

How do students see the role of serious games in education?

An Eastern-European example

Grabbing and holding student attention was a big challenge even before the Covid-19 era; however, the coronavirus and the obligatory digital education showed that new methods are needed to resolve these issues. One of them could be implementation of digital serious games. This paper presents the findings of a questionnaire about the feelings of students toward digital serious games. In all, 1755 answers were collected and analyzed and the results showed that most students do not shy away from using these kinds of video games in a classroom environment, although there are various concerns and key aspects educational professionals must consider.

Keywords: *Serious games, education, video games, student attitudes, gamification, learning*

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1. Introduction

Grabbing and holding student attention is a big challenge every teacher faces during lessons. The current literature has emphasized for years now the limitations of the traditional teaching methods and urges educational professionals to realize the need for more active student participation (Murray and Lang 1997). Traditionally, educators had the active role of professional performers on the classroom stage, whereas most students play the passive, silent audience seeking knowledge. However, based on several studies (Abdullah, Bakar and Mahbob 2012; Murray and Lang 1997; Rocca 2010; Tatar 2005), active student participation facilitates acquisition of knowledge and development of various skills better, as well as leading to a higher level of satisfaction. For this study, we refer to students who share their thoughts, ask questions, participate in group tasks, and do the various exercises as *actively* participating students. On the other hand, we refer to students who keep silent, take notes for themselves, or do something irrelevant to the lesson as *passively* participating students.

Based on various studies in the field of teaching and learning, it was found that students who play an active, participating role tend to have better academic achievement, show higher satisfaction in the learning process, and have a more effective and enjoyable learning experience compared to others (Astin 1999; Tatar 2005). Aguilon et al. (2020) mention that, based on their findings, men tend to participate more actively than women. According to Liu (2001), four forms of student involvement are recognized in the classroom: (1) integration, (2) participation in circumstances, (3) marginal interaction, and (4) silent observation. During full *integration*, students engage actively in work during lessons, and they discuss their thoughts with the educator, make questions, and give answers. Taking one step back, *participating in circumstances* means that students are led to participate due to various factors, such as obligatory exercises or one's internal need influenced by sociocultural factors. *Marginal interactions* refer to students who speak less during lessons. However, while they avoid any unnecessary interaction, they are active listeners, take notes, and, if they must speak, speak their mind but accept any given topic of the class discussion. The last category consists of students actively avoiding oral participation. They tend to make pictures about the boards and presentations and download the necessary educational material, not actively participating in the lesson. One can agree that Liu's first two categories consist of actively participating students, while the last two refer to passively participating students.

From the students' point of view, learning and participating in a lesson can be seen as a behavior aimed at acquiring knowledge. Like any other act, one must actively be present and do something to achieve one's goal. According to Meyers and Jones (1993), it would be advisable for educators to encourage this behavior and use techniques that require the more active participation of students, like cooperative learning, role-playing, problem-solving. Moving forward on this line of thought, educators are responsible for educating successfully, entertaining, and motivating students (Abdullah, Bakar and Mahbob 2012). However, this can be a challenging task given the wide variety of student perceptions, motivations, and interests. Addressing this issue, serious games can be one successful tool of the many possibilities.

The basis of the term serious game is the game itself. Based on previous studies, it is agreed that a game is a closed, formal system that operates through a well-designed set of rules, and the players are faced with many challenges in trying to achieve their given goal (Adams 2014; Avedon and Sutton-Smith 1971; Ellington, Addinall and Percival 1982; Tekinbaş and Zimmerman 2003, 2006; Stenros 2017). According to Wittgenstein (Wittgenstein and Anscombe 1953), the core building blocks of the term game (rules, play, competition) cannot define and delimit the concept. Instead, he says that the game terminology is used for activities that can be grouped by their similarities. Caillois (1953) said that a game must satisfy six criteria: (1) entertainment, (2) clear separation from the real world, (3) outcome cannot be predictable, (4) cannot be productive (e.g., earning money), (5) based on a specific ruleset, (6) based on its own, unreal world. As Caillois said, involuntary playing makes the game cease to exist as a game. Based upon this statement, a game can be defined as a voluntary activity where players can carry out various actions (Avedon and Sutton-Smith 1971; Dempsey et al. 2002; Duke 1974; Klabbers 2006; Suits 2005). According to Juul (2005) – similar to Caillois, but different in some aspects – a game can be defined according to the following concepts:

- closed, formal system with a set of rules
- the outcome is variable, quantifiable, and can be calculated and predicted
- different values for different outcomes
- outcomes can be influenced by player effort
- the player is emotionally attached to the outcome
- negotiable consequences.

Inspecting all the various definitions and examples of games leads to one common aspect: the closed system built upon a set of rules. However, academics interpret this aspect differently. One way to see the game is that the rules limit the playing activity (Avedon and Sutton-Smith 1971; Lévi-Strauss 2000), while others say that rules create the world of the game (Riezler 1941; Suits 2005). Furthermore, this set of rules results in a quantifiable process that game designers can consider (Crawford 1984; Ellington, Addinall and Percival 1982; Hunicke, Leblanc and Zubek n.d.; Stahl 1983; Zubek 2020).

The term *serious game* leads back to the renaissance era, where “*serio ludere*” was used for situations where humor was used to deal with serious matters (Djaouti et al. 2011; Manning 2003). The first definition, closer to the meaning academics use nowadays, comes from Clark Abt (1970). According to Abt, serious games are created with a well-designed educational goal in mind. This does not mean that these kinds of games cannot be entertaining. On the contrary, a good serious game is both an enjoyable game and an excellent educational tool. Using serious games for digital educational games comes three decades later from Ben Sawyer (2002), who launched the Serious Game Initiative and called for implementing the various techniques and mechanics from video games for the further development of game-based simulation.

According to Djaouti, Alvarez, and Jessel (2011), any serious game can be identified by three major aspects: *gameplay*, *purpose*, and *scope*. Together, these three aspects make up the G/P/S model, where *gameplay* refers to the structure and mechanics characteristic of games. *Purpose* stands for the game’s primary goal, not

in the sense of achieving something inside the game's world but beyond that (e.g., teaching something). Purposes can be grouped into three categories: broadcasting a message, exchanging data, or training. *Broadcasting a message* means that the game's primary goal in the real world is to give information about a specific topic. This can be – included but not limited to – with educational purposes in mind, for instance, or to raise awareness of an important issue. Exchanging data means that the given game was created in order to share knowledge. *FoldIt!*, for example, is a successful bio-research game where players need to achieve the optimal structure of protein molecules. The game is constantly monitored by experts who have thousands of helpers this way (who probably don't even know what they are doing, but they understand the rules of the game). Last but not least, the *training* games goal is to develop a specific skill set. *Pulse*, for instance, is a serious game to teach techniques for diagnosing in an emergency context. Finally, **scope** stands for the application the serious games are used in, like education, politics, marketing, and so on.

Examining the wide range of literature available in the field of serious games, one can agree that these kinds of games have the potential power to become a successful educational tool (Abt 1970; Alvarez and Laurent 2008; Arnab et al. 2015; Cain and Piascik 2015; Gredler 2004; McArthur and Teather 2015; Michael and Chen 2006; Ravysse et al. 2017; Tsai et al. 2020; Ghoman et al. 2020). However, according to Caserman et al. (2020), “high-quality serious games must achieve both the serious and the game aspects; they must systematically support players to reach the characterizing goal (serious part) and they must elicit and maintain player experience (game part).” While the original definition of serious games stands for not only digital games but more traditional games, for the purposes of this study the term will be used for digital serious games only.

2. Research and method

The present study aims to assess what Hungarian secondary school students think about entertaining and educational serious games in a classroom environment; why they think it is a good idea to use them or why not.

In order to answer these questions, a questionnaire survey was conducted among secondary schools. The selection was based on the Hungarian Enrollment Information System for Secondary Schools (in Hungarian: KIFIR). A unique database was created from the collected schools, including all types of secondary educational institutes with their email addresses (KIFIR 2021). The email addresses were collected with the help of the Google search engine from the official websites of the schools. However, in some cases in the Hungarian educational system, some schools belong to the same central institute and have the same central email address. In these cases, duplications were removed, which resulted in 1127 email addresses. According to the Hungarian Central Statistical Office (2021), there are 2243 secondary educational institutes in Hungary. However, their methodology includes the same school multiple times if said school or its sub-institute belongs to multiple categories. Keeping

this in mind, it is strongly believed that the 1127 emails covered all Hungarian secondary institutes.

The questionnaire was made using Microsoft Form, and it consists of four main parts. The first asks for information about the students' gaming habits, especially how often they play and what kind of game they prefer. The second section asks students about their opinions of the use of video games in education. This part mirrored one previous research (Péter-Szabó 2022) that asked teachers about the same thing but from their point of view. The third section consists of seven-point Likert scales that collect information about students' preferences in video games, focusing on the game mechanics. The last section consists of demographical questions. The questionnaire was sent twice for all institutes with two weeks between them, which summed up the data collection for a one-month period.

3. Results

In total, 1755 answers were collected within the one-month period; of those, 1753 were valid answers. For reasons of anonymity, it is not possible to tell from which and how many schools the answers arrived. The remaining two were removed because they were not finished, and only the first two or three questions were answered. More than half of the participants were *male* students (56%); the rest (44%) were *female*. Most of the participants were above 15 years old: about a quarter (25.15%) were aged 15, 21.33% were aged 16, 18.42% were aged 17, and 12.77% were aged 18. The majority of students came from a technical school (37.07%) or a high school (31.94%), while 13% came from a secondary vocational school and 12.09% from an ordinary vocational school. The gender and age distribution by the four main school types can be seen in Table 1.

	Technical school	High school	Secondary vocational school	Ordinary vocational school
Total answers received	647	558	228	211
Male	21.11%	15.57%	7.24%	7.53%
Female	15.80%	16.26%	5.76%	4.51%
15 years old	51.70%	29.71%	3.40%	10.43%
16 years old	39.30%	37.97%	6.15%	12.30%
17 years old	22.91%	37.15%	26.32%	11.76%
18 years old	19.64%	33.48%	25.89%	15.18%

Table 1. Total gender and age distribution by the main school types (own editing)

The first question asked students how often they play video games, and 35.71% answered they play video games every day, of which 86.42% were male students. Further, 415 students (23.67%) said they play at least every week, and 281 (16.03%) answered they do not play video games at all. The results can be seen in full detail in Table 2.

Question	Student	Percentage	Male	Female
Every day	626	35.71%	541	85
At least once a week	415	23.67%	282	133
Once every two week	108	6.16%	45	63
Once every month	112	6.39%	33	79
Less than once a month	169	9.64%	27	142
I do not play video games	281	16.03%	32	249
I don't know / no answer	42	2.40%	16	26
Totals	1753	100%	976	777

Table 2. Students' gaming habits (own editing)

Regarding students' preferences for the various video game genres, it can be stated that the most popular kind is action games (52.3%), followed by e-sport (40.53%), strategy (37.23%), and racing games (35.58%). As the competitive multiplayer segment of some games can be seen as "e-sport" by some of the players, this choice had a sidenote in the survey with examples that were made only for "e-sport" purposes (e.g. League of Legends, Dota, Fortnite). The most common platform students use for playing is a personal computer (66.21%), followed by their mobile phone (54.7%) and one of the released Xbox consoles (30.72%). Tables 3 and 4 show the gender distribution in terms of the top video game genre and the top-used platforms.

Genre	Male	Female	Sum
Action	585	172	757
E-sport	459	130	589
Strategy	365	179	544
Racing games	349	168	517

Table 3. Top-played genres by students (own editing)

Genre	Male	Female	Sum
PC	701	271	972
Mobile	442	361	803
Xbox (360,One,X)	296	155	451
Playstation (3,4,5)	206	97	303

Table 4. Top-used platforms by students (own editing)

The question “*What is your favorite game?*” generated 1681 answers; of these, 292 students said they do not have a favorite game. The remaining answers reveal a wide range of games from which stand out most of the free-to-play and e-sport games that are popular nowadays, like League of Legends, Valorant, Genshin Impact, Rainbow Six: Siege, Counter-Strike, and Fortnite, as well as some paid favorites like Call of Duty, Minecraft, Fifa, Grand Theft Auto, and Forza Horizon.

The second section of the questionnaire consisted of questions about using video games in a classroom environment. The first question asked the students’ opinions using a seven-point Likert scale about the usefulness of video games during lessons. Based on the results, students’ opinions vary widely, as there are almost as many students against using video games (32.8%) as there are students in favor of their use (45.4%). The detailed results can be seen in Table 5. However, 14 answers were removed since Microsoft Form due to an error allowed the users to leave questions unanswered.

Answer	Distribution	Male	Female	How many of them play video games at least once a month?
1	11.04%	84	108	83 (M:61; F:22)
2	8.05%	58	82	82 (M:50; F:32)
3	13.74%	106	133	146 (M:96; F:50)
4	21,74%	194	184	270 (M:182; F:88)
5	19.61%	196	145	273 (M:185; F:88)
6	8.63%	99	51	128 (M:98; F:30)
7	17.19%	232	67	270 (M:222; F:48)

Table 5. Usefulness of video games in a classroom environment (own editing)

Students were asked why they think a video game can be helpful during lessons and the answers provided covered a wide range of possibilities. However, some responses showed outstanding popularity among students. Mostly, they think a video game would make the lessons more interesting (57.33%), it would be easier to learn foreign languages (47.40%), they would be more motivated to learn the curriculum (38.62%), and it would be easier to do so (34.05%).

On the other side, inspecting the students' feelings and fears about using video games in a classroom environment, most stated that the school equipment is not sufficiently good to play games on them (27.32%). Further, 471 students feel that many of their schoolmates do not play video games, from which 134 students play games less than once a month or not at all. Also, 385 students (21.96%) fear they would not be able to differentiate between the actual knowledge and the possible fiction of the video game, and 349 (19.90%) of them stated that they do not even have time for the compulsory curriculum. While 310 students (17.68%) think the content of video games is inappropriate for a classroom environment, 399 (22.76%) do not see a problem at all with using them.

Of the responses for the question “*What lessons could you imagine teaching with a video game?*” the top three answers were informatics (61.15%), foreign languages (49.69%), and history (46.89%). However, mathematics (31.26%), media (29.78%), geography (28.69%), and physics (26.70%) are also among the honorable mentions.

The last section (not counting the demographical one) consisted of questions about the students' preferences for video games and their feelings about using them in a classroom environment. To answer these questions, seven-point Likert scales were used.

	Good graphics	Exciting story	Easy assibility	Multiplayer option	Challenging gameplay	Character progression
1	7.8%	8.4%	7.8%	9.0%	5.3%	7.4%
2	4.6%	6.1%	6.4%	6.1%	3.4%	5.2%
3	9.5%	8.9%	11.7%	9.3%	7.1%	9.8%
4	14.7%	14.4%	16.9%	21.5%	14.0%	17.4%
5	16.5%	17.1%	17.1%	15.9%	23.0%	17.5%
6	15.0%	16.1%	14.8%	14.4%	19.3%	15.9%
7	31.8%	29.1%	25.3%	23.8%	27.7%	26.8%

Table 6. Importance of game mechanics (own editing)

It can be seen that a vast majority of students think that a video game could be as good as possible, yet it cannot replace teachers. Moreover, 39.5% disagree with the statement that a video game can replace a teacher, and 34.4% somewhat disagree

with it. Only 14.9% answered with five or more points. However, most students feel that a properly made video game could help the teacher in lessons or could be an excellent substitute for homework. Only 7.1% of the students think that a video game is unsuitable for teaching, and 10.7% think it is somewhat unsuitable.

Regarding the video games themselves, it can be stated that the most important thing for the students is for the games to be and remain entertaining for a long time. They value good graphics, an exciting story, and easy accessibility. However, they do not mind if the game is not easy, and they welcome the various challenges. More than half of the students stated that it is important for them to have a multiplayer option and to be able to collect points, gear, and progress with their character level.

4. Discussion

The introduced results show that most students do not shy away from using video games in a classroom environment; however, some interesting points are worth mentioning. While more than half of the respondents play at least on a weekly basis, much fewer actually think that video games are appropriate for a classroom environment. This can be explained by the fact that the well-known video games are commercial games among these students, whose primary goal is not education but entertainment. Furthermore, suppose one investigates the favorite games the respondents indicated. It is easy to see that most of these games are not even remotely connected to education (except maybe Minecraft, but Minecraft Edu is a very different version of the base game). League of Legends, Fortnite, Call of Duty, Fifa, Grand Theft Auto, and the other earlier mentioned examples are all about entertainment and competitive gaming without content that is easily usable in a lesson.

Most responses given for the question “*Why do you think a video game can be useful during lessons?*” correlate well with what most researchers think about video games. When academics talk about the power of video games in a classroom environment, motivation, entertainment, and language learning are always among the top reasons. Investigating the question’s counterpart and analyzing the fears and possible barriers, it is worth mentioning that the perceived usefulness, in general, outperformed the perceived negative side of the coin. While asking for the positive sides of using video games, in many cases the number of answers was above 500 or occasionally 1000. However, inspecting the negative side, none reached 500.

Regarding the possible subjects video games can be used for, it can be seen that, according to the students’ opinions, mainly visually representable subjects were mentioned. Even math and physics can be classified in this category, the former due to its logical connections, the latter due to the possible representation of experiments. It is interesting to see that exercising and dancing received meager points because there are many movement-centered games, even consoles, out in the market (Just Dance, Nintendo Wii, VR). However, this can be explained by the fact that most students think that schools do not have the necessary equipment to run these kinds of games.

The students' video game preferences also give information for future serious game developers. While graphics (the most expensive part of developing a game) are important for most students, a good story and gameplay mechanics are more vital. Moreover, this fact can help to make use of serious games more available and popular among schools, as the modest graphical settings result in a much lower system requirement.

5. Summary

Many researchers have already found that many teachers already use video games for teaching purposes in Western-European countries (Kennedy-Clark 2011; Ruggiero 2013; Sandford et al. 2006). According to Williamson (2009), in the United Kingdom 35% of teachers already use and 60% plan to use a video game in a classroom environment. In Hungary, only 30% of teachers use a commercial video game for teaching purposes, and 55% use a serious game (Péter-Szabó 2022). Examining the results of this study, it can be safely claimed that most of the students would welcome teachers trying, at least.

The power of video games is recognized even on a global scale. Successful and well-known developers have already created mods for their game, giving an easy way to implement them into the curriculum (e.g., Assassin's Creed Discovery Mode and Minecraft Edu). Students are interested in video games, and, according to this paper's results, they are interested in being taught by them. This result is significant because positive feedback from students and teachers can influence developers and the video game market (Bokor 2014).

However, developing a good and entertaining video game is a challenging task, not to mention how extremely costly it could be to meet student expectations. However, seeing the results, it can be stated that there is a corresponding demand for educational video games in Hungary. Earlier research (Péter-Szabó 2020) showed that even a game as simple as a text-based adventure game can develop student knowledge successfully. Keeping this and the Western-European examples in mind, why shouldn't we try to make educational video games accessible, then?

6. Limitations

This study has its limitation in the number of received answers. According to the Hungarian Statistical Office (2021), there are approximately 469,428 students in secondary education, but for the questionnaire only 1753 valid answers arrived. This fact makes the response rate below 1%, but it must be pointed out that it is possible that not every school secretariat forwarded the questionnaire to the students, and many schools have students with special needs who did not complete the survey.

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