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APPROBATION OF THE GAMIFIED LEARNING PROCESS MODEL THROUGH PARTICIPATORY ACTION RESEARCH

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ABSTRACT

Gamification has shown the potential in developing motivation and changing behaviours. Still, research reveals that games as a learning tool are not sufficiently approbated in learning environments and longitudinal studies are rare. Theoretical objectives for gamification are essential to test in the learning environment. For this reason, The Gamified Learning Process Model developed by the author of this article was integrated into a higher education study course for future teachers with the aim of testing the model's effectiveness in the learning environment and evaluating the development of learning motivation among students. Students were divided into a control group (n = 20), where the gamification model was not present in their learning process, and a research group (n = 63), who were offered a gamification strategy to promote attendance, attention span, positive emotions, positive associations with the subject and lecturer, and motivation to master and better understand the course content. A points system was established in which points were awarded for attending lectures, completing a game-based task after each course topic (virtual breakout rooms or quizzes), and completing the course's final quiz (team competition). At the end of the semester, all the points were collated, and students with the highest score gained extra points in the final exam.

Participatory action research was conducted to collect feedback using a student survey based on the Motivation scale of the Motivated Strategies for Learning Questionnaire by Pintrich et al., adapting it and supplementing it with questions about the use of gamification elements and their impact on the development of motivation. The data collected were analyzed using the SPSS program and are presented in the article.

Keywords: *Action research; Gamification; Gamified Learning Process Model; Game-Based Learning; Learning Motivation.*

Introduction

Considering that gamification is a relatively new concept and serious research of this phenomenon has only started a few years ago, it is not yet possible to fully understand

the impact of this concept on pedagogical processes in the long term (Marklund, 2015). Since the 2002, when the term "gamification" was introduced by programmer Nick Pelling (Pelling, 2011), the research of this concept that describes a usage of game elements in non-game concept to motivate, engage and change attitude (Deterding et al., 2011; Kapp, 2012; Doherty et al., 2017; Woodcock & Johnson, 2017), has emerged and researchers are looking for answers not only to the question – "does it works?" but also how to use it more efficient. From the research, that defines and describes the concept (Deterding et al., 2011; Landers, 2014; Doherty et al., 2017; Domínguez et al., 2013; Karagiorgas & Niemann, 2017), the research have gone to the analysis of the influence of the gamification on specific audiences, environment and selected game elements on the motivation (Ibrahim et al., 2021; Hursen & Bas, 2019). However, there are still many unanswered questions about gamification and too little research that provides a comprehensive insight into the principles and effects of gamification on various processes, especially empirical longitudinal studies (Domínguez et al., 2013; Hanus & Fox, 2015; Landers & Callan, 2011).

One of the essential elements of the learning process is learning motivation, and in the context of gamification, it is often mentioned as the goal of gamification of the process. Already in the early 1980s, even before N. Pelling had proposed the concept of gamification, Thomas W. Malone published the first scientific studies explaining the addictive nature of computer games and how to transfer their positive aspects to other fields, focusing on how to motivate people to engage in certain activities (Malone, 1980; 1981; 1982). Even with the development of gamification research, many scientific articles on gamification of the learning process focus directly on the analysis of motivational development, but research on the effects of gamification on motivation has shown mixed results. There are articles that find that student performance and learning motivation improved after the use of gamification elements in the study course (Domínguez et al., 2013). The use of gamification in the study process has shown a positive effect on the development of internal motivation, indicating that both students and educators benefit from the use of gamification in the learning process (Luarn et al., 2023). Studies of gamification and learning motivation have also been carried out at the primary school stage, analyzing the impact of gaming on students' motivation to learn natural sciences. The results of the study showed that the indicators of learning motivation of the students involved in the study in learning natural sciences increased significantly (Hursen & Bas, 2019). It should be mentioned that there are also cases when gamification did not affect the motivation and attitudes of learners as expected (Monterrat et al., 2017). A study conducted in 2015 found that gamification of the learning process even reduced students' intrinsic motivation, indicating that gamification transforms intrinsic motivation into extrinsic motivation (Hanus & Fox, 2015).

Despite the potential of games described by many researchers, studies reveal that games as a learning tool are not sufficiently implemented in formal education (Gros, 2006), and the the approbation of theoretical objectives are wery important. For this reason, The Gamified Learning Process Model developed by the author of this article and

evaluated using the Delphi method described in "The Gamified Learning Process Model" (Dreimane, 2024) was approbated in the learning environment to test its effectiveness in the learning process. The approbation of the Gamified Learning Process Model was carried out using participatory action research at the same time as the model was evaluated. Participatory action research was selected as the research method to achieve the goal of testing the Gamified Learning Process Model in a learning process, involving students in the process, and checking the model's effectiveness in the learning environment. The model and its pedagogical principles are described in detail by Dreimane (2024); this article provides data collected via participatory action research and conclusions that helped to shape the final version of the Gamified Learning Process Model.

Methodology

To achieve the set goal of this paper, this research was conducted in three stages.

Stage 1 – Participatory Action Research

Action research was formulated for the first time in 1946 by Kurt Lewin (Lewin, 1946). Lewin explained action research as a research-based series of action experiments consisting of planning, acting, observing, and reflecting before repeating all these actions until the desired result is achieved, and he also believed that research should take place in a natural environment with the involvement of all its participants (Lewin, 1946; Carr & Kemmis, 1986). Lewin's insights were further explored and developed by Wilfred Carr and Stephen Kemmis, who defined three types of action research: (1) technical action research, (2) practical action research, and (3) participatory action research (Carr & Kemmis, 1986; Thawinwong & Sanrattana, 2022). By applying action research, researchers can study theoretical principles in a practical framework, review their own or others' actions with the aim of improving them and making them more effective, and promote change at the group, organizational, and even societal levels (Dickens & Watkins, 1999). Action research is more effective when its participants engage in self-reflection and problem-solving (Brown et al., 1982), which is also at the heart of participatory action research. For this reason, this work adopted a participatory action research design to approbate the Gamified Learning Process Model when working with students and asking them to reflect on the model's effectiveness and the development of their learning motivation at the end of the study course.

Stage 2 – Motivated Strategies for Learning Questionnaire

In order to evaluate the model's influence on the development of students' learning motivation, students involved in the study conducted a survey based on the Motivated Strategies for Learning Questionnaire (MSLQ) as part of the participatory action research.

The MSLQ is designed to assess and measure the development of motivation in various aspects. It consists of 81 questions divided into two scales: the Motivation scale and

the Learning Strategies scale. The Motivation scale includes 31 questions about intrinsic and extrinsic motivation, the value of the learning task, control over learning, self-efficacy, and performance and anxiety in the learning process. The Learning Strategies scale includes 50 questions about cognitive and metacognitive strategies, critical thinking, self-regulated learning, the influence of the learning environment and resources, seeking support, and learning in pairs or groups (Pintrich et al., 1991; Garcia & Pintrich, 1996). The survey assumes that the answers to the questions are given on a Likert scale and that the survey questions may be modified and adjusted according to the specifics of the study.

The MSLQ Motivation scale was used when creating the survey used for this study. The questions were adapted and supplemented to offer answers as to whether the integration of gamification elements and game-based learning strategies in the learning process contributes to the development of learning motivation, looking at aspects of intrinsic, extrinsic, and external motivation, such as self-efficacy and the learning task, the value of the methods, and tools used (see Table 1).

Stage 3 – Statistical Package for the Social Sciences

Statistical data processing was performed using the Statistical Package for the Social Sciences (SPSS) and Microsoft Excel software, analyzing:

1) Cronbach's alpha test results;
2) Kolmogorov-Smirnov test results;
3) Mann-Whitney U test results; and
4) descriptive statistics.

The author of this article was the one who created the gamification strategy and implemented it in the study process with university students throughout the semester and was an active participant, not just an observer. At the beginning of the course, all students were informed verbally about the gamification strategy applied and an option was given not to engage if one did not wish to. At the end of the course, students were asked to fill out a questionnaire if they wanted to participate in a further study, where the obtained data would be analyzed. The questionnaire was anonymous and the results were used in aggregate form.

Results

The research results are described according to the research stages described earlier. The first stage of the research – the participatory action research – was carried out during the 2022/2023 academic year, gamifying two study courses at the University of Latvia. In total, 83 students were involved, divided into a research group ($n = 63$) and a control group ($n = 20$). More students attended the lectures, but these 83 students were the ones who filled in the questionnaire afterward (not an mandatory action) and were involved in the evaluation process.

The action research was carried out after the first iteration by the Delphi method, based on the second version of the Gamified Learning Process Model, and tested in

the learning environment. This research was a step that helped to shape the final version of the Gamified Learning Process Model (Dreimane, 2024). The second version of the model consisted of the following six steps:

1. Identifying the problem and setting learning goals
2. Evaluation of the situation, environment, and target audience
3. Structuring the gamification process (strategy)
4. Selection of gamification elements
5. Implementation
6. Evaluation of the process

Step 1: Identifying the problem and setting learning goals

In step 1, the study course was evaluated by the author of this article, and problems related to the course and its attendance were identified. Lectures lasted between 4.5 and 6 hours in one day, not including breaks, depending on the course. Although the course is extensive in terms of content, attendance is not mandatory, but it is nevertheless desirable so that students can fully learn the entire course content and successfully achieve learning results. Accordingly, several gamification goals were determined for the students:

1) to promote maximum attendance of the study course;
2) to attract and keep students' attention throughout the day; and
3) to make the theoretical course engaging and interesting by developing learning motivation.

Step 2: Evaluation of the situation, environment, and target audience

Audience: students in the first year of the bachelor's study program "Primary Education Teacher" and the second year of the bachelor's study program "Teacher" were involved in the process of approving the pedagogical model of playing games, without or with minimal prior knowledge of the theoretical positions to be learned in the course. Most students had no difficulty using technology and had a good knowledge of English. The possibility for students to use mobile devices in face-to-face lessons and computers as part of remote lessons was clarified during the first lecture.

Environment: A semi-distance learning process was implemented. In remote classes was used the MS Teams platform, which offers the opportunity to present, demonstrate audio-visual materials, complete tasks on digital platforms, and devide in groups using the affordance offered by MS Teams to create separate rooms within the event. Users can connect to remote classes from a computer, as well as from a phone or tablet; however, users will not always be able to see the audience's faces and emotions for feedback because not all participants turn on their cameras.

Face-to-face lessons were held on the University of Latvia premises. The teacher had access to a computer, projector, blackboard, and other equipment if needed. It is impossible to predict how many students will bring their own laptops or tablets to the lecture to complete assignments; however, it is possible to provide students with university tablets for group work or searching for information.

Step 3: Structuring the gamification process (strategy)

In order to solve the problems identified and achieve the gamification goals, a gamification strategy was developed for the duration of one academic semester. The gamification strategy consisted of several small gamification goals and one big gamification goal at the end of the semester.

The small gamification goals included a scoring system for different types of tasks that students had to complete within the semester, with each completed task receiving a certain number of points that were added together to form a score for the main goal. The main goal was the opportunity to get one extra point at the end of the course in addition to the number of exam points, which could help students to improve their grade. This privilege went to the student with the highest score at the end of the semester. Points were awarded for:

1) Attendance.
2) Tasks: Each day of the course, students were offered game-based learning tasks and tests, and at the end of each major topic, students were offered digital breakout rooms. For completing each such task, the student received 1 point.
3) Grand final quiz: To help repeat what they had learned in the course throughout the semester, in the last lesson, students divided into teams and competed with each other in a quiz that included questions about all the topics learned during the course. This gave them the opportunity to have a good time and to repeat the topics learned. All participants received points according to their place on the leaderboard.

Step 4: Selection of gamification elements

This step involved the selection of gamification elements according to the gamification strategy created. Game-based learning platforms, like escape rooms and quizzes, were also selected and created.

Step 5: Implementation

At the beginning of the study course (in the first lesson), students were introduced to the rules and tasks to follow in order to receive a prize at the end of the course. The gamification strategy was carried out throughout the semester.

Step 6: Evaluation of the process

Lessons were evaluated at the end of each day to understand whether the chosen platform and game elements were appropriate for the audience. Students' opinions were also collected.

The second stage of the research involved the MSLQ to evaluate the influence of the model on the development of students' learning motivation.

In order to get a more complete picture of the development of the learning motivation of students whose learning process was gamified (n = 63), the research also included a control group (n = 20) whose learning process was not integrated with a gamification

strategy. The questions asked to both groups of respondents were divided into categories pertaining to intrinsic and extrinsic motivation, the value of tasks, learning methods, cognitive load, self-efficacy, and the role of the teacher. A summary of the survey is depicted in Table 1.

Table 1 Survey summary

	Research group	Control group
Participants	63	20
Questions	35	27
Type of question	34 – Likert scale 1 – open-ended	26 – Likert scale 1 – open-ended
Intrinsic motivation	4	4
Extrinsic motivation	4	4
Value of the task	5	5
Learning methods	16	8
Cognitive load	2	2
Self-efficacy	2	2
Role of the teacher	1	1
Comments	1	1

Students from both groups were asked to fill in the MSLQ after the final exam at the end of the course. As such, the answers reveal the situation after the application of the gamification strategy ended.

The third stage of the research involved data analysis with SPSS. When starting the data analysis, the issue of whether the questions included in the survey and the answers given to them were sufficiently homogeneous was assessed. The Cronbach's alpha test was used for this purpose, evaluating the internal consistency of the Likert scale and setting the critical value at 0.6. The results (see Table 2) show that the Cronbach's alpha test result for all 34 study group questions is 0.888, which is considered a high internal consistency. The highest value of Cronbach's alpha can be observed in the "Teaching methods" group of questions (0.879), which can be considered a very high coherence indicator. The "Cognitive load" group of questions shows a negative value (–0.603). However, it is based on an inverted question; thus, a negative value shows that the respondents answered the question with the answer "I do not agree," which, taking into account the formulation of the question, allows us to conclude that students did not feel cognitive overload and fatigue at the end of the lessons. Indeed, the second question from this group confirms that the students felt a sense of satisfaction at the end of the lessons. In general, all other groups of questions also exceed the set critical value of 0.6, which shows that the internal consistency of the questions is acceptable.

Table 2 Cronbach's alpha test results

Question group	Cronbach's alpha value
Intrinsic motivation	0.535
Extrinsic motivation	0.726
Value of the task	0.769
Learning methods	0.879
Cognitive load	−0.603
Self-efficacy	0.690
Together	**0.888**

The Kolmogorov-Smirnov test was used to test the fit of the data to a parametric or non-parametric distribution. Since the p-value for all questions was below the value of 0.05, a non-parametric method of data analysis needed to be used, which is the Mann-Whitney U test within the scope of this work.

The Mann-Whitney U test is a non-parametric test for testing hypotheses and comparing two samples (Nachar, 2008) and is appropriate for comparing and analyzing the responses of the study group and the control group to the MSLQ survey questions. This test also has the advantage of analyzing data obtained from a small number of respondents (Nachar, 2008), who, in this case, comprised 63 students in the research group and 20 in the control group.

If $p < 0.05$, then the medians have statistically significant differences. Accordingly, a statistically significant difference in the medians of the study group and the control group was found for 11 questions (see Table 3) and four groups of questions (see Table 4).

The most significant difference between the answers of the study group and those of the control group can be observed in questions related to the value of the performances: $p = 0.000$ for both question 10 ("I am very interested in the content of this course") and question 12 ("I like this course"). The other two questions about the value of the exercises also show a statistically significant difference: $p = 0.041$ for question 13 ("It is very important for me to understand the topics of this course") and $p = 0.038$ for question 11 ("I think that what I learned in this course will be useful to me").

It is possible to compare the questions about the teaching methods and techniques used only partially because game-based learning was only used for the research group; therefore, these questions cannot be compared. However, question 17 ("The learning methods used within the course helped to keep my attention throughout the day") showed a statistically significant difference between the two groups of respondents ($p = 0.002$), as did question 21 ("The methods used helped to form positive associations with the study course: group work"), where $p = 0.012$.

Another statistically significant difference in the respondents' answers can be observed in the question whether students have a cognitive load during the study course. The plan was to reduce it with the implementation of the gamification strategy.

Accordingly, for question 20 ("At the end of each lesson (day), I felt satisfied with what I had done and learned"), $p = 0.003$.

There was considerable variation in the group of questions to evaluate self-efficacy. The indicator of question 29 ("I am sure that I have understood even the most difficult topics taught by the teacher in this course") was $p = 0.002$, while in question 30 ("I believe that the teacher facilitated the learning of the course content"), $p = 0.001$.

Table 3 Mann-Whitney U test results (individual questions)

Question	Group	N	Mean rank	Sum of ranks	U	Z	P
1. I was most satisfied with this course's opportunity to understand the learning content as fully as possible	Control group	20	30.55	611.00	401	−2.716	0.007
	Research group	63	45.63	2875.00			
2. I prefer course assignments, methods, and apps that stimulate curiosity and interest, even when the topic is difficult	Control group	20	40.13	802.50	592.5	−0.463	0.643
	Research group	63	42.60	2683.50			
3. I prefer this course's assignments that really challenge me so that I can acquire new knowledge	Control group	20	35.13	702.50	492.5	−1.54	0.124
	Research group	63	44.18	2783.50			
4. I choose to do assignments that I enjoy or learn from, even if I don't get a grade	Control group	20	34.23	684.50	474.5	−1.908	0.056
	Research group	63	44.47	2801.50			
5. Getting a good grade in this course gives me a satisfaction	Control group	20	42.38	847.50	622.5	−0.084	0.933
	Research group	63	41.88	2638.50			
6. My priority right now is to improve my overall grade of the semester, so getting good grades in this course is important to me	Control group	20	47.38	947.50	522.5	−1.169	0.243
	Research group	63	40.29	2538.50			
7. I want to get better grades in this course than my fellow students	Control group	20	42.25	845.00	625	−0.055	0.956
	Research group	63	41.92	2641.00			
8. I want to be successful in this course so I can show my success to my family, friends, employer etc.	Control group	20	35.75	715.00	505	−1.367	0.172
	Research group	63	43.98	2771.00			
9. I think that I will be able to use what I learned in this course in other courses as well	Control group	20	40.08	801.50	591.5	−0.583	0.560
	Research group	63	42.61	2684.50			
10. I am very interested in the content of this course	Control group	20	25.35	507.00	297	−4.12	0.000
	Research group	63	47.29	2979.00			
11. I think that what I learned in this course will be useful to me	Control group	20	35.95	719.00	509	−2.04	0.041
	Research group	63	43.92	2767.00			
12. I like this course	Control group	20	25.38	507.50	297.5	−4.592	0.000
	Research group	63	47.28	2978.50			
13. It is very important for me to understand the topics of this course	Control group	20	34.38	687.50	477.5	−2.073	0.038
	Research group	63	44.42	2798.50			
17. The teaching methods used within the course helped to keep my attention throughout the day	Control group	20	28.30	566.00	356	−3.077	0.002
	Research group	63	46.35	2920.00			
18. The teaching methods used within the course helped to acquire theoretical knowledge	Control group	20	35.30	706.00	496	−1.603	0.109
	Research group	63	44.13	2780.00			
19. At the end of each lesson (day), I felt tired and overloaded with information	Control group	20	45.98	919.50	550.5	−0.875	0.381
	Research group	63	40.74	2566.50			
20. At the end of each lesson (day), I felt satisfied with what I had done and learned	Control group	20	29.00	580.00	370	−2.995	0.003
	Research group	63	46.13	2906.00			
21. The methods used helped to form positive associations with the study course: quizz	Control group	20	40.88	817.50	607.5	−0.263	0.792
	Research group	63	42.36	2668.50			
21. The methods used helped to form positive associations with the study course: clouds	Control group	20	33.90	678.00	468	−1.844	0.065
	Research group	63	44.57	2808.00			
21. The methods used helped to form positive associations with the study course: group work	Control group	20	31.40	628.00	418	−2.499	0.012
	Research group	63	45.37	2858.00			
22. The methods used within the course helped to form positive associations with the teacher	Control group	20	36.00	720.00	510	−1.818	0.069
	Research group	63	43.90	2766.00			
28. I am confident that I have mastered the basic concepts of this course and will be able to recognize them	Control group	20	33.93	678.50	468.5	−1.863	0.062
	Research group	63	44.56	2807.50			
29. I am confident that I have understood even the most difficult topics of this course	Control group	20	28.08	561.50	351.5	−3.143	0.002
	Research group	63	46.42	2924.50			
30. I believe that the teacher facilitated the learning of the course content	Control group	20	30.43	608.50	398.5	−3.365	0.001
	Research group	63	45.67	2877.50			

Table 4 Mann-Whitney U test results (groups of questions)

Question qroup	Group	N	Mean rank	Sum of ranks	U	Z	P
Intrinsic motivation	Control group	20	28.73	574.50	364.5	−2.862	0.004
	Research group	63	46.21	2911.50			
Extrinsic motivation	Control group	20	40.98	819.50	609.5	−0.219	0.826
	Research group	63	42.33	2666.50			
Value of the task	Control group	20	24.85	497.00	287	−3.889	0.000
	Research group	63	47.44	2989.00			
Learning methods	Control group	20	33.88	677.50	467.5	−1.732	0.083
	Research group	63	44.58	2808.50			
Cognitive load	Control group	20	37.55	751.00	541	−0.976	0.329
	Research group	63	43.41	2735.00			
Self-efficacy	Control group	20	29.15	583.00	373	−2.794	0.005
	Research group	63	46.08	2903.00			
Role of the teacher	Control group	20	30.43	608.50	398.5	−3.365	0.001
	Research group	63	45.67	2877.50			

Regarding intrinsic motivation, $p = 0.007$ for question 1 ("I was most satisfied with this course's opportunity to understand the learning content as fully as possible"). On the other hand, the questions about the level of external motivation did not show a significant statistical difference either in the groups of questions or when looking at the questions separately. However, it should be mentioned that the answers of both groups did not show that external stimuli, such as assessment, were important to them.

Taking a closer look at the results of the Mann-Whitney U test for question groups (see Table 4), statistically significant differences can be observed in the groups of questions about the value of tasks ($p = 0.000$), the role of the teacher ($p = 0.001$), intrinsic motivation ($p = 0.004$), and self-efficacy ($p = 0.005$). It should be mentioned that the group of questions about the teaching methods used did not show a statistically significant difference, but this could be explained by the fact that there were not many comparable questions.

Descriptive statistics showed that the most significant differences between the research and control groups were in questions about task value, learning methods, and cognitive load. Also, the research group scored higher for intrinsic motivation.

Data can also be viewed by the number of times a particular value appears in the data, which is called absolute frequency. On the other hand, relative frequency reflects the number of times a certain value appears in the data (absolute frequency) in relation to the total number of this variable's values, which can be expressed as a percentage (Vetter, 2017). The relative frequency distribution of the responses obtained from the research group shows that the Likert-scale response "5 – Agree" dominates most of the responses.

Central tendency is a value that describes the entire data set as a single measurement. The three main measures of central tendency are mean, median, and mode (Vetter, 2017). The present action research data analysis will take a closer look at the median and mode.

The median is the average value of the data when the data is ordered in ascending or descending order, while the mode is the most common value in the data set (Vetter, 2017).

The distribution of the research group's answers to the group of questions about the value of tasks shows that the mode is 5. Its frequency varies from 73% to 89% of all the answers. The task value group includes questions such as whether what was learned in the course will be useful (question 11 = 89%) and whether it will be possible to use it in other study courses (question 9 = 81%), if students are very interested in the course content (question 10 = 73%), and whether it is important to understand the topics to be learned (question 13 = 78%). Additionally, 86% of respondents gave a score of 5 in response to the question about whether they liked the course (question 12).

The highest frequency of mode 5 in the control group appears in two questions from the group about the value of tasks – question 9 ("I think that I will be able to use what I learned in this course in other courses as well") and question 11 ("I think that what I have learned in this course will be useful to me"). On the other hand, when answering statement question 10 ("I am very interested in the content of this course"), 50% of the respondents in the control group chose the rating 4, and only 25% chose 5. A similar distribution can also be observed in their responses to question 12's statement "I like this course," where mode 4 has a frequency of 45%.

Similarly, in the research group's question 30 ("I believe that the teacher facilitated the learning of the course content") and question 22 ("The methods used within the course helped to form positive associations with the teacher"), the mode is 5, which was indicated as an answer to these questions by 86% and 84% of respondents, respectively. The control group showed lower readings for the same questions: question 24 ("I believe that the instructor facilitated the learning of the course content") was rated 5 by 50% of respondents, while question 19 ("The methods used in the course helped to form positive associations with the teacher") was rated 5 by 65%. This allows us to conclude that the teacher plays a significant role in the formation and organization of the learning process, as well as in the choice of methods, and that the integration of the game-playing strategy in the study group's learning process had a positive effect on the formation of student associations not only with the study course but also with the teacher.

Differences can also be observed when analyzing the questions about teaching methods, which were the same for the study and control groups. There were no significant differences regarding the use of knowledge tests in the two groups – in the study group, 54% of respondents chose a rating of 5, while in the control group, 50% of students chose a rating of 5. On the other hand, the use of opinion walls and clouds had a more positive effect on the research group – 48% of students marked this with a rating of 5, while in the control group, 45% of students chose a rating of 4.

Group work in the study group was marked with a rating of 5 by 60% of the respondents, while 45% of the control group gave it a rating of 4. This could be explained by the fact that in the study group, these tasks were integrated within the framework of the game-playing strategy and were purposefully chosen as an external stimulus in order

to develop learning motivation, promote the learning of the course content, and keep students' attention.

The answers of the research group allow us to conclude that the respondents positively evaluated the integration of the pedagogical model of gamification in the learning process, i.e., the final quiz and breakout rooms. When asked whether the final quiz helped them to form positive associations with the study course, 73% of respondents answered "5 – Agree," and when asked whether the final quiz helped them to reinforce the topics learned within the course, 71% answered "5 – Agree." On the other hand, the breakout rooms used at the end of each big topic allowed them to look for clues and answer questions, and 70% of respondents agreed that they helped to reinforce knowledge about the given topic.

When looking at the distribution of answers from the internal motivation group, significant differences in the answers given can be seen. The mode of the answers provided by the research group is 5, and the frequency ranges from 41% to 67%. On the other hand, the control group answered the same questions with a rating of 5 for two questions and a rating of 4 for another two. If it is assumed that gaming primarily has the ability to influence external motivation but also has the ability to develop internal motivation through exciting activities and external stimuli, it can be concluded that the level of internal motivation of the study group is higher, the reason for which could be the use of games in the learning process.

Conclusions

A significant difference was found between the two groups in their responses to the question about the ability of the teaching methods used to keep students' attention throughout the day. The responses of the research group showed that the stated goal of gamification ("to attract and hold students' attention throughout the day") was achieved in whole or in part due to the developed and implemented gamification strategy. The entertaining nature of using game-based learning methods and the possibility of diversifying the learning process helped to keep students' attention throughout several lectures.

Statistically significant differences can also be observed in matters related to the research group's and control group's liking for the study course and interest in its content. The responses of the research group showed a greater liking for the course and interest in its content than the control group.

The survey also shows that the final quiz helped to reinforce the knowledge learned within the course, while the breakout rooms helped to reinforce the knowledge of the specific topic and were interesting. However, the open-ended questions show that students need additional quality feedback after using game-based knowledge tests and breakout rooms. Participatory research activities in breakout rooms were offered at the end of lessons, preventing immediate comments on unclear questions or mistakes. Accordingly, the teacher must evaluate how to deal with such a situation. It is possible to

discuss mistakes at the beginning of the next day of classes or add additional explanatory and informative materials to the content of the breakout room. After students complete the knowledge tests, it is necessary to provide immediate feedback and discuss the mistakes and questions that caused difficulties. This would provide additional added value to the use of game-based learning tools.

Overall, the participatory action research showed that using the gamification strategy and integrating the points system made the learning process more interesting. It was observed that attending the study course was important for the students to get maximum marks for all scoring disciplines. The analyzed answers lead to the conclusion that integrating the gamification strategy into the learning process positively influenced the attitude of students from the research group both toward the study process and the teacher. This, in turn, contributed to their motivation to attend the course and their desire to engage in all study activities in order to gain both more points and the opportunity to get an extra point in the exam. The answers also show that the study group's level of intrinsic motivation was higher than that of the control group, which could be correlated with the integration of the Gamified Learning Process Model in the learning process.

From the above, it can be concluded that all three goals of gamification were achieved: 1) encourage maximum attendance of the study course, 2) attract and keep the attention of students throughout the day, and 3) make the theoretical course engaging and interesting, developing learning motivation.

When evaluating the process with the MSLQ, it was found that it is necessary to develop evaluation criteria to be used by the educator when evaluating the entire gamification strategy as a whole, as well as the applied gamification strategy in intermediate stages, if the strategy can be implemented over a longer period. The educator will not always have the opportunity to take the MSLQ survey. Developing the evaluation criteria is a suggestion for future research, as this will help the teacher carry out such evaluations in more depth.

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