Play to Learn: Conducting a Playtest Session for Improving an Educational Game

Completed Research

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Abstract

The integration of game elements in education is a widespread trend to increase learner’s engagement and motivation. Nevertheless, many game-based learning applications fail because they are not fun. Game design processes that are used to iteratively develop commercial games include playtests during the entire design process to make sure that the desired gaming experience is achieved. However, playtests are seldom used in the development process of game-based learning applications. For this reason, we conduct and evaluate a playtest session for a digital prototype of a serious game for learning. Generally, the results show that the playtesters positively assessed the serious game but there are some aspects for improvement as well.

Keywords

Game-based Learning, Serious Game, Game Design Process, Playtest.

Introduction and Motivation

Playtesting is one of the most important activities a designer of a game is engaged in during the entire game design process. Playtests allow gathering insights into the game play and support identifying whether the desired gaming experience is achieved or not (Fullerton 2014; Schell 2014). Nevertheless, in the development of digital game-based learning applications, playtests are often neglected for time and cost reasons. Especially in the development of educational games there are much smaller budgets available than in the development of commercial games (Fullerton 2014).

Digital game-based learning is defined as the integration of game elements in education and is currently a widespread trend (Hamari et al. 2014). There are two possibilities for including game elements in education: gamification and serious game. Gamification means the integration of game elements in a non-game context. This non-game context can be education (Deterding et al. 2011). Compared with this, a serious game can be described as the development of a full-fledged game with fix rules and goals in a non-game context (Deterding et al. 2011). Both possibilities of game-based learning use game elements (e.g. story, points and leaderboard) for motivational reasons in the context of learning. Game-based learning supports an active learning. Furthermore, learning becomes more fun and motivation is increased. Consequently, learners deal more intensively with learning topics (Kapp 2012).

One reason for the failure of many game-based learning applications is that the applications are not fun. Students do not enjoy playing and learning with it. Often, the focus is on achieving learning objectives instead of creating a game-based learning application that is fun (Zichermann and Cunningham 2011). In traditional game-design processes, an iterative development process with prototypes, playtests and concept revisions is emphasized. Furthermore, an interdisciplinary team with different knowledge and skills is needed for a well thought-out game (Fullerton 2014).
These traditional game design processes are seldom used in the development of game-based learning applications (Moschini 2006). Nevertheless, the advantages like improvements of the game design through the performance of playtests are strongly recommended (Boller and Kapp 2017). For example, in the developing process of the educational game “Legend of Zyren”, student feedback was directly gathered during conceptualization. This feedback was then used for improvement, so that a step-by-step development took place (Knautz 2015). Information was gathered through recording game-based interactions and conducting interviews while students learned with the game-based learning application “Defense of Hidgeon”. As a result, the designers of the application formulated suggestions for improvement (Markey et al 2008). Nevertheless, the game designers decided not to upgrade “Defense of Hidgeon” because they believe that they can not accommodate students’ needs. For this reason, their formulated suggestions for improvement went into the design of a new educational game (Markey et al. 2010). In most cases, educational games are developed, used and evaluated with regard to achieving the learning goals, e.g. “GamEducation” for learning strategic planning and decisions in electronic business, even when some changes were made during the usage (Siemon and Eckardt 2017). Winn and Heeter (2007) performed three playtests during the development of an educational game for learning standards in adaptation and evolution. They were able to make some improvements with the help of this iterative design process. Although they tested and further developed their prototypes, they did not fully follow the guidelines for conducting playtests in the game design process of a classic commercial game. To the best of our knowledge, playtests including recruiting ideal playtesters and conducting a playtest session as performed in traditional game design processes have not yet been carried out in the context of game-based learning application.

In this paper, a playtest session is therefore conducted and assessed for a serious game as an example. The results should be used for game design improvements. Furthermore, the conducted playtest session can be adapted and reused during other development processes of game-based learning applications.

**Theoretical Background**

*Game Design Process and Learning-Game Design Process*

Figure 1 summarizes both almost identical design processes, traditional game design process and learning-game design process.

![Figure 1. Game design process vs. learning game design process](image)

The traditional game design process starts with the conceptualization of the game. Therefore, ideas are needed. The creative process of Csikszentmihalyi (1996) helps to understand the emergence of innovative game ideas (Csikszentmihalyi 1996). In the preparation phase, the aim is to look intensively at the topic or domain of interest. In the incubation, the subconscious has the possibility to connect different information with problem definition for developing new ideas. Creative techniques, such as Brainstorming can help overcome personal barriers, develop new perspectives and encourage idea generation (Osborn 1957). The “aha!” moment follows in the insight phase, when ideas begin to fit together. In the evaluation, it is decided whether the idea is truly original. Finally, the concretization follows in the longest and hardest part of the creative process, the elaboration (Csikszentmihalyi 1996). During idea revision, ideas are evaluated in terms of technical feasibility, market opportunities, budget (money and time) and artistic considerations (Fullerton 2014). It follows a refinement of these ideas and definition of key elements of the game. Opinions about game idea and potentials for improvement can be detected through feedback groups or surveys. The
decision for one idea is made at the end of the process phase. For this idea, concept is then formulated, and
game elements (e.g. story) are defined (Fullerton 2014; Macklin and Sharp 2016).

The second phase of the game design process is prototyping. A prototype is a representation of the game
idea for testing the game feasibility and making improvements (Fullerton 2014). Although a prototype is
already playable, it is only an approximation to the game planned. The focus should be on the selection of
game elements and how they fit together (Fullerton 2014; Schell 2014). There are many possibilities to
create a prototype. Physical and digital prototypes are often used. Physical prototypes, e.g. in paper form,
have the advantage that the focus is on trying the game experience instead of technological aspects. For this
reason, iterative processes are easier than with digital prototypes (Schell 2014). Consequently, physical
prototypes are mostly used in the beginning of game developing (Fullerton 2014). Like physical prototypes,
digital prototypes include only elements of the game. They are prototypes and not finished games. For this
reason, the gameplay is incomplete and the prototype is made with minimal sound and art, focusing only
on parts of the game design (Fullerton 2014).

Playtesting enables testing to make improvements and is something that is performed during the entire
game design process (Fullerton 2014). Furthermore, in the context of educational games, playtests support
creating learning applications students want to learn and play with (Boller and Kapp 2017). The game
design process is an iterative process and, as a consequence, often leads to a revision of the concept,
prototype and so on (Fullerton 2014; Schell 2014; Boller and Kapp 2017).

In the learning-game design process, the conceptualization phase is a little different in comparison to the
traditional game design process. Before conceptualization, the learning foundations have to be set. Learning
foundations include formulating learning goals that are necessary for the conceptualization of the learning-
game design (Boller and Kapp 2017).

In this paper, we concentrate on playtesting a digital prototype as a part of the game design process.

**Playtesting**

Playtests are performed by the designer during the entire game design process to gain insights whether the
desired gaming experience is achieved or not (Fullerton 2014). Playtests provide detailed information to
improve gaming experience when the questions asked are specific enough (Schell 2014). For example,
playtests allow answers to the following questions:

- Does the game work and is the gaming experience perceived like intended?
- Is the game conclusive and balanced?
- Is the game fun?

There are different playtesters who can positively support the game design in dependence on development
phase. The first people who test the game are the developers. They play the game for a long time and can
provide thoughtful feedback, but they are too close to the game and that negatively affects their objectivity
(Schell 2014). The next people who test the game are confidants (e.g. friends and colleagues). They consider
undiscovered things, but they are predisposed to like the game and do not want to hurt the developers’
feelings (Fullerton 2014). The next step is to test with people the game designer does not know. They offer
fresh perspectives and they are untainted by personal relationships (Fullerton 2014). The ideal playtesters
are the target audience. They can provide detail information about what they like and dislike (Fullerton
2014).

There are different methods of playtesting. One-on-one testing allows asking the playtester questions about
her/his expectations. Furthermore, the playtester is watched while playing and based on the observations,
questions are asked. A group of people plays together the game in group testing. They are observed during
the session and have to answer questions after the session (Fullerton 2014). Independent of the method,
there are different feedback forms. Getting quantitative feedback is possible with a standard list of
questions. Playtesters have to answer them after playing and results can then be compared. Interviews are
a face-to-face form and allow qualitative feedback with specific questions and no discussions. One-on-one
or group discussions can be realized as freeform discussions or more structured with a guided conversation.
Gathering game data with metrics show which elements are used or not used in the game (Fullerton 2014).
In this paper, we use the target audience for playtesting, students of mechanical engineering. In the end, they use the game for learning and to realize a balance between fun and learning success, their feedback is particularly relevant for development. Furthermore, the target audience allows suggestions for refinement and improving formal details. The playtesting method is group testing and a quantitative feedback form with open and closed questions is used.

**Study Design**

*Learning-Game Design Process of the Serious Game*

Designing a serious game for learning information literacy for students of mechanical engineering is the aim. Information literacy is defined as the ability of a person “to recognize when information is needed and [...] to locate, evaluate, and use effectively the needed information” (American Library Association 1989).

For idea generation and conceptualization, a project was carried out with students, the target audience of the serious game. 45 students, divided into 12 groups participated. Students learned theoretical game design knowledge and facts about the interaction of different game elements to optimally promote motivation. This knowledge served as a basis for idea generation.

First of all, each group had to independently develop ideas for a game concept for learning information literacy in the project. Creative techniques were used in idea generation. These game concepts were regularly presented to the other groups and developed step by step after feedback. Overall, three revisions were performed. Following the revisions, each group had to determine the three best ideas. However, the own idea was not allowed to be chosen. After evaluating all the rating of the groups, the three best ideas were determined. In a discussion, the most promising idea and a name for the serious game were selected. The joint vote about the game concept helped to maintain the students’ identification with the serious game to be developed, so that not only the group stays motivated, whose concept has been selected for realization. Librarians have set the learning foundations because they are experts in the topic information literacy. In addition to the learning content set by librarians (e.g. research strategies, bibliographic management, and academic writing), students received exemplary materials for knowledge transfer and knowledge verification. Based on this, the students developed levels, including game story, that match the entire game concept. An iterative development including feedback rounds with other student groups and librarians took place again. For ensuring the feasibility of the ideas developed, the project was consistently accompanied by a designer and a business IT specialist.

The serious game, designed by the students within the project, is about a research expedition to the South Pole. Figure 2 shows four screenshots of the serious game that is a point-and-click browser game.

![Figure 1. Screenshots of the serious game](image)

After creating an avatar (screen 1), the students travel as research team to the South Pole. Due to a snow storm, they crash. As a consequence, they have to repair the defective airplane in addition to their research.
Within different levels (screen 2) representing different topics of information literacy, students have to collect components to repair the defective airplane. Each level has an identical structure and is embedded in the background story. The students have to follow a checklist (screen 3). The students have to acquire different skills (e.g. in presentations, videos or stories to scroll down) and thereby apply their acquired knowledge in tasks. The tasks vary from drag and drop, multiple choice, crossword puzzles (screen 4), tasks where students have to collect lines, memory games, free text tasks and tasks that students have to solve as team (e.g. votes and case studies). In each level, students have to achieve a minimum score to reach the next level and to receive a component for repairing the defective airplane. These airplane components represent the game progress. Additional points can be exchanged on a market place through mini games (e.g. bubble shooter) that are just for fun. Duplicates of aircraft components can be exchanged there with other teams as well. An individual and team ranking support competition (Eckardt and Robra-Bissantz 2016).

Participants

A sample of 46 playtesters that represent the target audience of the serious game, students of mechanical engineering, were invited to participate in the study. The students consisted of 38 males and 8 females, with the mean age of being 25. All students share approximately the same level of knowledge and must write a Master thesis in the coming semesters. Learning some information literacy skills is therefore important. For this reason, the students are ideal playtesters and represent the target audience.

Playtest Session

For the playtest session, a digital prototype of the first four levels (internet search, catalogue search, research strategies and database search) including avatar creation is used. Figure 3 shows the playtesting process used in accordance to Fullerton (2014).

![Figure 3. Playtest session](image)

The playtest session was conducted by an objective person, who was not involved in the design process. This ensured that the testers are not influenced by personal preferences because the designers of course like their game.

In the introduction (2-3 minutes), playtesters were welcomed and the test leader of the playtest session was introduced. Furthermore, playtesting process and how the results will help to improve the serious game is explained. The warm-up discussion (5 minutes) helps to find out what kind of games the playtesters like and how experienced they are with game-based learning. Most of the testers knew about game-based learning or had tried it with learning Math for example, as a child. The playtesters had no concrete expectations but were curious about the fun factor. The playtest session lasted 20 minutes. The students spent the time with evaluating all the features without restrictions. The aim was to get their feedback on the gaming experience and not to test their skills. After the playtest session, a discussion of gaming experience follows in the form of a questionnaire (open and closed questions). In the wrap-up, the playtesters were thanked for helping to improve the serious game.

Study Results

In the following, the results of the questionnaire are discussed. Table 1 shows the mean values (MV) and standard deviations (STD) for the closed questions. Thereby, a five point Likert scale was used (1 = strongly disagree, ..., 5 = strongly agree).

<table>
<thead>
<tr>
<th>Factor</th>
<th>Content</th>
<th>MV</th>
<th>STD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like the idea to convey learning contents in a game.</td>
<td></td>
<td>4.35</td>
<td>0.77</td>
</tr>
</tbody>
</table>
Overall Impression  | The first impression of the game was positive. | 4,07 | 0,80 |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall, I liked the game.</td>
<td>3,85</td>
<td>0,79</td>
</tr>
<tr>
<td>Game Design Elements</td>
<td>The game has a logical and comprehensible structure.</td>
<td>3,70</td>
<td>0,81</td>
</tr>
<tr>
<td></td>
<td>The aim of the game was always clear.</td>
<td>3,48</td>
<td>1,11</td>
</tr>
<tr>
<td></td>
<td>The game progress was always clearly visible.</td>
<td>3,87</td>
<td>1,02</td>
</tr>
<tr>
<td></td>
<td>I like the available possibilities to customize my avatar.</td>
<td>4,09</td>
<td>0,94</td>
</tr>
<tr>
<td></td>
<td>I like the story of the game.</td>
<td>3,74</td>
<td>0,93</td>
</tr>
<tr>
<td>Usability and Navigation</td>
<td>Usability of the game is good.</td>
<td>3,46</td>
<td>1,07</td>
</tr>
<tr>
<td></td>
<td>Operating the game was simple and intuitive from the beginning.</td>
<td>3,59</td>
<td>1,09</td>
</tr>
<tr>
<td></td>
<td>Navigational controls and icons were always unambiguous, i.e. it was always clear what they mean.</td>
<td>3,39</td>
<td>1,16</td>
</tr>
<tr>
<td></td>
<td>The interface is clearly structured for intuitive operation.</td>
<td>3,59</td>
<td>0,93</td>
</tr>
<tr>
<td></td>
<td>Texts and additional information were always understandable.</td>
<td>3,96</td>
<td>0,79</td>
</tr>
<tr>
<td></td>
<td>Writings were easy to read.</td>
<td>4,24</td>
<td>1,06</td>
</tr>
<tr>
<td>Fun</td>
<td>Playing the game was fun.</td>
<td>3,48</td>
<td>0,94</td>
</tr>
<tr>
<td></td>
<td>It never got boring.</td>
<td>3,13</td>
<td>0,93</td>
</tr>
<tr>
<td></td>
<td>Tasks are varied and enjoyable.</td>
<td>3,80</td>
<td>0,98</td>
</tr>
<tr>
<td>Design</td>
<td>Visually, I liked the game a lot.</td>
<td>4,11</td>
<td>0,85</td>
</tr>
<tr>
<td></td>
<td>I like the colors used in the game.</td>
<td>4,50</td>
<td>0,86</td>
</tr>
<tr>
<td></td>
<td>The overall „Look and Feel” is positive.</td>
<td>3,98</td>
<td>0,83</td>
</tr>
</tbody>
</table>

Table 1. Mean values (MV) and standard deviations (STD)

The playtesters positively evaluated all dimensions. Their overall impression of the serious game including their first impression was positive. They liked the idea of learning and instruction in a game. Achieving a positive impression is important for learning. If students do not like the game-based learning application, their attitude towards learning with this application will be negative. This would maybe negatively influence their learning success, which would be negative for the instructional designers and learners as well. A good impression of the serious game is a first step to a good learning application.

In general, the included game design elements are positively assessed. The playtesters liked the story of the game, enjoyed creating their own avatar, liked the clearly visible game progress and recognized the logical and comprehensible structure of the game. Nevertheless, they neither agreed or disagreed the statement “The aim of the game was always clear”. Therefore, there is potential for improvement.

Usability and navigation was positively evaluated as well. Usability describes that a service or product is usable, when “the user can do what he or she wants to do the way he or she expects to be able to do it, without hindrance, hesitation, or questions” (Jeffrey and Chisnell 2008, pp. 4). Texts were easy to read and understand. The structured interface allowed an intuitive and simple operation from the beginning. But in general, the usability received an average score (MV = 3.46) and it was not always clear what is meant by the icons or how to handle the navigation control (MV = 3.39). For this reason, the usability and navigation should be improved, for example through a support video in the beginning that introduces the navigation and aim of the game to the player or a hover effect to explain the function of a button.

Fun was differently evaluated. Playtesters enjoyed the variety of tasks. The statement “Playing the game was fun” received assessments from ‘neither agree nor disagree’ to ‘agree’ and the statement “It never got boring” was assessed in average with ‘neither agree nor disagree’. Generally, traditional games are equated with having fun, but fun is not the key element in game-based learning applications (Kiili 2005). The
Playtesting for Improving an Educational Game

students should be more engaged and motivated in learning through the experience with the game. The promise is to provide a game that is internally consistent and fair, so that no one gains unearned advantages (Rollings and Adams 2003). Game-based learning applications are balanced, when the player’s skill level is the key factor to succeed in the game (Kiili 2005). Nevertheless, the aim of instructional game designers is to create a game, that is characterized by a balance between fun and achieving learning goals. For this reason, the fun level should be improved, maybe by adding more details and graphics to underline the experienced story of the game.

Playtesters evaluated design aspects of the serious game positive. Visually, they liked the game and enjoyed the used variety of colors.

The mean values over all items of the respective dimensions are visualized in a bar diagram in figure 4. Generally, all mean values of the dimensions are approximately ≥ 3.5, which corresponds to a positive evaluation.

<table>
<thead>
<tr>
<th>strongly disagree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Overall Impression</td>
<td>4.09</td>
</tr>
<tr>
<td>Game Design Elements</td>
<td></td>
</tr>
<tr>
<td>Usability and Navigation</td>
<td>4.20</td>
</tr>
<tr>
<td>Fun</td>
<td></td>
</tr>
<tr>
<td>Design</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 4. Mean values of the dimensions**

Table 2 and 3 shows the answers to the open questions. The answers are summarized, and the number of mentions is indicated in brackets.

<table>
<thead>
<tr>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Briefly describe your first impression of the game.</td>
<td></td>
</tr>
<tr>
<td>Pleasant visual design (11)</td>
<td>Confused and uncertain what to do in the beginning (6)</td>
</tr>
<tr>
<td>Good / positive / interesting (10)</td>
<td>Visually too playful / not serious (3)</td>
</tr>
<tr>
<td>Clean / well-structured interface (4)</td>
<td>Long loading times / server problems (3)</td>
</tr>
<tr>
<td>Appealing colors (3)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name three things that you have noticed positively/negatively.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasant visual design (15)</td>
</tr>
<tr>
<td>Videos for knowledge transfer (10)</td>
</tr>
<tr>
<td>Clean / well-structured interface (6)</td>
</tr>
<tr>
<td>Diverse types of tasks (6)</td>
</tr>
<tr>
<td>Easy / intuitive operation (4)</td>
</tr>
<tr>
<td>Reward system as incentive for learning (4)</td>
</tr>
<tr>
<td>Feedback system (3)</td>
</tr>
</tbody>
</table>

**Table 2. Positive and negative aspects of the serious game**

The playtesters described their first impression of the serious game at first. Most of the answers were positive. A particularly positive aspect is the design. This corresponds with the answers from the closed questions. Furthermore, the game was perceived as a good and interesting application with a well-
structured interface and appealing colors. Nevertheless, the playtesters did not always know what they have to do, especially in the beginning. As mentioned earlier, a support video to introduce the game could help. Additionally, a feedback function could be integrated, so that students could always get in contact with the game designers and ask for help. Some playtesters believed that the game is visually too playful and not serious enough. This contradicts the opinion of the majority, whose first impression of the serious game was positive. However, some too playful graphics (i.e. hearts in memory games) could be exchanged. Long loading times have been noticed during the playtest session. System analysis revealed frequent game-progress-related database requests as the main issue. To accelerate these, we should cache a large portion of per-user-progress calculations. This should solve the problem of long loading times.

The playtesters enumerated up to three positive and negative things of the game. In addition to the already mentioned positive aspects (e.g. design), some more aspects were named. For example, playtesters liked the usage of videos for knowledge transfer as well as the feedback and reward system as incentive for learning. Furthermore, the variety of task types is mentioned as a positive aspect and corresponds therefore to the answers from the closed questions. In addition to the already mentioned aspects, negatively mentioned was the checklist that is hard to find and a too little minimum score that has to be reached in each level. Game goals that are too easy to achieve have a negative effect on motivation and engagement (Kapp 2012). An activity that is not overstraining or underchallenging is the optimal mental state a game activity can reach, the so-called flow (Csikzentmihalyi 1990). Flow in a game-based learning application can support a better learning outcome and is therefore desirable (Hoblitz 2015). For this reason, the minimum score that is needed for a successful level completion should be raised.

<table>
<thead>
<tr>
<th>Where?</th>
<th>What?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossword puzzle</td>
<td>Hover effect not intuitive</td>
</tr>
<tr>
<td>Image search</td>
<td>Not clear what to do</td>
</tr>
<tr>
<td>System performance</td>
<td>Long loading times / server problems</td>
</tr>
</tbody>
</table>

Table 3. Frustrating moments in the serious game

The playtesters had some frustrating moments in the serious game. In addition to the previously mentioned long loading times, they had problems with two task types, crossword puzzle and image search. Both problems show ambiguities in understanding what to do. Tasks therefore should be formulated more clearly.

**Conclusion and Future Research**

Generally, the playtesters assessed the digital prototype of the four levels positive. The design and the overall impression of the serious game especially were positively assessed but the included game design elements as well. The design with the appealing colors and the well-structured interface was positively mentioned several times, in the open and closed questions.

Nevertheless, there are identified some aspects for improvements. This affects the usability and the fun factor of the serious game. Sometimes the playtesters did not know what they have to do and this arouses a feeling of uncertainty, which negatively effects the feeling of flow of a person (Csikzentmihalyi 1990). If a person feels overstrained or underchallenged, it is not fun either. A more clearly description of the next steps and tasks could counter this. Another problem identified with the open questions is the loading time. This could be reduced by a change in the database.

Even though playtest sessions are often not used in the development of educational games, they offer some advantages. As the conducted playtest session in this paper shows during the development of a serious game for learning information literacy, deficits can be identified and eliminated or at least reduced. A gradual improvement of an educational game can lead to an increased identification of the learners with the game, because of the learners’ integration in the development process and the consideration of their opinions. This means that development is no longer exclusively carried out by the teachers, who dictate what has to
be learned and how. This cooperation between teachers and the target group of the educational game, the students, supports the development of a game with which the students want to learn.

The playtest session conducted in this paper is a first test of the digital prototype of the serious game. It is a part of the iterative learning-game design process. Generally, nothing has to be changed in the conceptualization of the game design because it has been rated positively. Nevertheless, there are some improvements to make. After integrating these changes in the serious game, another playtest session should be conducted with more focus on gaming experience. With the EGameFlow model the gaming experience of a game-based learning application is measurable (Fu et al. 2009). The model consists of eight dimensions (concentration, clear goal, feedback, challenge, autonomy, immersion, social interaction and knowledge improvement) that make the pleasure of games extensively measurable. Based on this, changes could be made to directly improve gaming experience. The focus would therefore be on improving the game experience instead of improving the serious game in general (i.e. design or usability).

In a next step, after improving the gaming experience based on the EGameFlow model, it is possible to revise the playtest with measuring the gaming experience. This iterative design process would make changes (improvements or deteriorations) in gaming experience measurable, which could show the importance of playtesting in the context of game-based learning.

The conducted playtest session in this paper could be relevant for practice as well because it serves as an example of how to conduct a playtest session on a digital prototype for an educational game. For example, the playtest session procedure could be adapted and reused for the iterative development process of another educational game.

In summary, it can be noted that real feedback only occurs when people, for example the target audience, test the game-based learning application. Therefore, playtests can be used to iteratively create an educational game characterized by a balance between fun and learning success.

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