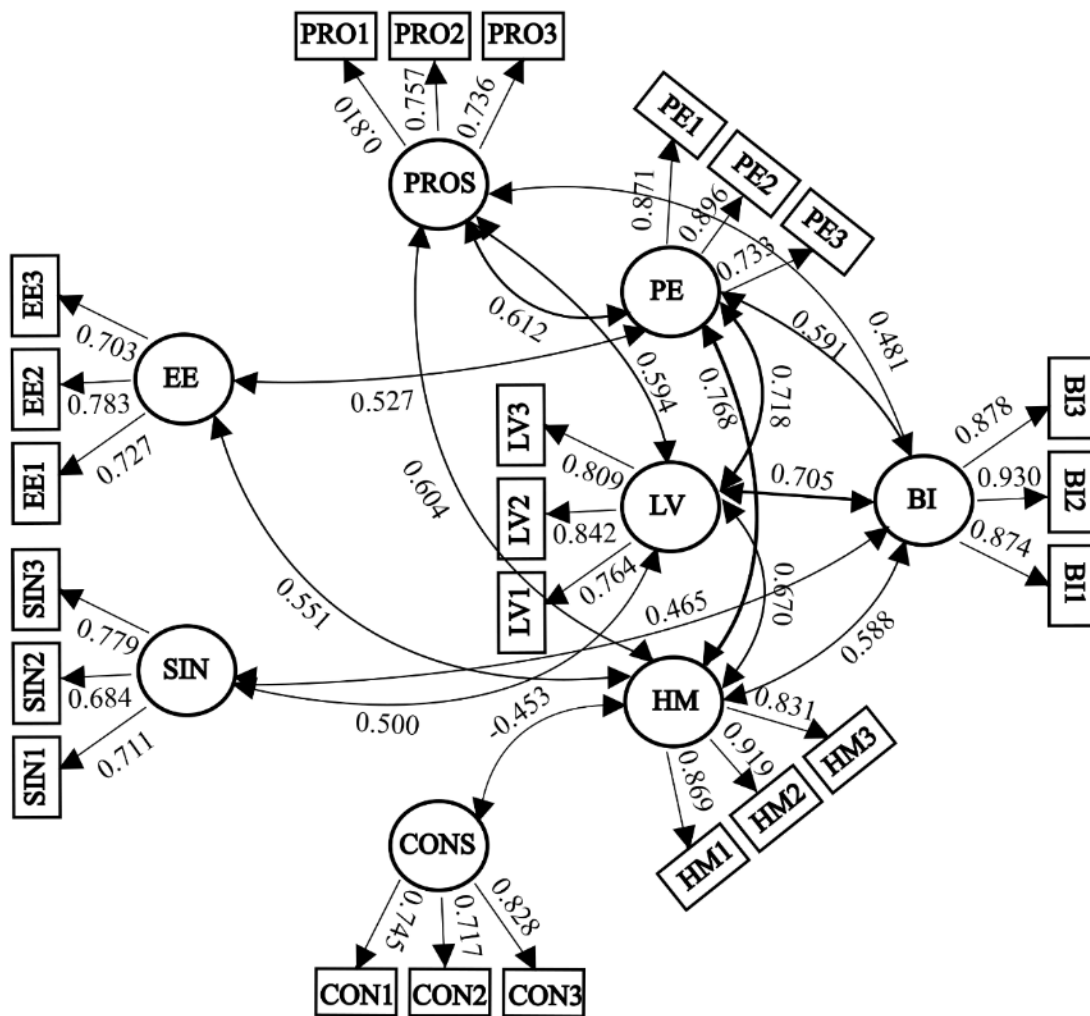


Figure 1. Graphical representation of the CFA model (loadings and construct correlations)

Construct correlations were calculated by using Spearman's correlation (double headed arrows) Loadings were represented by single headed arrows only those correlations were depicted the absolute value of which was larger than 0.45.

[Source: Authors' Calculation.]

Figure 1 presents the estimated CFA model with loadings and construct correlations. Spearman's correlation coefficient calculated construct correlations and all coefficients were significant at a 99.9% confidence level ($p < 0.001$). Only those coefficients were depicted for

the sake of better understanding that were greater than 0.45. The largest correlation can be seen between PE and HM ($r=0.768$) and PE and LV ($r=0.718$). The best influential variable on BI was LV ($r=0.708$). It seemed that PE, LV, HM can be considered as mediator variables and EE and CONS did not affect BI directly. PROS mainly influenced PE, LV, HM but also had a direct relationship with BI ($r=0.481$). SIN also related directly through LV and indirectly to BI ($r=0.465$). Sample size (N) for CFA should satisfy the following 3 criteria (Myers et al., 2011): 1) $N \geq 200$; 2) $N/p \geq 10$, where p is the number of variables in the model; 3) $N/q \geq 5$, where q is the number of parameters in the model. The model contained 24 indicators, 8 latent variables and $28+24=52$ model parameters (total number of arrows, 24 simple and $(8*7)/2$ double headed). Based on the above mentioned criteria, the sample size of 350 was satisfactory for the analysis. Figure 2 presents the clustering patterns of the indicators examined. The final clustering was done by K-means clustering using MacQueen’s method, as this gave the highest Silhouette index compared to the other methods.

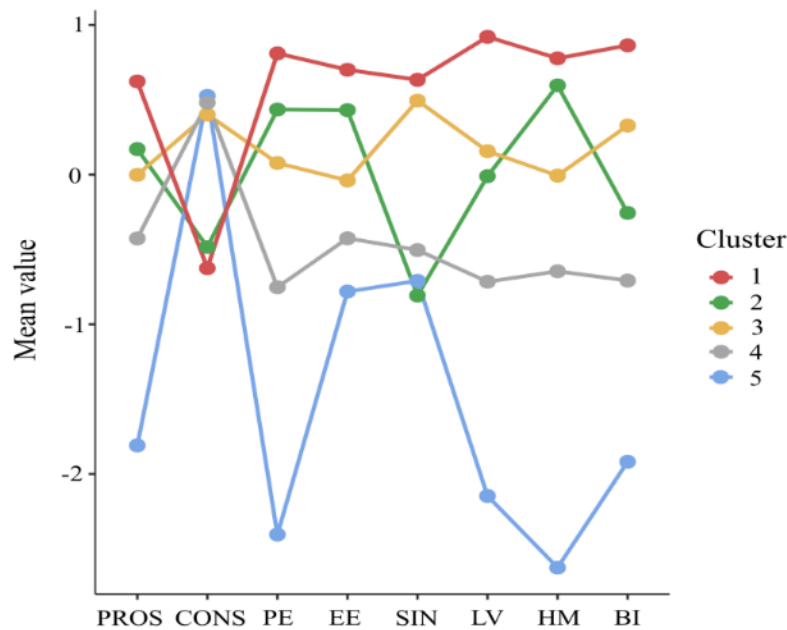
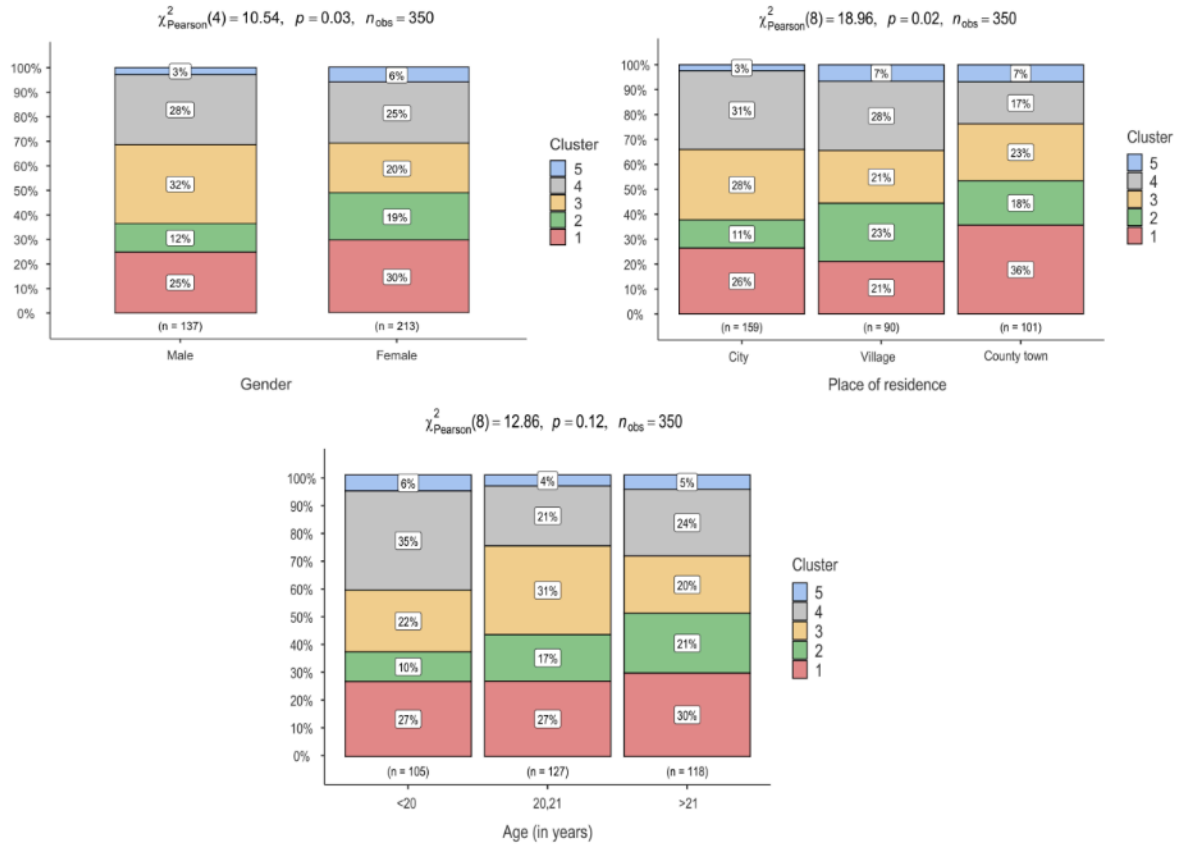


Figure 2. Indicator patterns (mean value differences) of the studied clusters

CFA constructs are standardized variables where a 0 value represents the average. Lower than the average values are negative numbers and positive values indicating above average values. There was a clear ordered pattern that can be detected by K-means cluster analysis (MacQueen’s method). The optimal number of clusters was 5. Within the first two clusters (red and green) the respondents perceived more advantages towards gaming in education compared to the drawbacks. All other indicators were the highest in the first (red) cluster. In the second (green) cluster HM, EE, PE were also relatively high, but SIN was relatively lower compared to the 3rd (yellow) cluster. The 3rd cluster can be considered as the average group, while the worst two clusters are the 4th and 5th (gray and blue) clusters. The BI value as well as the perceived advantages of gamification in the education, HM, LV, PE were the lowest in the 5th (blue) cluster.

Figure 3 presents the results of the Chi-squared test and the distribution of cluster memberships between the different gender, age and place of residence groups. Differences are shown in a bar chart.



χ^2 indicates the Chi-squared test statistic

Figure 3. Cluster distributions within Gender, Age and Place of residence categories

It can be stated that the proportion of red and green clusters (best two clusters with respect to gamification support) were relatively higher among Females (Chi-squared = 10.54; $p=0.032$). Place of residence also caused differences in the acceptance of gamification. The proportion of the first two clusters were the higher among those living in county towns (Chi-squared = 18.96; $p=0.015$). The results for gender and place of residence were statistically significant at the 5% level of significance ($p<0.05$). Although older (over 22 years old) students were more supportive, as the ratio of the best two clusters was highest among them, no significant relationship with age could be found (Chi-squared = 12.86; $p=0.117$).

DISCUSSION

The study aimed to explore the factors that may influence young students' attitudes towards technology adoption. Thus, the authors investigated certain UTAUT variables as well as arguments for (PRO) and against (CONS) gamification in a unified model. Although there have been several studies on the measurement of gamification and technology adoption and intention to use, the authors used the new approach presented previously to investigate complexity. The authors examined the attitudes of students in higher education and the factors that influence them from a new perspective. The results of the study may also help lecturers who have already introduced gamification in their teaching or are considering introducing it in their courses. Research to fill a gap in the literature has investigated the context of a version of the well-known UTAUT model supplemented with other constructs. The introduction of the new latent variables is an appropriate complement to existing academic work. Similar construct extensions have also been investigated by Hashim et al. (2018) & Altalhi (2021), where they highlight that openness and positive competition can promote intention to use in the presence of gamification.

The results show that PE and HM and PE and LV are the most correlated constructs. This result can be interpreted as indicating that, since young university students associate greater perceived usefulness with the method to be used (gamification), their hedonic motivation is related to their intrinsic motivation and reward system from using technology. This has been supported by several studies (Pappas, 2015; Lin et al., 2012; Mekler et al., 2017). BI, i.e. the intention to use, is most directly influenced by LV. Thus, the young people surveyed link their intention to use to their expected learning value. That is, the more learning value they associate with a technology, the more willing they are to use it. This is in line with the finding of other researchers that this depends on previous technology use and experience (Ofosu-Ampong et al., 2020). This finding is enhanced when the age factor is taken into account. In the following, the constructs PE, LV and HM act as a kind of proxy for BI. In contrast, EE and CONS do not directly affect the propensity to gamble.

Further analysis has shown that two clusters of young students in higher education are delineated, those who associate more benefits with gamification than negatives. They can be called gamification pioneers by the authors. The second cluster has relatively high values for HM, EE, PE but relatively low values for SIN. This group of students can be considered intrinsically motivated, but they do not consider themselves innovative. They can be considered as progressive. The third and fourth clusters were identified as the average group, while the fifth cluster had the lowest HM, LV, PE and BI values. This group was identified as gamification rejectors.

In terms of demographic variables, older students are more supportive of gamification in the classroom than their younger counterparts. This can be explained by the fact that they have been part of the higher education system for longer and are more open to technological innovation. However, this finding is not statistically significant; it merely highlights a trend. A similar finding was made by (Caserman et al., 2023; Larson, 2019, Kochoian, 2016; Aydin, 2018) in previous studies. In addition, the authors also found differences by place of residence. Those living in a city with county status (a large city) are significantly more open to gamification compared to those living in other areas. This finding is consistent with Koivisto

and Hamari's study in similar areas (Koivisto & Hamari, 2014;) that where we live may predispose our openness and acceptance.

CONCLUSIONS

Overall, this study points out the conditions that promote the intention to use gamification in higher education. The authors have presented a multifaceted approach to gamification, the potential of the method in several areas of life, such as marketing, education, etc. The research has complemented some UTAUT variables with new contexts to investigate the complex factors that influence the intention to use gamification. The results indicated that there was a strong relationship between the constructs of learning value, hedonic motivation and expected performance, so intrinsic motivation and the possibility of easier learning through technology may be motivating these audiences. The paper also highlights the potential for demographic characteristics, revealing a significant effect between place of residence and intention to use, and with age as a variable, students in the older group are also more open to using gamification. The research found results consistent with those of several other studies, but with a new multi-criteria analysis that lecturers can take into account for their courses and university administrators when designing a course in the future.

LIMITATIONS

The results of the study should be interpreted with caution. Firstly, the research is based on a survey of higher education students, which may limit how widely the results can be generalised to other age groups or educational levels. Secondly, while statistical analyses revealed significant associations between gender, place of residence, and support for gamification, a non-significant trend was identified for age. Further research is needed to explore the extent to which age affects the acceptance of gamification in higher education, and to consider other moderator variables in the model. Thirdly, the study used a self-report questionnaire to collect data, which may have influenced respondents' answers due to bias or a concern for social desirability. Finally, as the study examined the adoption of gamification in a specific context, and different subjects or teaching methods may produce different results. Future research may wish to explore these contextual factors in more depth.

THE THEORITICAL AND PRACTICAL IMPLICATIONS

The article highlights fundamental problems and opportunities in the higher education system. It stresses the need to look at today's young people at university from a new and innovative perspective. Fostering critical thinking and intrinsic motivation are all possibilities in a gamification-enhanced education. The study has identified and highlighted through research the factors that indirectly and directly influence the intention to use gamification. Students' sense of learning value and usefulness for a given subject or course is salient. The authors believe it can offer guidance to current and future instructors when designing the training and output requirements of a university course, as well as the semester of a course.

Setting clear objectives and motivational opportunities with appropriate reward systems can also be an excellent option for higher education. Gamification as a tool for increasing intrinsic motivation could also be included as a recommendation in the regulatory framework of educational institutions. Overall, the study may advance the adoption and implementation of gamification in higher education, both on the teaching and the institutional side, if decision-makers duly support it. This in turn, creates opportunities for self and institutional innovation, which will be a priority for future generations.

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Authors' Note

All correspondence should be addressed to
 Sándor Kovács
 University of Debrecen, Coordination and Research Centre for Social Sciences
 4032 Debrecen, Böszörmányi Street 138.
kovacs.sandor@econ.unideb.hu

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