

Exploring the Attitudes of Computer Science High School Teachers Towards Gamification: A Work in Progress

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Abstract—This work-in-progress research paper describes the results of research conducted as part of an ongoing project "Enhancing Motivation for Learning Through Gamification" on the attitudes of high school computer science teachers towards gamification. The main goal of the project is to develop a pedagogical-technological gamification framework to help high school teachers design and implement gamification activities. Teachers play a key role in introducing gamification into the classroom, but encouraging them to do so can be as much of a challenge as introducing any other educational innovation. Therefore, it is important to research teacher attitudes and use this knowledge to identify how to encourage greater use of gamification, particularly in schools where it is currently less prevalent compared to universities. The paper describes the research in this direction and focuses on investigating the attitudes of computer science teachers and the use of gamification in their classrooms, as they should be the most competent to introduce digital innovations. An anonymous survey was used as a quantitative research method. The research questions were formulated to find out to what extent teachers are familiar with gamification, whether they use game elements and/or digital tools for gamification in the classroom, and what teachers' attitudes towards gamification are. The last research question related to the comparison of knowledge, use and attitudes between the computer science teachers and the other high school teachers. The main finding was that computer science teachers use gamification to a greater extent compared to other teachers because they want to achieve a higher quality of teaching and believe that they know how to create gamified activities. These results will be helpful for further work as a focus group of computer science teachers will be formed to help design the gamification framework.

Keywords—gamification, game, high school, computer science

I. INTRODUCTION AND BACKGROUND

Teachers play a key role in introducing pedagogical innovations in the classroom, especially technology-related innovations. There are several factors that influence this, of which teachers' beliefs about teaching and learning with ICT are particularly important [1].

With the aim of fostering student motivation, interest and engagement, technologies adapted to students of the so-called "digital generations" [2], [3], including those using digital games, i.e. game-based learning (GBL), are particularly important today. In addition to GBL, the modern approach in education is gamification, i.e. the application of game design elements and game principles in the classroom with the aim of enhancing student motivation, interest and engagement which can ultimately lead to more successful learning outcomes [4],

[5], [6]. Since the feedback students receive during the learning process is one of the most important segments of motivational strategies [7], the advantage of gamification is that it can provide this in a simple and interesting way for students by turning tasks into games that motivate students through rewards for success. Gamification is distinctly different from the use of educational games, where the goal is to immerse the student in the game itself and achieve learning outcomes in a hidden way [8]. For gamification of classroom activities, it is sufficient to incorporate some game elements such as levels, points, badges and avatars and to use digital tools that are accessible to teachers, such as LMS and quiz tools [9].

As with GBL [2], gamification utilises mechanics, aesthetics and thinking from the player's perspective to help students learn and solve problems more successfully [10], [8]. The role of the teacher is also a crucial factor in this case [11], i.e. the adoption of the use of GBL or gamification in their courses depends on their attitude towards it. Therefore, it is important to research teachers' attitudes towards gamification and use this knowledge to determine the possibilities for implementing gamification in schools.

Despite the potential for the implementation of gamification at different levels of education, a review of the existing literature shows that gamification is more commonly used in higher education than in schools [12]. Furthermore, research shows that students [13], [10], [14] and teachers [15] [16] accept gamification and that this area is worthy of further research.

This work-in-progress research paper describes research in this direction conducted as part of the ongoing project "Enhancing Motivation for Learning Through Gamification". The main objective of the project is to develop a pedagogical-technological framework for gamification to help high school teachers design and implement gamification activities. The preliminary research for the project included a survey of high school teachers about the use of gamification [16]. It was concluded that teachers only partially recognize the potential of gamification, and that additional work is needed to better familiarize them with the concept of gamification and how to implement it in the classroom. Besides participating in the surveys, it is planned to involve teachers as practitioners in the creation of the gamification framework by using a Design-Based Research approach during the project, which will require careful selection of teachers suitable for participation.

This paper focuses on the results of a study conducted to investigate the attitudes of high school computer science teachers and the use of gamification in their classrooms, given

their expertise in introducing digital innovations. The work not only provides information for the project research, but also contributes to understanding the attitudes of teachers with experience of using digital technologies towards gamification.

II. METHOD - STUDY DESIGN AND PROCEDURE

The purpose of the research was to investigate the attitudes of computer science teachers and the use of gamification in their classrooms, as they should be the most competent to introduce digital innovations. The research methodology is based on a quantitative research method using an anonymous survey. The research questions were: Q1: To what extent are computer science teachers familiar with gamification? Q2: To what extent do computer science teachers use gamification? Q3: What are computer science teachers' attitudes towards gamification? Q4: Is there a difference in knowledge, use, and attitudes towards gamification between computer science teachers and other high school teachers?

The study was conducted with computer science teachers from the "District Vocational Council of Computer Science Teachers at High Schools" as part of lecture on the possibility of using gamification at high schools in November 2023.

As this was a follow-up study to the preliminary study, in which the attitude and use of gamification among high school teachers was investigated [16], an identical questionnaire was used in paper form. The questionnaire consisted of an introductory section with general questions on teacher profiles (e.g. age) and three groups of questions on gamification and was adapted from studies by [15]. The groups comprised a total of 34 questions on familiarity with the use of gamification, the use of gamification in the classroom and teachers' attitudes towards gamification. The last open-ended question refers to additional comments from the teachers. Of the 30 teachers present, 26 of them filled out the questionnaire (response rate approx. 83%). All but one teacher, who did not answer the last group of questions on attitudes towards gamification, completed the questionnaire in full. There were no responses to the open questions. The average age of the respondents was 45.23 years, with an average working experience in teaching of 17.96 years.

In the next section the most important results regarding the answers of the computer science teachers to the questions on gamification are presented. In addition, these results are compared with the results of previous research conducted with other teachers to answer Q4.

III. RESULTS

A. Familiarity with the Use of Gamifications

For the questions on teachers' familiarity with the use of gamification, a 5-point Likert scale (0 - not at all, 1 - a little, 2 - moderately, 3 - to a greater extent, 4 - completely) was used to collect data to find out to what extent teachers are familiar with the concept of gamification, which elements of game design and which digital tools they use with their students (Table I). When asked about the knowledge of gamification in the classroom for the purpose of motivating students, the majority of respondents (39%) believe that they are to a greater extent or completely familiar with the possibilities of gamification for the purpose of motivation, and 38% of them believe that they are moderately familiar. In terms of familiarity with elements of game design, 43% of respondents

said they were familiar with the concept of elements such as points, badges, avatars, etc., while around a third (31%) said they had limited or no familiarity with such concepts. When asked about knowledge of the use of digital tools and platforms for gamification, 35% of respondents said they were completely or somewhat familiar, while 38% believe they are moderately familiar. Considering that these are computer science teachers, it is surprising that even 12% of respondents are not at all familiar with digital tools and gamification platforms.

TABLE I. FAMILIARITY WITH THE USE OF GAMIFICATION

N=26	0	1	2	3	4	Mean	SD
Gamification	8%	15%	38%	27%	12%	2.19	1.07
Game design elements	8%	23%	27%	35%	8%	2.12	1.09
Digital tools	12%	15%	38%	27%	8%	2.04	1.09

B. Application of Gamification in Teaching

In this part of the questionnaire with the questions related to the use of game design elements and digital tools for gamification, teachers had to choose an answer on a Likert scale: 0 - never, 1 - rarely, 2 - sometimes, 3 - often, 4 - always (Table II). Regarding the use of game design elements, the majority of teachers (40%) often or always use points. The next most common element in terms of frequency of use was leaderboards (31%). The majority of teachers (around a third) stated that they do not use avatars, storylines and badges at all. However, even with these elements, around a third of teachers said that they use them at least sometimes. It was found that teachers use the digital tool Kahoot! (47%) and/or Quizziz (38%) often or always. Of the tools mentioned, the digital platform Loomen (the version of the LMS system Moodle), which in addition to quizzes, also offers games such as Memory, Who Wants to Be a Millionaire, is rarely used. The Genially platform is also never or rarely used by 58% of respondents.

TABLE II. USING GAME DESIGN ELEMENTS AND DIGITAL TOOLS

N=26	0	1	2	3	4	Avg.	SD
Points	4%	15%	31%	23%	27%	2.54	1.15
Leaderboards	8%	23%	38%	19%	12%	2.04	1.09
Badges	31%	35%	23%	12%	0%	1.15	0.99
Storyline	35%	31%	27%	8%	0%	1.08	0.96
Avatars	31%	35%	31%	4%	0%	1.08	0.87
Kahoot!	8%	19%	27%	12%	35%	2.46	1.34
Loomen	35%	19%	23%	12%	12%	1.46	1.37
Genially	23%	35%	23%	4%	15%	1.54	1.31
Quizziz	31%	19%	12%	19%	19%	1.77	1.53

C. Teachers' Attitudes Towards Gamification

The last section of the survey analysed teachers' attitudes towards gamification. A 5-point Likert scale was used to collect data (0 - strongly disagree, 1 - disagree, 2 - neither agree nor disagree, 3 - agree, 4 - strongly agree). The questions are divided into four groups and relate to: teachers' attitudes towards the use of gamification in the classroom, teachers' attitudes towards motivation and encouragement in the use of gamification, teachers' views on the reasons for not using or insufficiently using gamification in the classroom, and teachers' views on factors that would encourage them to use gamification.

Regarding teachers' attitudes towards the use of gamification in the classroom (Table III), most teachers agree or strongly agree with the statements that students are more motivated to learn (86%), prefer to come to class (72%), approach tasks competitively (84%) and are more interested in the subject of computer science (64%). However, more than half neither agree nor disagree that students understand the subject matter better and achieve better grades with the help of gamification. It should be noted that no one explicitly disagrees with any of the statements.

TABLE III. TEACHERS' ATTITUDES TOWARDS THE USE OF GAMIFICATION IN THE CLASSROOM

N=25	0	1	2	3	4	Mean	SD
Students are more motivated	0%	0%	24%	64%	12%	2.88	0.59
Students achieve better grades	0%	0%	56%	44%	0%	2.44	0.50
Students understand the subject matter better	0%	4%	52%	36%	8%	2.48	0.70
Students prefer to come to class	0%	4%	24%	64%	8%	2.76	0.65
Students approach tasks competitively	0%	0%	16%	60%	24%	3.08	0.63
Students are more interested in the subject	0%	4%	32%	48%	16%	2.76	0.76

TABLE IV. TEACHERS' ATTITUDES TOWARDS MOTIVATION AND ENCOURAGEMENT IN THE USE OF GAMIFICATION

N=25	0	1	2	3	4	Mean	SD
Increasing student motivation	0%	0%	0%	68%	32%	3.32	0.47
Modernising teaching	4%	0%	16%	48%	32%	3.04	0.92
Making subject more attractive	4%	0%	8%	60%	28%	3.08	0.84
Increasing student engagement	0%	0%	0%	56%	44%	3.44	0.59
Achieving a higher quality of teaching	0%	0%	4%	56%	40%	3.36	0.56

In all statements about the reasons that motivate them to use gamification more often in the classroom, teachers express a desire to use it (Table IV). In particular, it should be noted that almost all of them agree or completely agree that they want to increase student motivation and engagement. They also want to achieve a higher quality of teaching (96%), make their subject more attractive to students (88%) and modernize teaching (80%).

Regarding teachers' views on the reasons for not using or insufficiently using gamification in the classroom (Table V), most of them agree or fully agree that the reason for not using gamification is the lack of free time (40%). It is important to

point out that only 4% of them state that they do not know how to create gamified activities, which is to be expected since they are computer science teachers. Most of them disagree or strongly disagree with all the other statements. It is worth emphasising the percentage of 96% who disagree that gamification is an expression of frivolous teaching.

TABLE V. TEACHERS' VIEWS ON THE REASONS FOR NOT USING OR INSUFFICIENTLY USING GAMIFICATION IN CLASSROOM

N=25	0	1	2	3	4	Mean	SD
I don't know how to create gamification	48%	24%	24%	4%	0%	0.84	0.92
I don't have time to prepare it	16%	28%	16%	32%	8%	1.88	1.24
Gamified activities do not benefit students.	36%	44%	20%	0%	0%	0.84	0.73
Gamification is expression of frivolous teaching	72%	24%	4%	0%	0%	0.32	0.55
I don't have support of supervisors	48%	32%	16%	4%	0%	0.76	0.86
Gamification is a passing trend.	40%	28%	24%	8%	0%	1	0.98

The last group of questions related to factors that would encourage teachers to use gamification more in the classroom (Table VI). Teachers emphasised the availability of digital tools and platforms for gamification (80% of respondents agreed or strongly agreed), the availability of computer equipment for implementing gamification (72%) and training on the application of gamification and the use of digital tools (72%). An equal number of respondents (72%) agreed that it would encourage them to use more free time. The lowest percentage of teachers (44%) believe that they would need support in the form of a trained person in the school to help them implement gamification.

TABLE VI. TEACHERS' VIEWS ON FACTORS THAT WOULD ENCOURAGE THEM TO USE GAMIFICATION.

N=25	0	1	2	3	4	Mean	SD
Education on gamification	0%	4%	24%	44%	28%	2.96	0.82
Digital tools	0%	4%	16%	52%	28%	3.04	0.77
Computer equipment	0%	4%	20%	48%	24%	2.92	0.8
Support at school	0%	20%	36%	24%	20%	2.44	1.02
More free time	0%	8%	20%	32%	40%	3.04	0.96

D. Comparison between computer science teachers and other high school teachers

In addition to the basic descriptive statistical analysis, a comparison of the results of the survey completed by the computer science teachers with the previously conducted survey [16] was also carried out. Since both groups of teachers were small samples, The Mann-Whitney U test (or Wilcoxon rank sum test) was used to compare these two independent samples. Of the total of 34 questions, 9 questions showed a

statistically significant difference between the two groups of teachers.

The biggest difference is in the group of questions about the use of gamification in teaching, i.e. the use of game design elements and digital tools for gamification. It has been shown that computer science teachers use badges ($U=166.5$, $p<0.001$), stories ($U=249$, $p<0.05$) and avatars ($U=167.5$, $p<0.001$) as well as the tools Kahoot! ($U=230$, $p<0.05$), Genially ($U=187$, $p<0.01$) and Quizizz ($U=235$, $p<0.05$) significantly more often than other teachers. In the group of questions about teachers' attitudes towards motivation and encouragement in the use of gamification, computer science teachers also emphasised to a greater extent that they want to achieve a higher quality of teaching ($U=213.5$, $p<0.01$). In contrast to the other teachers, the computer science teachers mostly disagreed with the statements: *I do not know how to create gamified activities* ($U=459.5$, $p<0.05$) and *I believe that the use of gamification is an expression of frivolous teaching* ($U=489.5$, $p<0.01$), when asked about the reasons for not using or insufficiently using gamification in the classroom.

IV. DISCUSSION

This study was conducted to answer the research questions mentioned above. With regard to research question Q1, it has been shown that the majority of respondents are familiar with the possibility of using gamification to motivate students, as well as with game design elements, digital tools and platforms for gamification. Regarding Q2, it should be noted that all teachers surveyed use points and leaderboards, which is positive, as is the fact that they sometimes use other elements. Teachers should be encouraged to make more use of other elements, especially badges, as the literature [4], [12] shows that the very common combination of PBL (points, badges, leaderboards) is successful in practise. Consistent with the fact that they use points the most is the fact that they mostly use popular tools for quizzes: The most popular tool is Kahoot! [17] followed by Quizizz [18]. This is also a common practise when using gamification in schools. It should be emphasised that teachers could also list some other unspecified gamification tools they use in class in the questionnaire, but no one did.

Research question Q3 was particularly important, i.e. to determine teachers' attitudes towards gamification, as the extent to which it is used depends on this. The results obtained are extremely positive, as teachers recognise the positive aspects of using gamification in the classroom and want to use it to increase the motivation and engagement of their students and achieve a higher quality of teaching. The main reason given by teachers for the lack of or insufficient use of gamification in the classroom was that they do not have time to prepare gamified activities. As expected, teachers cited more free time and the availability of digital tools/platforms for gamification as the most important factors that would encourage them to use gamification.

With regard to the last research question Q4 on the comparison between computer science teachers and other high school teachers, it was found that there are differences in terms of the digital tools and game design elements used. Furthermore, as expected, it was found that computer science teachers themselves are able to use tools to create gamified activities for their students.

Although no significant differences were found between the two groups of respondents in the first set of questions

assessing teachers' knowledge of gamification and about a third of the computer science teachers categorised their knowledge as "moderate", the continuation of the questionnaire showed that a larger percentage actually uses gamification. It is therefore possible that the teachers categorised their knowledge as more modest than it actually is. However, it is important to point out that the computer science teachers emphasised to a greater extent that they want to achieve a higher quality of teaching and that they do not believe that the use of gamification is an expression of frivolous teaching.

If we compare this study with a similar study, we can see similarities, but it should be emphasised that the respondents in this study showed a greater interest in using gamification than in [15] and it is not stated that gamification is just a fashion trend as in [19].

Regarding the limitations, the study was conducted with computer science teachers from one particular group. A small sample, which may not be representative of all high school computer science teachers, could limit the depth of understanding of teachers' experiences and attitudes toward gamification and limit the generalizability of the results. The data collected is based on self-reporting by teachers, which could be influenced by biases such as a tendency to provide socially desirable responses or inaccuracies due to challenges in remembering previous knowledge and experiences with gamification, possibly leading to a discrepancy between self-perceived and actual knowledge and implementation practices.

V. CONCLUSION AND FUTURE PLANS

This paper presents findings from the ongoing research in the context of the project "Enhancing Motivation for Learning Through Gamification" on the attitudes of high school computer science teachers towards gamification. The highly positive attitude of the teachers shows that they have recognized the benefits of gamification and the potential of this approach to enhance student motivation and engagement. The research revealed that they are familiar with elements of game design as well as digital tools and platforms for gamification, of which they most frequently use Kahoot! and Quizizz. The research also highlighted areas for improvement, such as encouraging the use of different gamification elements beyond points and leaderboards.

The main finding was that computer science teachers use elements of game design and gamification tools to a greater extent than other teachers. This finding will be helpful for further work on the project as a focus group of computer science teachers will be formed to help design the gamification framework. By leveraging the expertise and experiences of these teachers, the framework will address the specific needs and contexts of high school classrooms. Further systematic research on the technological and pedagogical aspects of gamification is planned for the future in order to propose a suitable framework to support the effective application of gamification in schools and the creation of a more engaging and motivating learning environment for students.

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