

Brief Guidelines for Educational Adventure Games Creation (EAGC)

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Abstract— Many recent studies have shown that educational games are effective tools for learning. Nevertheless, it is hard to find any practical guidelines for the creation of such games. The goal of this paper is to develop such guidelines for the creation of educational adventure games.

Keywords— educational adventure games; game design; digital game-based learning; game development; e-learning

I. INTRODUCTION

The effectiveness of educational games for learning has been investigated in many previous studies showing primarily positive outcomes [1]. But if one decides as a consequence to build his/her own educational game, he/she will soon face the questions *where to start?*, *how to proceed?* and *how to succeed?* Despite the recent popularity of game-based learning, there is a lack of useful practical guidelines for the creation of such educational games. Our goal in this paper is to try to fill this research gap and to develop useful, clear and practical guidelines especially for the creation of educational adventure games. In order to do so, we take existing guidelines for the creation of entertainment games [2] and guidelines for the creation of educational games into account:

EFM Model: In this model, Song and Zhang [3] connect theories about the requirements for effective learning environments, theories about flow experience and essential strategy components for stimulating motivation.

Experiential gaming model: Kiili [4] proposes a model which describes both the learning process in an educational game and the design process of an educational game.

Game Object Model (GOM) and Game Achievement Model (GAM): Amory [5] developed GOM, which links pedagogical dimensions with game elements. Expanding GOM, Amory proposed the more concrete GAM in which the story forms the basis for game design.

Design Stages and Steps: Quinn [6] suggests to combine elements of instructional design and elements to foster engagement. Based on these elements, he proposes the following stages of educational game design: analysis, specification, implementation, evaluation.

Design Framework for Educational Adventure Games: Moser [7] developed a Design Framework especially for educational adventure games. For this purpose he proposes the cycle of iterative prototyping: design, prototype, test, analysis. The inner design cycle consists again of six stages

that are continuously run through: goal, setting, puzzle design, plot details, support, interface.

Besides the work of Quinn, Moser and partly Amory, the models all remain quite theoretical. Moser's model is very fine-grained, but it fails to give a clear easy-to-understand step by step overview about the major issues for the design of educational adventure games. Based on the mentioned models, we identified the most important aspects for the creation of educational adventure games and combined them in order to develop practical and clear guidelines.

II. THE EAGC GUIDELINES

We propose five design stages for the creation of educational adventure games: conceptual design and game design, implementation, testing and validation. Beyond that, we also address the basic concepts of project management in order to help to manage this complex creation process.

A. Conceptual Design

Our first stage is the stage of conceptual design, in which the basic decisions for the creation of the game are made. As Adams [2] stated in his model for game design, the outcome of this stage can hardly be changed later on. Since we want to represent guidelines for educational games creation, we have to start where every good instructional design has to start:

First, the topic as suggested by Moser [7] and moreover the target audience must be defined. This is a mutual process because not every topic is suitable for every target audience and the other way round. It is also important to choose a topic that is suitable for the implementation in a computer (adventure) game [7, 8].

When a suitable topic is chosen, the target audience needs to be analyzed regarding their interests, motivation, existing knowledge and possible misconceptions as suggested by Quinn [6].

With the topic and the target audience along with their characteristics defined, specific learning goals and a suitable methodical setting should be defined. The specific learning goals and the methodical setting are once again influenced by each other. Methodical setting means the applied learning theories (constructivism, behaviorism, cognitivism, etc.), the level of difficulty and how assessment and adaptivity should be integrated. The level of difficulty is determined by the target audience and is connected to adaptivity. In order to integrate adaptivity into the game, assessment should be embedded into the game environment [9].

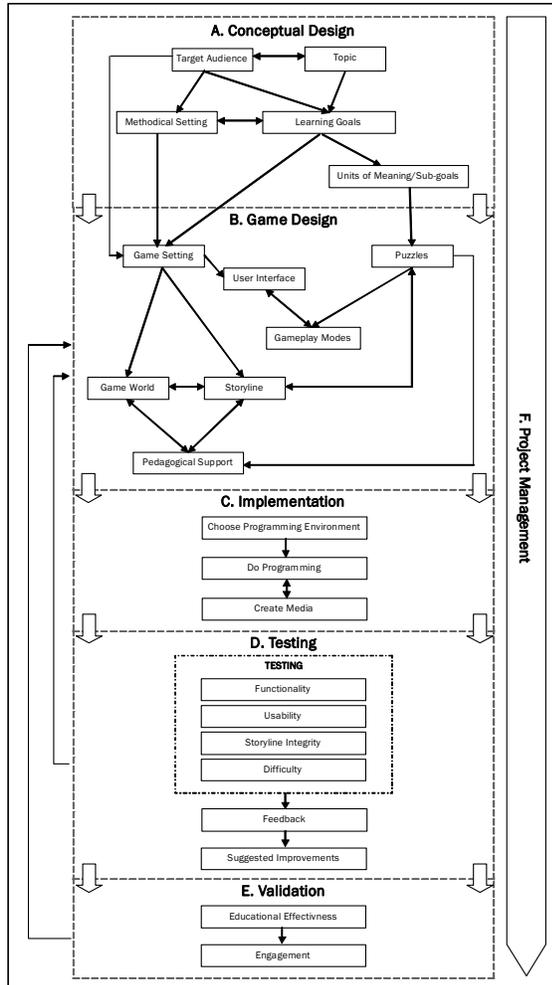


Figure 1. The EAGC Process: Stages and Dependencies.

Next, corresponding units of meaning and sub-goals for the chosen learning objectives need to be defined in order to embed them into the game environment [3, 7].

B. Game Design

Building upon the specifications made in the conceptual design stage, the main game creation process begins and details are shaped [2].

First of all, the game setting (which depends on the target audience, the methodical setting and the learning goals) needs to be determined [7]. The game setting forms the basis for the game world and the storyline.

Especially in the genre of adventure games, the setting is the essential element to make the game appealing or not [2]. It is hence important that the player can identify with the setting in order to get engaged [7]. This means that the setting needs to be adapted to the specific target audience. At this point, gender should be considered in order to create a game, which is appealing for both sexes. Primarily, stereotypes should be avoided [10]. The setting must also be matched to the learning goals and the methodical setting in order to make their seamless integration possible [7].

The next step is to develop the storyline along with its characters, the game world, and the puzzles related to it. Those parts can, to a large extent, be developed simultaneously [2].

Based on the units of meaning and sub-goals, according to puzzles need to be created and embedded into the storyline and the game world [7]. Therefore, Song and Zhang [3] suggest to divide the game into several scenes, which deal with a certain unit of meaning or sub-goal. Amory [5] states that these scenes can be wrapped up to a number of acts, which tackle specific learning goals and tell a part of the story. This process should also make use of the strong connection of place and content of adventure games [11].

Therefore, following the suggestion of Moser [7], acts of the story should be connected to enclosed sections of the game world and the individual scenes should be connected to freely accessible rooms of the corresponding section. The player needs to get involved with the units of meaning and sub-goals of every section/act in order to achieve the specific learning goals related to it and to proceed to the next section/act.

As far as puzzles are concerned, one should integrate (pedagogical) support, feedback, and treatment of potential misconceptions in order to avoid frustration [6, 7, 12]. Again, they need to be implemented into the game world and the storyline in order to maintain the gaming experience (hidden in books, advises from characters, etc.).

Another important aspect connected to the game setting is the user interface. In adventure games, this is mainly a point and click interface, although specific puzzles could, for instance, demand other game play modes and subsequently the definition of other user interfaces. Nonetheless, every user interface should be designed in a way that it is appropriate to the setting [7].

C. Implementation

If the game design stage has reached a point at which the implementation of the conceived aspects seems to be necessary, the implementation stage begins [6].

First of all, a programming environment needs to be chosen. In the field of adventure games, there are a lot of free programming environments available like OpenSludge, AGS, Wintermute Engine or, especially for educational games, the <e-Adventure> platform.

Once this choice is made, programming can start and game mechanics are established. This process is guided by the creation of the media for the game. Graphical design, sound design and music design must be approached with the target audience and setting of the game in mind. Voice output has to be created apposite to the game characters.

D. Testing

After the implementation stage has been completed and a playable version of the game has been created, the game needs to be tested for several aspects. This encompasses tests for functionality, usability, storyline integrity and difficulty. Functionality has to be verified in order to avoid gameplay errors. Test for usability means to test whether the user can handle the user interface effectively. According to Quinn

[6], this can be tested by defining tasks the user can accomplish through the use of the user interface. Storyline integrity needs to be validated in order to avoid logical errors or goofs. Finally, the level of difficulty needs to be tested to ensure that it is appropriately balanced.

The so-gained feedback should be used to identify improvements for the game and its design [2, 6, 7]. At this point, the design process is taken back to the game design stage in order to implement the improvements.

E. Validation

Once the game design process is finished and a stable functioning version of the game has been established, the validation stage begins. In this stage, educational effectiveness and engagement are tested with the target audience. Tests for educational effectiveness refer to whether the learning goals have been achieved or not. This test can also be included as final task into the game in order to maintain a meaningful context. A test for engagement is a very complex task. According to Quinn [6], engagement is a rather subjective term and can be measured for instance by the degree that someone liked the game or not.

The results of this final development stage can once again be taken into account in order to improve and refine the game until a satisfying product has been created.

F. Project Management

Based upon literature about the topic of game design [2] and project management [13], the most important steps of project management for educational games creation should also be outlined in short:

According to [13], project management can be divided into four major phases: project initiation, project planning, project execution and project closure. In the project initiation phase, the treated problems and opportunities of the project need to be defined. For the creation of an educational game, this means to determine the reasons for the creation of the game and the goals, which should be achieved with it. In the next step, potential solutions are analyzed. This should help to get an idea of the overall theme of the game. After a certain solution has been identified, roles and responsibilities need to be determined and a rough project plan including the necessary funds needs to be established.

Next, following Adams [2], a rough description of the game should be developed, the high concept statement followed by the more detailed game treatment document. Both documents are sales tools that should help to raise funds and generate interest for the game.

According to [13], as soon as the rough project planning has been managed and the project is funded, the planning phase starts, which encompasses for instance the creation of a detailed project-, resource- and financial plan and the setup of a project schedule. After the project has been planned successfully, the execution phase begins. For an educational game, this implies that game elements are designed and implemented.

To support this process, Adams [2] suggests to generate several documents: the character design document, the world design document, the flow board, the story and level

progression document and the game script. These documents are important in order to record decisions, to shape ideas and to communicate the design concept to other team members.

Following [13], the execution phase is accompanied by monitoring and controlling, which encompasses for instance time-, cost- and quality management. When the project has reached its completion, the closure phase begins and the outcome of the project is analyzed. In an educational game, this analysis should address educational effectiveness of the game and the reached engagement by the player.

III. CONCLUSIONS

Taking previous work into account, we identified the most important aspects of educational games creation and organized them in a way so that they can be used in order to handle this process. Due to the fact that we made our guidelines as practical and simple as possible, we had to limit details to a certain level. Our next steps are to put the EAGC guidelines into practice and to show their applicability illustrated by a concrete example project.

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