

**THESES OF THE DOCTORAL (PhD) DISSERTATION**  
**THE PERCEPTION OF GAMIFICATION'S TECHNOLOGICAL**  
**ACCEPTANCE IN EDUCATION**

Kovács Tamás

Supervisor:

Dr. Várallyai László

associate professor



UNIVERSITY OF DEBRECEN

Károly Ihrig Doctoral School of Management and Business

Debrecen

2021

# TABLE OF CONTENTS

1. RESEARCH BACKGROUND .....	3
1.1. Major questions, objectives and hypotheses of the research.....	5
1.2. The structure of the research .....	8
2. DESCRIPTION OF DATABASE AND APPLIED METHODS .....	9
2.1. Document and literature analysis .....	9
2.2. Quantitative research.....	10
2.3. Structure and method of analysis of the basic research model.....	12
3. MAIN FINDINGS OF THE DISSERTATION .....	16
3.1. Results of the literary analysis.....	16
3.2. General knowledge and judgment of gamification .....	18
3.3. Results of the model study .....	27
3.4. Limitations and future possibilities of the research.....	30
4. NEW AND NOVEL FINDINGS OF THE THESIS.....	32
5. PRACTICAL APPLICABILITY OF THE RESULTS.....	33
6. LIST OF PUBLICATIONS RELATED TO THE RESULTS .....	35
7. REFERENCES.....	37

## **1. RESEARCH BACKGROUND**

The choice of topic for my PhD research was mainly influenced by business simulation games and my attachment to gamification, which I became familiar with during my previous studies. At the beginning of my research, few people dealt with the topic of gamification in Hungary but as I became more and more familiar with the literature published on the subject, I either found no examples of its introduction and attitude testing in higher education or only in other fields.

In higher education, some disciplines are characterized by students taking more theoretical subjects during their studies. These subjects often emerge in the form of theoretical knowledge for the majority of students but in the labor market they may not necessarily be applicable in practice. Moreover, the gradual deterioration of professional attitudes, the desire for knowledge and learning among students is a growing problem, against which higher education institutions are making significant efforts. Gamification is considered to be one of the new methods of modern educational technology nowadays, so I also consider it important to deal with this topic in my doctoral dissertation due to its timeliness. With an attitude survey, I assess the possibility of introducing this new method in Hungarian higher education from the point of view of students and lecturers, and I examine the background provided for its implementation. It is believed that “time flies” while playing, so that many people would learn a professional or even a practical example without noticing and, unlike in case of spoon-fed education (cramming), they would be able to use their knowledge for a long time in class and later in the labor market. Gamification is playing an increasingly important role in both business and education. With its help, students can master the curriculum more efficiently and with less effort. It is no coincidence that this innovative approach to learning and education is becoming increasingly popular on an international level.

With the spread of technology and the Internet, the way of teaching has changed in recent decades. In contrast to traditional personal practice, given the current

pandemic situation, various forms of distance learning have come to the fore, which have posed an increasing challenge to both educators and students at all levels of education. In many places, lecturers may experience a negative shift in the motivation and the level of attention of university students, so that distractions or appearance in class, in addition to technical problems, are becoming more frequent. At the same time, there is a huge increase in the amount of time spent on certain video games among young people. Gamification seeks to promote the connection between the fun experience of games and learning in education. Studies have shown that some game elements can effectively contribute to learning, and the method can also have a number of positive benefits for higher education. In spite of this, many higher education institutions have not introduced it into their programs, nor are they listed in the individual recommendations as an effective method of educational technology. The aim of the research is to explore the perception of gamification in higher education, especially among students and teachers. In my primary research, I examine the applications already used for gamification and the general perception of educators and students. In my secondary research, my goal is to explore the current trends in gamification. I collected the current literature on the topic and then systematically processed and synthesized it. My specific goal, as a result of my research, is to improve the perception and awareness of gamification in both teacher and student circles at the Faculty of Economics of the University of Debrecen. I believe that the adaptation of certain business simulation software and gamified applications in education could provide an opportunity for students to develop their leadership, decision-making, and other skills, while on the faculty side, with the usage of technology, classes could be made more active and interesting. Along these assumptions, I conduct an attitude survey from the student and faculty side, the hypotheses of which are summarized in the tables in the next section.

## **1.1. Major questions, objectives and hypotheses of the research**

In formulating the research questions, I relied on the literature I got acquainted with during the preliminary research. Along these, I formulated the objectives that gave the hypotheses of the final dissertation. In the course of the research, I relied on the secondary data sources but mainly on the results of the primary research.

I based the hypotheses described below (*Figure 1*) on the preliminary document analysis, information gathering and my previous research and knowledge. My first hypothesis that, at the national and international level, few people study gamification and its potential in higher education (H1), is based on a number of studies, including the fact that in 2011 it was still at the top of Gartner's Hype curve. There were high expectations for the method, but it was dropped within a few years (MUNTEAN, 2011). Besides the representatives and pioneers of the method, there have also been articles that have directly attacked the existence, effectiveness, and legitimacy of gamification (BOGOST, 2014). After being an early "hot-topic," researchers conducted a number of literary analyses, conceptual structuring, and mappings on the topic, where they came to contradictory results (SULAIMAN, 2020; SILVA et al., 2020). My second hypothesis (H2), that the general perception of gamification is positive among students and educators, was based on the work of two well-known authors on the topic of gamification. Positive perceptions of gamification were examined by MARTÍ-PARREÑO et al. (2016) from a teacher perspective, while ORTIZ et al. (2017) summarized its impact on learning performance, student perceptions, and articles on this topic. Several studies have shown a strong correlation between gamification, motivation, arousal of interest, and a more positive experience of the enjoyment value of classes (AMON et al, 2019; HARVIAINEN-MIKKO, 2019; DREIMANE, 2019), which served as the basis for my third (H3) hypothesis. Consequently, those who say gamification evokes interest, would find the lessons more enjoyable and would be more motivated.

<b>Research problem</b>						
<i>New generations on the benches with motivational problems.</i>			<i>Few research examine the intention to use of gamification.</i>			
<b>Q1</b>		<b>Q2</b>		<b>Q3</b>		
<i>What is the gamification's role and potential in education?</i>		<i>Is there a difference in the perception of gamification by status (teacher, student) and generation?</i>		<i>What factors influence the behavioural to use gamification from the faculty and student side?</i>		
<b>C1</b>	<b>C2</b>	<b>C3</b>		<b>C4</b>	<b>C5</b>	
<i>Sistematic mapping the possibility of gamification, especially by synthesizing the domestic and international literature on the basis of its role in higher education.</i>	<i>Based on the literature, formulate recommendations for the introduction of gamification in education .</i>	<i>Explore generational and status differences in accepting the method of gamification, while examine being open to newer technologies.</i>		<i>Examine is the unified theory of technology acceptance model (UTAUT) useable for measuring student and teacher acceptance of gamification.</i>	<i>Assess the attitudes of students and teachers in the dimension of gamification.</i>	
<b>H1</b>		<b>H2</b>	<b>H3</b>	<b>H4</b>	<b>H5</b>	<b>H6</b>
<i>At the national and international level, few people are investigating the possibilities of gamification in higher education.</i>		<i>The general perception of gamification is positive among students and faculty.</i>	<i>Those who say gamification evokes interest would find the lessons more enjoyable and would be more motivated.</i>	<i>Men spend more time playing games, so they are presumably more open to gamification.</i>	<i>There is a generational difference in the behavioral intention to use gamification.</i>	<i>There are external factors that influence the behavioral intention to use gamification for educators and students.</i>
<b>Methods</b>						
<i>Descriptive Statistics, Content Analysis, Keyword Mapping (MCA, PCA, MOS clustering)</i>		<i>Descriptive Statistics, Content Analysis, Mann–Whitney-test</i>	<i>Sperman's rank correlation analysis, descriptive statistics</i>	<i>Content analysis, Mann – Whitney test</i>	<i>Descriptive statistics, Chi-square test, Ordinary logistic regression</i>	<i>PLS-SEM, Bootstrap, Chi square test, (discontinuity test, CB, AVE, etc.)</i>

**FIGURE 1: RELATIONSHIP BETWEEN RESEARCH PROBLEMS, QUESTIONS (Q), OBJECTIVES (C) AND HYPOTHESES (H)**

*\*Note: Q values illustrated the research questions, C values below them, the objectives associated with them, while H values illustrated the research hypotheses with the methods used for their analysis..*

*Source: Own editing, 2021*

Several authors have argued that men play more and, at the same time, have a more positive relationship with technology than women (GREENBERG, 2010; FUNK and BUCHMAN, 1996; LUCAS and SHERRY, 2004; HARTMANN and KLIMMT, 2006). In addition, a specific gender-based study was conducted by PEDRO et al. (2015), where as a result, men were found to be more open to games. Based on this, I formulated my fourth hypothesis (H4), according to which men spend more time with games, so they are presumably more open to gamification as well.

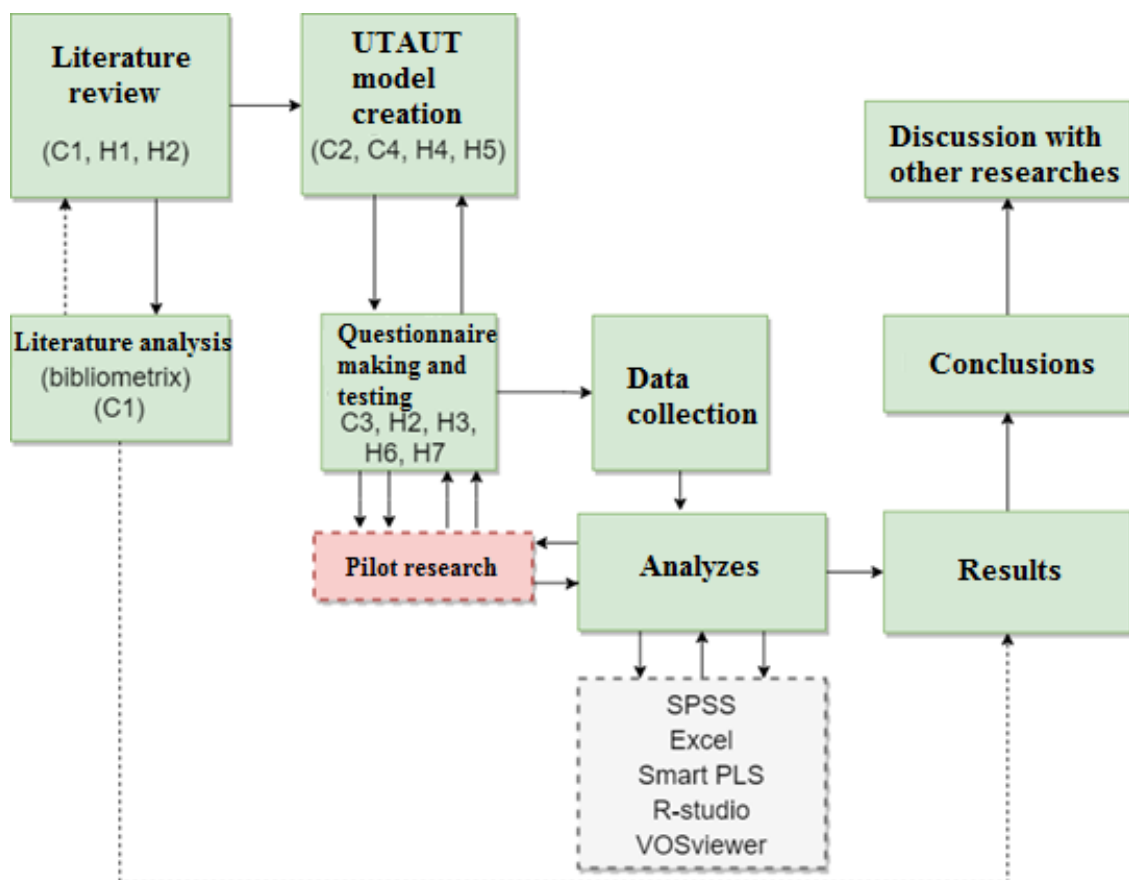
In the academic literature available on the subject of gamification, a number of topics are grouped around generations, where significant differences appear as a result. These are due to various differences in motivation and interest, especially in terms of a teacher-student relationship. ALGAVI et al. (2017) envisioned it almost as a Boss Fight, a sort of tension between generations, in their article, where they examined gamification in education. In addition, the possibility of gamification in higher education has been explored by several researchers, where they have examined generational and motivational differences, as well as technological and use factors in the older age group and age differences (POOLE et al., 2014; BARNA-FODOR, 2017; KENESEI, 2020). Based on these, I formulated my fifth hypothesis (H5), according to which there is a generational difference in the behavioral intention to use gamification.

During the literary review, the attitude tests and the behavioral intention tests were performed in each model. The models used most were the TAM and the UTAUT, which was also used by me. Most publishers in a field similar to this research have extended Venkatesh's model by extending a variable appropriate to the purpose of the research (LIN-BHATTACHERJEE, 2008; HUAN et al., 2015; MAJÓ-PETRI, ZOLTÁN, et al., 2020; IBRAHIM et al., 2011; VARANNAI et al. al., 2017). Thus, I set it as a goal and also formulated it as a hypothesis (H6) to examine if there is an external factor that influences the behavioral intention to use in the case of teachers and students.

## 1.2. The structure of the research

The research began primarily with literature collection, processing, and synthesis. For a more accurate result of the conceptual delimitation, I prepared a thematic, structured list of domestic and international literature. Secondary research was used to prepare the questionnaire for my primary research in addition to literary analysis. I have sought to support the study with concepts, methods, and the use of model variables widely implemented by previous researchers. I interpreted the analysis of the secondary data sets by systematizing the time series statistics and drawing the appropriate conclusions, which supports the timeliness of the topic.

During my data collection I tried to use the latest available international and domestic data, and the latest studies and sources during the synthesis of the literature, apart from some articles considered to be basic literature. During the research, I carried out the primary data collection by means of a questionnaire, while, of course, I used secondary data, international and domestic databases as a supplement.



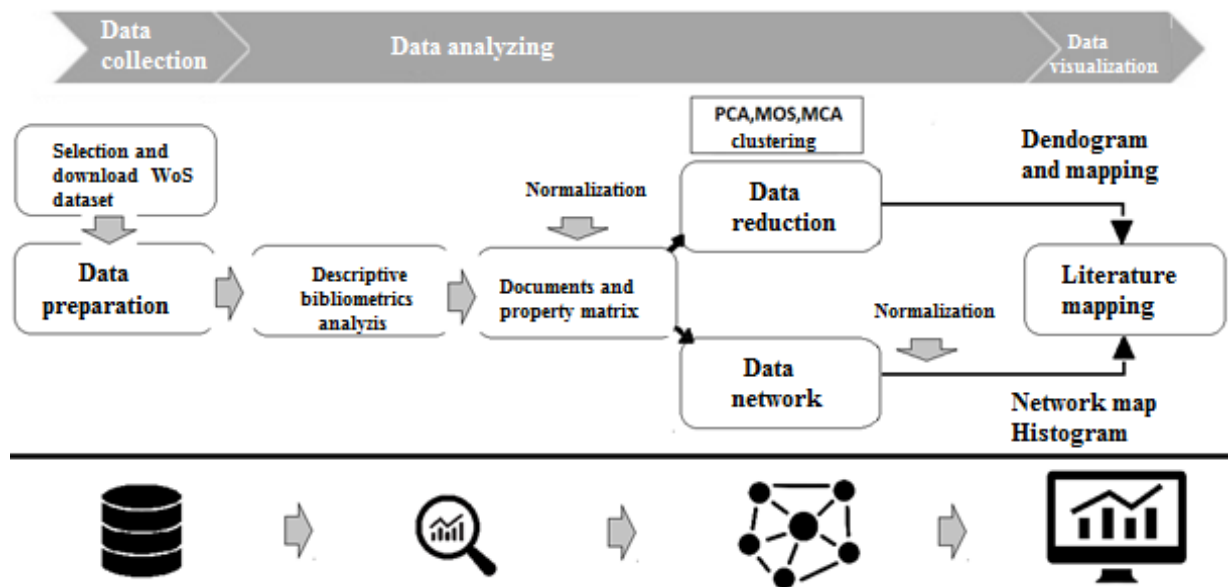
**Figure 2. The course of the research and the related objectives and hypotheses**

*Source: Own editing, 2020*

## 2. DESCRIPTION OF DATABASE AND APPLIED METHODS

### 2.1. Document and literature analysis

Considering the complexity of the topic, I collected and processed the secondary data with document analysis, which helped in the text analysis of the keyword pairs in the abstracts of the articles published in the topic and in the delimitation of the literature. Subsequently, I performed the thematic mapping of keywords in aggregate, which was part of my results.



**Figure 3. Literature analysis process**

*Source: Own editing based on Bibliometrix, 2019*

As a first step, the appropriate amount of data was determined, which I performed with a keyword filtering. The next step was to scan into the program R and then I did a descriptive bibliometric analysis. This was followed by the compilation of the document and the associated property matrix using the bibliometrix package, with which the first normalization process was performed. Then data reduction (principal component analysis, multiple correspondence analysis) was performed with help of the listed methods, in parallel with the creation of the contact network. Here we can prepare the data with another normalization, and then we can visualize it with different display forms (factorial mapping, contact network map, schematic mapping, etc.), so we can display a question we ask informatively.

## 2.2. Quantitative research

In terms of material, I chose the questionnaire as a research instrument from the quantitative methods during the primary data collection. The target group of the questionnaire was primarily students and lecturers participating in Hungarian higher education. In addition to this, students in vocational, secondary, and grammar school who plan to continue their studies in a higher education institution were also targeted as well as undergraduate students at BSc and MSc levels. From the faculty side, I measured the opinions of PhD students and faculty members involved in education, regardless of status. Due to the appropriate segmentation, I investigated the research questions from two sides, so I conducted the survey from two different perspectives (teachers, students), but with the same content.

The primary research was carried out using CAWI (Computer Assisted Web Interviewing), an online query method, for which I used the Google Forms software. When preparing the questionnaire, I took into account the applicable GDPR and data management laws, and I did not collect sensitive data about the respondents. The questionnaire was anonymous, in which participation was voluntary, and I used its results aggregated, exclusively for analysis.

In addition to sociodemographic issues, the scope of the questions includes the knowledge of gamification, applications that use gamification, and also the variables of the UTAUT model in the field of gamification. The structure and measurement levels of the completed questionnaire can be seen in Table 1, broken down into topics. There is a clear distinction between questions on sociodemographic variables, issues of equipment and the knowledge of gamification, and the perceptions of gamification.

The examined sample, taking into account the feasibility aspects in case of the lecturers, was sent to the PhD students as well as to the lecturers with the help of the Faculty mailing system and by further sharing and forwarding through it. The lecturers of the University of Debrecen have a total of 1541 people, of which the lecturers related to UD-FoE (or "DE-GTK" in Hungarian) amount to only 153 people. Thus, I reached 1.8% of the target group, while more than 17% of the faculty members completed my questionnaire. In the case of PhD students participating in Hungarian language training, the behavioral intention to answer accounted for 3% of the total number, while the completions related to the Faculty

of Economics reached 18%. Thus, a total of 51 people (including PhD students) completed it from the faculty side.

The student sample was provided by the already mentioned undergraduates and 7 high school students who wish to continue their studies at a university. The way of questioning was limited due to the pandemic period, so they could fill it out online. Some of the fill-ins could be completed voluntarily by first-year students majoring in Sport and Recreation Management in the first week of attendance education. In addition, it was shared on various student forums and, in terms of social sites, in the "DE-Hallgatók" Facebook group. It can be stated that its distribution in relation to the total number is close to 3%. The self-enrollment period took place from 15 September 2020 to 15 October 2020 for both students and faculty. The sample is not representative.

Statistical analysis was performed with help of the SPSS 22.0 software, while path analysis was performed with the SmartPLS software. I also used Microsoft Office Excel 2016 as an addition to create the figures and to perform some calculations.

**Table 2. Structure and measurement levels of the questionnaires**

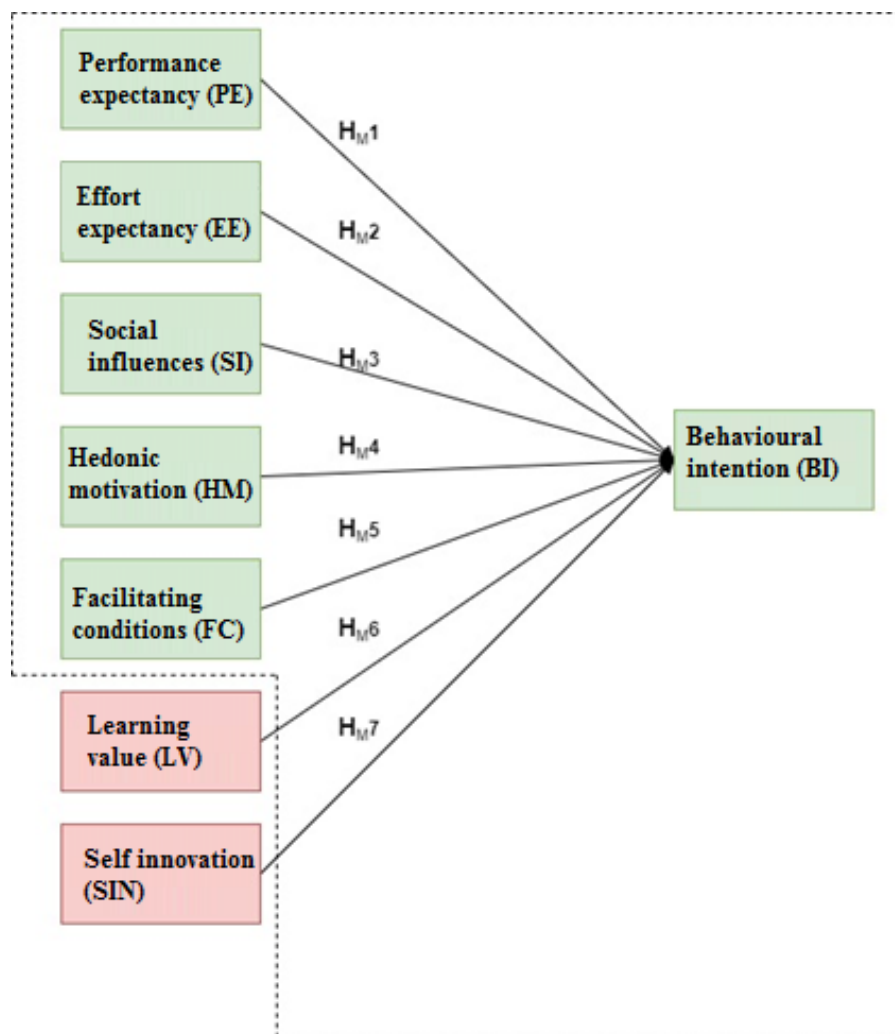
<b>Topic</b>	<b>Topic of the Question</b>	<b>Measurement level</b>
<b>Sociodemographic variables</b>	Gender	Nominal
	Age	Ratio
	Institution	Nominal
	Status	Nominal
	Residence	Ordinal
<b>General judgment of gamification</b>	Reputation	Ordinal
	Openness	Ordinal
	Motivational Power	Ordinal
	Examination/Openness to Examination	Ordinal
	Activity/Activation	Ordinal
	Previous Use (Applications)	Nominal
<b>Judgment of gamification (EDU)</b>	Pro	Ordinal
	Con	Ordinal
<b>Model variables*</b>	Expected Performance, Expected Effort Required, Social Impact, Facilitating Conditions, Hedonic Motivation, Expected Learning Value, Personal Innovation, Behavioral Intention to Use	Ordinal

\*The model variables and their items will be explained in detail later.

*Source: Own editing, 2020*

### 2.3. Structure and method of analysis of the basic research model

As the research does not examine corporate circumstances but the behavioral intention to use gamification in higher education, the original UTAUT model was modified, where some variables were omitted while some were extended (*Figure 4*), as used by many authors in the academic literature. The variables of expected learning value (LV) and personal innovation (SIN) were included in the theoretical model of the student survey in the internal measurement model. This is because I hypothesize that both expected learning value and personal innovation have a positive effect on students' acceptance of various technologies. In contrast, I omitted the price-value variable because it is irrelevant to the research. Furthermore, I did not examine the actual use because the goal was to measure technology acceptance for intended use. Consequently, I also did not examine moderating variables such as age, gender, experience, or volunteering from the original model.



**Figure 4. Structure of the basic research model (UTAUT model dashed)**

*Source: Own editing, 2020*

The arrows of the measurement model can be interpreted as hypotheses, where the effects of latent exogenous variables (PE, EE, SI, HM, FC, LV, SIN) can be measured as a function of BI in terms of endogenous variables. With the effects of independent variables on a dependent variable, I try to measure the behavioral intentions to use on the students' and teachers' side. In this case, I examine the acceptance of gamification as an educational technique, a tool in the field of higher education. The modified UTAUT model has a direct effect on the behavioral intention of use through the application of gamification as a new technology and technique in higher education intent by the seven exogenous variables (SUNG and HWANG, 2009). The study does not measure actual use, which is an endogenous variable, so it was not included in the model.

**Table 3. Model variables from the student and faculty side**

	Items	Students	Teachers
<b>BI</b>	<b>BI1</b>	I intend to use gamification in the upcoming months.	I intend to use gamification in the upcoming months.
	<b>BI2</b>	I plan to use gamification in the near future.	I plan to use gamification in the near future.
	<b>BI3</b>	I plan to use gamification next semester.	I plan to use gamification next semester.
<b>EE</b>	<b>EE1</b>	I use gamification for learning easily.	I use gamification for teaching easily.
	<b>EE2</b>	I understand the method of gamification.	I understand the method of gamification.
	<b>EE3</b>	Compared to other learning methods, I do not find it more difficult to master gamification.	Compared to other learning methods, I do not find it more difficult to master gamification.
	<b>EE4</b>	Overall, I find it easy to use gamification.	Overall, I find it easy to use gamification.
<b>FC</b>	<b>FC1</b>	In general, the University and Campus where I study is positive about gamification.	In general, the University and Campus where I teach is positive about gamification.
	<b>FC2</b>	The University and Campus where I study are technologically prepared (ICT devices, Wifi, etc.) to introduce gamification.	The University and Campus where I teach are technologically prepared (ICT devices, Wifi, etc.) to introduce gamification.
	<b>FC3</b>	I have every tool to to have gamified classes.	I have every tool to to have gamified classes.
	<b>FC4</b>	I have all the knowledge to have gamified classes.	I have all the knowledge to hold gamified classes.
	<b>FC5</b>	I can count on the help of my teachers if I get stuck learning a gamified material or during a gamified class.	I can count on the help of my colleagues if I get stuck teaching a gamified material or during a gamified class.

<b>HM</b>	<b>HM1</b>	I find gamification entertaining and interesting.	I find gamification entertaining and interesting.
	<b>HM2</b>	I would happily use gamification.	I would happily use gamification.
	<b>HM3</b>	Gamification contributes/would contribute greatly to my motivation.	Gamification contributes/would contribute greatly to my motivation.
<b>LV</b>	<b>LV1</b>	Gamification provides an opportunity for me to control my time spent studying.	Gamification provides an opportunity for me to control my time spent on teaching.
	<b>LV2</b>	Gamification provides an opportunity for me to expand my knowledge and strive for success.	Gamification provides an opportunity for me to expand my students' knowledge and their strive for success.
	<b>LV3</b>	Gamification helps me to master the given material immediately and easily.	Gamification helps me to pass the given material immediately and easily.
<b>PE</b>	<b>PE1</b>	I find / would find gamification useful in higher education	I find / would find gamification useful in higher education
	<b>PE2</b>	The method of gamification makes / would make learning more effective	The method of gamification makes / would make learning more effective
	<b>PE3</b>	With the application of gamification I finish / would finish tasks faster	With the application of gamification I finish / would finish tasks faster
	<b>PE4</b>	Gamification increases / would increase activity in class.	Gamification increases / would increase activity in class.
<b>SI</b>	<b>SI1</b>	Teachers should use gamification in class as a supportive method.	Teachers should use gamification in class as a supportive method.
	<b>SI2</b>	According to people important to me, I should use gamification to support my learning methods.	According to people important to me, I should use gamification to support my teaching methods.
	<b>SI3</b>	I would like to try the gamified methods and applications tested by my friends.	I would like to try the gamified methods and applications tested by my colleagues.
<b>SIN</b>	<b>SIN1</b>	If I hear about something new, I always find a way to try it as soon as possible (for example smartphones, TikTok, Snapchat).	
	<b>SIN2</b>	In my group of friends, I would be the first to try a new technology.	
	<b>SIN3</b>	In general, I strive to experiment with new technologies.	

*Note: Items were measured on Likert scales (1-5) which were selected based on the work of Venkatesh and Ain (VENKATESH, et al., 2012; AIN et al., 2016; ZHANG and SONG, 2013).*

*Source: Own editing, 2020*

In the previous table, we could see the variables included in the models and the items related to them, for the analysis of which I used the method presented below. Modeling with latent variables has appeared in a number of areas in previous studies, where one of the most commonly used methods was the Structural Equation Modeling. The model is basically a multivariate analysis method that combines multivariate regression and the basics of factor analysis (KOVÁCS, 2013). In the case of modeling structured equations, hereinafter referred to as SEM, we can distinguish two important parts, which are the measurement part and the structural part. The measurement part can be considered as a confirmatory factor model, where latent variables are measured with manifest indicator variables. SEM is basically made for confirmatory or exploratory purposes. In my dissertation, I examine the exploratory aspect to confirm the use of a modified UTAUT model. My aim is to support the hypothesized relationships with the help of this method and to examine whether the model fits the previously created model (MÜNNICH and HIDEKGUTI, 2012). Closely related is the path analysis, or path diagram, where the variables of the SEM are graphically represented. Here, the hypothesized cause and effect relationships are expressed by marking the hypothesized relationships with arrows pointing from our explanatory variables to the dependent variables (HAIR et al., 2010). The model is generally accepted and applied in the social sciences and behavioral sciences (BOLLEN, 1989).

A major advantage of PLS path analysis over covariance (CB) analysis is that studies can be performed with a relatively small number of elements, and normal distribution is not a prerequisite. The disadvantage is that our model cannot be described with a clear fit index, while in the case of CB there are several indicators used to determine the fit accurately. A further disadvantage is that we cannot directly test the path coefficients due to the lack of a normal distribution (no significance level can be tested), however, this disadvantage can be solved by testing the bootstrapping regression coefficient. Several programs are available to help us perform these calculations, such as LVPLS, PLS-Graph, and the SmartPLS also used by me (HENSELER et al., 2009).

### 3. MAIN FINDINGS OF THE DISSERTATION

#### 3.1. Results of the literary analysis

In line with my objective (C1), I carried out a keyword mapping of gamification, with a special emphasis on publications related to higher education and empirical studies.

*H1: At the national and international level, few people are investigating the possibilities of gamification in higher education.*

**Table 4. Thematic mapping of databases**

	Keywords	N	2020 (n)	2020n/N %
<b>MMTMT2</b>	TS="gamifikáció" OR "játékosítás"	99	11	11%
	TS="gamifikáció" OR "játékosítás" AND "felsőoktatás"	18	3	17%
	TS="gamification" AND "highereducation"	12	1	8%
<b>WoS</b>	TS=("gamification")	5934	833	14%
	TS=("gamification" AND "higher education")	1282	132	10%
	TS=("gamification AND "higher education" AND "empirical")	49	12	24%
<b>Scopus</b>	TS=("gamification")	61051	7321	12%
	TS=("gamification" AND "highereducation")	11301	1243	11%
	TS=(gamification AND higher education AND empirical)	43	9	21%
<b>Google Scholar</b>	TS=("gamification")	74600	19900	27%
	TS=("gamification" AND "highereducation")	39700	11900	30%
	TS=("játékosítás" AND "felsőoktatás")	50	18	36%
	TS=("játékosítás" AND "felsőoktatás" AND "tanulmány")	37	14	38%

*Source: Own editing, 2021*

At the domestic level, I examined the MTMT2 database, while at the international level, I filtered the data collection of Web of Science (WoS) and Scopus along the keywords given in the table. I did not set up a separate filter, the only criterion was that the publication would be of scientific nature. In addition, I searched the Google Scholar database for both Hungarian and English keyword pairs. Most of the results for the keyword “gamification” were given by Google Scholar, which appeared in line with the results of the publication on the mapping and building up of databases by Martín-Martín et al. However, the authors point out that nearly 18–38% of Google Scholar citations do not come from journals (MARTÍN-MARTÍN et al., 2018). Furthermore, the table shows that in the case of the

keyword pair of "gamification" and "higher education" more than 50 percent of the articles deal with the topic of higher education and gamification, and what is more, 30% was published in 2020. Similarly, in the case of the Hungarian keyword pair only 50 a total of such publications appeared, 36% of which were issued in 2020. In the case of studies, 37 records were listed, 38% of which were published last year.

In case of the Scopus database, I found 61051 articles for the keyword “gamification,” 12% of which were published last year. By adding "higher education" as a keyword pair, this made up almost 18% of the publications, and 11% of these 11301 articles were published in 2020. A search in the WoS database for the keyword “gamification” resulted in 5,934 publications, 14% of which were released in the previous year. 21% of all articles published on gamification were articles related to higher education, of which 10% were published in 2020. In terms of empirical research, the number of studies dealing with higher education is low (43), but almost a quarter were published in the previous year. Examining the MTMT2 database, I found surprisingly few articles written in Hungarian (18), but the number of publications written in English by Hungarian researchers on the relationship between higher education and gamification is close to 100, of which 11% was published in 2020. Consistent with the results, I examined several studies dealing with systematic literature processing (BORGES, 2014 and DICHEVA et al., 2015), where similar proportions could be perceived. Most of the topics written about gamification were about motivation, behavioral influencing, community research, and activation. In my opinion, ensuring activity in distance learning and online education, as well raising attention at a monotonous lesson have become the center of focus again, so it is not surprising that more and more articles have been published on gamification in recent years both domestically and internationally. However, we must also see that the primary language of science is English, so fewer and fewer Hungarian-language articles are being published and getting uploaded into the MTMT database. Based on the results of previous scientific publication, we can state that gamification is also a popular topic in higher education, however, I found a very low number of actual attitude studies in the course my research, which focused on higher education. Based on the examined databases, ~ 10-30% of all publications on “gamification and higher education” were published in 2020. Based on these, I reject my first hypothesis H1, as there is more

research in the dimension of gamification and higher education both domestically and internationally.

### 3.2. General knowledge and judgment of gamification

To examine the behavioral intention to use a particular technology, it is worth reviewing the gamification competencies of the fillers. The measurement of knowledge and use of gamification is detailed in Table 5, where “I don’t know” was given a value of 1 on the Likert scale, while regular use was marked with a value of 5. Looking at the table, it is striking that 34% of students is unfamiliar with gamification, compared to only 20% on the faculty side. The second group included those who had heard of the concept but had not yet applied it or did not know it. This proportion was 30% in favor of students, while 25% of faculty members marked this answer. The proportion of those who used it for teaching or learning was 21% to 29%. There were surprisingly few regular users, as 2% of students marked this option, while 6% of responses were from the teacher side.

**Table 5. Students’ prior knowledge and use of gamification**

	<b>Student</b>	<b>%</b>	<b>Teacher</b>	<b>%</b>
I do not know it	118	34%	10	20%
I have heard about it but have not tried it yet or do not know about it	106	30%	13	25%
I have used it a few times but not for learning/teaching	45	13%	10	20%
I have already used it for learning/teaching	74	21%	15	29%
I regularly use it for learning/teaching	7	2%	3	6%
	<b>350</b>	<b>100%</b>	<b>51</b>	<b>100%</b>

*Source: Own editing, 2021*

There is a difference in the prior knowledge of gamification between the completing students and the instructors. To support this idea, I used the Mann-Whitney test. There is a significant difference between the rank means (Mann-Whitney U 6942.5, Z -2.66, p <0.001). The average knowledge of the responding students on the five-point scale was 2,274, while the prior knowledge and use values of the teachers was 2,765.

I also used the questionnaire method to examine the use of certain well-known gamification applications, the results of which are illustrated in the following table. These apps may also be familiar to the average user as I have tried to cover many areas of life with them. Kahoot

has been added as an online software to compile task sets, tests and quizzes; Learning Apps as a so-called "Tankocka" development tool; Duolingo and Drops, as applications boosting language skills; and the Strava application which is focused on the gamification aspect of the activity (sport).

**Table 6. Use of known gamified applications (N = 401)**

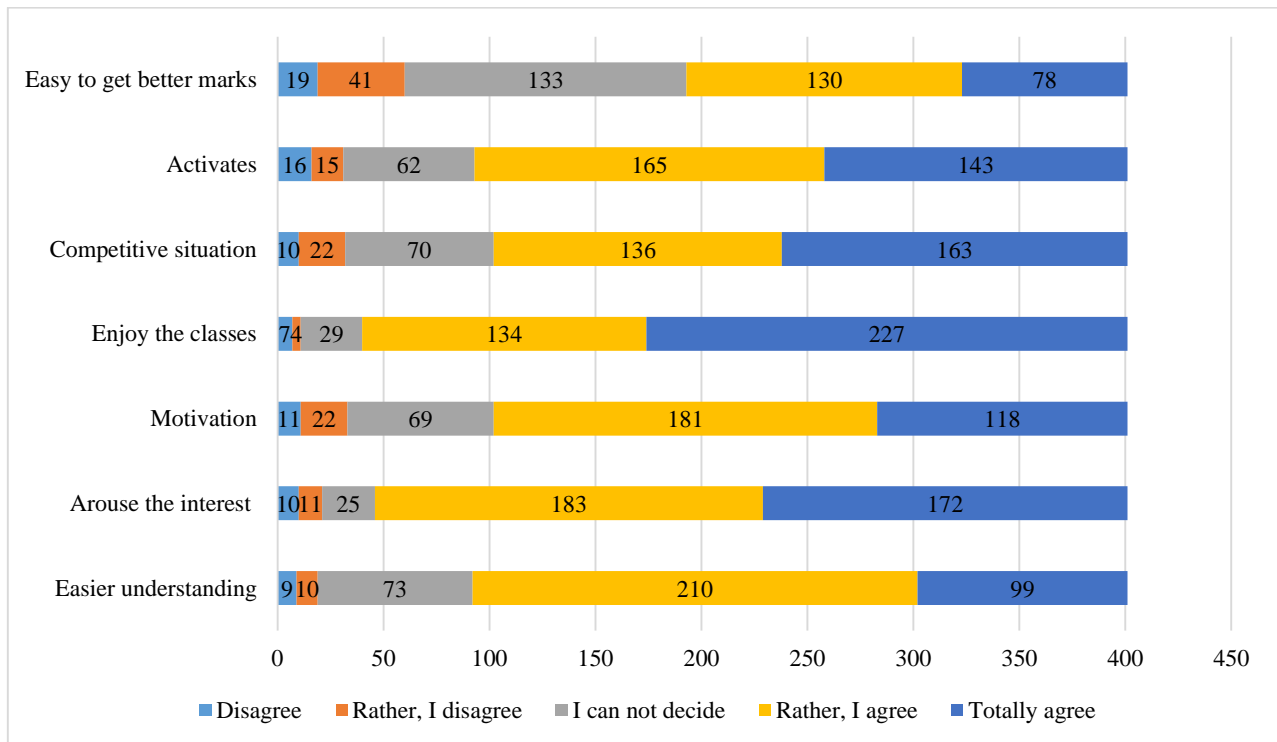
	Student		Teacher		Total	
	No	Yes	No	Yes	Yes	Nem
Kahoot	238	112	23	28	261	140
Learning Apps	59	291	9	42	68	333
Duolingo	246	103	20	31	266	134
Strava	12	338	3	48	15	386
Drops	46	304	3	48	49	352

*Source: Own editing, 2021*

We can see that there is a similarity in the usage rate of certain applications. The most used from both the faculty and student side were the Kahoot and Duolingo apps. Nearly 70% of students have already used the applications, while in case of instructors this proportion is ~ 43%. The third most used app was Learning Apps, on both the teacher and student side. In addition, Drops, an interactive software supporting language skills, was almost used by students in an equal rate. The least used application was Strava, a software intended to make activities more game-like, however, on the teacher's side, this application is used at a higher rate compared to students. Based on the results, it can be stated that there is a significant difference in the prior knowledge of students and teachers about gamification.

We can only talk about the possibilities of the usage and the behavioral intention to use gamification if we know the general opinion of the respondents about the topic. First, I examined the arguments for and against gamification, which are illustrated in the following figures.

In general, it can be said that the arguments in favor of gamification were viewed positively. According to both students and lecturers, motivation, the easier understanding and mastering of the curriculum are all key positive factors.



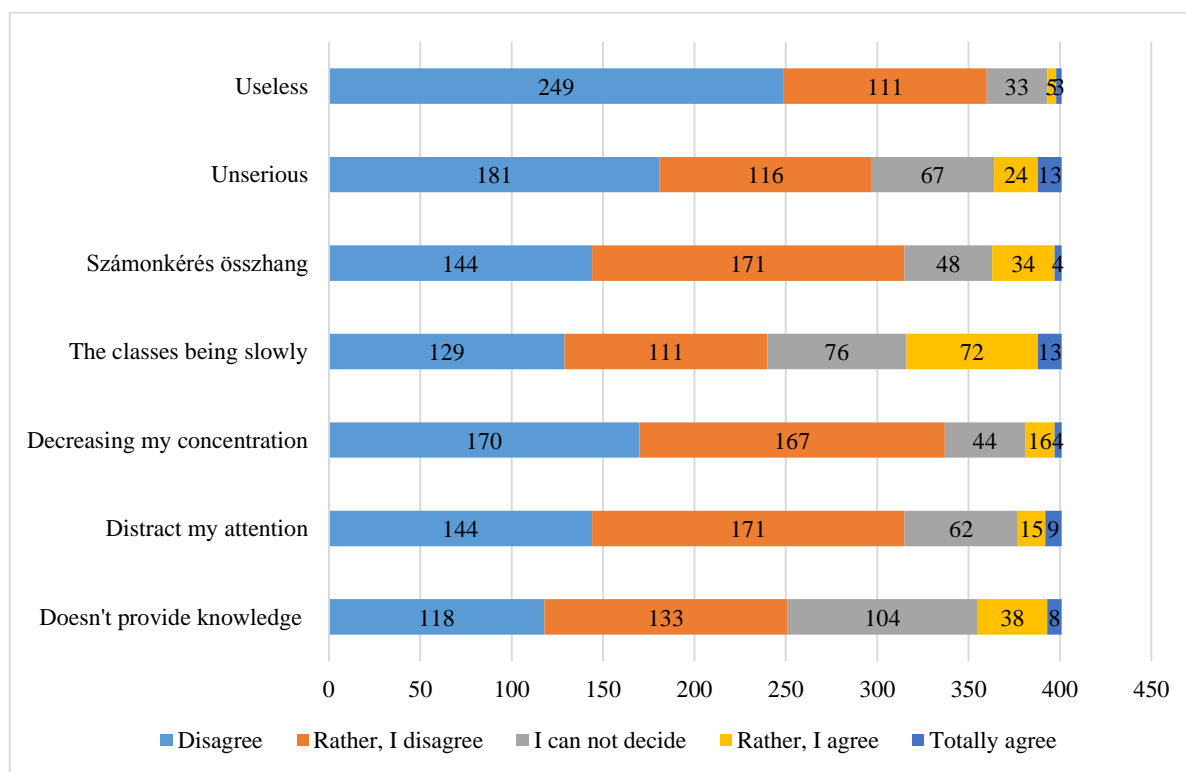
**Figure 5. Assessment of the arguments in favor of gamification (N = 401)**

*Source: Own editing, 2021*

In my opinion, a gamified task can create a competitive situation, which can also affect the group's performance.

It is outstanding to improve the enjoyment value of the lessons and to arouse the interest of the students, which is in line with what has been read in the related scientific publications. However, the opinions of students and teachers are divided over judging whether it would be easier to get or to give better grades if gamification was applied, which may also indicate a conflict of interest between the two sides.

Simultaneously, in the case of the counter-arguments, it can be stated that they mostly disagree with the uselessness of gamification (*Figure 6*). Most don't find it frivolous, but concerns have already been raised in the fillers about the progress of the lesson.



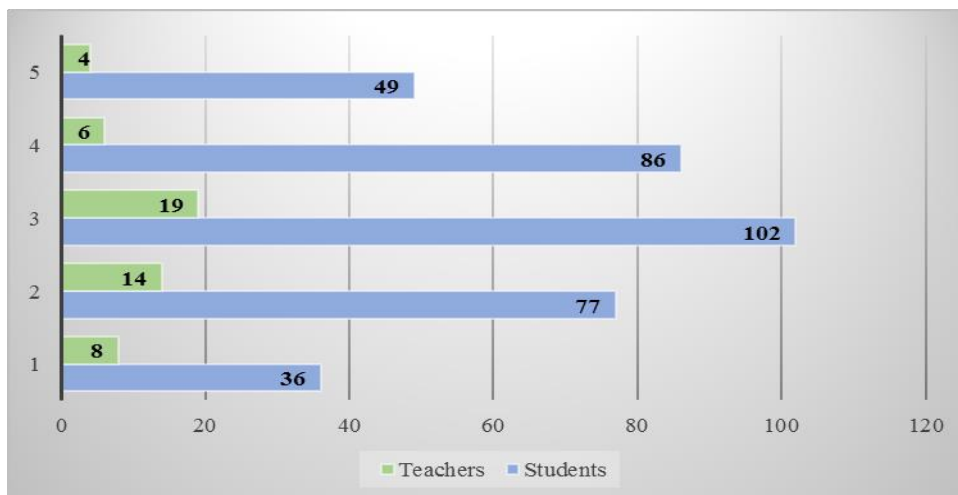
**Figure 6. Assessment of arguments against gamification (N = 401)**

*Source: Own editing, 2021*

So, in terms of usefulness, there is also a positive perception among students and teachers about gamification, but many are concerned about the lack of time frame and that the lesson would be slower than usual. Moreover, it was also raised, predominantly in the case of respondents on the students' side, whether a possible examination and the submitted curriculum would be consistent.

I also considered it important to present the results reflecting the opinions of both students and teachers in terms of how appropriate current forms of education are for us, and how appropriate they are for changing student needs and trends. This is illustrated in *Figure 7*, where a value of 1 indicates disagreement, while a value of 5 expresses complete agreement with the statement.

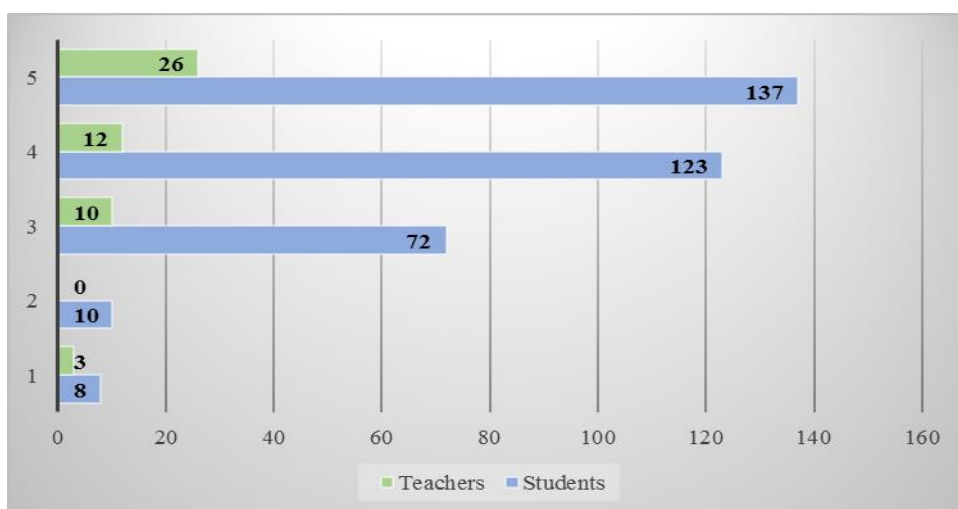
We can see that judging the adequacy of the different forms of education is a rather difficult issue for both students and teachers. Responses are close to a normal distribution in the examined groups, so it can be stated that there is no definite positive or negative perception for either the students or the lecturers about the current forms of education. (Students' average: 3.1; standard deviation: 1.19, while instructors' average: 2.67; standard deviation: 1.12).



**Figure 7. Current forms of education meet the changing trends and needs of students (N = 401)**

*Source: Own editing, 2021*

However, in judging whether there is a need for alternative educational methods in higher education, such as gamification, we can see different results.

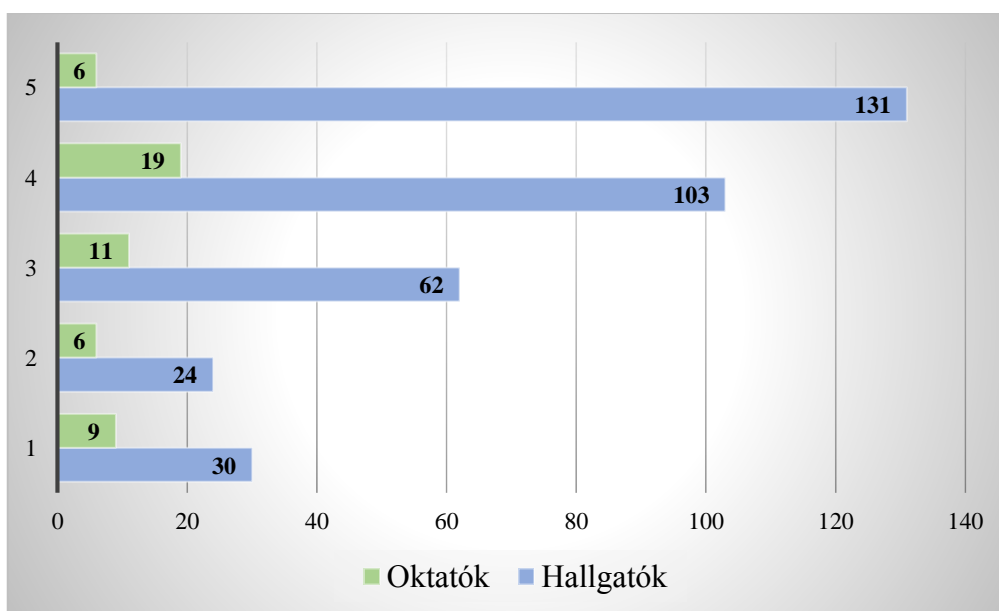


**Figure 8. There is a need for alternative educational methods such as gamification (N = 401)**

*Source: Own editing, 2021*

Based on Figure 8, we can say that the general perception of the respondents differs significantly in terms of different forms of education. Both students and faculty alike feel the need for a novel approach, the introduction of alternative teaching techniques such as gamification.

The development of computerculture and technology, just as the inclusion of younger generations in higher education, justifies educational methods based on such or similar techniques, as well as on IoT tools. This was supported by Bartha and Gubik in their work on educational challenges (BARTHA and GUBIK, 2018). We live in the days of digital pedagogy, so the effectiveness of frontal education for the net generation is questionable, and support must be provided from the educational and institutional side for students to acquire certain skills.



**Figure 9. Results of student and teacher responses on the issue of openness to examinations in a gamified framework (N = 401)**

*Source: Own editing, 2021*

In the pilot research, I have already examined among high school and college students how willing the two groups would be to take an exam in a possible gamified framework. The results of that showed a significant difference in the assessment of the two groups, so young people would prefer to take the exam in a gamified framework. Figure 9 illustrates the views of the students and faculty involved in the research. It can be observed that students are more positive about the opportunity, while it has proved to be a divisive issue among faculty.

Along with these results, based on positive assessment, I examined the problem from three sides, which were openness, motivation, and necessity. Its criterion is that the average of both student and faculty responses should reach a value of 4. In the case of openness, in terms of motivation, and to measure necessity, I examined the variables, the averages of which are shown in *Table 7*.

**Table 7. General perception of gamification among students and teachers**

Variables	Average of Student Responses	Average of Teacher Responses
Openness	4,177	4,254
Motivation	4,120	4,098
Necessity	4,060	4,137

*Source: Own editing, 2021*

**Table 8. The results of the general assessment of gamification by status**

Status	N	Rank Average	Rank Sum	Mann-Whitney	Wilcoxon W	Z	p Value
G2. Openness	Student	350	199,23	69732,00			
	Teacher	51	213,12	10869,00			
	Total	401			8307,0	69732,0	-0,862
G3. Motivation	Student	350	200,65	70226,50			
	Teacher	51	203,42	10374,50			
	Total	401			8801,5	70226,5	-0,172
E2. Necessity	Student	350	198,82	69586,00			
	Teacher	51	215,98	11015,00			
	Total	401			8161,0	69586,0	-1,050

*Source: Own editing, 2021*

To examine the difference in the perceptions of students and teachers, I performed a Mann-Whitney test again for the previous three variables, in the dimension of status (student or instructor). Looking at the results of Table 8, it can be said that no significant difference can be detected between the mean values of the two samples ( $p > 0.05$ ), so it is proven that the general assessment of both students and lecturers is positive ( $> 4.00$ ). The previous findings and the values in the table support my acceptance of the second hypothesis H2.

*H2 The general perception of gamification is positive among students and faculty.*

Based on what has been read in previous academic literature, according to which gamification is an excellent method for motivation, improving enjoyment value (eg. flow

experience), and arousing interest in the fields of marketing, education and human resources, I examined, in line with Hypothesis 5, to what extent these variables go hand in hand in higher education, and whether they show a significant positive correlation in the pro/con evaluation of gamification. As ordinal variables were compared, the results were calculated using Spearman's rank correlation, according to which values below 0.2 are weak, values between 0.2 and 0.6 are moderate, and values equal to or above 0.6 show a strong correlation between the two variables.

In terms of correlation between motivation, interest and enjoyment value in the pro/con evaluation, a positive correlation can be observed for all three variables at the significance level of  $p < 0.01$ . Based on these, the arousal of interest-motivation with a rank correlation value of 0.571 can be considered moderate, while making the lesson more enjoyable - arousal of interest with a value of 0.6 shows a strong correlation. It showed a moderate value of 0.544 for the relationship between motivation and a more enjoyable lesson. Since the results show a significantly positive correlation, I consider my third hypothesis H3 accepted.

*H3: Those who say gamification evokes interest would find the lessons more enjoyable and would be more motivated.*

The mapping of two grouping factors such as status and gender differences is necessary to support the hypotheses. Accordingly, in the following, I examined gender differences in terms of openness, motivation, and activity.

**Table 9. Results of general perception of gamification by gender**

Status		N	Rank Average	Rank Sum	Mann-Whitney	Wilcoxon	Z	p Value
G2. Openness	Male	164	193,46	31727,5				
	Female	237	206,22	48873,5				
	Total	401			18197,5	31727,5	-	0,243
G3. Motivation	Male	164	193,16	31678,0				
	Female	237	206,43	48923,0				
	Total	401			18148,0	31678,0	-	0,226
G5. Activity	Male	164	199,21	32671,0				
	Female	237	202,24	47930,0				
	Total	401			19141,0	32671,0	-	0,783

Source: Own Source, 2021

It can be derived from *Table 9* that the differences between the hypothesized genders do not have a significant effect on the variables of openness, motivation and activity I have delineated ( $p > 0.05$ ). In line with this, I reject my fourth hypothesis H4.

Then I tried to estimate the chances of falling into each category by ordinal logistic regression to find out the probability of the values of each variable in terms of gender and status for the variables examined above.

*H4 Men spend more time playing games, so they are presumably more open to gamification.*

The results of the regression can be seen in *Table 10*, where in terms of variables we can say that in one case a significant difference can be measured based on the grouping factors. Accordingly, the activity-increasing effect of gamification is judged differently by educators and students ( $p < 0.01$ ). Compared to students, the log value of teachers' odds ratio to fall into a higher category increases by 0.6912 ( $p = 0.009$ ), which in practice means that teachers consider the activating effect of gamification to be higher than students.

**Table 10. Ordinary logistic regression in terms of two grouping variables**

<b>Dependent</b>	<b>Independent</b>	<b>Coefficient</b>	<b>p-Value</b>
Openness (G2)	Status	0,8432	0,399
Motivation (G3)	Status	0,0024	0,992
<b>Activity (G5)</b>	<b>Status</b>	<b>0,6912</b>	<b>0,009</b>
Openness (G2)	Gender	-0,1652	0,357
Motivation (G3)	Gender	0,3099	0,097*
Activity (G5)	Gender	0,0338	0,856

*Source: Own Source, 2021*

Related to my hypotheses, the last grouping factor is the examination of differences between the generations. In the following, the relationship between behavioral intention and age groups per generation is being investigated. The relationship between the highest factor BI3, as a dependent variable, and the independent variable, belonging to generations (GEN), is illustrated in the following table.

**Table 11. Generational differences in the behavioral intention to use gamification**

<b>Dependent Variable</b>	<b>Independent Variable</b>	<b>Coefficient</b>	<b>p-Value</b>
Behavioral Intention to Use (BI3)	Generations (GEN)	-0.2234486	0,089**

*Source: Own Source, 2021*

According to Tables 11 and 12, there is a significant relationship between behavioral intention to use and generations at the 10% confidence level.

**Table 12. Ordinary regression results (Generations, BI3)**

	-2 Log Likelihood	Chi-Square	df	p-Value
Estimated	68,540			
Final	65,649	2,891	1	0,089

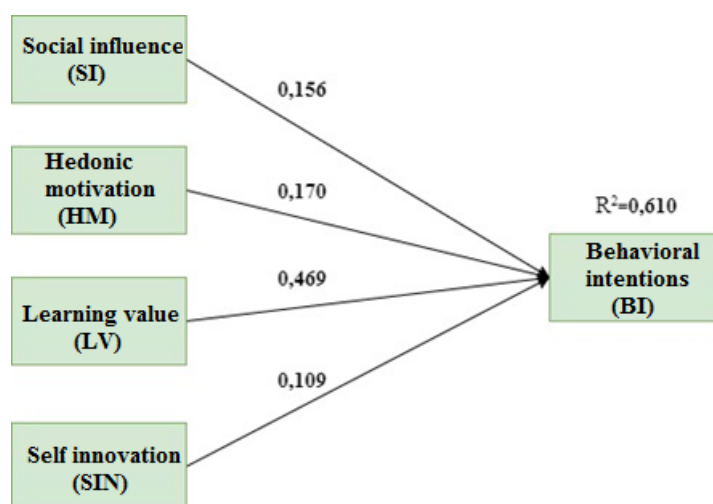
Source: Own Source, 2021

Belonging to the older generation reduces the assessment of behavioral intention to use (coefficient: -0.2234). With this, I proved that moving towards higher age groups, the behavioral intention to use gamification decreases. Therefore, I accept my fifth hypothesis (H5).

*H5 There is a generational difference in the behavioral intention to use gamification.*

### 3.3. Results of the model study

The significant effects of the model of the variables explaining the students' behavioral intention to use gamification are shown in *Figure 10*.



**Figure 10. Model of variables explaining students' behavioral intention to use gamification**

Source: Own editing, 2021

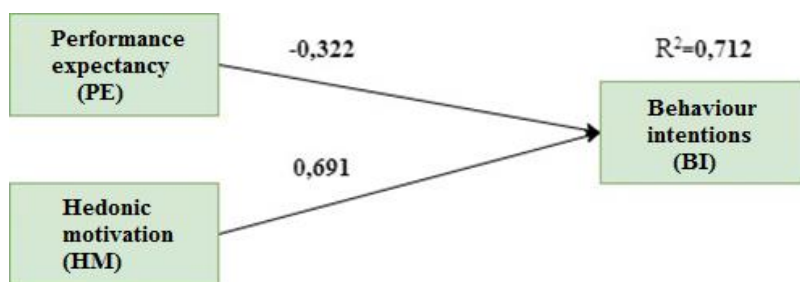
From the exogenous variables of the original model, expected performance (PE), expected effort (EE), and facilitation conditions (FC) were not included in the final model. In that

model, social impact (SI), hedonic motivation (HM), expected learning value (LV), and personal innovation (SIN) appeared as independent variables. The direct effects were performed using the standardized path coefficients indicated above the arrows in the model, which shows that a positive effect is observed in case of all significant relationships. It can be confirmed that the expected learning value (LV) has the strongest factor ( $\beta = 0.469$ ), followed by hedonic motivation (HM) ( $\beta = 0.170$ ). Social impact (SI) is the third significant factor in the model ( $\beta = 0.156$ ), while personal innovation (SIN) ( $\beta = 0.109$ ) has the least effect on R2. Overall, therefore, the explanatory power of the model describing the students' behavioral intent to use gamification (BI) is 61.2%, which corresponds to a good value in the field of social sciences. In practice, this means that students' behavioral intention to use is most influenced by the easy usage/ better performance ratio of gamification, i.e. the possibility of the energy invested and the result obtained. In addition, the experience and entertainment value resulting from the use of technology also has a great importance. It is also influenced by the opinions of important people for the students, who may be their mentors or family members. Furthermore, they are least, but significantly, influenced by their openness to the technological innovations surrounding them.

Looking at the final student model, social impact (SI), hedonic motivation (HM), expected learning value (LV), and personal innovation (SIN) emerged as independent variables, which are factors influencing behavioral intention to use (BI). In terms of outcomes, students' behavioral intention to use is mostly driven by the easy usage of gamification and the proportion of better achievable performance. Besides, the experience and fun value of using technology has also emerged. The opinions of people who are important to the students is also of great importance. Furthermore, they are least, but significantly, influenced by their openness to the technological innovations that surround them, which may be due to the fact that a large proportion of respondents belong to Generation Z, so for them new technology is part of their daily lives. These results are consistent with other technology acceptance studies investigating the relationship between higher education and gamification (CHUNG et al., 2019). However, we cannot deviate from examining the omitted variables. FC as facilitating conditions, expected performance (PE), and expected effort (EE) were not included in the final model. In the case of facilitating conditions, the generational skills already mentioned may explain the lack of effect of the variable. Similarly, in the case of e-

learning educational interfaces, the ease of use did not affect the behavioral intention to use either (GONZALEZ et al., 2012). The lack of PE and EE variables may also be explained by the relationship of young with technology, as they do not see it as a comparative advantage. As part of their everyday life, they no longer seem to apply and learn technical innovations, so Davis' statement that learning technologies and the ease of acquisition (DAVIS, 1989) have a positive effect on behavioral intention to use is no longer valid.

The model of the variables explaining the teacher's behavioral intention to use modified gamification based on significant effects is presented in *Figure 11*. With help of the standardized path coefficients ( $\beta$ ) on the arrows, it can be read that the expected performance (PE) ( $\beta = -0.322$ ), in the case of instructors, has a negative explanatory power on the dependent variable of behavioral intent to use. In parallel, hedonic motivation (HM) ( $\beta = 0.691$ ) is the strongest explanatory variable in the model that affects  $R^2$ . The full explanatory power of the modified instructor model is ( $R^2 = 0.712$ ).



**Figure 11. Model of variables explaining the behavioral intention of educators to use gamification**

*Source: Own editing, 2021*

*H6 There are external factors that influence the behavioral intention to use gamification for educators and students.*

I accept the last (H6) hypothesis of the research based on the results of both the student and the instructor model, as there were variables in both researches that had a significant effect on the behavioral intention to use gamification.

Looking at the teacher's model, a total of two variables had a significant effect on the behavioral intention to use gamification, namely expected performance (PE) and hedonic motivation (HM). Interestingly, the expected performance is perceived by teachers as a negative factor in light of behavioral intention of use. One reason for this may be that some

educators see a decrease in the performance of the activities while applying this technology, which may result from technological anxiety. In this sense, some educators perceive this relative advantage as a relative disadvantage, which has also been demonstrated previously by Celik and Yesilyurt (CELIK and YESILYURT, 2013).

The most influential factor in the educator model is hedonic motivation, which is the experience that results from the use of technology. It can increase the enjoyment value of work among educators, so it is not surprising that it greatly influences the behavioral intention to use gamification. The research of Raman and Don as well as Bower et al. found a similar result when investigating the teacher side (RAMAN and DON, 2013; BOWER, 2020).

### **3.4. Limitations and future possibilities of the research**

Among the main limitations and future directions of the research, I would like to mention that due to the qualitative sample of the study, it is considered a non-representative survey, but it is excellent for presenting the underlying correlations and processes. Based on this, I would suggest territorial expansion on the topic, which could mean research carried out at the University of Debrecen as a whole, as well as a possible survey covering the whole system of higher education. As a consequence, it might be worth examining whether there are significant effects on the perception of universities, as well as differences in the openness of their faculty.

In line with the aims of the dissertation, I would suggest expanding the qualitative research with expert interviews with the faculty members as well as the HR managers of companies using gamification in the corporate sector.

Certain specific cases of gamification in higher education might be worth examining separately, such as the introduction of competitions with simulation applications or of serious games in the corporate sector and their efficiency on the performance of business enterprises.

The omitted variables of the research models, which were not included in the final model, could be worth examining in a another research in terms of cause and effect, which could reveal more deeply the intrinsic motivations behind each influencing factor as a behavioral intention of use.

Among the limitations of the research, as well as its future possibilities, I would mention the extension of the created models by including moderator variables, as the aim of the study was to examine only the relationship between endogenous and exogenous variables. In this sense, extending age, gender, and previous experience with moderating variables and examining the results could form the basis of a later study.

In addition, expanding the instructor model with newer constructors may provide a future opportunity to investigate the relationship between other previously applied variables such as perceived risk, trust, personal innovation, and based on the results, technology anxiety may be a key opportunity for research.

Finally, due to the topic of the research and its rather rapid development, I consider it important to emphasize that the data of individual analyses and future estimates (for example literature analysis) as well as the availability of databases are constantly changing, so an estimated-fact thematic keyword comparison could provide valuable results for those investigating this topic.

#### **4. NEW AND NOVEL FINDINGS OF THE THESIS**

**Thesis 1:** The possibilities of gamification in higher education are examined both internationally and domestically. Year by year, the number of researches in international databases is showing an increasing trend, however, the publication of Hungarian studies in languages used internationally is less conducive to the Hungarian academic literature on gamification and its wider knowledge.

**Thesis 2:** Based on the literature used and the results of the dissertation, it can be stated that even though men spend more time with games, based on the research results, there is no significant difference between the genders in terms of openness to gamification.

**Thesis 3:** The general perception of gamification among students and lecturers is positive, which raises the possibility of supporting the use of gamification in certain courses, as well as its inclusion in certain subject matters as a modern educational technique.

**Thesis 4:** Based on the results, those who say that gamification arouses interest would consider lessons more enjoyable and would be more motivated. In this sense, given the current situation, the use of gamification as a long-term strategy would also have a positive effect on some motivational problems in personal and distance learning.

**Thesis 5:** In terms of results, there is a generational difference in the behavioral intention to use gamification, according to which those in the older age category show less interest in it.

**Thesis 6:** Students' behavioral intention to use is most influenced by the simple usage of gamification and the better achievement ratio that can be earned by it. In addition, the experience and fun that comes with using the technology stands out when examining the model.

**Thesis 7:** In the case of educators, the behavioral intention to use gamification is most strongly influenced by hedonic motivation, while the negative side was dominated by expected performance, which may also indicate the technological anxiety on the educators' side.

## 5. PRACTICAL APPLICABILITY OF THE RESULTS

My research has also confirmed that the scholarly literature on gamification has undergone tremendous development and transformation in recent years. The focus from the initial marketing related studies shifted to the topic of education. By analyzing scientific literature, answering research questions, and verifying objectives and hypotheses, I consider the statement that higher education needs innovative tools that apply different technologies and techniques, such as gamification, confirmed. In education, the positive assessment of faculty and students can provide an opportunity and guidance for faculty leaders to include it as a recommendation in certain subject areas where the responsible instructor would apply it voluntarily. I have outlined the steps and possibilities of introducing gamification paired with the appropriate tools and methods, which is briefly illustrated in the following figure.



**Figure 12 Steps to introduce gamification**

*Source: Own editing, 2021*

In line with my objective, I have made recommendations that can be used in practice as the initial steps to launch a gamified course, covering the opportunities, good practices and applications provided in the university framework.

Several analyses and scholarly literature have supported the claim that gamification can have a great effect on evoking students' interest and motivation, as well as making lessons more enjoyable by its application. This is especially true given the current pandemic situation and the resulting online education. Furthermore, it is important to note that there are also generational differences in terms of interest in gamification, so the older age group values gamification less than younger people. This confirms that a possible Faculty recommendation should only appear as an option among the methods.

The models demonstrating the behavioral intention to use of students and teachers show that in the case of students, easy usage and the proportion of better achievement ratio play a major role, and the experience and entertainment values resulting from the use of technology proved to be the most important external factors. From an educator perspective, hedonic motivation has the greatest positive effect on the behavioral intention to use, but expected performance has emerged as a negative factor, which may indicate the technological anxiety of instructors, which can be mitigated by IT and other related trainings in higher education. With this, my research has highlighted the most important external factors that faculty leaders and educators need to consider in the case of a course that may use gamification, but it can also contribute to increasing the strategic competitiveness of a university or faculty.

## 6. LIST OF PUBLICATIONS RELATED TO THE RESULTS



**UNIVERSITY of  
DEBRECEN**

**UNIVERSITY AND NATIONAL LIBRARY  
UNIVERSITY OF DEBRECEN**

H-4002 Egyetem tér 1, Debrecen

Phone: +3652/410-443, email: [publikaciok@lib.unideb.hu](mailto:publikaciok@lib.unideb.hu)

Registry number: DEENK/426/2021.PL  
Subject: PhD Publication List

Candidate: Tamás Kovács

Doctoral School: Károly Ihrig Doctoral School of Management and Business

MTMT ID: 10060940

### List of publications related to the dissertation

#### Articles, studies (7)

1. **Kovács, T.:** Role of gamification at the University of Debrecen, with special regard to the Faculty of Economics.  
*Journal of Agricultural Informatics*. 12 (2), 28-36, 2021. EISSN: 2061-862X.  
DOI: <http://dx.doi.org/10.17700/jai.2021.12.2.601>
2. **Kovács, T., Szilágyi, R., Várallyai, L.:** The role of gamification in sustainable agricultural higher education.  
In: Bio-economy and Agri-production : Concepts and Evidence. Ed.: Dionysis Bochtis, Charisios Achilles, Georgios Banias; Maria Lampridi, Academic Press Ltd Elsevier Science Ltd, London, 279-288, 2020. ISBN: 9780128197745
3. **Kovács, T., Várallyai, L., Szilágyi, R.:** Gamification and augmented reality in agriculture: Education and practice possibilities.  
*Georgikon for Agriculture*. 23 (3), 103-119, 2019. ISSN: 0239-1260.
4. **Kovács, T., Várallyai, L.:** A játékosítás az emberi erőforrás területén, egy kreatív toborzási technika napjainkban.  
*International Journal of Engineering and Management Sciences*. 3 (5), 373-382, 2018.  
EISSN: 2498-700X.  
DOI: <http://dx.doi.org/10.21791/IJEMS.2018.5.35>
5. **Kovács, T., Várallyai, L.:** Gamifikáció, avagy a játékosítás szerepe napjainkban.  
*International Journal of Engineering and Management Sciences*. 3 (3), 171-180, 2018.  
EISSN: 2498-700X.
6. **Kovács, T., Várallyai, L., Szilágyi, R.:** Possibility of agri- and food industry applications in higher education.  
*Journal of Ecoagritourism*. 14 (1), 36-41, 2018. ISSN: 1844-8577.





7. **Kovács, T.**, Várallyai, L., Nagy, K., Szilágyi, R.: Development of Farm simulation application, an example for gamification in higher education.  
*Journal of Agricultural Informatics = Agrárinformatika folyóirat.* 8 (2), 12-21, 2017. EISSN: 2061-862X.  
DOI: <http://dx.doi.org/10.17700/jai.2017.8.2.373>

### List of other publications

#### Articles, studies (2)

8. **Kovács, T.**, Várallyai, L.: Egészségügyi mobilapplikációkra történő használati szándék mérése UTAUT-modellben: tanulmány egy online felmérés eredményei alapján.  
*Információs Társadalom.* 21 (1), 166-187, 2021. ISSN: 1587-8694.  
DOI: <https://dx.doi.org/10.22503/inftars.XXI.2021.1.7>  
IF: 0.163 (2020)
9. **Kovács, T.**: Agrárkereskedelmi portál fejlesztése és a közösségi média marketingje.  
*Economica.* 7 (3), 122-126, 2014. ISSN: 1585-6216.

#### Conference presentations (1)

10. **Kovács, T.**: Debrecen város és a környező települések lakóinak egészségügyi alkalmazások használati szokásai.  
In: Interdiszciplinaritás a régió kutatásban IX." nemzetközi konferencia IV és "A jog tudománya, a mindennapok joga III." Tudományos konferencia : rezümé kötet. Szerk.: Dajnoki Krisztina, Pierog Anita, Szűcs Lászlóné, Siska Katalin, Debreceni Egyetem Gazdaságtudományi Kar, Debrecen, 27, 2019. ISBN: 9789634901518

**Total IF of journals (all publications): 0,163**

**Total IF of journals (publications related to the dissertation): 0**

The Candidate's publication data submitted to the iDEa Tudóstér have been validated by DEENK on the basis of the Journal Citation Report (Impact Factor) database.

31 August, 2021



## 7. REFERENCES

- Ain, N., – Kaur, K., – Waheed, M. (2016): The influence of learning value on learning management system use: An extension of UTAUT2. *Information Development*, 32(5), 1306-1321.
- Algavi, L. O., – Desyaeva, N. D., – Kilpelyaynen, E. S., – Volkova, I. I. (2017): Gamification in Education: Boss Fight. *EEIA2017 Proceedings*. Moscow: Russian Acad. Educ 28 (2017): 61-69.
- Barna, B., – Fodor Sz.(2017): An empirical study on the use of gamification on IT courses at higher education. *International Conference on Interactive Collaborative Learning*. Springer, Cham, pp. 56-63
- Bartha, Z., – Sáfrányné Gubik, A. (2018): Oktatási kihívások a technikai forradalom tükrében. *Észak-magyarországi Stratégiai Füzetek*, 15(1), 15-29.
- Bogost, I. (2014): Why gamification is bullshit. *The gameful world: Approaches, issues, applications* pp. 65-79.
- Bollen, K. A. (1989): *Structural equations with latent variables*. New York: Wiley,
- Borges, S., – Durelli, V. H., – Reis, H. M., – Isotani, S. (2014): A systematic mapping on gamification applied to education. In *Proceedings of the 29th annual ACM symposium on applied computing* (pp. 216-222).
- Bower, M., –DeWitt, D., –Lai, J. W. (2020): Reasons associated with preservice teachers' intention to use immersive virtual reality in education. *British Journal of Educational Technology*, 51(6), 2214-2232.
- Celik, V., – Yesilyurt, E. (2013): Attitudes to technology, perceived computer self-efficacy and computer anxiety as predictors
- Chung, C. H., – Shen, C., – Qiu, Y. Z. (2019): Students' acceptance of gamification in higher education. *International Journal of Game-Based Learning (IJGBL)*, 9(2), 1-19.
- Davis, F. D. (1989): Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*. v. 13, n. 0, pp. 319–340.
- Dicheva, D – Dichev, C. – Agre, G. – Angelova, G. (2015): Gamification in Education: A Systematic Mapping Study. *Educational Technology & Society*. 18. pp. 75-88.
- Dreimane, S., (2019): Gamification for education: Review of current publications. *Didactics of smart pedagogy* pp. 453-464.
- Funk, J. B., – Buchman, D. D. (1996): Children's perceptions of gender differences in social approval for playing electronic games. *Sex Roles*, 35(3-4), pp. 219-231.
- Gonzalez, G. C., – Sharma, P. N., – Galletta, D. F. (2012): The antecedents of the use of continuous auditing in the internal auditing context. *International Journal of Accounting Information Systems in Press*. pp. 248-262 doi: 10.1016/j.accinf.2012.06.009
- Greenberg, B. S., – Sherry, J., – Lachlan, K., – Lucas, K., – Holmstrom, A. (2010): Orientations to video games among gender and age groups. *Simulation & Gaming*, 41(2), 238-259.
- Hair, J. – Black, W. – Babin, B. – Anderson, R. (2010): *Multivariate Data Analysis*. 734p. (Exploratory Data Analysis in Business and Economics).

- Hartmann, T., – Klimmt, C. (2006): Gender and computer games: Exploring females' dislikes. *Journal of Computer-Mediated Communication*, 11(4), 910-931.
- Harviainen, J. T., – Meriläinen, M. (2019): Educational gamification: Challenges to overcome and to enjoy. *Neo-simulation and gaming toward active learning*. Springer, Singapore, pp. 553-560.
- Henseler, J., Ringle, C. M. és Sinkovics, R. R. (2009): „The use of partial least squares path modeling in international marketing”, *Advances in International Marketing*, 20, pp. 277–319.
- Huan, Y., – Li, X. –Aydeniz, M., – Wyatt, T. (2015): Mobile learning adoption: An empirical investigation for engineering education. *International Journal of Engineering Education*, 31(4), pp. 1081-1091.
- Ibrahim, R., – Khalili K., – Azizah J. (2011): Towards educational games acceptance model (EGAM): A revised unified theory of acceptance and use of technology (UTAUT). *International Journal of Research and Reviews in Computer Science* 2.3 p. 839.
- Kenesei, Zs., (2020): A technológia használatának segítő tényezői idős korban. *Vezetéstudomány/Budapest Management Review* 51.p. 10
- Kovács, A. (2013): Strukturális egyenletek modelljének alkalmazása a Közös Agrárpolitika 2013-as reformjának elemzésére. *Statisztikai szemle*. v. 93, n. pp.8–9,
- Lin, C.-P. – Bhattacharjee A. (2008): "Learning online social support: an investigation of network information technology based on UTAUT." *CyberPsychology & behavior* 11.3 pp. 268-272.
- Lucas, K., – Sherry, J. L. (2004): Sex differences in video game play: A communication-based explanation. *Communication research*, 31(5), pp. 499-523.
- Majó-Petri, Z. – Pronay, S., – Huszár, S., – Dinya, L. (2020): Digitális transzformáció az egyetemeken: Egy tömeges, nyílt, online oktatási működési modell, és az egyetemisták digitális oktatáshoz fűződő attitűdjének vizsgálata [Investigating a MOOC educational model and the attitude of university students towards digital education *Információs társadalom: társadalomtudományi folyóirat* 20.1 pp. 72-94.
- Martín-Martín, A., – Thelwall, M., – Orduna-Malea, E., – López-Cózar, E. D. (2020): Google Scholar, Microsoft Academic, Scopus, Dimensions, Web of Science, and OpenCitations' COCI: a multidisciplinary comparison of coverage via citations. *Scientometrics*, pp. 1-36.
- Martí-Parreño, J., – Seguí-Mas, D., – Seguí-Mas, E. (2016): Teachers' attitude towards and actual use of gamification." *Procedia-Social and Behavioral Sciences* 228 pp. 682-688.
- Muntean, C, R.(2011): Raising engagement in e-learning through gamification." *Proc. 6th international conference on virtual learning ICVL*. Vol. 1. 2011.
- Münnich, Á. – Hidegkuti, I., (2012): Strukturális Egyenletek Modelljei : Oksági Viszonyok és Komplex Alkalmazott pszichológia. v. 1, pp. 77–102.
- Ortiz Rojas, M. E., – Chiluíza, K., – Valcke, M. (2017): Gamification and learning performance: A systematic review of the literature. *11th European Conference on Game-Based Learning (ECGBL)*., 2017.

- Pedro, L. Z., – Lopes, A. M., – Prates, B. G., –Vassileva, J., – Isotani, S. (2015): Does gamification work for boys and girls?: An exploratory study with a virtual learning environment. In Proceedings of the 30th Annual ACM Symposium on Applied Computing, pp 214-219.
- Poole, S. M., – Kemp, E., – Patterson, L., – Williams, K. (2014): Get your head in the game: using gamification in business education to connect with generation Y.pp. 14-25
- Raman, A., – Don, Y. (2013): Preservice teachers' acceptance of learning management software: An application of the UTAUT2 model. *International Education Studies*, 6(7), pp. 157-164.
- Rapp, A., – Hopfgartner, F., – Hamari, J., – Linehan, C., – Cena, F. (2019): Strengthening gamification studies: Current trends and future opportunities of gamification research, *International Journal of Human-Computer Studies*, Volume 127, 2019, pp. 1-6, ISSN 1071-5819, <https://doi.org/10.1016/j.ijhcs.2018.11.007>.
- Silva, R., – Rodrigues, R. – Leal, C.(2020): Gamification in management education - A literature mapping. *Educ Inf Technol* 25, pp. 1803–1835 (2020). <https://doi.org/10.1007/s10639-019-10055-9>
- Sulaiman, M. A., – Sadeeq, M., –Abdulraheem, A. S., – Abdulla, A. I. (2020): Analyzation study for gamification examination fields." *Technol. Rep. Kansai Univ* 62.5 pp. 2319-2328.
- Sung, H. Y., – Hwang, G. J. (2013): A collaborative game-based learning approach to improving students' learning performance in science courses. *Computers & Education*, 63, pp. 43-51.
- Varannai, I., – Sasvári, P. L., – Urbanovics, A. (2017): The use of gamification in higher education: an empirical study. *International Journal of Advanced Computer Science and Applications*, 8(10), pp. 1-6.
- Venkatesh, V., – Thong, J. Y., – Xu, X. (2012): Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS quarterly*, pp. 157-178.
- Zhang, M., – Song, C. L. (2013): Analysis on the Current Situation of the Self-Innovation of China's Manufacturing Industry Based on Structural Equation. *International Journal of Business and Management*, 8 (15), p. 124.