Improving learning experiences through customizable metagames

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Abstract. Since game-based learning require much planning and careful design, and also tailoring the learning content to game structures, the uptake of game-based learning activities remains limited, as their construction often requires a significant amount of time, and the reuse capabilities of such activities are minimal. This paper describes how the different components of a gamified lessons path can be adapted and reused. In order to ensure the reusability of the different learning paths, a set of minigame templates has been used.

Keywords: AT-CC, minigame, reuse, Beaconing.

1   Introduction

The shift toward student-centric teaching requires uptake of new methodologies and teaching practices. Gamification and gaming technologies offer opportunities in line with the new demands [1] and can be used in order to achieve "learning at the speed of need through formal, informal and social learning modalities" [2], which is the definition of pervasive learning. "The purpose of adaptation is to optimize the relationship between the learning requirement and course content, hence, the learning outcome could be obtained with minimum time and interaction expended on a course" [3]. However, while the intention of the adaption of a lesson plan towards fitting individual needs is to increase the learning outcome and as Muhammed et al. write thus to

spend less time for the student, the effect on the teacher side is in an increase in effort. Consequently, the teacher will often experience an overload of work.

Therefore, the deployment rate and their proper insertion in meaningful curricula are still quite low. In addition there is certain reluctance towards the use of games, and difficulties in adapting and integrating such learning tools in a simple and time efficient way [4]. For digitalized learning paths, the re-use of components can contribute to reducing this extra workload. As stated in [6] the goal of reuse strategies is to facilitate the reuse of components, assets and knowledge. Technically, systematic software-reuse enables robust, faster and less costly design, development and implementation processes. The key benefits of reuse are: better allocation of resources; enhance error handling; enable standards compliance; and time compression.

The BEACONING project aims to foster a personalized learning experience and provide teachers a tool that makes adaption and customization of lessons plans easier, while focusing on the personalization of the learning units to specific student needs [5]. In order to ensure the reusability of the different learning paths, we use a set of templates and a taxonomy described in [7]. This paper focuses on how the different components of a gamified lessons path can be adapted and reused.

2   Reusing a Gamified Lesson Path

The Beaconing Platform provides several minigame templates that can be used to tailor the learning content to specific subjects, needs and contexts. A minigame is a short, modular, game-based activity that can be used to create learning paths.

A minigame, "*Catch the intruder*", has been created using the Authoring Tool for Context-aware Challenges (AT-CC) developed by Geomotion, Spain. The component provides two minigame templates for location-based activities: "Treasure Hunt" and "Follow the path" and it is one of the most innovative components of the project. The AT-CC uses geolocation technologies and promotes creative learning by participation in outdoor educational activities.

"*Catch the intruder*" has been customized to include three other minigames that have been used to test the students:

- Two minigames, "*It's elemental*" and "*Molecularium*", that have been created using the minigame templates "Drag IT" and "Match IT" developed by SIVECO, Romania. The minigames are based on drag and drop actions. When using these templates two main restrictions have been identified: the content that teachers can create can be associated only with the images available in the case of the "Drag IT" minigame template, or with the images and text available in the case of the "Match IT" minigame template.

- The minigame "*Atomix*" that have been created using the "Generic Quiz – Multiple choice" minigame template developed by Imaginary, Italy. This is a minigame where students must check the correct answer from a given list. To make the minigame more interesting and more challenging teachers can insert images to give hints for the answer.

These four minigames were used to create several versions of GLPs to showcase their reuse potential:

1) A GLP with a location based game and three minigames. This is a complex GLP that is recommended due to its novelty and interactivity, as it includes both outside and/or classroom activities. Students had to discover who stole an important research paper. They had to find the intruder and the documents stolen by visiting different locations in the city of Targoviste.
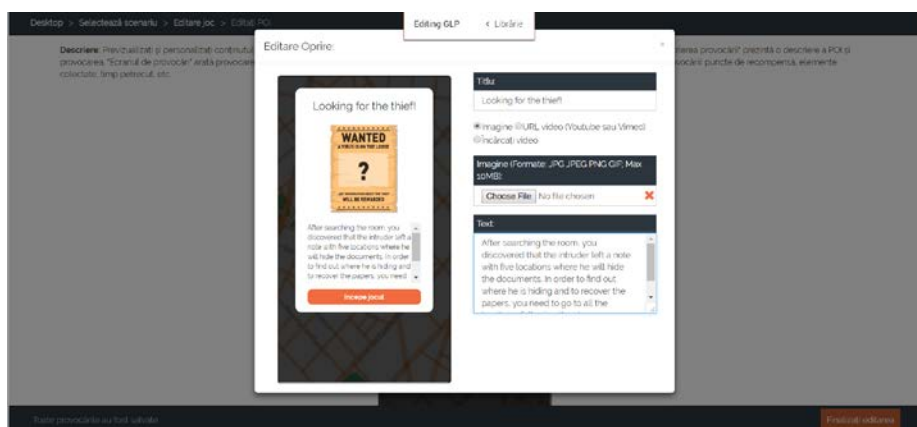

Fig. 1. The narrative content for a location

After playing the location-based minigame, students are further evaluated through three minigames, which are integrated into the narrative flow presented in the location-based minigame to streamline and enhance the user experience:

- *It's elemental*. In this minigame, students must discover the missing elements from the periodic table. Based on the initial template, the minigame has been customized to be finished within 120 minutes and additional information was provided when the player reached the third location in the location-based game.

- *Atomix*. In this minigame, students had to give correct answers to five questions about the characteristics and atomic structure of five periodic elements. No time limit had been customized for this minigame, Some of the questions provided hints for the answer.

- *Molecularium*. Students have to match the name of a chemical product with its graphical representation. As a hint, students could use the chemical formula provided in the name, in order to identify the molecule.

2) A GLP with only one location-based game. Unlike the GLP presented above that customized existing minigame templates, this GLP has been created reusing the structure of the GLP described above and it included only the location-based minigame, ending the game flow at the first activity. Teachers can opt to shorten an existing GLP, thus reducing the time required to customize the learning experience, while enabling students to enjoy activities outside the classroom.

3) A GLP with a location-based minigame and one minigame. Teachers can opt to customize the GLP to include only two minigames, thus benefiting of the outside

the classroom activities and being able to further evaluate the knowledge the student has acquired through a second minigame.

There are other options to reuse a GLP. For example, the **extension and/ or improvement of the learning content of the GLP**. This gives teachers the opportunity to create a GLP and improve it or customize it based on the feedback they get from their students. Another option could be the reuse of the narrative content of the GLP or the customization of the learning content of the minigames.

3 Discussion and conclusions

Among the key issues identified by [8] we highlight the following: (1) The lack of time available to teachers to familiarize themselves with a game, and the methods of producing the best results from its use; (2) The amount of irrelevant content or functionality in a game, which could not be removed or ignored.

The Beaconing Project addresses these challenges and provides authoring tools that facilitate the customization of game-based learning activities. The teachers have the opportunity to reuse games they are familiar with and customize them to fit certain components of the curriculum, as well as specific learner needs. This significantly reduces the time requires to create engaging learning experiences, and enables teachers to use game features that support a certain learning activity. The paper presents a GLP created using tools developed in the Beaconing project and discusses several means to reuse and customize it. Future work includes testing of the customization capabilities, in order to further improve the user experience.

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