THE INFLUENCE OF GAMIFICATION AND MOTIVATIONAL FACTORS ON DRIVER ENGAGEMENT IN ONLINE LEARNING

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Abstract

Gamification of education is a developing approach for increasing motivation and engagement by incorporating game design elements in educational environments. Despite increasing academic research exploring the use of gamification in education little is known about the application of the approach in the context of driver training. This study verified whether the gamification of educational platforms affects drivers' motivation to learn. The influence of individual elements of gamification on motivation was described. Moreover, the research contributes to understanding what demographic characteristics of drivers are related to the perception of different motivational factors used in gamified platforms. To advance understanding if and how educational gamification fosters and influences driver learning, the following three research questions were analyzed: (1) To what degree does educational gamification in general increase drivers' perceived motivation in learning? (2) To what degree do specific game elements impact perceived motivation in learning? (3) Are the benefits of gamification limited to or enhanced in participants with specific demographic characteristics? The study (n = 30) examined how participation in the gamified course overall impacts drivers' motivation, and described the impact of individual gamification elements on motivation. The study demonstrates that a large part (69,6%) of participants reported that, in general, the educational gamification environment used increased their perceived motivation. Participants found it more motivating than a traditional course. Game elements related to tracking one's own progress were found to be most motivating. The involvement of the respondents was strongly related to the need for clearly defined goals that they should pursue when using the platform. These goals should be clearly explained, with a clear system of challenges and rewards. The study showed the benefits of gamification were not limited to participants with specific demographic characteristics. Conducted research suggests that the implementation of gamification schemes in e-learning may bring many benefits which are connected with increasing drivers' engagement in learning and their vocational development. The results indicate a positive recipience of the proposed gamification elements and high level of their acceptance among the people who are about to enter professional driving profession.

Keywords:

gamification, drivers, driver training, motivational affordances

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1. Introduction

1.1. Gamification – definition and assumptions

Education with the use of game methodology is a relatively young field. The concept of gamification was first used by Nick Pelling in 2002 and even then it meant a set of actions from role-playing games that could be adapted to other fields [22, 24]. One of the most universal and commonly used definitions of gamification is the definition of S. Deterding, D. Dixon, R. Khaled and L. Nacke, which says that it consists in "using the elements (mechanisms) of games in a context other than games" [8]. The authors argue that this is a process that uses the way of reasoning and tools from game design to real problems, outside of the context of the game.

The existing literature on the topic emphasizes that gamification should be treated as a method which increases the motivation to learn by covering a wide range of educational activities with a motivating system similar to the course of a game. Gamification should not be understood as the use of games in the didactic process. The main goals of using gamification are to increase involvement in a given activity and to cause or change certain behaviors. Gamification is based on satisfaction with taking up challenges, overcoming difficulties and achieving new goals, opportunities for competition and cooperation. It is a conscious and deliberate application of mechanisms and techniques aimed at strengthening motivation towards initiating activity, increasing sacrifice, loyalty and changing habits [5, 24, 26].

The basis of gamification are three pillars – fun, friends, feedback (3F), which are the basis for the long-term commitment of the game participants [27].

The primary aspect that attracts people to games is the desire to have fun. Any activity that has fun elements in it is considered interesting and, contrary to appearances, less exhausting. Even in situations where the task actually requires more work and more time. A well-built gamification system engages people in a given activity, even if it is considered boring or routine. It should also be noted that play can mean different things to different people. Therefore, it is important to adapt the gamification system to its users. The system should refer to both short-term player satisfaction (i.e. what makes the system interesting for the user) and long-term pleasure (i.e. what makes the user want to return to the system). In order for the system to perform its role well, it should contain three elements: discovery, improvement and rewards. In other words, discovering is arousing the user's curiosity, while improvement is associated with the possibility of acquiring and improving the skills that are necessary to obtain rewards, ie the third element [27].

The second pillar concerns the social context and is based on meeting the human need to establish and maintain relationships with other people and a sense of belonging. This pillar also means the possibility of establishing cooperation within the game or competition. Users of the gamified system through interactions with others define their goals, needs and status. The desire to build their status and gain recognition makes users more willing to perform tasks.

The third element necessary to keep the participant engaged is feedback. Thanks to it, the user learns what he has already achieved, how much work and time it takes to move to the next stage or get a reward. He can also learn about the progress of others. Appropriate feedback is important especially in long gamification systems, consisting of many stages. It stimulates users to be regular and strive for further success. It also helps to build a picture of the game world [27].

1.2. Gamification in education

There is an increasing interest in the use of gamification in education. E-learning in particular seems to be a promising area. In order for the gamified e-learning course to be interesting for users with different motivations, the elements drawn from the games should be properly selected. In the literature on the subject, these elements are classified according to various criteria and defined at different levels, therefore their selection may be difficult for people who design gamification systems.

A properly gamified e-learning course should be interesting for the widest possible group of users and take into account various motivational

factors. Each participant should see aspects in the system that satisfy his needs. In a gamified e-learning course, the main goal is not just to increase participants' engagement, but to achieve specific learning goals.

There have been many studies on the effectiveness of educational gamification in many different disciplines, using various elements of the game [1, 3, 4, 7, 9, 10, 11, 14, 15, 16, 18, 20, 23, 28]. All these studies, including publications presenting the results of empirical research, prove that the implementation of gamification systems brings positive results. Research confirms that the use of gamification elements works well in education – higher commitment and motivation among pupils and students is observed [4]. Similar results were observed with regard to driver education [2, 12, 13, 26, 31], although it should be noted that there is still little research on the application of the gamification method in the context of driver training.

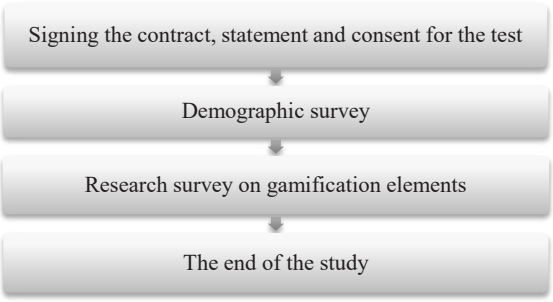
Research on gamification mechanisms indicate that the most frequently used elements are point, badges and result tables [16]. They are aimed at autonomy, competences and relations development [21 after: 29]. Researchers indicate the necessity of fulfilling certain requirements of gamification systems in order to achieve aspired effects. These are i.e. provision of quick and positive feedback, division of the main aim into smaller tasks, design of many paths which lead to achieving the aspired goal, task customization to user competence level, possibility to repeat tasks, use of differentiated elements of game mechanics and encouraging to further action despite temporary failures [19].

2. Methodology

There has been a deficit of research and analysis on the impact of educational gamification mechanisms on driver motivation and performance, and even less on the impact of specific game elements. For this reason, a study was prepared to verify the hypothesis regarding the importance of gamification and individual gamification elements in the context of driver training and their impact on motivation to learn.

More specifically, the purpose of this article was to contribute to the understanding of whether and how gamification affects users of the learning platform, and whether and how demographic characteristics matter. To achieve this goal, we conducted a survey of 30 drivers who were candidates for professional drivers and were provided with two different versions of the learning environment: gamified and non-gamified. Each study participant had access to both versions of the educational platform for a month. A self-report survey was developed to measure perceived impact on motivation to both use each version of the platform and each of the 10 components.

The study was conducted in accordance with the research methodology developed at the Motor Transport Institute. The research scheme is presented in the figure below.



2.1. Research questions

To advance understanding of whether and how gamification fosters and influences drivers' motivation to learn, the following three research questions were posed:

1) To what extent does the gamification of the educational platform increase drivers' perceived motivation in learning?

2) To what extent do specific game elements influence perceived motivation in learning?

3) Are the benefits of gamification limited or enhanced in drivers with specific demographic characteristics?

2.2. Participants

30 people participated in the study, the analyzes were made on the basis of data from 23 people, including 19 men and 4 women. All participants of the study belonged to the NEET group – they were unemployed and at the same time candidates for professional drivers who applied themselves or were sent for training in order to acquire professional qualifications by the local employment office. Each participant had to have valid driving license (category B driving license) and be an active driver. Their participation in the study was not remunerated. The survey was anonymous.

2.3. Educational platform

The author tried to determine what features should be characterized by a well-carried out gamification of an educational platform used for driver training. To answer this question, a synthesis should be made that combines the best practices of general gamification with dedicated concepts for gamification in the field of education. The author, developing the concept of a gamified system, selected the most important elements in his opinion on the basis of recommendations indicated by many other researchers [5, 19, 30]. The separated gamification elements that have been implemented on the educational platform include:

- Points – which are a reward for making progress and conducting desired activities. Points always bring the user closer to winning, therefore they do not have a demotivating factor. For some users, the mere need to collect points may be motivating. Points were awarded for achievements in courses and modules.
- Badges – an element intended to give the user satisfaction. With their help, information about the achievements, challenges faced by the player and his progress is communicated. Badges can be used as achievement markers and replace levels (for example, ranks from novice to master). In the system, it was possible to earn badges for the quantity and quality of tasks performed.
- Levels – form the structure of the game and determine the user's status. They show its position in the classification in relation to other course participants. In selected courses, modules were introduced (division according to the level of difficulty). Reaching a higher level is usually associated with unlocking additional benefits that are not available to users at lower levels – e.g. new tests, the ability to move to previously unavailable options or topics.
- Information about progress – detailed information on progress and achievements. The Activity Monitor was introduced on the platform. The monitor contained course statistics such as: number of consecutive study days, average number of questions per day, percentage of slides read, percentage of exercises completed. This information was usually provided in the form of graphs, histograms or in digital form. The messages showed the user's current score relative to those previously obtained.
- Quick feedback – mean immediate information on the activity and results of the user's decisions. This information was provided to the user in the form of messages in a visible place (speech bubbles, a separate part of the screen).
- Ranking – detailed information about the progress and achievements compared to other participants. Ranking tables have been introduced on the platform, making it possible to compare achievements and competing.
- Challenges – difficult, demanding tasks or problems to be solved allow for maintaining a high level of commitment. The system is based on 2 types of questions – difficult questions and questions to be reviewed. Difficult questions are questions that the user marked while taking the tests by clicking on the "mark as difficult" button, while questions for revision are questions that were answered incorrectly twice. In the exam mode, the participant has the option of running an exam consisting of difficult questions and questions to be repeated, supplemented with random supplementary questions (due to the fact that the exam must have 32 questions). In addition, a "recommended module" was created, i.e. the module with which the user had the biggest problems and the most incorrect answers. The module is marked in red on the educational platform.
- Adjustment (Avatar) – an element of strengthening engagement among users for whom social motivation is characteristic. On the educational

platform, each user has an individual profile that contains information about the user's status, membership of the participant in a given group, badges received by him, and the awards and virtual goods, i.e. progress towards the set goal. The user can freely adjust the profile according to individual preferences, e.g. by adding information about himself or a photo.
- Clear goals – clearly defined long and short-term goals, which are to strengthen the sense of purposefulness of the activities undertaken by the user. Precisely defined goals are the reasons why the user wants to learn with the platform. Achieving these clearly defined goals is rewarded based on clear rules. The platform has a clear division into type of training, course and tests. The possibility of checking knowledge in all trainings was introduced, i.e. the possibility of verifying the achievement of the goal. Internal communication was enabled both between users and between the user and the instructor, i.e. on-line help and a forum for beginners.
- Rewards – goods awarded for achievements and progress on the educational platform. Points awarded for individual activities, which are virtual currency, can be exchanged for other goods, virtual or real. An example of a prize may be a surprise prize for the leader of the ranking.

After selecting the most important gamification elements, they were implemented on a specially prepared e-learning platform. The educational platform used in this study was designed and piloted in cooperation with the CARGO Group. After the pilot implementation, the system was made available to users, who were then asked to evaluate the introduced functionalities.

2.4. Research survey

A proprietary research survey was used to verify the perceived impact on the motivation of both the entire gamified course, as well as each of the 10 gamification elements. The survey was based on self-report measures. It was concluded that self-report ratings would be more useful in this study than an objective measure of motivation (e.g. user ratings in tests), which would say little about why educational gamification affects or does not affect drivers' motivation. The developed questionnaire consisted of questions on a 5-point Likert scale. Users' perceptions of the impact on motivation were measured with one question for each game element. A question about motivation for each gamification element was as follows:

This survey is designed to check your opinion on each gamification element presented to you. For each item listed below, respond to the following statement: Based on your learning goals, do you think that this element of gamification could affect your motivation to learn? Determine on a 5-point scale to what extent you were [much less, less, neither less or more, more, much more] due to this element of the game, compared to your typical level of motivation.

To measure the overall impact, participants answered the following question:

Considering the combination of the above-mentioned gamification elements, how would you rate your motivation to complete this course? Use a 5-point scale to indicate to what extent you were [very poorly, poorly, moderate, well, very well] motivated to complete.

In addition the participants of the study completed a short questionnaire on demographic elements and behavior in road traffic, important for the purpose of the study. The survey also included questions about gaming experiences, such as: the frequency and type of games played, knowledge of the concept of gamification and previous experiences with gamification elements.

3. Results and discussion

3.1. Demographic survey

Of the students, 82.6% were men and 17.4% were women. They were aged from 21 to 40 (M = 28; SD = 5.9), with 73,9% being 20–30 years old. All study participants were Caucasian, which is representative of the local geographic demographics. 47.8% of participants had secondary education, 26.1% had vocational education, and 26.1% already had a university degree. The subjects were active drivers, regularly driving the vehicle under their driving privileges. All participants had a standard driving license (category B in the Polish transport system). However, some of them also had a different type of driving license (category A – 17.4%; category C – 8.7%; category T – 4.3%). Driving experience ranged from 2 to 21 years (M = 8.42; SD = 4.88). The participants rated their driving skills as poor or very poor (21.7%), intermediate (4.3%), good (30.4%) and very good (43.5%). In the context of driving frequency 87% declared that they were everyday road users as drivers, 8.7% drive a vehicle several times a week. Drivers participating in the study have extensive driving experience, some of them (30,4%) passing month, more than 1 700 km. Third of them (30,4%) travel between 250 and 850 km a month, 34,8% of the respondents travel between 860 and 1700 km, 4.3% up to 250 km.

3.1.1. Part of the survey regarding gamification

Most of the surveyed drivers (78.3%) use electronic devices such as a computer, smartphone or tablet on a daily basis. 95.7% assess their ability to use these devices as good or very good. This indicates a great sense of comfort in using technology. 43.5% of respondents play games sporadically (once a week), while 26.1% play games several times a week. Only 3 people declared that they do not play at all. Most people (34.8%) choose computer games. 26.1% choose board and card games, while 21.7% declare that they play all of the above-mentioned types. More than half of the respondents had not encountered the notion of gamification, gamification or gamification before (60.9% of the respondents). Only 26.1% answered in the affirmative. Before this course and research, 34.8% of participants had no experience of using any elements of gamification.

3.2. Motivational factors and drivers' involvement in learning

After getting acquainted with the interfaces of the platform, the participants were asked which one they prefer to use in a gamified or traditional one – 69.6% of drivers indicated the course with gamification as the one that was more motivating than the traditional course. Almost 91.3% of the survey participants rated their overall motivation to complete the course as good or very good. In addition to overall motivation, the level of motivation provided by the 10 game elements was measured (see Table 1). The five most motivating elements of the game are clear goals, rewards, challenges, points, and progress information.

Table 1. Percent of responses given for each motivation level for each game element (motivational factor)

Gamification element	Average	Much less (1)	Less (2)	Neither less or more (3)	More (4)	Much more (5)
Points	4,0	0	13	4,3	52,2	30,4
Badges	3,82	4,3	13	8,7	43,5	30,4
Levels	3,65	8,7	17,4	8,7	30,4	34,8
Information about the progress	4,04	0	13	8,7	39,1	39,1
Ranking	3,73	4,3	17,4	13,0	30,4	34,8
Challenges	4,08	8,7	4,3	13,0	17,4	56,5
Avatar	3,08	17,4	21,7	13,0	30,4	17,4
Quick feedback	3,82	0	21,7	8,7	34,8	34,8
Clear goals	4,26	0	4,3	13,0	34,8	47,8
Awards	4,21	0	13,0	0	39,1	47,8

Pearson's correlation coefficient (see Table 2) was used to calculate the correlation matrix for the survey variables. Rows with missing data were dropped for specific correlation pairings and p values were computed for each correlation.No significant correlations were found between overall motivation to complete the course and any measured demographic variable. In other words, the motivation was maintained regardless of the student's age, gender, education, current status in relation to the situation on the labor market, or the sense of comfort in using technology. A positive correlation was found between age and the platform interface ($r = 0.56$, $p = 0.01$). Moreover, education was negatively correlated with the level of perceived motivation in relation to the elements of gamification: levels ($r = -0.54$, $p = 0.01$), challenges ($r = -0.53$, $p = 0.01$) and rewards ($r = -0.43$, $p = 0.05$).

Table 2. Correlation matrix for demographics and game element motivation.

Variable		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Gender																	
2	Age	0,36																
3	Education	-0,32	0,04															
4	Motivation	-0,24	-0,09	0,06														
5	Work	0,09	0,40	0,10	0,00													
6	Comfort	-0,15	-0,23	0,31	0,16	0,09												
7	Interface	0,30	,556**	0,26	0,00	0,22	0,17											
8	Points	0,12	-0,34	-0,26	0,00	-0,35	-0,08	-0,20										
9	Badges	0,13	-0,23	-0,37	-0,24	-0,29	-0,18	-0,15	,826**									
10	Levels	0,05	-0,32	-,540**	-0,17	-0,33	-0,31	-0,25	,697**	,881**								
11	Information about the progress	0,02	-,323	-0,36	-0,04	-0,17	-0,27	-0,41	,747**	,739**	,792**							
12	Ranking	0,00	-0,29	-0,20	-0,07	0,01	-0,04	-0,09	,724**	,660**	,555**	,614**						
13	Challenges	0,21	-0,18	-,563**	-0,07	0,01	-0,36	-0,04	,618**	,761**	,828**	,811**	,596**					
14	Avatar	0,03	-0,20	-0,26	-0,26	-0,15	-0,17	-0,04	,540**	,679**	,675**	,533**	,811**	,585**				
15	Quick feedback	0,13	-0,32	-0,27	0,00	-0,29	-0,05	-0,23	,578**	,591**	,593**	,624**	,502*	,461*	0,40			
16	Clear goals	0,14	-0,29	-0,36	0,05	-0,24	-0,12	-0,32	,662**	,594**	,618**	,759**	,444*	,581**	0,35	,822**		
17	Awards	0,22	-,463*	-,432*	-0,05	-0,25	-0,30	-0,34	,717**	,705**	,790**	,882**	,557**	,784**	,502*	,705**	,827**	

** p<.05, ** p<.01.*

4. Conclusions and recommendations

The use of gamification in e-learning is becoming more and more popular due to its great potential to strengthen motivation and increase engagement in learning. In this study, we tried to verify the effects that each element of gamification can have on the motivation and commitment to e-learning training. This study can be the basis for further work to determine which game element configurations work best and why, in the context of driver training. The three research questions posed above brought the following conclusions. First, this study shows that a large part (69.6%) of course participants reported that the gamification environment used increased their perceived motivation; found them more motivating than the traditional course design. Secondly, the game elements related to, among others, with tracking own progress. Moreover, the drivers showed the need for clearly defined goals. These goals should be clearly explained, with a clear system of challenges and rewards. Third, it has been shown that the benefits of gamification are not limited to drivers with specific demographic characteristics. Motivation was maintained regardless of the driver's age, gender, education, current status in relation to the situation on the labor market, or the sense of comfort in using technology.

It should be noted that although the majority of the surveyed drivers found the gamified educational platform motivating to learn, 30.4% of the trainees found it less motivating than the traditional course. In further research, these results should be verified in order to understand and adjust the motivational styles of these people.

In this study, we used a survey tool to assess motivation, we did not use an experimental study or an attempt to assess learning outcomes. As mentioned earlier, it was found that this evaluation method would be more useful in this study than an objective measure of motivation (e.g. user ratings in tests), which would say little about why educational gamification affects or does not affect drivers' motivation. In our opinion, this is the best approach to studying gamification at the moment. Currently, little empirical research has been published on specifically gamification in driver education. At the moment, there are no widely accepted best practices, theoretical justifications or definitions, models, tools and methods of assessment that are specific or have evolved from educational gamification research. We believe that it is important at an early stage of development of the theoretical foundations of educational gamification to explain what effective educational gamification is, define its principles and establish a theory of its operation [3, 19]. For these reasons, in this study, we used the survey method to gather data that will help elucidate the theory behind how an educational gamification course should be designed to ensure the greatest impact. We believe that once effective theoretical models and assessment tools are developed, the next step will be to look at the overall impact of specific implementations on student performance in experimental research.

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