# Game-Based Learning and Gamification Technologies in the Preparation of Future Mathematics Teachers

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**Abstract—**Our paper advocates the preparation of future mathematics teachers for the use of game-based learning and gamification technologies. For this purpose, we created a university course that is dedicated to familiarizing the students with basic concepts of game-based learning and gamification and to conveying direct experience with their use. We support the concept and activities in this course by the positive results of the research on the opinions of 115 students. We hope that the positive results and our description of the course will be an inspiration for the broader incorporation of game-based learning and gamification technologies into the training of future mathematics teachers. Limitations of our research are the research sample, we investigated students' reactions only at the author's home university. Therefore, in the future, the research could be done with a broader sample and studying more in detail the students' beliefs related to game-based learning and gamification before and after the course to get a better view of their development.

**Keywords—**game-based learning, gamification, learning technologies, mathematics, teacher education

## 1 Introduction

In our paper, we understand game-based learning (GBL) as playing games with educational goals [1]. The games can be in the digital or non-digital form [2]. When designing game-based learning, it is important to keep the educational goals in mind while maintaining the appeal of the game-based activity [3]. Game-based learning we would distinguish from gamification, which refers to the use of game elements in a setting other than the game [4]. This includes, for example, the use of certain game elements to motivate the performance of tasks that would be less appealing without them. The most used game elements in education are points, challenges, badges, rankings, leaderboards, and stories [5].

Nowadays, GBL and gamification educational technologies are gaining great popularity, mainly because of broader integration of digital and mobile tools [6], [7]. These approaches have the potential for education to improve students' motivation, engagement, and performance [8], [9]. In our paper, we focus on the use of GBL and gamification in mathematics education.

### 1.1 Game-based learning and gamification technologies in mathematics education

GBL and gamification in mathematics education represent innovative educational technologies that enjoy great popularity [10]. The results of the research into the effectiveness of GBL and gamification in mathematics teaching point to beneficial effects on students' knowledge, especially in the topics of mathematical operations with numbers, the basics of algebra, geometry, and measurement [11], [12]. An increase in the students' motivation and engagement and the improvement in their attitudes toward mathematics and its teaching were additionally noted [13] – [15]. Considering these positive results of research on the effectiveness of GBL and gamification in mathematics teaching [16], [17], it is desirable to prepare future mathematics teachers for the integration of GBL and gamification in their educational practice [18]. Such preparation turns out to be very important in building the competencies necessary for applying GBL and gamification [19].

In the research by [20] there were identified four main competence areas which influence the successful using of GBL and gamification technologies. These are pedagogical, technological, collaborative, and creative. Authors stress that the meaningful learning experience using GBL, and gamification depends on teachers' knowledge, skills, personal interest, and pedagogical and emotional engagement. These results again highlight the importance of teachers' preparation for the use of GBL and gamification technologies. The trend for this preparation is also the lifelong education of teachers in practice in the field of using GBL and gamification in mathematics [21]. The importance of this process is demonstrated, for example, by a study [22] that examined the relationship between teachers' attitudes toward GBL and gamification and their readiness to use these learning technologies in practice. The research sample consisted of 102 pre-service teachers and 118 in-service teachers. The authors found that attitudes toward these learning technologies determined teachers' openness to their use in the classroom. Previous experience with these technologies also had a positive effect on the willingness to use them. The results of the study show the importance of providing direct experience with GBL and gamification in university courses. Furthermore, if it is possible for future mathematics teachers to develop positive attitudes toward these learning technologies during their university study, this will have a great impact on their future integration into the classroom by these students.

Therefore, in the university study of future mathematics teachers at the Faculty of Mathematics, Physics, and Informatics of the Comenius University in Bratislava (FMFI UK BA), we familiarize students with the topics of GBL and gamification in the mathematics education within the university course "Mathematics Teachers Assembly" (MTA).

In this article, we introduce the content of this university course and give descriptions and examples of some of the GBL, and gamification activities implemented. We also present the results of the survey on students' opinions about this course. We know that students' engagement during the course is a key factor, along with their motivation, game development, and perspective on the use of GBL and gamification [23]. Therefore, the research question we aim to answer is: *What are the responses of future mathematics teachers to our university course that incorporates GBL and gamification learning technologies?* Through our research, we aim to support the integration of GBL and gamification technologies into mathematics teacher preparation, which seems to be beneficial from the perspective of the state of the art in this problematic [20].

### 1.2 Game-based learning and gamification technologies in the university course “Mathematics Teachers Assembly”

In this part of the contribution, we will give a brief description of the course MAT. The aim of this course is to present the elements of GBL and gamification technologies. The course is optional in all years of the bachelor's degree in the university study of the future mathematics teachers at FMFI UK BA. The course has been offered to students since 2011. In the years 2006 to 2010, we implemented such activities for students as a voluntary action without the possibility of obtaining credits. In the years 2011 to 2021, the course was divided into the Spring MTA and the Autumn MTA, which had the same content and differed only in the semester of study. The Spring MTA took place during the summer semester (February to June), and the Autumn MTA during the winter semester (September to December).

After the new university study program accreditation in 2022, the course has two parts. The theoretical part is dedicated to familiarizing students with the educational background of GBL and gamification technologies and preparing them for their practical implementation. This part of the course takes place in the winter semester of the study. The practical part of the course consists of a three-day meeting of students held during the summer semester. In this meeting, GBL and gamification technologies for teaching mathematics, such as mathematics competitions, and mathematics games, are integrated.

The very basis of the practical format of the course, and its organization have their roots in the activities realized as part of the meetings of successful solvers of the Mathematical Olympiad, respectively some Slovak correspondence mathematics seminars. These have in the Slovak Republic their beginnings in the activities held within the Young Mathematicians’ Camps [24] and follow-up activities [25], [26].

The main pillars of the course MTA are GBL and gamification technologies in mathematics education. The elements of GBL and gamification technologies are within the course most visible in these activities: competitive math games, strategic math games, and team tournament. Their structure is depicted in Figure 1. We will describe them in the next part of the article.

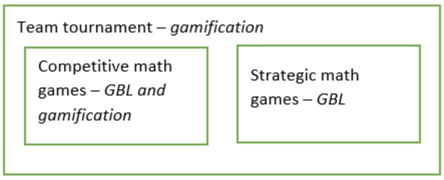


**Fig. 1.** The main GBL and gamification activities within MTA

Competitive math games represent both GBL and gamification activities associated with solving mathematical problems. The whole activity takes place within the team tournament, which is running during the entire course. When playing the competitive math game, teams receive certain benefits (moves, resources, etc.) for a correctly solved math task. These advantages can be used in the accompanying game activity. The assignments of the mathematical tasks that the students solve are mostly from face-to-face competitions organized by the Slovak mathematical seminars (KMS, STROM, etc.). The accompanying game activity could be e.g., inspired by some existing game. For example, in this activity in the fall of 2015, students received one card of the Set game for each correctly solved task. The Set game was invented by the author M. J. Falco in 1974 and its rules can be found in [27]. During the final evaluation of the activity, the teams received a point for each correctly solved task and extra points for each correctly composed set.

Strategic math games are used during the course in the form of two opponents playing a math game. These games are chosen to develop players' ability to think strategically. The games are mostly played on a special playing plan (e.g., a square grid of given dimensions). Players move by placing their symbol or performing a certain operation. The opponents are, in our case, players from different teams. The whole activity runs in the form of a "one-on-one" tournament when each player from the team plays against each player from the second team. The activity can also be implemented in the form of a rating competition. In this rating form, players choose opponents from other teams at approximately the same level when playing a given strategic game.

An example is the game "Symmetrical tic-tac-toe", implemented at MTA in the spring of 2014 [28]. In it, players proceed similarly to classic tic-tac-toe, with the difference that with each move they must place two symbols, symmetrical according to the horizontal or vertical axis that divides the game board into parts. Figure 2 shows one state of the given game. More detailed rules can be found in [28].

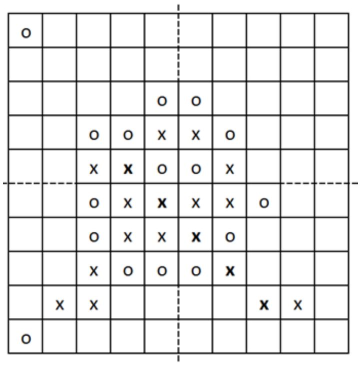

**Fig. 2.** Game state in the Symmetrical tic-tac-toe

The team tournament, as part of gamification, takes place throughout the MTA course. Students are usually divided into four teams. The division into teams is done with the goal of equality of the teams in terms of mathematical ability and other factors (composition according to the student subjects' combination, etc.). Students receive points for their team for all activities performed during the course. Their score is displayed on the leaderboard, which is visible to all. The points are counted at the end of the course and teams are rewarded based on their gain. This reward is usually in the form of sweet gifts and does not involve the official evaluation of the university course. As for the official evaluation of the course, all participating students who have completed all activities receive the highest possible grade of A for the course.

## 2 Methods

In the following part of the article, we will describe our research sample and the research tool that was aimed to find out the reactions of students to MTA.

MTA is mainly attended by future mathematics teachers' students. These students are preparing to teach mathematics in combination with one other subject at FMFI UK BA. Here we are dealing with combinations of subjects: mathematics-physics, mathematics-informatics, and mathematics-physical education. Due to the openness of the course to all students at Comenius University in Bratislava, students from other programs also participated. From the FMFI UK BA, they were mainly students of applied informatics. For the purposes of our research, we studied the statements of 115 students who belong to the FMFI UK BA, as only these can answer the survey.

Our source of information about students' opinions on the course MTA is a survey conducted every semester at the Faculty of Mathematics, Physics and Informatics of Comenius University in Bratislava [29]. The survey serves as a space for students to express their opinions on the completed courses and is realized in the form of the online questionnaire. It has been filled out by students every time after the end of the semester since 2011. The survey items relevant to our research are:

1. Overall assessment of the quality of the course. (A value from 1 to 5, 5 being the best.)
2. Was the course content interesting for you? (A value from 1 to 5, 5 being the best.)
3. Would you recommend this course to other students? (Values: Definitely yes. Rather yes. Rather not. Definitely not.)
4. Write your opinion on this course. Give reasons why you would recommend/not recommend it. (Optional item.)

For the analysis of the survey data, we used descriptive statistics and statistical verification by Chi-Square Test for Goodness of Fit. For the last survey item, we applied qualitative open coding of responses. The selection of these methods was made according to the type of data. The Chi-Square Test for Goodness of Fit was selected because it can compare the distributions of the collected data with the expected statistical distribution.

## 3 Results

This chapter describes the results of the survey from the summer of 2011 to the winter of 2019. The date of the start of data collection relates to the creation of the student survey. The end date is due to the Covid virus pandemic, which caused a two-year break in the realization of MTA in its standard form. During this period the course was either suspended or realized just as a distant version based on the writing of the essays by students. The course was resumed in the standard form in the winter of 2022, but the survey results are not yet available from this period.

The following Table 1 captures the number of students in individual semesters of the course and the number of students who answered the survey. As we mentioned above, in addition to students from the Faculty of Mathematics, Physics and Informatics, some students from other faculties of the Comenius University in Bratislava applied for the course. These were mainly students of teaching combinations with mathematics from the Faculty of Natural Sciences of Comenius University in Bratislava. These are combinations of mathematics-biology, mathematics-chemistry, mathematics-geography, and mathematics-geology. These students did not have the opportunity to vote in the faculty survey, so we list their numbers separately.

**Table 1.** The number of participating students and survey respondents

| # | Semester of study | Number of participating students FMFI UK BA | other faculties | Number of survey respondents |
|---|---|---|---|---|
| 1 | summer 2011 | 5 | 4 | 3 |
| 2 | winter 2011 | 19 | 6 | 11 |
| 3 | summer 2012 | 18 | 18 | 8 |
| 4 | winter 2012 | 12 | 10 | 6 |
| 5 | summer 2013 | 9 | 5 | 1 |
| 6 | winter 2013 | 20 | 8 | 9 |
| 7 | summer 2014 | 12 | 3 | 5 |

| | | | | |
|---|---|---|---|---|
| 8 | winter 2014 | 9 | 1 | 3 |
| 9 | summer 2015 | 24 | 1 | 8 |
| 10 | winter 2015 | 15 | 0 | 5 |
| 11 | summer 2016 | 12 | 4 | 3 |
| 12 | winter 2016 | 25 | 1 | 12 |
| 13 | summer 2017 | 26 | 4 | 14 |
| 14 | winter 2017 | 12 | 5 | 7 |
| 15 | summer 2018 | 11 | 3 | 4 |
| 16 | winter 2018 | 15 | 4 | 8 |
| 17 | summer 2019 | 17 | 9 | 5 |
| 18 | winter 2019 | 13 | 3 | 3 |
| Sum | | 274 | 89 | 115 |

Table 1 shows that a total of 363 students completed the course during the assessment period. Of these, 274 students were from the Faculty of Mathematics, Physics and Informatics. The remaining 89 students were primarily students of teacher combinations with mathematics studying in the Faculty of Natural Sciences. These 89 students were unable to participate in the survey. In total, 115 out of 274 potential students expressed their opinion in the survey, which is about 42%. Such a response rate is common for this student survey, the participation in the survey varies from 25% to 52% in all courses.

Table 2 shows the mean values of the answers to the first two items of the survey, as presented in the previous chapter.

**Table 2.** Mean values of responses to the first two survey items

| **#** | **Semester of study** | **Mean value and number of individual responses per item:** ***1) Overall assessment of the quality of the course. (A value from 1 to 5, 5 being the best.)*** | **Mean value and number of individual responses per item:** ***2) Was the course content interesting for you? (A value from 1 to 5, 5 being the best.)*** |
|---|---|---|---|
| 1 | summer 2011 | 5 (3px5)* | 5 (3px5) |
| 2 | winter 2011 | 5 (11px5) | 4,91 (10px5, 1px4) |
| 3 | summer 2012 | 5 (8px5) | 5 (8px5) |
| 4 | winter 2012 | 4,83 (5px5, 1px4) | 4,83 (5px5, 1px4) |
| 5 | summer 2013 | 5 (1px5) | 5 (1px5) |
| 6 | winter 2013 | 4,44 (7px5, 1px4, 1px1) | 4,22 (5px5, 3px4, 1px1) |
| 7 | summer 2014 | 5 (5px5) | 5 (5px5) |
| 8 | winter 2014 | 5 (3px5) | 5 (3px5) |
| 9 | summer 2015 | 5 (8px5) | 5 (8px5) |
| 10 | winter 2015 | 4,8 (4px5, 1px4) | 4,75 (3px5, 2px4) |
| 11 | summer 2016 | 5 (3px5) | 5 (3px5) |
| 12 | winter 2016 | 4,73 (9px5, 1px4, 1px3, 1px0) | 4,75 (10px5, 1px4, 1px3) |
| 13 | summer 2017 | 4,93 (13px5, 1px1) | 5 (14px5) |
| 14 | winter 2017 | 5 (7px5) | 4,71 (5px5, 2px4) |
| 15 | summer 2018 | 4,67 (2px5, 1px4, 1px0) | 5 (3px5, 1px0) |

| | | | |
|---|---|---|---|
| 16 | winter 2018 | 5 (8px5) | 5 (8px5) |
| 17 | summer 2019 | 5 (5px5) | 5 (5px5) |
| 18 | winter 2019 | 5 (3px5) | 5 (3px5) |
| Overall average | | 4,91 | 4,90 |

* The expression (3px5) represents a shortened notation of the information that 3 people gave a score value of 5 in the survey item

The distribution of individual responses to the first item of the questionnaire is recorded in Table 3. The table shows actual frequencies and values from an expected uniform distribution of responses. Subsequently, the chi-square value of the goodness-of-fit test was calculated from these data.

**Table 3.** Observed and assumed frequency of answers to the first item

| The response in survey | 1 | 2 | 3 | 4 | 5 | Sum |
|---|---|---|---|---|---|---|
| Observed frequency | 2 | 0 | 1 | 5 | 105 | 113 |
| Assumed distribution | 22.6 | 22.6 | 22.6 | 22.6 | 22.6 | 113 |

The chi-square goodness-of-fit criterion value is 376.159. This shows statistically significant differences from a uniform distribution of responses at the 0.001 significance level.

Table 4 shows similar values for the second item of the questionnaire.

**Table 4.** Observed and assumed frequency of answers to the second item

| The response in survey | 1 | 2 | 3 | 4 | 5 | Sum |
|---|---|---|---|---|---|---|
| Observed frequency | 1 | 0 | 1 | 10 | 102 | 114 |
| Assumed distribution | 22.8 | 22.8 | 22.8 | 22.8 | 22.8 | 114 |

In this case, the value of the goodness-of-fit chi-square test criterion is 346.789. Again, this is the difference in observed frequencies versus a uniform distribution of responses at the 0.001 significance level.

Table 5 captures the number of responses in the individual options of item 3) Would you recommend this course to other students? (Values: Definitely yes. Rather yes. Rather not. Definitely not.). In this item, only two options were possible in the survey conducted in the summer of 2011. Here, there were only options: a) Yes. b) No. At the same time, all 3 students who took part in the survey this semester marked the option: Yes. Starting from winter 2018, item 3 was removed from the survey. Therefore, the Table 5 shows the values from the period winter 2011 to summer 2018.

**Table 5.** The number of answers in the individual options of the third item of the survey

| **#** | **Semester of study** | **Number of answers in individual options of the item:** ***3) Would you recommend this course to other students? (Values: Definitely yes. Rather yes. Rather not. Definitely not.)*** | | | |
|---|---|---|---|---|---|
| | | **Definitely yes** | **Rather yes** | **Rather not** | **Definitely not** |
| 1 | winter 2011 | 11 | 0 | 0 | 0 |
| 2 | summer 2012 | 6 | 2 | 0 | 0 |
| 3 | winter 2012 | 4 | 1 | 1 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| 4 | summer 2013 | 1 | 0 | 0 | 0 |
| 5 | winter 2013 | 6 | 2 | 0 | 1 |
| 6 | summer 2014 | 4 | 1 | 0 | 0 |
| 7 | winter 2014 | 3 | 0 | 0 | 0 |
| 8 | summer 2015 | 8 | 0 | 0 | 0 |
| 9 | winter 2015 | 4 | 1 | 0 | 0 |
| 10 | summer 2016 | 3 | 0 | 0 | 0 |
| 11 | winter 2016 | 11 | 0 | 0 | 0 |
| 12 | summer 2017 | 14 | 0 | 0 | 0 |
| 13 | winter 2017 | 6 | 1 | 0 | 0 |
| 14 | summer 2018 | 1 | 2 | 0 | 1 |
| Sum | | 82 | 10 | 1 | 2 |

The following Table 6 captures the distribution of responses to the third item of the survey, and the expected values in case of uniform distribution.

**Table 6.** Observed and assumed frequency of answers to the third item

| The response in survey | Definitely yes | Rather yes | Rather not | Definitely not | Sum |
|---|---|---|---|---|---|
| Observed frequency | 82 | 10 | 1 | 2 | 95 |
| Assumed distribution | 23.75 | 23.75 | 23.75 | 23.75 | 95 |

Using the chi-square goodness-of-fit test, we get a value of 192.537. This indicates statistically significant differences between the observed distribution and the uniform distribution at the 0.001 significance level.

For the optional fourth item on the survey, "4) Write your opinion on this course. Give reasons why you would recommend/not recommend it.", Table 7 shows the number of student responses.

**Table 7.** Number of student responses to the optional fourth item of the survey

| # | Semester of study | Number of student responses to the optional fourth item of the survey: *4) Write your opinion on this course. Give reasons why you would recommend/ not recommend it.* |
|---|---|---|
| 1 | summer 2011 | 1 |
| 2 | winter 2011 | 5 |
| 3 | summer 2012 | 3 |
| 4 | winter 2012 | 2 |
| 5 | summer 2013 | 1 |
| 6 | winter 2013 | 2 |
| 7 | summer 2014 | 1 |
| 8 | winter 2014 | 0 |
| 9 | summer 2015 | 2 |
| 10 | winter 2015 | 2 |
| 11 | summer 2016 | 1 |

| | | |
|---|---|---|
| 12 | winter 2016 | 2 |
| 13 | summer 2017 | 2 |
| 14 | winter 2017 | 1 |
| 15 | summer 2018 | 2 |
| 16 | winter 2018 | 2 |
| 17 | summer 2019 | 2 |
| 18 | winter 2019 | 0 |
| Sum | | 31 |

We subjected the 31 responses to the fourth item to qualitative analysis, and Table 8 lists each of the identified codes with their description and frequency of occurrence.

**Table 8.** Codes from the qualitative analysis of the fourth survey item

| # | Name of the code | Code description | The number of respondents whose answers contained the given code |
|---|---|---|---|
| 1 | praise | The student expresses positive feedback on the course. Example statement: *"This course is absolutely the best."* (Summer, 2012) | 25 |
| 2 | activities | The student gives a positive reaction to the activities carried out during the course. Example statement: *"We played math games all day :)"* (Winter, 2011) | 10 |
| 3 | recommendation | The student recommends a course to other students. Example of a statement: *"I definitely recommend it to others :)."* (Summer, 2016) | 8 |
| 4 | people | The student expresses positive experiences with social interactions within the course. Example statement: *"The best lecturers, participants are not only students but also graduates, always a great team, even if you go there knowing no one."* (Winter, 2018) | 6 |
| 5 | emotions | The student expresses the good feelings he/she experienced during the course. Example of a statement: *"You will understand that mathematics can also be fun..."* (Winter, 2018) | 3 |
| 6 | comments | The student expresses a comment on the course. Example statement: *"Too bad you can't get credits every time."* (Summer 2017) | 3 |
| 7 | repeated participation | The student expresses willingness to repeat the course. Example of a statement: *"I will definitely participate in the next semesters as well, even if, unfortunately, there will be no credits for it."* (Summer, 2013) | 2 |
| 8 | negative social feeling | One student expressed negative feelings about the collective. Student's statement: *"It felt almost like an uninvited guest at a private event."* (Winter, 2013) | 1 |

# 4 Discussion

## 4.1 Discussion of research results

As part of the discussion, we will point out how the data from the conducted survey of students' attitudes towards our course point to the appropriate design of this course. The data regarding the quality and attractiveness of the course (Table 2) clearly document the positive opinions of students in these areas. Likewise, the values of the statistical tests show that these positive opinions prevail at a statistically significant level. These results, therefore, allow us to claim that we have managed to prepare a high-quality and interesting course for students, which familiarizes them with GBL and gamification technologies for teaching mathematics. The preparation of such a course is in accordance with the needs of practice [18], [20].

At the same time, the students expressed their willingness to recommend the course to their colleagues, which provides a good prerequisite for the sustainability of the given approach. It also shows us the possibilities to expand the offer of this course not only for students of mathematics teaching but also for teachers in practice, which is in line with the needs expressed by previous research on the given issue [21].

Verbal comments on the course (Table 8) show that the students praise the course, and also GBL and the gamification activities it contains. They are expressing their willingness to recommend it to other students, and they also highlighted the social dimension of their experience. This social dimension is important for the development of collaborative competence, which was identified as one of four important competencies for game-based teaching [20].

Our results illustrate the fulfillment of the need to promote game-based teaching for future teachers and to provide them with experience in such teaching [22]. Therefore, we believe that our course can support the integration of GBL and gamification technologies in mathematics education. The students' reactions also show engagement and high motivation during the course which are important factors for the effective use of GBL and gamification technologies [23].

Besides the research data, positive feedback on the course also is the fact that in addition to students who take MTA as a course included in their study programs, this activity is also visited by students who want to take it repeatedly, without the possibility of obtaining additional credits. We also very highly evaluate the fact that some teachers from practice with long-term experience in teaching mathematics also come to MTA. This leads to the creation of a community of future teachers and experienced teachers, which is beneficiary to all participating students [30].

## 4.2 Limitations and implications for future research

The limitations of our research are the following facts: 1) the research was conducted only at Comenius University in Bratislava; 2) since MTA is an optional course, the students who participated in it form a sample that may have some differences from a normal selection from the population; 3) only a part of the students participated in the survey, which in turn may lead to some bias in the results; 4) the transferability of the design of our course may be limited to some extent due to some peculiarities. Despite these facts, we believe it is useful to acquaint the scientific and educational community with our course design as an example of good practice. The positive reactions to the course support its potential to promote the use of game-based teaching of mathematics among pre-service teachers.

For future research in the given issue, it would be desirable to examine the effects of our course on the change of students' attitudes towards the game-based technologies of mathematics education before and after completing the course. An equally interesting research problem would be to find out in the long term whether students who have completed the course have a higher incidence of game-based teaching in their pedagogical practice.

## 5 Conclusion

The increasing use of game-based learning and gamification technologies in mathematics education and related research point to the need for teachers' preparation to incorporate these technologies into the classrooms. Therefore, in our paper we present the design of the university course for future mathematics teachers focused on the GBL and gamification technologies. We describe the research on the students' opinions on this course, which was carried out on a sample of 115 students using the online questionnaire. Based on the results of this survey, we can conclude that future mathematics teachers positively evaluate our course. These results, therefore, support the suitability of the course's concept and design. The students appreciated that we introduced them to GBL and gamification technologies. Based on their positive experiences from the course, we can assume that they will be more open to applying these technologies in their teaching practice. Future research on this issue could be focused on the change in students' beliefs towards GBL and gamification technologies before and after the course. Interesting will be also a longitudinal study on the frequency of the use of game-based teaching among students who completed our course.

The paper is intended for those interested in using game-based teaching of mathematics. The presented university course aimed at preparing future teachers for the integration of such game-based technologies in the learning of mathematics is an example of good practice that can serve as inspiration. The research results on students' attitudes towards the course document the appropriateness of its concept and design.

## 6 Acknowledgment

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