Escaping Online: Teacher Student Engagement in a Digital Escape Game

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Abstract: Escape games have become popular as a learning activity and are being used in a large variety of subjects (e.g., chemistry (Peleg et al, 2019), music (Babazadeh et al, 2022)). Research has shown that they are generally engaging for students (Veldkamp et al, 2020). However, the study of engagement is often limited to its observable aspect (e.g., the students are having fun; they are participating in the learning activity) or is not the focus of the analysis. Fewer studies are also investigating the use of escape games in fully online settings, when students are each playing from their own location. This research study is exploring engagement from the students' perspective, within a fully online course in a teacher education program at a Norwegian university. Teacher students were invited to play Radioaktiv, a digital escape game for natural sciences on the topic of radioactivity. Six pairs of students also participated in guided interviews after playing. Reflexive thematic analysis of the interview data with the students was conducted to investigate what characterised the students' experience of engagement while playing the online escape game Radioaktiv. Through this research question, the study is taking a closer look at what it means when the students say they were engaged in the game. Findings show four main aspects of the students' experience of engagement. First, the time pressure was found to be a double-edged sword. Students found the timer engaging, but some were also too stressed by its presence to the detriment of learning outcomes. Second, students were engaged in completing tasks for their own sake, independently from other game aspects. Third, students appreciated having a read thread, but were not engaged in the specific narrative of the escape game. Finally, students positioned themselves as teachers and it strongly defined their experience of engagement in the game. They saw the game through the potential it held for their own pupils. These findings raise questions about the selection of escape games for learning in online environments and when and how to use them (e.g., discover a new theme, repetition, focus on soft skills).

Keywords: Escape Game, Online Learning, Game-based Learning, Engagement, Teacher Education

1. Background

Escape games have become popular as a leisure activity, especially in the form of escape rooms, but also as boardgames or video games. They are "live-action team-based games in which players encounter challenges in order to complete a mission in a limited amount of time" (Veldkamp et al, 2020: 1). This trend has also been picked up by educators, who started using and developing their own escape games for the classroom to provide students with a more active way of learning. Educators have used either digital programs (Bisanti et al, 2022) or a physical paper format (Babazadeh et al, 2022) to adapt these games to the classroom and develop students' content knowledge or soft skills, and bring variation in learning through interactive and engaging activities (Botturi et al, 2020; Fotaris et al, 2022).

The interest in escape games for learning has also reached the scientific community, e.g., a special track in the *European Conference on Games Based Learning* (ECGBL), a special issue in the journal *Sciences du jeu* (2021: 16). Review articles (Veldkamp et al, 2020; Taraldsen et al, 2022) show that students are engaged while solving escape games. However, the study of engagement is often limited to its observable aspect or peripherical in the studies. Fewer studies also have digital escape games used in online learning as their research focus (see section 3 for a review of the field).

Through the example of one digital escape game, *Radioaktiv,* used in a distance learning course, this paper will investigate the students' experience of engagement while solving the game and answer the following research question:

What characterises the students' experience of engagement while playing the online escape game *Radioaktiv*?

2. What is Engagement?

There is a general agreement in educational research that engagement is a multifaceted construct (Reschly and Christenson, 2022). However, a review of research studies on engagement in online learning reveals no clear consensus on how to define student engagement. Firstly, engagement is defined as student investment in their learning, for example the energy that students devote to their learning (Heilporn et al, 2021). Similarly, Bolliger and Halupa (2018) describe it as the psychological investment in learning expressed through the effort students

are putting towards learning. Secondly, engagement is conceptualised in several dimensions: Behavioural, Cognitive and Emotional (Nkomo et al, 2021; Muir et al, 2019). Each of these dimensions is representing an aspect of engagement, e.g., the actions the students perform, the feelings and emotions linked to being engaged or disengaged in learning. This type of framework is closely linked to the literature on school research and dropout, where engagement is often divided in four dimensions, e.g. academic, behavioural, affective and cognitive (Reschly et al, 2020).

In the field of Game-Based Learning (GBL), where educational escape games can be placed, the understanding of engagement is more fragmented. Sometimes engagement is not even linked to learning but instead is understood as the use of the program or software and operationalised through frequency of use, quality, or duration of engagement (Looyestyn et al, 2017).

Engagement in learning, however, is sometimes defined as how much the students participate in their learning and sometimes analysed through one specific aspect of the engagement framework, e.g., academic engagement (Martín-Hernández et al, 2021). In their framework developed specifically for GBL, Ke et al. (2016: 1183) define engagement as "a collection of mindfully goal-directed behaviors and reflections" and propose four facets to develop this definition: affective, cognitive, content engagement, and gameplay relevance.

In their review of engagement in GBL, Jabbar et al. (2015: 741) focus on the emotional aspect of engagement and define it as the connection the students create with the activity and game features, as well as students' actions towards their goals.

In this study, although we want to acknowledge the complexity of this research field, we will take a pragmatic understanding of engagement in digital GBL and define it as the students' emotional and cognitive investment in the activity. We will now turn to empirical research and see how engagement relates to GBL, and more specifically educational escape games.

3. Empirical Studies of Student Engagement

3.1 Different Aspects of Engagement in Game-based Learning

Studies from the field of game-based learning (GBL) generally show that games and playful learning are engaging students. Engagement can be a direct result of using a game or gamified programme: e.g., Kahoot (Eltahir et al, 2021). In their systematic review, Yu et al. (2020) have found a positive relationship between student engagement and GBL. Studies found that student engagement was higher in GBL, or gamified learning activities, than previously used instructional methods (Zainuddin et al, 2020; Tsay et al, 2020). Similar findings were discovered in the use of games in online education (Dominguez et al, 2013) or in connection with flipped classroom (Huang et al, 2019). Students in gamified learning activities for foreign language learning were also engaged and completed tasks out of their own initiative (Cruaud, 2016).

Different elements in GBL can promote engagement. In their systematic review, Jabbar et al (2015) show that narratives and storylines are engaging elements, albeit not always recognized as important by the students, especially when using longer introductory texts. In the same way, videos and their content are often ignored by the students. Challenges are an effective engaging element, and they make students curious about the content (Jabbar et al, 2015). Some of the most engaging elements in Jabbar et al.'s (2015) review are pedagogical concepts: e.g., scaffolding, built-in learning tools.

However, Jabbar et al (2015: 767) also remark that "engagement is related to students' cognitive and emotional involvement in the gameplay" calling attention to the fact that student engagement is more complex and that other factors can come into play.

3.2 Escape Games: Engaged and Active Students

Research on escape games for learning is a growing field within Game-Based Learning research. The reviewed studies on escape games accord well with the previous section and reveal that most students find this type of learning activity enjoyable. Indeed, we can read in a central review that "in all studies [investigated] a vast majority of students enjoyed the activity and educators concluded that students were highly engaged and active during the activity" (Veldkamp et al, 2020: 8).

In their recent comparative study, Olombel et al. (2022) did not find any difference in learning outcomes between using the escape game for learning or the non-ludic learning activity. However, they do note that pupils

showed more engagement when using the escape game. The researchers report for example signs of excitement, joy, and positive behaviours. In the same way, Peleg et al. (2019) have found nursing students to be very engaged in the learning activity when using an escape room for learning chemistry. Many studies and reviews report similar findings: observations or self-report showed that students were engaged while playing an escape game for learning (e.g., Ho, 2018; Cain, 2019; Veldkamp et al, 2020).

However, in their study about grade 3 students' development of 21st century skills, Duncan (2020) found no significant difference in engagement between the escape game or the traditional learning activities, even though students said that they enjoyed learning in the game-based class. Differences in study duration and research methods might explain this contrasting finding and more generally differences in the literature (Taraldsen et al, 2022).

4. Escape Games for Learning: a Research Project

The research project Escape Games for Learning, funded by the Norwegian Regional Fund, aimed at investigating the potential and limits of digitalising escape games for use in the classroom. Three researchers (including this paper's author) investigated the use of one digital escape game: *Radioaktiv*.

4.1 Radioaktiv: a Digital Escape Game for the Classroom

Created by the Norwegian company Escape History, *Radioaktiv* is a web-based digital escape game. According to the developers, this game is aimed at first year students of upper-secondary school and has for theme radioactivity (science class – *naturfag*). In the version of the game that is investigated here, two players are solving collaboratively five consecutive puzzles while communicating over Zoom within a 45-minutes playtime.

After selecting their role (player 1 or player 2), students access two parallel webpages each with a map of the laboratory of Dr. Doppler followed by a long introductory text. The text narrates the situation in which the players find themselves: during a visit to a research laboratory an alarm starts ringing and Dr. Doppler is stuck with radioactive substances. The mission is then presented: save Dr. Doppler before the time runs out or he will die of radiation exposure. Each webpage contains a narrative text, often giving hints, a puzzle (e.g., fill in the blanks, finding a code, crossword) and sometimes a contextual video on the theme of radioactivity (e.g., biography of Marie Curie, the three types of radiation and their effects). Players have access to different information on their respective webpage and need to collaborate to solve the riddles. The answer to the puzzle is then entered in the form of a password or code, in a padlock on the next page. A correct code will open the padlock and grant the students access to the next page and puzzles.

4.2 Data Collection

To gain insight in both the experience of playing the game and a reflexion on its potential use in the classroom, teacher students from a Norwegian university were invited to try *Radioaktiv* during one of their courses. As students were taking the class from home, they played the game in pairs over Zoom. A total of six online game sessions and the following group interviews were recorded for the main project and used as data for this present study (a total of twelve participants). After playing the game, the students participated in a guided interview in a conversational form (Brinkmann and Kvale, 2015). Interviews were selected as a preferred data collection method to access the students' perspective of their experience of engagement. Reflection notes were considered but would have not given the possibility for the research to ask follow up questions.

The recordings of game time and interview were then transcribed with some detail of interaction (e.g., gestures, tone) and anonymised. The videos were reviewed alongside the transcripts during the analysis process to support interpretation. The extracts presented in this article were translated from Norwegian to English by the researcher.

5. The Students' Experience of Engagement

5.1 Methods: Reflexive Thematic Analysis

Reflexive Thematic Analysis (RTA) was used to interpret the students' experience of engagement through what they were saying about it and the latent meanings in their conversations (Braun & Clarke, 2006; 2019). RTA gives the researcher an active role in the analysis (Braun & Clarke, 2006; 2019). As this study is placed within a dialogic understanding of learning, where researchers bring their own voice to the interpretation process, RTA was a

fitting methodical choice. This methodical trait of RTA will be made explicit by the use of the first-person subject in the following presentation of methods.

As the author of this paper, I conducted the analysis of the interview data. However, another member of the research project was involved during the analytical process. We started with an early data-familiarisation workshop to go through all the recordings together and discuss first impressions, as different researchers had collected and observed different play sessions. Then I coded the data following an inductive (data-driven) approach. Extracts were marked with both semantic and latent codes (e.g., time pressure; distance from narration). I created initial themes, that were then presented and discussed in a workshop with both researchers. The themes were then revised, and the analysis was completed during the writing process.

The following thematic map (Figure 1) presents the four themes I generated through the analysis and their main strands of meaning.

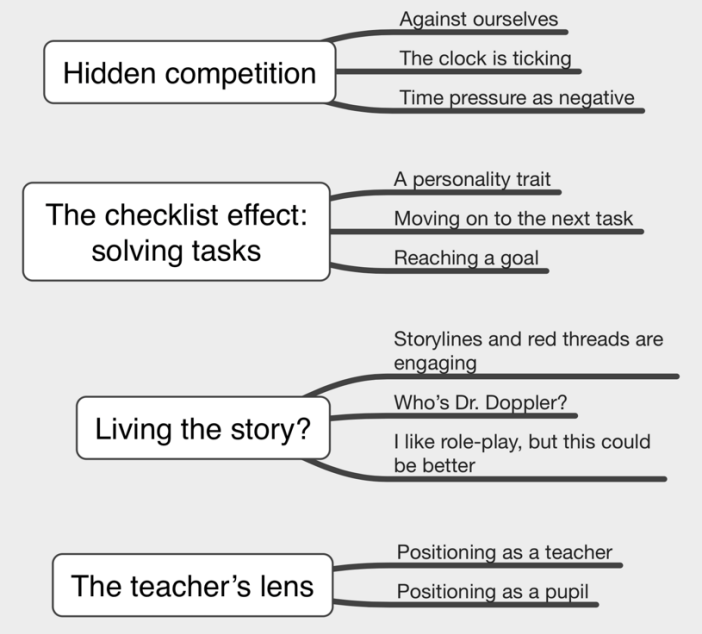

Figure 1: Thematic map of the four generated themes

5.2 Hidden Competition

Radioaktiv is not presented as a competitive game. Students are solving the tasks together and must collaborate to succeed. As they play over Zoom, they do not have contact with other teams, and thus no way of knowing how well (or bad) they are doing compared with other students. However, the students are trying to find ways to compete. In the following occurrence two students reflect on the competitive aspect of the game:

> Stefan: Yes, but was it the competition aspect that was engaging?
>
> Kjetil: Yes, without there being really any competition.
>
> Stefan: Yes.
>
> Kjetil: There was in fact no competition. We have not competed against anyone other than ourselves and the clock.

Competition is an engaging factor for most students, either against oneself or sometimes within the team. Another aspect students find engaging is beating the clock. The game must be finished within the time limit of 45 minutes and a timer is present at the top of the screen. The ticking clock is an image that comes back a lot in the interviews and students discuss its effect on them:

> Dan: yes so, it's just, it's the fact that you have a clock blinking, right? (blinks with his hand) just fuck, we have to make it!

> Malin: I think I felt more tension now [compared to another escape room] considering that you have this clock that counts down and, yes, like you said earlier that it's kinda oh I was stressed by this clock and we have so little time (laugh together)

Feeling the time pressure seems to be one way to keep students engaged on the tasks at hand. However, this engagement can border on stress and even turn into a negative experience when the pressure becomes too stressful. Group 6 did not manage to finish the escape game as they were stuck for a long time on the first puzzle. As the clock was ticking the minutes away, they began to question the usefulness of spending time watching the videos:

> Erlend: I think the video in and of itself is quite nice, but I think they should rather demand that we have to watch the video, and that the clock stops [while watching]
>
> Lise: Yes, I think so too
>
> Erlend: something like that. Because you're kind of sitting there and looking at the ticking clock, and then you start thinking, but what can I use of this here?

If the subject content is supposed to be presented through the videos, it might come in direct opposition to the time pressure effect of the clock: students will want to speed up and may pay less attention to the content presented to finish the tasks on time.

5.3 The Checklist Effect: Solving Tasks

If finishing the game within the imparted time is crucial, students find finishing each individual task also to be engaging. As in checking items from a list, students want to keep going to the next puzzle, advancing in the game, sometimes to the detriment of other aspects of the game:

> Kjetil: I wasn't thinking so much about the map and these other things. I was mostly concerned with moving on, moving on, moving on.

Some students also express being engaged by problem-solving in general, also in other contexts. They present it as a personality trait independent of the game, as something they enjoy:

> Malin: I think it was really engaging, I like this type of problem-solving tasks as I mentioned earlier […] so I like in a way that you get a challenge

Personal interest can explain why some students are particularly focused on solving the tasks. Some also find going towards a goal very engaging as it gives the tasks more meaning:

> Hanna: It's a different way of learning because you, you sit down. You have a goal. You must find information about, in this case, radiation and radioactivity and because you're going to use it for something. It's a really nice way of learning.
>
> Knut: yes, I think it was a fun way to work with this theme here. And the fact that you get to collaborate, to work towards a given goal.

Solving tasks is an engaging factor for students. Students do not seem to mind what type of tasks they are undertaking, if they can solve them and come closer to a final goal.

5.4 Living the Story?

The goal of the escape game is an important part of the narrative, and students find having a narrative, or storyline, engaging.

> Petter: I think it is smart of them that there is a kind of story. Well as I have said I haven't tried another escape room, so I don't really know how it is, but to have someone to save worked for me.

However, students don't seem to be particularly engaged by the storyline of *Radioaktiv*. For example, some students mixed up the storyline (saving Dr. Doppler) with the theme of the videos from the first puzzle (biographies of Marie Curie and Henri Becquerel):

> Hanna: You got a in a way a bit, you got a bit engaged by it in a way. That there was a theme throughout, that you understood, you understood the story. And understood what they were trying to do. Quite

> early. Considering that it was Marie Curie and Henri Becquerel. So there was a red thread and it was quite all right.

Hanna appreciates having a red thread, but she forgets all about the main character of the narrative: Dr. Doppler. Other students are directly expressing not caring about Dr. Doppler or his fate. They are not empathising with the main character and are generally more interested in the tasks and puzzles:

> Kjetil: yes. I wasn't really feeling, I wasn't really feeling like it was Dr. Doppler I was supposed to save. I just have to say it. I didn't get a great impression like 'oh, I have to save Dr. Doppler.'

The map showing in which room the two players and Dr. Doppler are in the laboratory at each stage of the story is an important way of inviting players in the storyline. But these elements are mostly ignored:

> Kjetil: You didn't have a map either?
>
> Stefan: yes, it was right at the start I think, let's see… No, I think I had several maps. […] But I forgot to pay attention along the way [to the maps]

Even students that are particularly interested in role-play express ways to improve this game and to make it more engaging, for example, by making it more multimodal:

> Dan: but I was about to say, you did have, I don't know how it would have worked, but if they could have played this voice then,
>
> Lene: yes
>
> Dan: like through the sound system, instead of having to read it then, that we get, that it becomes even more multimodal in a way
>
> Lene: yes [unclear, speak at the same time]
>
> Dan: it would have been cool, to have this kind of narrator's voice

Erlend's comment on *Radioaktiv* highlights what might be the challenge with the design of this game – the balance between tasks and story – and underlines the potential for engagement that was maybe untapped:

> Erlend: it was quite like focused on tasks in a way. It was less story, it was less escape room and more just tasks.

5.5 The Teacher's Lens

Students are taking a meta-perspective on playing the game. They do not only experience *Radioaktiv* as students conducting a learning activity, but also as teachers in training. Students discuss how they would use it in their own teaching:

> Petter: my immediate reaction was that this here, could be extremely instructive for the pupils.

This teacher's perspective comes back in all the students' answers in the interview, even when the questions were only directed towards their own experience of playing the game. When Dan and Lene discuss the possibility of making the game more multimodal, Dan links this topic to inclusive learning:

> Dan: it would have been cool, to have this kind of narrator's voice and then you would get, well you and I can read this, but if we're thinking about it in a school context, then we could also get to include pupils that are struggling with reading.

This positioning as teacher, or in the case of Dan special education teacher, comes back clearly in the interview. A secondary positioning appears also when the students are bringing imaginary pupils' voices in their conversation. They discuss how their pupils would react and experience the game:

> Sindre: Pupils like that, because it's digital and, yes, because it's cool

This metaperspective on playing the game is an important aspect of the students' experience of the digital escape game *Radioaktiv*.

6. Discussion

Time pressure is a central aspect of escape games. Solving the game within the given time limit is an engaging factor in the analysis of the students' experience. However, the effect of the timer can become too stressful for some students, and they start hurrying and paying less attention to the content. This relates to the concept of perceived cost of information learning as presented in Ke et al.'s (2016: 1192) framework on engagement in GBL. If students perceive the activity as not being in direct relation with the main goal of the game, for example watching a long video instead of solving the puzzle, they will consider it as wasting time and not bother with it. The presence of a timer turns then into a double-edged sword, useful for engaging with the game but sometimes to the detriment of learning engagement.

A second aspect of engagement is completing individual tasks for their own sake, independently of other aspects or goals of the game. This finding relates to need for a sense of achievement where players are receiving adequate challenge and level of difficulty as well as continuous stimuli in the form of new challenges (Ke et al, 2016:1187). This sense of achievement is closely linked to the player's affective engagement with the game.

The third aspect of engagement is linked to the presence of narrative elements. If the theme and red thread in the game were an important part of the students' experience of engagement, the narrative did not mark the players. Similarly to Jabbar et al.'s (2015: 757) findings, the story of Dr. Doppler was not recognised as important for the students. This finding is closely link to the previous one, where students clearly showed engagement in solving the tasks independently of the storyline. The lack of engagement in this specific story might have been improved by alterations to the design, e.g. more multimodal formats, or shorter texts. Jabbar et al. (2015: 755) found that longer texts were often ignored by students and in the case of Radioaktiv, the whole narrative was presented in writing.

A last aspect of the students' engagement is their positioning as teachers. Students took a meta-perspective and saw the game and its activities not only as players but also as educators. Their perspective was defining for their experience of engagement as it related closely to how they connected to the game emotionally and how they connected cognitively to the game's features (Jabbar et al, 2015: 741).

7. Implications and Conclusion

This study is limited to one class of teacher students and can only illustrate one example of the use of escape games in higher education. However, the findings presented in this paper have concrete implications for designing and selecting escape games for learning. On the question of narratives' roles in escape games we can ask if a digital educational escape game can focus equally on tasks and narrative. But also, if a good and engaging storyline is a must-have or a bonus. The presence of a time-limit can reinforce engagement, but also weaken the students' interest in the content. As timers are a central element in the design of escape games, teachers will need to think about how they want to use these games in their teaching. They might be good activities to train soft skills (e.g., collaboration, communication) instead of focusing on learning content. Escape games might also work best as an introduction activity, creating a common memory of a new theme that the teacher can build upon later in the course. The teaching unit becomes less abstract by anchoring it in the students' experience of the game. In the same way, the emotional connection with the game could make online learning a more humane experience, giving students an intimate experience of being engaged in the activity and in their course.

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