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# Can a serious game be designed to increase engagement in a mandatory postmodern novella at Danish gymnasiums?

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**Abstract.** For this study, we designed a serious game to engage Danish gymnasium students when reading the novella *A Love Story*, written by the prize-winning Danish author Naja Marie Aidt. The novella is mandatory reading in postmodernism. The study included 41 students from two Danish gymnasiums, who were divided into three classes. Two classes were included in the experimental study, which employed the serious game as part of reading the novella. One class served as the control group and engaged only in an analog reading of the novella. The evaluation criteria, which were assessed through a questionnaire, were based on items from the reading engagement index, the user engagement scale, and the narrative engagement scale. Furthermore, the evaluation consisted of in-depth interviews with teachers and students. The findings revealed a positive effect on students' engagement in the experimental group and the possibility for future work in the field of serious games implemented in high school curricula. The serious game developed for this study balanced challenge and skills appropriately, but it could be improved in terms of the story world and controls.

**Keywords:** Reading engagement, Serious games, Storytelling, Game design.

## 1 Introduction

This study was aimed at supplementing a mandatory analogue reading of a novella in two Danish gymnasium (i.e., upper secondary) classes with a digital serious game. The novella was *A Love Story*, written by the Danish poet and writer Naja Marie Aidt, who won the Nordic Council's 2008 literature prize. *A Love Story* is taken from Aidt's novella collection *The Watermark*, published in 1993. Aidt's published work is part of the curriculum in Danish literature, as outlined in the learning objectives regarding mandatory readings in the style of postmodernism.

There is an international concern about reading engagement among young adults [1]. In Denmark, only 8.4% of Danish 15 year old students have a high level of reading, and 16% of Danish teens, aged 15, are reading at a very low level [1]. Furthermore, male students struggle more with reading engagement compared to female students [1,

2]. This lack of reading engagement may partly explain why male students in particular lag behind compared to female students in Danish gymnasiums, a fact that poses challenges for male students in terms of later educational opportunities and access to the labor market [2]. In Danish gymnasiums, the average grade difference is 0.5 points (based on 7-point grading scale) in favor of female students [3]. However, in the subject Danish, female students' grades are 1.4 points higher on average [3].

Over the past few decades, young adults have changed their habits, reading less fiction, but spending more time reading online than before [4–6]. In Denmark, 20% of young adults do not read fiction [7], which is equivalent to other international reporting [1, 8]. On average, across OECD countries, 37% of young adults (students) report that they do not read for enjoyment at all [1]. Reading has always been encouraged through complex and diverse practices [6-10]. However, there is a huge concern that young adults do not read well enough to cope with the increasing literacy demands of an information society [6-10]. Reading fiction among young adults appears to be positively associated with higher performance on reading assessments [1]. Reading is a skill with many gradations of proficiency, and comes with lots of complexity, and it is not an easy task for young adults to read the mandatory literature in the Gymnasium. The research question for this study was: Can a serious game be designed to increase reading engagement in Naja Marie Aidt's novella *A Love Story* as part of the mandatory reading in Danish literature at Danish gymnasiums.

## 2 Previous Research

Reading engagement is multidimensional and used from various perspectives in various fields; it is also complex, with many variables, including e.g. behavioral and cognitive dimensions, the frequency of reading, emotional engagement, genre preferences, gender preferences, and the storytelling [11-15]. One way to motivate reading engagement is to include a text-based story in a serious game via digital storytelling [11, 12, 17, 20]. This opens an interactive story world, including both text and game, with the potential to engage a user in the digital storytelling experience and make them focus on the story itself instead of the text or gameplay alone. Digital storytelling is well covered and discussed within serious gaming [24–28]. However, digital storytelling is much more than telling a story in a digital format. In a serious game, it is mainly about making stories engaging and interactive, with meaningful skills and knowledge for the users. Storytelling and reading engagement, both in serious games and in other media (analogue included), requires the reader to be motivated [16]. This involves, e.g., important elements within the text's content, comprehending the text, gaining new knowledge, and social interactions with used knowledge and/or lessons learned from the text [16]. Furthermore, to design a motivating reading experience in a serious game, scholars have already emphasized aspects of intrinsic motivation, such as curiosity, a desire for challenge, and involvement [16, 17]. However, the success of a serious game for reading engagement depends on players' motivation to start playing the game and spend their time, effort, and energy. Hence, players' intention to interact with the game for

specific learning (reading) objectives is crucial [17]. It is assumed that the experiences of intrinsic motivation, flow, and engagement are crucial in this process [17-20]. In spite that O'Brien and Toms [21] define engagement as an ongoing process with quality of user experience, and provide an evaluation framework [23], it is still highly complex to define and integrate engagement in serious games. The challenge is that engagement, also in the context of serious games, is a complex subject, as it encompasses various related concepts related to the user experience, including e.g. immersion, presence, flow, transportation, and absorption [13, 18, 21-23]. Most often the engagement in serious gaming is a means to provide some kind of learning [19], and elements of game attention, perceived usability, aesthetic appeal, and worthwhile playing [11-12, 21-23].

### 3 Methods

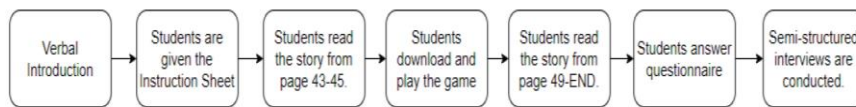
#### 3.1 Participants and ethical issues

The participants were from two Danish gymnasiums in three separate classes, two from ZBC Vordingborg and one class from Ørestad Gymnasium. ZBC Vordingborg is a technical gymnasium located in the Danish region of Zealand, south from Copenhagen. The ZBC Gymnasium has a focus on technical skills and science subjects. One class from the ZBC Gymnasium functioned as a control group for the evaluation, provided with the same reading text and evaluation criteria, but without playing the game (only analogue novella read). The control group consisted of a class with 11 students (7 male and 4 female), and had math as their major. The other class (experimental group) from ZBC had game design as their major and consisted of 10 students (9 males and 1 female). Ørestad Gymnasium is located in Copenhagen, Denmark, and has a special profile focusing on media, communications and culture. The class from Ørestad Gymnasium consisted of 21 students (11 male and 10 female), and had science as their major. All participants gave informed consent and were informed that they could withdraw from the study at any time and their participation did not influence their grade. In addition, all participants were provided with anonymized ID numbers, and all data were labeled with these IDs. We applied special considerations when recruiting teenagers (ages 17-19), in accordance with Danish data law, the international code of conduct and ethical approval from the gymnasium.

#### 3.2 Procedure

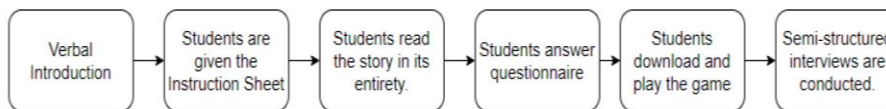
An important focus of this study was to involve the teachers from both Ørestad Gymnasium and ZBC Vordingborg who taught the students about *A Love Story*. This was done by following a participatory design approach [31] in which the end-users included both teachers and students; also within a substantial work of pilot testing. The pilot testing was made with five students outside the experimental- and control group. The teachers served as gatekeepers who facilitated and controlled the reading process in areas such as the curriculum's aims, focus, knowledge, skills, and analysis. Therefore, the teachers were involved as co-designers very early in the process.

This study used a mixed method approach consisting of both a questionnaire and interviews. The questionnaire started with items regarding gender and experience of gaming. Participants were then asked three questions from the Reading Engagement Index [10], followed by items from the User Engagement Scale - short form [23], and lastly items from the narrative engagement scale [32]. The interviews follow a semi structured interview guide; and six students and two teachers were interviewed. One class from the ZBC Gymnasium and the class from Ørestad Gymnasium follow the experimental procedure as outlined in Figure 1.



**Fig. 1.** The procedure for the experimental group. Combined analogue read and serious game.

The control group included in this study was from a class at the ZBC Vordingborg gymnasium, following the procedure as outlined in Figure 2.



**Fig.2.** The procedure for the control group. Analogue reading only.

### 3.3 Data analysis

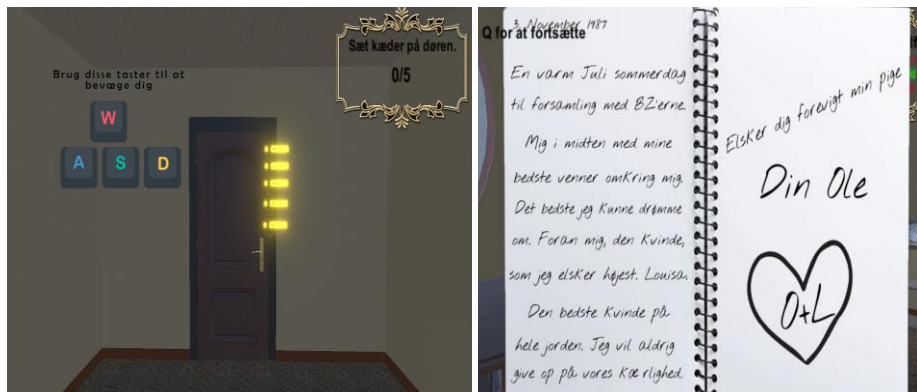
A total engagement score was calculated based on items and procedures from the narrative engagement [32] and the user engagement [23]. The interviews were analyzed by traditional coding [29] following four steps: organizing, recognizing, coding, and interpretation. The interviews were transcribed verbatim to be organized and prepared for data analysis. Researchers then coded and labelled the data in categories/subcategories, followed by content analysis and interpretation [29].

## 4 Design and Implementation

The serious game was designed in Unity using C# for Windows, Mac and Linux. The novella *A Love Story* is about the protagonist Louisa, who lives alone in a very messy apartment. Louisa has schizophrenia with symptoms including hallucinations (hearing voices), delusions, and disorganized thinking. It is a first person simulation game, as the player should experience the narrative from the protagonist's point of view and be engaged in the story in the 3D environment. The story and the game are as follows: 1. Introduction (analogue text book read): The reader is introduced to Louisa, her life and her messy apartment. Louisa goes shopping. 2. Door chains, bathroom, and apartment

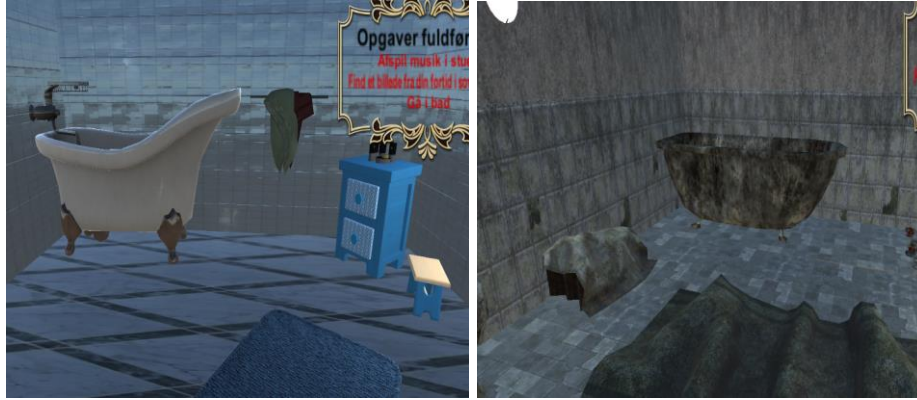
(Game start): Louisa locks the door with five chains after the shopping and goes into a clawfoot tub with very hot water. 3. Her Ex-boyfriend, income support, and fruit flies: Louisa recalls her time as a squatter with her ex-boyfriend (named Ole). Louisa gets a letter with her income support from municipal social security. She can hear the fruit flies talking. 4. Louisa recalls when a bumblebee entered the apartment and terrified her so that she had to hide in the bathroom. Since then, she has not let in fresh air (End of the game). 5. End (analogue text): The neighbor is asking about bug problems in the entire building. The next day the police and social authorities use force for having Louisa hospitalized (implicitly told).

In order to improve the engagement we reproduced the plot of the novel (story sections 2-4) in an interactive and empathizing way. The design was developed by following the game principle for player enjoyment in games, suggested by Sweetser and Wyeth [30]. Players need to complete five tasks, in a specific order, in order to progress and finalize the story and the game. The first task (lock the door with five chains) is at the very start of the game (Figure 3, left). The graphical user interface is designed with a "quest log" in the upper right corner of the screen, containing information about the specific task the player needs to complete, and how many out of the five tasks the player has completed (Figure 3, left). The visual representation of the WASD controls is also shown in the graphical user interface (GUI) when the player starts the game (Figure 3, left). The readings in the game were implemented through interactive and digital storytelling elements - for example as letters dropped through the letter slot or included as a diary (Figure 3, right).



**Fig.3.** The beginning of the game (left) with tasks, and the in-game text reading (right).

It was not an easy task to design and tell the story of Louisa and her schizophrenia, including the symptoms such as hallucinations and voices. Therefore, we designed the game by mixing scenes between the clean and the messy (Figure 4) to illustrate the schizophrenic perspective.



**Fig. 4.** Mixed perspectives of clean and messy to illustrate the schizophrenia perspective.

## 5 Findings

The quantitative findings reveals that the experimental groups had a significantly higher user engagement score than the control group (Table 1). Interestingly, there was a lower score than expected, for the experimental group in the narrative engagement. The items for the reading index (Table 1) included the following questions: I read often, I get easily distracted while reading, and I am good at reading. In spite that these self-reported answers needs further validity, it is interesting that the reading index is higher in the control group, but is at the same time less engaged than the experimental group (Table 1). The user engagement followed the validated items from user engagement scale short form [23], and included the following questions: Focused Attention: I lost my self in the experience. The time I spent just slipped away. I was absorbed in the experience. Perceived Usability: I found it confusing to play the game. The game was taxing. Rewarding: My experience was rewarding. I felt interested in this experience. The user engagement is significantly higher (Table 1) in the experimental group (Mean 3.47., STD: 0,93) than the control group (Mean 2.96/ STD: 0.67). Especially the focused attention and rewarding is significantly higher for the experimental groups. An interesting part of the statistical analysis was the items within the narrative engagement, which remained almost the same for both the control group and the experimental group (Table 1). The findings within the narrative engagement remains a bit unclear, but might be explained by the way the questions from the narrative engagement scale were translated into Danish. Possible explanations could also be within common desires to know how the story is going to unfold [18] (digital or not), with common curiosity, suspense, excitement, and involvement in the story and character [16, 24]. It is a well-told novella with some embedded emotions (both positive and negative) for Louisa and her schizophrenia. The included masturbation descriptions in the analogue story might also have an impact for the narrative engagement, especially taken the participants' ages into account.

**Table 1.** Findings based on questionnaire items. Con = control group (n=11). Exp = Experimental group (n=31).

	<b>Con</b>	<b>Con</b>	<b>Exp</b>	<b>Exp</b>	<b>Mean</b>	<b>STD</b>
	<b>Mean</b>	<b>STD</b>	<b>Mean</b>	<b>STD</b>	<b>Diff</b>	<b>Diff</b>
<b>Reading Index</b>	3.27	1.23	2.78	1.11	0.49	0.12
<b>Narrative Engagement</b>	3.45	0.67	3.37	1.10	0.08	0.43
<b>User Engagement</b>	2.96	0.67	3.47	0.93	0.51	0.26
Focused Attention	2.91		3.55		0.64	
Perceived Usability	3.18		3.50		0.32	
Rewarding	2.78		3.37		0.59	

Interviews revealed that most participants were very satisfied with the game. Most of the positive comments concerned reading engagement, but they also positively addressed the story world, and the match between challenge and skills (Table 2). No participants expressed hindrance in progressing in the game, and only a few (especially the more experienced gamers) felt that the in-game quests should be more challenging. All participants expressed their excitement about the game experience, and several stated that it exceeded their expectations. Many participants expressed that they paid more attention to the details of the story when experiencing it through the game rather than the analog text reading. The most frequent critical comments concerned the controls; these included minor bugs and complaints that the mouse was too sensitive. The content analysis and interview examples are from the four categories extracted below in Table 2. It is interesting that, within the story world, some participants found the game too scary, but also realistic and creative.

**Table 2.** Accumulated number of coded interview statements with positive and negative aspects of the game. Based on six student interviews.

	<b>Positive</b>	<b>Negative</b>
Challenge/Skills	20: It was absorbing. The quests were good, and should not be more difficult. I like it is simple. The quests match the format.	6: It could have been much more difficult. It was too easy to complete the quests. More complicated quests.
Reading engagement.	30: I liked the letters. I can actually recall what I read. More reading like this. It made me understand the story much better. Great supplement to the book read. Would like to continue the reading. Would for sure recommend this game as supplement to in-class readings. It makes the reading much more exciting.	3: I could not really bear reading it. The reading was not paying much attention before the end of the game. Did not feel like reading the text in the game.
The story world	10: Awesome. Pretty and fun. Realistic and creative. I was positively surprised. I got a shock with the bee, well done.	6: Larger play area. A bit too scary for me. The in-game story should be longer. The bee was a bit strange.
Controls	4: No problems of controls, it was perfect. Very straightforward and well known. I had control.	7: The mouse was too sensitive. Shift and space did not respond as expected.



## 6 Discussion and conclusion

In this study, we implemented the novella *A Love Story* in Danish classes at a Danish gymnasium using a transmedia storytelling approach by supplementing the analog text reading with readings and storytelling delivered via a serious game. The results revealed a significantly higher user engagement (Mean 3.47., STD: 0,93) for the students in the experimental groups, reading parts of the novella by playing the game, than the control group not playing the game as part of the reading (Mean 2.96/ STD: 0.67). Further, in the interviews, all participants stated that they could see the potential benefits of supplementing analog text reading with a serious game to improve reading engagement. However, some participants suggested that the reading elements, rather than the completion of specific quests, should receive more attention in the game. Both this study and previous research [11-13, 20] identified positive effects of serious games used to supplement and improve reading engagement, but this approach also faces some barriers. The main barrier is uncertainty regarding how to develop a successful serious game that engages students and fulfills specific learning objectives in a curriculum. These objectives need to be very clear from the beginning during the research design and game design processes. It is vital to know what the game is intended to achieve and specifically how it can supplement the text reading. It is also crucial to involve the teachers in the design process. Although we followed the methods of the participatory design approach [31], it was difficult to include the teachers at the applied level of improved matching between the text and game. The problem could be that we, as game researchers and designers, did not explain the foundation, framework, opportunities, and game design limitations clearly enough.

The story in the game was well told, and the learning outcome was achieved through increased engagement. However, future work is needed to create significant evidence of and insight into regarding students' reading engagement via transmedia storytelling. First, researchers need to include a much larger number of students from classes across various gymnasiums during the data collection process. Second, they need to collect additional identifying details about the readers, including their reading confidence levels. Third, there is a need for longitudinal studies that include well-defined data obtained through repeated measurements over time. Fourth, there is also a need for improved study designs that include comparable experimental and control groups. One of the strengths of this experimental study was its included experimental and control groups. However, in practice, it was difficult to match classes in terms of level and curriculum progression. In this study, the control group consisted of a class of math majors, which could constitute a potential bias in our research design, as the students from the experimental groups were game design and media communication majors. However, narrative engagement was similar between the experimental and control groups, and the reading index was higher in the control group. In the literature [19, 20, 33, 34], there are various examples of how to evaluate serious games. However, when performing evaluations in very specific contexts with real users, it can be difficult to conduct a perfect research evaluation. Logistics, time constraints, gatekeepers, legislation, lack of a proper posttest, technical issues, and resources can be barriers that prevent perfect evaluations. In addition, randomization is often impractical for evaluating

serious game in a fieldwork context. It could also be unethical to randomize students in the same class, with some playing the game, and some not; this should also be avoided because of the potential learning effects.

There is no agreed taxonomy for reading engagement, and the inclusion of serious games is still both diverse in its outcomes and understudied as a transmedia subject for inclusion in gymnasiums. Future studies should be focused on designing various game options to accommodate diverse students and reader types.

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