# Making Fiscal Policy Engaging for Students in Social Studies by Used Game-Based Learning

Mads Strømberg Petersen, Niklas Lee Skjold Hansen, Gustav Jakobsen, Daniel Henriksen, and Thomas Bjørner(✉)

Department of Architecture, Design & Media Technology, Aalborg University, A. C. Meyersvænge 15, 2450 Copenhagen, SV, Denmark
tbj@create.aau.dk

**Abstract.** In this study, we present the effect of game-based learning within the fiscal policy subject in the Danish Gymnasium (upper secondary). The study included 51 students from two classes in social studies. One class with 31 students was included in the experimental study, which employed the game-based learning as part of reading about fiscal policy. One class with 20 students served as the control group and engaged only in an analog reading of fiscal policy. We based the evaluation criteria, which we assessed through a questionnaire, on items from the user engagement scale and a knowledge test. Further, the evaluation consisted of an interview with the teacher in social science and interviews with nine students. The findings revealed positive effects in favour of game-based learning, especially in students' interest in the learning material and being immersed while learning. The interviews revealed positive feedback toward the game-based learning, especially regarding the novelty and learning outcome. The results from the knowledge test were only slightly in favour for the experimental gaming group. Previous research has the same findings, but there is a lack of improved game design suggestions for how to make the perfect match between engagement and learning.

**Keywords:** Game-based learning · Serious games · Engagement · Fiscal policy · Students

## 1 Introduction

The Danish Gymnasium offers a 3-year upper secondary program. This qualifies a student for admission to higher education (e.g., universities or professional education). Internationally, there are reported various educational gender differences [1], which also refers to the Danish Gymnasium. The differences, among others, that need to be addressed concern differences in grade, reading engagement, dropout rate, and time use on video games. Danish female students overall score higher than Danish male students do with a 7.4 average versus the male students with a 6.9 average [2]. This gap has only

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increased in the last five years [2]. In subjects demanding more text reading, such as in social science, female students' grades are 1.4 points higher on average [2]. According to PISA [1], with an evaluation of the 15-year-old´s skills in reading, 10 other comparable countries scored significantly higher than the Danish students did. Almost no changes have been observed in the Danish students' reading skills since 2015, especially among the weak readers. One perspective into the problem could be to focus more on the reading engagement [3, 4] to provide further intrinsic and extrinsic motivation to start reading. Young males have scored the lowest in reading engagement [1], which could explain the lower grade for male students in the text-heavy subjects [2]. Male students also have a higher dropout rate than female students have, equal to around 20% for males and 15% for females [2]. Another difference between young males and females (aged 15) is that males play computer games more often and play for longer periods when playing [5]. For males, 28% played 2 h or more when playing, which was only 10% of the females. Furthermore, 28% of the males and 19% of the females played computer games several times daily.

In today's educational learning, game-based learning is becoming increasingly integrated as part of the teachers' didactic toolbox, in which games can supplement other types of learning materials [6, 7]. Others have already well documented how game-based learning can promote learning goals and stimulate reading engagement [7–13]. However, a continuing problem has understood the underlying design processes that govern the success of game-based learning. The research question for this study is as follows: Can game-based learning increase engagement in fiscal policies as part of the curriculum in social studies for Danish Gymnasium students?

## 2 Previous Research

Like other scholars [14, 15], we define a serious game as a one designed for a primary purpose other than pure entertainment. In this study, we used the term game-based learning [5, 16, 17] as a subgenre of serious games. However, it is worth mentioning that game-based learning has been practiced since at least the 20th century [15], and paper-based games became popular in the 1960s and 1970s. During the last decade, the use of digital game-based learning has gained popularity, along with computer gaming for various educational aspects. There is no consensus on what defines game-based learning, and it used in divergent ways, focusing on various perspectives depending on their purpose, the players' goals, and content [14, 18]. Furthermore, some categorical problems often exist within mixed terminologies (e.g., game-based learning, serious games, and gamification), and their connection to specific learning goals. Scholars have described multiple principles for game-based learning [5–8], including a focus on reading engagement [10, 19–24]. Important aspects of game-based learning and reading engagement include realism, feedback, discovery, repetition, guidance, flow, digital storytelling, social interaction, briefing, and debriefing [10, 19–24]. Furthermore, motivation is important. Reading engagement, both in game-based learning and in other media, including analog media, requires the reader's motivation [4, 20]. This involves aspects such as important elements within the text's content, text comprehension, knowledge acquisition, and social interactions that employ knowledge and lessons the text teaches [4, 20]. Scholars have

also emphasized the specific aspects of intrinsic motivation as important when designing game-based learning for reading engagement [19–26]. These can include elements such as curiosity, a desire for a challenge, flow, involvement, and narrative engagement [25, 26]. The latter [27] seems important within game-based learning games that focus on reading engagement because of its relation to the story experienced while playing the game. Thus, it may result in imaginative immersion, narrative involvement, or narrative immersion. The desire to find the key to the office and adjustment the fiscal policy, or to obtain cheaper tickets to the music festival, might evoke curiosity, suspense, and narrative engagement, making the players want to continue playing [27]. Studies have also included transmedia storytelling as a gateway to reading engagement or educational purposes by combining analog reading with parts of the story included within game-based learning [23, 28]. There are still major challenges of how to measure the learning outcomes of game-based learning. The learning outcomes are often measured via self-report and knowledge tests [29]. Previous studies have reported that gamed-based learning has positive outcomes regarding being more engaging compared to traditional classroom instruction [7, 10, 24, 29, 30]. However, the effects of game-based learning on specific knowledge tests are more diverse and inconclusive [29].

## 3 Methods

### 3.1 Participants

This study is made in cooperation with a teacher in social science at a Danish Gymnasium. The Gymnasium is situated in the center of Copenhagen with 390 students across five lines of study, including science, languages, and social studies. This study included two classes consisting of 51 students in social science. Both classes had the same teacher. Class A consisted of 31 students with 13 males and 18 females. Class A functioned as the experimental group that used video games as a transmedia storytelling for the upcoming lecture about fiscal policy. Class B consisted of 20 students with 14 males and 5 females, and one student outside the gender dichotomy. Class B functioned as a control group for the evaluation, provided with the same reading and evaluation criteria, but without playing the game (only analog reading). The teacher in social science selected which of the classes would be in the experimental group and which would be the control group. Based on self-reporting, there was no difference between the two groups regarding time spent on computer gaming per week (Table 1). The groups were also similar in their interest in social studies, and their self-reported assessment for answering correctly to most questions in social studies (Table 1).

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 anonymous 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.

**Table 1.** Characteristics for Class A—the experimental gaming group (in grey); characteristics for Class B—the control group (in white) with analog reading only.

| **1=0-5 hrs weekly. 2=6-10 hrs weekly. 3=11-20 hrs weekly. 4=21-30 hrs weekly. 5=30+ hrs weekly** | **1** | **2** | **3** | **4** | **5** | **Total** |
|---|---|---|---|---|---|---|
| How much time do you spend on video games on a weekly basis | 15 | 3 | 7 | 2 | 0 | 27 |
| | 6 | 3 | 6 | 2 | 1 | 18 |
| **1=Strongly disagree. 2=Disagree. 3.=Neither agree or disagree. 4=Agree. 5=Strongly Agree.** | | | | | | |
| I am interested in social studies | 0 | 0 | 4 | 9 | 7 | 20 |
| | 0 | 0 | 2 | 5 | 9 | 16 |
| I can answer correctly to most questions in social studies | 0 | 0 | 5 | 13 | 2 | 20 |
| | 1 | 0 | 7 | 6 | 2 | 16 |

### 3.2 Procedure

The procedure (Fig. 1) for Class A (Exp = the experimental gaming group) included first a written introduction from the teacher with instructions of what to read. This was followed by an instruction from the researchers of how to download the game. Students could ask some of the present researchers if there were any downloading problems. After gameplay, the students filled in a two-part questionnaire. The user engagement scale (short form) inspired Part 1 [31]. Part 2 consisted of questions regarding a knowledge check of fiscal policy, as provided within the game's learning content. After the gameplay session and filling in the questionnaire, nine students (seven females and two males) were interviewed. The interviews took place as friendship pairs, in which three students were interviewed simultaneously in three groups. As a method, friendship pairs can encourage the participants of this age group to feel more comfortable [32], thus facilitating a more open and deep discussion that might give the interview more spontaneity and surprising twists. Further, after two weeks, we interviewed the social studies teacher. The interview followed a semi-structured interview guide.

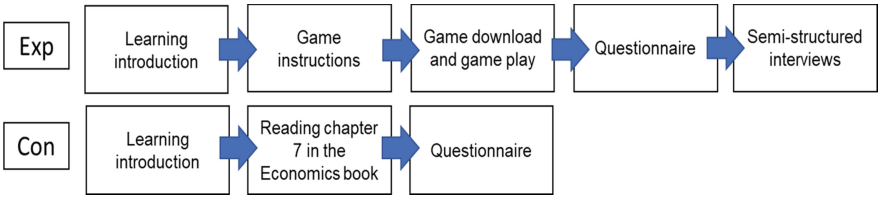


**Fig. 1.** The procedure for the experimental group (Exp) and the control group (Con).

Class B (the control group) received the same instructions from the teacher (Fig. 1), and had the same questions for the user engagement scale and knowledge check as Class A had. However, Class B did not play the game, but were only reading in the economics book.

### 3.3 Data Analysis

The items from the user engagement scale and the knowledge check were analyzed by a Shapiro–Wilk test for normality and Levene's test for homogeneity of variance. An independent samples t-test was performed in SPSS on parametric data and the Mann–Whitney U test for non-parametric data. Descriptive statistics was performed on the data from the user engagement scale reported via cumulative frequency. All the interviews were analyzed via traditional coding [33]. The coding followed four steps: organizing, recognizing, coding, and interpretation. Researchers transcribed the interviews and organized and prepared them for data. The codes in each interview were labelled in the predefined themes, although providing the possibility for additional themes. The data were analyzed via content analysis [33]. Intercoder reliability [34] was measured through Cohen's kappa for the friendship pair interviews. Intercoder reliability assesses the agreement among multiple coders for how they assign codes to text sections and can be used to assess consistency and validity among the codes [34]. The use of the Intercoder reliability resulted in a score of 0.86, which suggests a very strong agreement between the two coders for the codes applied based on the interview data.

## 4 Design and Implementation

The game was developed in the Unity Engine version 2021, utilizing asset packs from the Unity Store for the majority of the included 3D models. The in-game story takes places in the family home of the Minister for Finance. The home-alone teenage son (the main character) would like to join the Roskilde Festival in Denmark, which is one of Europe's largest music festivals. However, by fiscal policy, the teenage son would like to make an effect on the festival's prices. There are specific fiscal policy choices to make, as well to find the father's (the Minister for Finance) key to his home office. The home consists of five rooms, including the kitchen (Fig. 2), which opens to the living room, the office, the hallway, the bedroom, and the bathroom. At all times, in the upper right corner, there was information for the players regarding what to do next, for example, as in Fig. 2, "Explore the living room" (Udforsk stuen).

Before gameplay, the students were provided with the game controls in an introductory tutorial. The instructions appeared visually showing the keys (WASD, the arrows, or the mouse) to use for in-game controls and navigation. As the players discovered interactive objects, hints were shown, including which buttons to use for interaction (e.g., press E for interaction). To promote concentration, the game implemented visual and auditory stimuli using interactive objects that rewarded the player with a voiceover of the written text. The tasks (objects) needed to be completed in a specific order to ensure that the students received the story chronologically and followed the plot for adjusting the fiscal policy accordingly. To highlight the reading objects, a particle system (Fig. 3) was implemented on the objects. The particles made it easier for the players to identify the objects that needed to progress in the story. To avoid confusing players, the particles disappeared once activated.

To evoke further engagement, sound effects were added when picking up clues or keys, which simultaneously provided immediate feedback. At all times, it was possible


**Fig. 2.** The family home of the Minister for Finance. A particle system highlighted the reading objects


**Fig. 3.** A particle system highlighted the reading objects.

to read in the notebook "Press C to open or close the notebook" (Fig. 4, lower left corner), with the possibility off going back to re-read learnings about fiscal policy.

To provide reading engagement about fiscal policy, we provided the readings in different formats (Fig. 5), for example, as provided on the iPad (Fig. 5, left), in the notebook (Fig. 5, right), as text messages on the mobile phone, or stickers on the fridge.

Further, to provide engagement, we used an interactive push button system during the game to encourage the students to provide correct answers within the fiscal policy (Fig. 6).

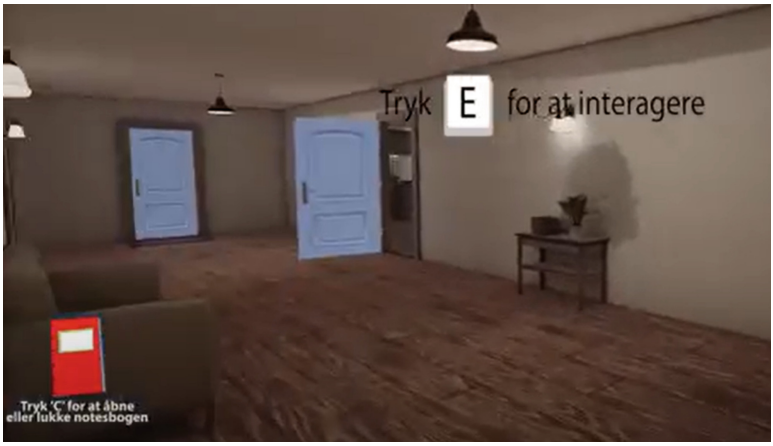


**Fig. 4.** A notebook was present with possibilities to read about fiscal policy at all times.

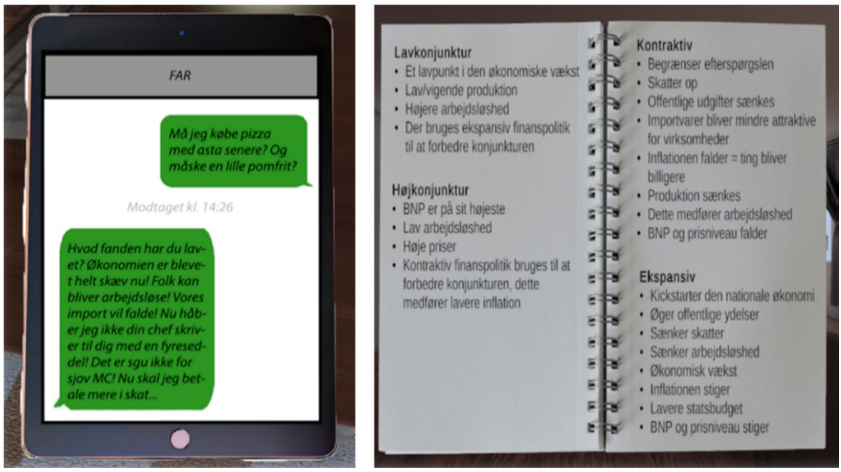


**Fig. 5.** The readings were present in different formats, e.g., on an Ipad or in a notebook.


**Fig. 6.** Interactive push buttons for learning engagement in fiscal policy. Left (red) button is the choice of expansionary fiscal policy, and to the right (blue), is the choice of contractionary fiscal policy.

## 5 Findings

### 5.1 Game-Based Learning Engagement

We found significant difference by t-test in the user engagement scale (UES) between the experimental group ($M = 3.68$, $SD = .50$) and the control group ($M = 3.29$, $SD = .40$) conditions; $t(34) = -2.48$, $p = .018$, ($d = .46$). These findings suggest that using game-based learning can positively supplement teaching about fiscal policies among Gymnasium students. These results reflect those from previous research based on the UES [7, 24], which also revealed an increased engagement in a learning context due to gaming. Table 2 further reveals the findings, based on items asked in the UES (perceived usability excluded).

The item from the UES that yielded the highest mean score ($M = 4.00$, $SD = 0.68$) was Q3.2 in the aesthetic appeal (Table 2), where 21 students in the experimental gaming group either totally agreed or agreed that the learning about fiscal policies was visually well communicated. In contrast, only nine students in the control group agreed on this. This means that the game was well designed, and it added further visual communication aspects. At the same time, and interestingly, the only item in the questionnaire (Table 2) where the control group had a higher mean score than the experimental group did was also within the aesthetic appeal. However, the mean difference is low, thus this finding comes with some uncertainties. Nevertheless, we were surprised that the score for the question "Learning about fiscal policies was interesting" (Q3.1) was not in more favor of the experimental gaming group. In the items for the focused attention in the UES, the experimental group had a small increase in the mean score (Q1.1: $M = 3.42$, $SD = 0.72$;

**Table 2.** Findings from the items in the User Engagement. The experimental gaming group (in grey), and the control group (in white) with analog reading only.

| 1=Strongly Disagree. 2=Disagree. 3=Neither Agree or Disagree. 4=Agree. 5=Strongly Agree. | 1 | 2 | 3 | 4 | 5 | n | Mean | SD | Mean diff. |
|---|---|---|---|---|---|---|---|---|---|
| **Focused Attention:** | | | | | | | | | |
| Q1.1: The time flew by while I learned about fiscal policies | 0 | 3 | 13 | 14 | 1 | 31 | 3.42 | 0.72 | +0.37 |
| | 0 | 4 | 11 | 5 | 0 | 20 | 3.05 | 0.69 | |
| Q1.2: I was immersed while learning about fiscal policies | 0 | 5 | 10 | 12 | 2 | 29 | 3.38 | 0.86 | +0.18 |
| | 0 | 4 | 10 | 4 | 2 | 20 | 3.20 | 0.89 | |
| **Aesthetic Appeal:** | | | | | | | | | |
| Q3.1: Learning about fiscal policies was interesting | 0 | 2 | 7 | 18 | 1 | 28 | 3.64 | 0.68 | -0.04 |
| | 0 | 0 | 8 | 9 | 2 | 19 | 3.68 | 0.67 | |
| Q3.2: Learning about fiscal policies was visually well communicated | 0 | 0 | 6 | 15 | 6 | 27 | 4.00 | 0.68 | +0.50 |
| | 0 | 0 | 9 | 9 | 0 | 18 | 3.50 | 0.51 | |
| **Rewarding:** | | | | | | | | | |
| Q4.1: Learning about fiscal policies was worthwhile | 0 | 2 | 8 | 13 | 4 | 27 | 3.70 | 0.82 | +0.14 |
| | 0 | 0 | 8 | 10 | 0 | 18 | 3.56 | 0.51 | |
| Q4.2: It was a rewarding experience to learn about fiscal policies | 0 | 0 | 9 | 17 | 1 | 27 | 3.70 | 0.54 | +0.37 |
| | 0 | 2 | 9 | 6 | 1 | 18 | 3.33 | 0.77 | |
| Q4.3: I became interested in the learning material | 0 | 0 | 9 | 16 | 2 | 27 | 3.74 | 0.59 | +0.57 |
| | 0 | 3 | 9 | 6 | 0 | 18 | 3.17 | 0.71 | |

Q2.2: M = 3.38, SD = 0.86) compared to the control group (Q1.1: M = 3.05, SD = 0.69; Q2.2: M = 3.20, SD = 0.89). The findings reveal that the game-based learning scored better regarding providing immersion about fiscal policy in contrast to the non-gaming control group. The experimental gaming group scored higher in the mean scores for all items related to "Rewarding." The highest difference observed between the experimental group and control group in the UES questionnaire (and in favor to the gaming group) was for the question Q4.3: "I became interested in the learning material" (M = 3.74, SD = 0.59), compared to the control group (control: M = 3.17, SD = 0.71). Findings from previous research can possibly explain the positive results in favor of the experimental gaming group [35], revealing that game-based learning significantly creates more flow experiences than does the non-game-based learning group, and game-based learning can provide significantly higher interest, based on students being able to control their learning [35].

### 5.2 Learning Goals

The participants were asked knowledge questions about fiscal policies in a questionnaire, immediately after the UES questionnaire. Table 3 reveals the percentage of correct answers for each question: Q1–Q5 for the experimental group and control group.

**Table 3.** Correct answers in % from the knowledge test.

| | **% Correct answers Eksperimental group** | **% Correct answers Control group** |
|---|---|---|
| Q1: How do you lead an expansive fiscal policy? | 45 | 56 |
| Q2: What effect does an expansive fiscal policy have? | 75 | 50 |
| Q3: How do you lead a contractionary fiscal policy? | 50 | 56 |
| Q4: What effect does a contractionary fiscal policy have? | 25 | 19 |
| Q5: What is the gross domestic product (GDP)? | 90 | 94 |
| Mean | 57 | 55 |

The experimental group answered correctly on 57% of the questions related to fiscal policy, while the control group answered 55% of the same questions correctly. These scores alone suggest that game-based learning has not provided a significant positive effect on students' learning capability beyond that of analog text reading. These relatively unexpected low scores for the experimental gaming group also stand in contrast to the findings of other studies that included knowledge tests in game-based learning [40]. One of the shortcomings in this study was the excess freedom it allowed for creating the game. Setting boundaries around the specific learning goals/success criteria for the fiscal policy theory to be implemented in the game could potentially have helped disseminate the theory and increase the number of correct answers from the game-based learning group.

However, from the interviews (Table 4), we found the comments about the game were very positive, also concerning the learning outcome, motivation, and novelty. Elements that could be improved in game are mainly based on the usability, with matching screen sizes for different playing formats. Some students were also missing further levels regarding more content within the game-based learning, as this was perceived as motivation for learning.

**Table 4.** Findings from the interviews based on content analysis.

| Themes | | Frequency | Quote examples |
|---|---|---|---|
| **Feedback** | Positive | 7 | It was manageable and easy to navigate and find out what you needed to do (ID1: M) |
| | Negative | 1 | There was a time where it said infiltrate your dad's office, and I didn't know what that meant (ID3: F) |
| **Immersion** | Positive | 21 | From the very start I was already deep in the game, so I found myself being easily immersed in the game. (ID1: M) |
| | Negative | 4 | There was a lot of walking back and forth which could get a bit homogeneous. (ID: 4 (Male)) |
| **Aesthetic Appeal** | Positive | 6 | I feel that the graphics were realistic and were directed at us, opposed to if it had been cartoonish. (ID8 F) |
| | Negative | 3 | It would have been cool to see some of the characters in the story. (ID8: F) |
| **Motivation** | Positive | 21 | The requirement to answer correctly to progress in the game motivated me to learn. (ID6: Female) |
| | Negative | 5 | It could have been cool if when I finished, I was able to progress to further levels. (ID8: F) |
| **Usability** | Positive | 12 | I did not experience any bugs or inconsistencies in the game. (ID1: M) |
| | Negative | 14 | It was like the game was not tuned to my screen size. Sometimes text went out of the screen. (ID3: F). |
| **Learning Outcome** | Positive | 27 | The game related to what was taught in the class. Not too difficult, and no boredom (ID2: F). |
| | Negative | 10 | I don't think the game would yield the same return as from reading 10 pages The game comes with more fun, but less learning. (ID6: F). |
| **Novelty** | Positive | 36 | The game was a good introduction to the material instead of having to read it. It was a lot cooler to learn about it through the game. (ID8: F) |
| | Negative | 0 | |
| **Relatability** | Positive | 11 | I liked the in-game text. The game was target for us, which was nice. (ID4: M) |
| | Negative | 0 | |

## 6 Discussion

### 6.1 Methodological Issues

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 prevent perfect evaluations. In addition, randomization is often impractical for evaluating serious games in a fieldwork context. It could 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. Research must also pay greater attention to evaluating serious games that target students in the Gymnasium. Moreover, some important challenges persist in increasing the validity and reliability of evaluations of game-based learning when students are the users, as well as which form of evaluation researchers should consider. Participants, including the teachers, should be motivated and want to participate—including in the evaluation phase itself. Further research must also consider the choice of method to be used and the way to ask the right type of questions in alignment with the students' capacities for reflectiveness in relation to their behavior and habits. There are also limitations in generating significant evidence and insights regarding students' learning of fiscal policy via game-based learning. First, a much higher number of participants is needed, and further experimental and control groups should be included in the research design. Second, further details on the participants' identities are needed (e.g., their confidence in gaming, game genre preferences, current knowledge, motivation, expectations, and technology acceptance).

### 6.2 The Importance of the Teacher and Collaborative Planning

A commonly used collaborative planning approach for including users in game-based learning projects emerged from participatory design methodologies [7, 24, 36, 37]. This approach includes, for example, co-creative tasks, collective iterations, consensus building, and problem solving. Much research has examined the collaborative planning approach via the pupils or students playing the games with intended learning outcomes, but less attention has been paid to the very important role of the teachers. Scholars have argued that teachers are key to the success of game-based learning as tool to motivate students and promote deep learning and, therefore, that it is important to provide the teachers with necessary gaming knowledge and skills so that they can integrate game-based learning effectively and efficiently in their classes [38, 40]. A teacher who does not find game-based learning useful will not implement it with the students. The teacher is the crucial gatekeeper, but is also the classroom figure who provides instructions and can include game-based learning within the progression of a class's content over a period of time, as well include the game content within specific, structured in-class discussions, and learning modules. An important aspect when designing game-based learning for teaching fiscal policy to students in upper secondary grades is the teacher's inclusion at an early stage. The teacher can provide valuable insight regarding students, specific learning outcomes, and content, while serving as the gatekeeper of information for the students and providing valuable evaluative information. It is also important to emphasize that this study was focused on teaching methods able to motivate all students. One aspect missing from a teacher's game was a competitive element that, according to the teacher, might have drawn more focus, especially from the male students.

Previous research [39] has already stated the importance of having the teacher(s) play the game themselves before presenting it to the students, as students are annoyed when the teacher does not know how the game works. The teacher's preparation within game-based learning needs to be minimal; for both the teacher and the students, it can

often be beneficial to integrate the tutorial in the game. Further, this study benefits from an experienced teacher who can, e.g., mitigate risk or execute plan B when needed. However, it must also be emphasized that the teacher might not be skilled in how game-based learning can be optimally designed to meet learning outcomes. Among the prerequisites for successful collaborative planning with teachers are the creation of a common language [15, 36] and an efficient onboarding process, which could include visualization of game ideas, story ideas; and clear roles. The teacher is the expert in teaching the subject (in this case fiscal policy); we are the experts in games.

## 7 Conclusion

It is not an easy task to design a digital game for students with the intention of increasing their understanding of fiscal policy. We can conclude that the most important element in developing educational games may be engagement in good games that engage both pupils and teachers, and that the interplay between game play, students, and teachers can create some dynamic learning opportunities. However, a core foundation for making these learning opportunities possible is to have the right balance of skills and challenges for the participants; both within specific learning objectives, but also for control of gameplay.

The game-based learning about fiscal policy developed in this study was engaging for the students. Based on participants' responses, the game was well-fabricated visually, increased students' attention, and was a more rewarding experience than reading the textbook would have been. However, the results from the knowledge test only slightly favoured the experimental gaming group.

We must emphasize that there is no established taxonomy of game-based learning, which is still diverse in its outcomes and is certainly understudied as a means of providing knowledge about fiscal policy. A further direction might create different game design options for targeting different kinds of learning styles, as well as to increase the game's competitiveness and personalization by including the participants' knowledge and motivation.

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