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САДРЖАЈ
TARTALOM
SADRŽAJ
CONTENTS

BORSOS ÉVA, HALASI SZABOLCS, NÁMESZTOVSZKI ZSOLT
Hogyan változott meg a tanítók véleménye a tantermen kívüli oktatásról az elmúlt években? 13

GYŐRFI TAMÁS, PATOCSKAI MÁRIA, PAJROK ANDOR, TAROVÁ TÓTHOVÁ ÉVA
Logikai gondolkodás összehasonlító vizsgálata pedagógus és gazdaságtudományi képzésben résztvevő hallgatók körében 21

KOVÁCS MIHÁLY, MURÁNYI ZOLTÁN
Usage of escape game to the formation of elementary teacher students' environmental attitude 29

ÁGNES MAGYAR
Digital storytelling on musical impulse 36

MAJOR LENKE, GRABOVAC BEÁTA, NÁMESZTOVSZKI ZSOLT, HORÁK RITA, KALMÁR LAURA
Interdiszciplináris műhelymunka a környezettudatosság fejlesztésére 43

IVANA NIKOLIĆ, SARA RATKAJ, SNJEŽANA MRAKOVIĆ
Tjelesna aktivnost i status uhranjenosti učenika primarnog obrazovanja 53

LEONA ROCA, MARKO BADRIĆ, ANA NIKIĆ
Povezanost prehrambenih navika i tjelesne aktivnosti kod učenika primarnog obrazovanja 59

HRVOJE ŠLEZAK, TIHANA ŠKRINJARIĆ
Pokus u nastavi Prirode i društva 71

STANKOV GORDANA, PAPP ZOLTÁN
Kommunikáció a matematika nyelvén 84

ГОРДАНА СТАНКОВ, ГАБРИЕЛА ТОТ-БАБЧАЊИ
Увођење појма функције и развијање математичке комуникације 93

TÓTH MARIANN
The constructive possibilities of drama pedagogy in the light of school performance 99

АУТОРИ / SZERZŐK / AUTORI / AUTHORS 106

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USAGE OF ESCAPE GAME TO THE FORMATION OF ELEMENTARY TEACHER STUDENTS' ENVIRONMENTAL ATTITUDE

Abstract

Grastyán (1983) stated that one of the most adaptive answers to the passivity and "boredom" that occurs as a result of technical civilization is the game. In addition, one of the possible and nowadays increasingly researched ways to influence students' environmental attitudes is also the game.

We have planned an offline escape game on the topic of waste, which we are going to get elementary teacher students to play with during October. We measure attitudes before and after the games, for which Uzun et al. (2019) questionnaire's Environmental emotion subscale was translated and adapted to Hungary. During the games, we are also going to observe how the players communicate with each other and for what they use their smart devices during the game. We plan to evaluate the results of the attitude tests using the Wilcoxon test. We would like to report our results at this conference.

Keywords: *Escape game, environmental attitude, attention, usage of smart device, waste*

1. Introduction

There were more authors in the field of educational research who had defined escape rooms. Wiemker, Elumir, and Clare's definition (2015, 55.) is for educational purposes, therefore we cite this first: "an escape room is a game played by a team of people where they have to 'escape' from a room filled with challenges within a given time limit. In order to win ('escape'), the players must solve the challenges contained within the room. At the outset of the game, the challenges may be made inaccessible and must be found by completing puzzles." They emphasized that this game was more than just a series of puzzles, but in the core, it was similar: a challenge, a solution and some kind of reward.

However, Nicholson (2015, 1.) has written the most cited definition of escape games: „Escape rooms are live-action team-based games where players discover clues, solve puzzles, and accomplish tasks in one or more rooms in order to accomplish a specific goal (usually escaping from the room) in a limited amount of time."

The first well documented escape room was opened in Kyoto, in 2007. (Nicholson, 2015) As we have seen, this game type was used for educational goals in 8 years, as Wiemker, Elumir, and Clare's definition was from 2015. Since 2007, the escape games inspired other fields of culture. Now, there are escape board and card games, escape books and escape comics on the market, which can be played even alone, as well.

Grastyán (1985) stated that games were especially important to human beings, as they could prevent boredom, which was a consequence of the increasingly impulsive world. So, he concluded, that games could prevent stimulus deprivation states and this way it could even save someone's life. Games also helped the players to keep their arousal on an optimal level. In the case of school, this one is the more important aspect since this helps the students to be motivated.

Douglas and Brauer (2020) have found in their review that gamification, particularly board games could lead to increase of environmental attitudes. Besides, Kovács, Manojlović, and Pintér Krekić (2022) suggested that escape rooms could be used for improving soft skills, they examined the problem-solving skills and got promising results. So, our first research question (Q1) was if could environmental attitudes increased with escape games, too? And based on the previously mentioned results, our first

hypothesis (H1) was that educational escape games would influence the environmental attitudes of elementary teacher students.

The most important definition of attitudes was given by Allport (1935). He suggested that attitudes were mental and nervous state based on experiences, which influenced the individual's behavior toward their object. However, the description of Hunyadyné (1979) fits better to the questionnaire we used in our research. She wrote that attitudes are emotional-cognitive relations interwoven with evaluation.

Our second research question (Q2) was how did the players use their smart devices during an offline Educational Escape Game? Would they even use it, and if the answer was yes for what purpose? In the review of Lathwesen (2021), the escape games were described as immersive educational methods. Therefore, our second hypothesis (H2) was that they would use their devices rarely during the game and mainly to achieve its goal.

Zhang et al. (2018) and Taraldsen (2022) connected the escape games to four major learning theories: behaviorism, social learning, cognitivism, and constructivism. The connection with behaviorism is quite simple, opening the lock means they thought process was right. This effect can be stronger, if the puzzles are ordered in a sequential line, but we chose another arrangement to provoke debates, which is an important factor of learning in the socio-constructivist paradigm. The connection with Banduras' social learning theory (1971) is based on the possibility to observe the teammate who solves a riddle successfully. In the cognitivist theory of Grider (1993), the source of learning is problem solving, and the reason is the motivation to work out that problem. Every single puzzle of an escape game is a different problem, and also, we hope that escape, the goal of the whole game, is a problem which motivates the participants.

To plan the game, we used the socio-constructivist approach, which was declared the most important learning theory connected to the escape games. (Zhang et al, 2018 and Taraldsen, 2022) We found that Bélanger's description (2011) fits the best to this type of game. He stated that construction of knowledge happened during communication, projects, or problem solving. This process needed a problem of suitable difficulty, which also activates prior knowledge. Cognitive conflict originated from mistakes and debates. However, we also considered the paper of Driver et al. (1994), in which they wrote that the source of cognitive conflicts was the teacher. We thought that in the situation of the game the teacher could be replaced with the more experienced player.

2. Description of our game

The participants worked as a group of detectives, who searched for robbed money in the house of a suspect. They found a briefcase and a money box next to each other on the desk, and there was a short poem on the case. Their goal was to open these two things, both had number locks.

Firstly, the players had to solve an introductory puzzle, with which they could open the briefcase and started the clock. They had to found six hidden numbers in the short poem, they had to realize, that some of the letters were exchanged to similar digits. From the opening of the case's locks, they had twenty minutes to achieve the second goal. In the briefcase, they could find a lot of waste. We hoped that this quiet shocking experience could help to increase the environmental attitudes, too. When they opened the briefcase, they had to found and work out three parallelly solvable puzzles connected with the wastes. Then, with the three results they could get through on a meta-puzzle, so open the money box and also win the game. One of the puzzles was about recycle. The players had to solve an encrypted text which directed them to select those PET flasks which were recyclable. The letters of the text were changed to numbers based on their place in the alphabet. Besides, one of the bottles were polluted, so they had to exclude it, and read together the roman numeral on the remaining flasks.

Another puzzle was about reduce. The players had to search for two smaller papers in the briefcase. On the first one there were instructions to count how many elements could be deleted from a shopping list, which was on the second piece of paper. We wrote an enormous amount of four items on the list, therefore this was the easiest exercise.

The remaining puzzle was about dangerous wastes. The players had to find a sentence which was hidden in a table filled with words. They had to jump from words to words like the knight in chess to read it. Then, the sentence directed them to count the number of dangerous wastes in the briefcase. They had to know that drugs, electrical devices, and containers of dyes belonged to this category.

In the meta-puzzle, the players had to find out in which order the numbers were. There was a small logo on every paper which contained a riddle. The symbol was connected to the theme of the puzzle.

They had to realize which logo belongs to which concept. Although it was not articulated, they were arranged based on their priority: reduce, reuse, recycle.

When we explained the rules before the game, we did not say, that the players must not use smart devices, because the story of the game was compatible with it. Furthermore, we did not say they could use, because we were curious about their spontaneous behavior. However, when they asked whether they could use them, we said yes. We gave them oral hints during the whole game if they needed, or if we thought they might need. This happened first typically around in the tenth minute.

3. Method

We used the attitude scale of Uzun et al. (2019) for testing the first hypothesis. This questionnaire measures the attitudes toward the natural environment. It is a 5-point Likert-scale type test, which can be divided to three subscales, namely the Environmental Behavior Subscale, the Environmental Opinion Subscale, and the Environmental Emotion Subscale. Based on the paper, these can be used separately for research goals, therefore we narrowed our examinations to the last one, because 16 items seemed enough. The reason was rather ethical than scientific, since our game lasted for just a little bit more than 20 minutes, and we did not want the participants to spend more time with the tests than with the game. So, they could finish the pre- and the post-questionnaire in 5-5 minutes.

We chose this attitude scale because it is widely validated. It was tested to secondary schoolers, high schoolers, and undergraduate students. We have not found another scale which was validated to such a wide range of grades. Moreover, the sample for validation was collected from three different countries in three different languages to get rid of the effects of translation. (Uzun et al., 2019) So, we could quiet freely translate and adapt the Environmental Emotion Subscale to Hungarian.

The students filled this questionnaire before and after the game. Sometimes there were a short discussion between the game and the post-test. The most team, which was not successful wanted to know the solution, so we showed them with a short explanation before the test. Some of them even wanted to solve the puzzles accepted the fact that they had lost, but unfortunately, we were not able to let them because firstly, we did not have time, and secondly, it would have limited our results too. However, these asks strengthened the results of our observation, which also showed that our game was engaging, as we will see later in this paper.

Table 1: *Our tool for structured observation of the usage of smart devices*

	usage of smart device		discussion		debate		statement of a player		hint
	for game	else	about game	else	about game	else	about game	else	
0-3 min.									
3-6 min.									
6-9 min.									
9-12 min.									
12-15 min.									
15-18 min.									
18-20 min.									

So, the usage of the smart devices was tested with structured observations (Falus, 1996). We developed an own tool for this goal. It can be seen as 1. table, which's columns contained the aspects of our observations: usage of smart devices, discussion, debate, statement of a student and hints. These letter categories were based on the constructivist learning theory, since they were either the source of learning or cognitive conflict in this paradigm. Furthermore, in all but the last column there were two

sub-columns: for/about game and else. So concretely, the usage of smart device was for achieving the goal of the game or for something else. The rows of the table contained time, it was divided to three minutes long blocks. We marked a cell, if an act which could classify in a category occurred during the three minutes interval. If it did not occur, we crossed that cell. We differentiated between the discussion and the debate based on the fact, that either of the players contradicted one of their mates, which meant more or less the usage one of the negatives.

4. Results and discussion

Our game was tried out by 30 elementary teacher students, but one of them did not complete both tests, so we had to exclude all of his/her answers. However, one of the participants only skipped the question about their age, their answers were evaluated. At last, our sample contained 29 members (N=29). Three of them were full-time students and the remaining were correspondence. There were 8 groups, each of them had 2-5 members, 3 teams escaped. The descriptive statistic of our sample can be seen in 2. table.

Table 2: *Description of the sample*

	Value
Male	7
Female	22
Age (N=28)	
Median	39
Mean	38.64
Minimum	19
Maximum	56

4.1. Results of Structured Observation

In the structured observation (1. Figure), the discussion column had the most marks (45), but the statement of players also had 43 marks, which is a very little difference. Besides, usage of smart devices had the less, only 3. The else categories were empty in three columns, only the else category of statement of players had 13 marks, these were jokes and greetings their mates because they played in a hall where other students could walk through.

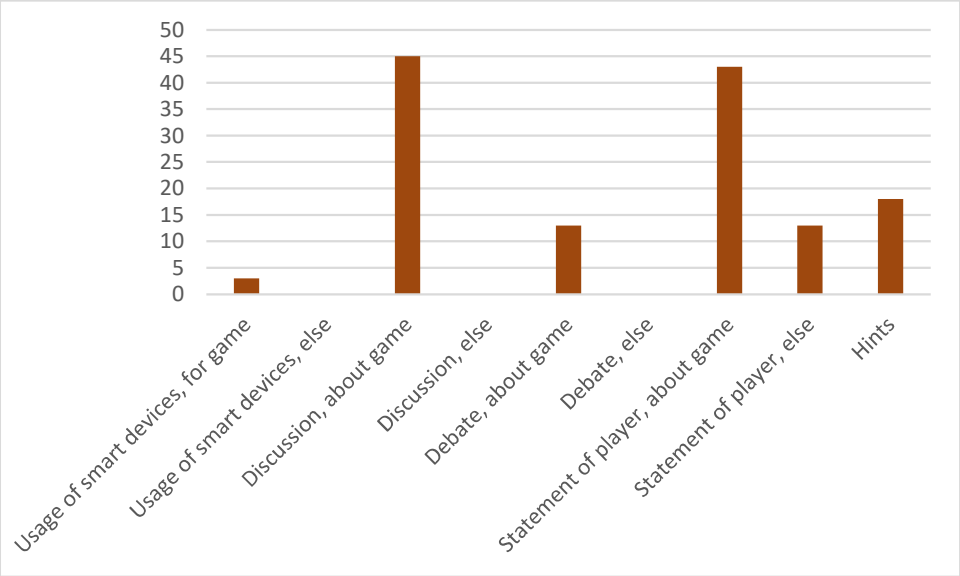

Figure 1: *Results of structured observation, number of marks in each category*

On the 2. Figure, we can see, that usage of smart devices happened simultaneously, when the groups were the most active, and they used it at the beginning of this active period. Indeed, there were 20 marks between 6-9 minutes and 25 marks between 9-12 minutes, but there was no smart device usage in any other period, included between 12-15 minutes, which was the second highest.

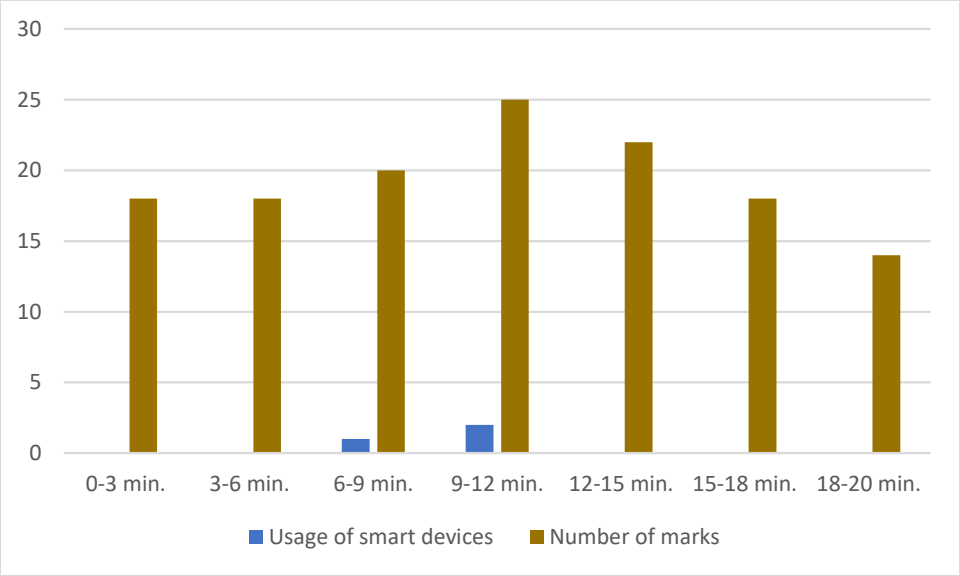

Figure 2: *Number of marks as a function of time*

We noticed some other interesting events, which were beyond the scope of our structured observation. The youngest group, all four of them were 19, did not use mobiles at all. Secondly, another student left their phone untouched on the desk, however, it played the notification tones multiple times. Lastly, that the group with the most debates were the fastest in a tie with the youngest group. This group had the most jokes, too.

Based on these results, we can accept the H2 hypothesis. The teams used their devices only 3 times, which were only 2.2% of the total number of marks. They used it when they were the most active, and they were eager to solve the puzzles. Based on these results, we can accept the H2 hypothesis.

However, in our next game, we should pay more attention to generate more debates between the group members, because it had only 13 marks, less than 10 % of the total number of marks, and only two teams had more than one mark. This is a problem, since this would have been the most important source of cognitive conflicts based on the learning theory, we had chosen to plan our game.

4.2. Result of the attitude scale

We used the Wilcoxon Signed Rank Test in PSPP to evaluate the environmental attitude scale. The items of the questionnaire were coded 1 to 5, and we calculated it to the sum of the answers (Uzun et al., 2019), and also to every item. In the first case (3. Table), the median was 66 before the game, the mode was 64, the minimum was 54 and the maximum was 80, which is by the way the maximum possible score. After the game, the median became 71, the mode became 73, the minimum decreased to 51, and the maximum remained 80. The improvement of the scores were significant (Z=-3.39, p=.001), therefore we can accept our H1 hypothesis, too.

Table 3: *Results of Wilcoxon Test for the sum of the answers*

		N	Mean Rank	Sum of Ranks
Sum Before-Sum After	Negative Ranks	20	11.53	230.5
	Positive Ranks	2	11.25	22.5
	Ties	7		

We found that four items increased significantly, these were the foundation of the previously mentioned result. These are:

- I am angry with people who cause environmental pollution. (Z=-2.33, p=.020)
- If I don't warn the people who damage habitat for animals, I would regret it. (Z=-3.21, p=.001)
- I feel anxious because of the decrease of the forests (Z=-3.77, p<.001)
- I get excited when I participate in any activity in nature. (Z=-3.05, p=.002)

The change of the other twelve items were not significant. We did not collect data about the differences between successful and unsuccessful groups, but it would be an interesting question.

Three of the significantly increased items were those, which we counted on. That one, which were about environmental pollution is closely related to the theme of the game, which was the waste. The damage of the habitat for animals is also a topical issue today, and is definitely related to wastes, the internet is full of the pictures of animals trapped in plastics. The item about the activity in nature might be explained with the shocking effect of playing with garbage. However, these two items need further investigation.

We cannot explain why the item about the decrease of the forests changed, seemingly it has no connection with wastes. Besides, we found this results a little bit sad, too, because we hoped it could increase the attitudes such a way on which the participants anxiety level would have not increase, but this was not the case. Therefore, we had to think about this, and plan our next game with more attention to this aspect.

5. Conclusion

Our escape game, which were planned based on the principles of socio-constructivist learning theory, was a good instrument to improve elementary teacher students' environmental attitudes. To test this, we used the Environmental Emotion Subscale (Uzun et al., 2019), which measured attitudes toward the natural environment. The Wilcoxon Signed Ranked Test showed significant improvement of the participants' environmental attitudes (Z=-3.39, p=.001). Therefore, we accepted our H1, namely that educational escape games would influence the environmental attitudes of elementary teacher students.

We have also calculated the Wilcoxon Test to every item. Although, we experienced an unexpected improvement of the item, which questioned about the anxiety level connected to the decrease of the forest areas, other three items were related to the theme of our game: the waste, which changed significantly, too.

We can also accept our H2, that undergraduates would use their devices rarely during the game and mainly to achieve its goal. Therefore, we can also state that our game was immersive because we observed only marginal smart device usage. We had some unstructured notes about the games, which also strengthened this statement, namely even that player whose phone sent multiple notification did not checked their device. However, this was not our goal, the players could use their phones if they wanted. Moreover, we could think about the question, if smart phone usage would help more teams to get out, or whether more device usage would increase or decrease the effectiveness of our game. Our experiment left these questions opened. The relatively small size of the sample (N=29) also limits our results.

However, based on our results we concluded that our escape game was immersive, and helped the students to increase their environmental attitudes.

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A SZABADULÓJÁTÉK HASZNÁLATA TANÍTÓ SZAKOS HALLGATÓK KÖRNYEZETI ATTITŰDFORMÁLÁSÁBAN

Összefoglaló

Grastyán (1983) azt állapította meg, hogy a technikai civilizáció következményeként fellépő passzivitásra, „unalomra" az egyik legjobb válasz a játék lehet. Emellett annak egyik lehetséges, és egyre többet kutatott módja, hogy hassunk a hallgatók környezeti attitűdjeire, szintén a játék.

Egy offline szabadulójátékot terveztünk a hulladékok témakörében, amit tanító szakos hallgatókkal tervezünk végigjátszatni október folyamán. A játék előtt és után attitűdmérést végzünk, amihez Uzun et al. (2019) kérdőívének Environmental emotion alskáláját fordítottuk, adaptáltuk. A játékok során megfigyeléseket is végzünk azzal kapcsolatban, hogy a játékosok mennyire kommunikálnak egymással és mire használják játék közben az okoseszközeiket. Az attitűdvizsgálatok eredményeit Wilcoxon-próbával tervezzük kiértékelni. Az eredményekről pedig ezen a konferencián szándékozunk beszámolni.

***Kulcsszavak**: szabadulójáték, környezeti attitűd, figyelem, hulladék*

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