

TimeMesh – A Serious Game for European Citizenship

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Abstract

Serious games are games where the entertainment aspect is not the most relevant motivation or objective. TimeMesh is an online, multi-language, multiplayer, collaborative and social game platform for sharing and acquiring knowledge of the history of European regions. As such it is a serious game with educational characteristics. This article evaluates the use of TimeMesh with students of 13 and 14 years-old. It shows that this game is already a significant learning tool about European citizenship.

Keywords: serious games, game-based learning, adventure games, history, Europe.

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1. Introduction

Computer games are enjoyed by millions of people around the world and they have become a relevant part of our social and cultural environment [1][2]. Games purpose extends beyond the simple entertainment as games can assume the role of a learning medium, with benefits like: involving students in complex, risk-free, skill practices, improving psychomotor skills, enhancing knowledge retention, enhancing decision-making skills, promoting interactive learning, providing opportunities for repeated practice and immediate feedback [3].

Games differ from most software applications because they use a multitude of interaction possibilities (text, audio, animations, etc.) and present the user with success indicators, partial or absolute. Game rewards are a major part of this motivational strategy and beyond its translation into game entities (increased life, more power, access to new levels, new capabilities or better equipment, etc.) is the fact that they translate into human neurological impulses for satisfaction and sense of achievement which creates a mild form of addiction. Comparatively, in real life, humans do

not achieve so easily the rewards and satisfaction obtained with games.

“Games present problems that must be solved and overcome by taking action. However, games depart from reality in the consequences of success or failure and in the clarity of the outcomes.” [4]

Serious games take advantage of all the elements that make gaming so appealing and combines them with knowledge to create interactive sources for learning that motivate users to learn and go deeper in their study through a fun, challenging and instant feedback environment that provides an immersive experience [5].

In this article we propose a serious educational game that aims to motivate teenagers by establishing a strong relation with their curricular learning process. This proposal aggregates game and pedagogical design so that learners are able to relate their game experience with curricular contents and subjects, assess their multidisciplinary learning on different areas about the evolution of the European places over the last 600 years in social, cultural and economic terms. The game was applied in several schools of the island of Madeira and the article presents an overview of the results achieved.

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2. Serious Games

Serious games “are games insofar as they have rules, simulate behaviors, accept input from the player, and provide feedback within the context of the rules and behaviors” [6]. This type of games is defined as “an interactive computer application, with or without a significant hardware component, that: has a challenging goal; is fun to play and/or engaging; incorporates some concept of scoring; imparts to the user skills, knowledge or attitudes that can be applied in the real world” [4].

Mike Zyda describes Serious Games as “a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives” [7]. However, the main emphasis of a serious game is still the educational purpose [8] with focus on learning and training and the application of new pedagogies [9].

Freitas and Jarvis [10] research on game-based learning “shows some initial evidence of accelerating learning, increasing motivation and supporting the development of higher order cognitive thinking skills”. Digital game-based learning supports a new approach to learning because the player, which in the educational context is a learner, uses games to explore, discover, question and ultimately construct concepts and relationships in authentic contexts [11].

Educational games, according to Mohamed and Jaafar A. [12] put learners in the role of decision makers, receiving immediate feedback from their actions and decisions, inviting to exploration and experimentation. The study by Sara de Freitas [11] also concluded that games helped learners to understand very complex concepts more easily and also increased their motivation through a positive association between the learner and his learning. In this work it was also concluded that “the advantage of serious games approaches lies in their ability to create dedicated content for learning purposes, rather than adapt existing leisure games to education practice”.

The growing interest on Serious Games also results from the theoretical grounding in different learning theories, the development of high-quality gaming experiences, the increased offer of collaboration and competition options and the opportunity for integrated assessment [12].

3. TimeMesh

TimeMesh is an online, multi-language, multiplayer, collaborative and social game platform for sharing and acquiring knowledge of the history of European regions. It was developed in the scope of the SELEAG project, funded by the European Commission.

The proposition behind TimeMesh was to introduce a new relation between teenagers and learning by stimulating their motivation to learn through the use of serious educational games. With TimeMesh teenagers can establish a relationship between their game experience and the

curricular contents and multidisciplinary subjects on different areas like history, geography and economics.

Besides this historical and social context, the game environment prepares young students for future challenges in a competitive, technology based society, where continuous learning, strategy, decision making, team work and leadership skills are required.

Another objective of the SELEAG project was the development of an evaluation methodology to assess the learning, the social awareness and changes in attitudes towards a European identity.

3.1. Game design

Designing games for learning is a new complex area of design in the game universe [13]. When designing a serious game one of the main concerns is to organize game play with the learning contribution, but preserving the entertainment aspects of the game experience. As such, in serious educational games the pedagogical model and its integration in the game context are two fundamental aspects of design.

TimeMesh is an adventure-strategy game where control actions and player choices emphasize mental reflection rather than frantic action [14].

Most strategy and graphics adventures games are designed across a mix of the following characteristics: narrative, problem solving, exploration, immersive environment, collection and manipulation of objects, mystery or situation about which little is known and player assumes the roles of a character that embarks on a quest [15]. In TimeMesh, the game narrative covers about 600 years of European history. Users are required to collect and interact with objects in the game, in different time epochs to complete the goals.

The first step on the game design process was to build rich models for the game scenarios and storyboards where an interaction model, functionalities and graphics are included.

To stimulate engagement alternative non linear structures were created, combining them with collaboration and competition elements [16]. Unlike a linear game type (dialogue based) where only a specific action or correct solution allows the player to progress through the game, the layered event structure allows events to run in parallel and the player may take multiple routes through the game. In this structure the main events must be connected by learning keys which are included in the game.

Tashiro [17] emphasizes the advantage of the game being a more engaging, fun and reusable product with this multiple route system and provide the user with varying and repeatable experiences while still delivering the required information. However, Fullerton [18] is concerned with the distraction from key learning objectives because when creating a complex narrative through the sub events, it can draw the player’s attention away from the main aims of the game.

In TimeMesh the advantages of the multiple-path structure were considered more relevant than the possible negative aspects.

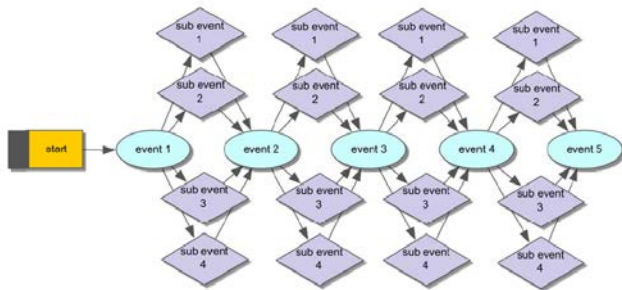


Figure 1. Multiple route structure

3.2. Game concept

The target group of the game were children aged from 11 to 16 years old for whom European history is part of their own identity. The game concept is based on the idea that students/gamers become a character within the game (located in historically relevant times) and help solve the mysteries laid out for them, so they can better understand the evolution of the European places over the last 600 years in social, cultural, economic and resources.

TimeMesh concept is based on a time travel narrative: the player is faced with a game reality that is different from what we have today. Each trigger event leads to a different scenario. These trigger events can take various forms like reading a newspaper articles, television commercials or European maps with different borders.

The player then goes into a specific scenario where he learns of past events or a sequence of events in history and with that knowledge he can change history to accurately represent our current reality.

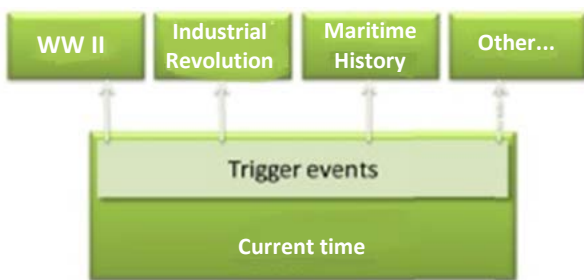


Figure 2. Alternate time trigger events start scenario action

Three scenarios were developed for TimeMesh: Maritime Discoveries, Industrial Revolution and World War II. Each scenario consists of a number of scenes (four for the developed scenarios) representing different stages of the

historical period. In each scene, the player can follow different story threads and each story thread has a number of different goals to be achieved in order to progress.

Each scene must have at least two common plot points in order to allow collaboration. The scenes are built from context and have associated with them key events or locations. Others events/locations can be added if the story requires, however the narrative can always be used between events/locations to establish context or fill in any gaps in the players knowledge.

Players may start and end in different points depending on what thread they are completing. Players can meet in the game, regardless of what thread they are playing through, at common locations in order to collaborate and swap information/objects relevant to them to complete aspects of the scenario they are in.

With this framework different threads can contain both different and common plot points, as illustrated figure 3. It is thus possible to interlink different threads in specific plot points to obtain inter player collaboration while still preserving the storyline of each individual threads. This way players can meet, they can communicate and share information to achieve their goals. In some cases this communication is even obligatory to complete challenges.

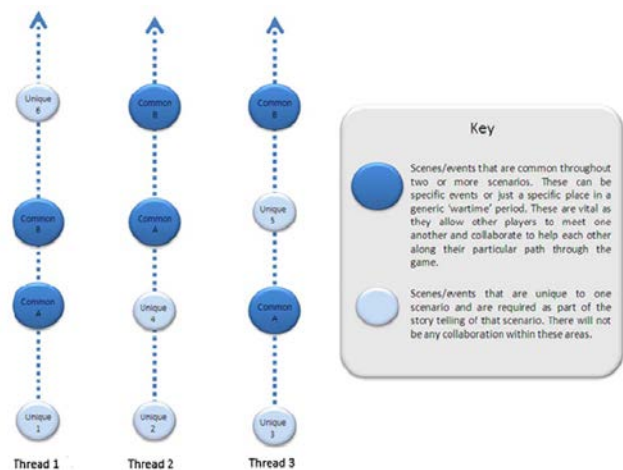


Figure 3. Common and unique plot points in threads

To design each scene and its threads it is important to identify a certain number of actions which player will be required to do. These individual actions are performed in a specific plot point and enable the player to interact with Non Player Characters (NPC) or objects through dialogues, fights, receiving, giving, using, opening objects, for instance.

From this thread of actions results a graph that establishes precedence between plot points and alternative paths. For instance, to open a door the player is required to first find a key, but the information he can find behind the doors can also be obtained by talking with a NPC.

Some plot points can lead to side quests. These side quests can provide information, health point and fuel points.

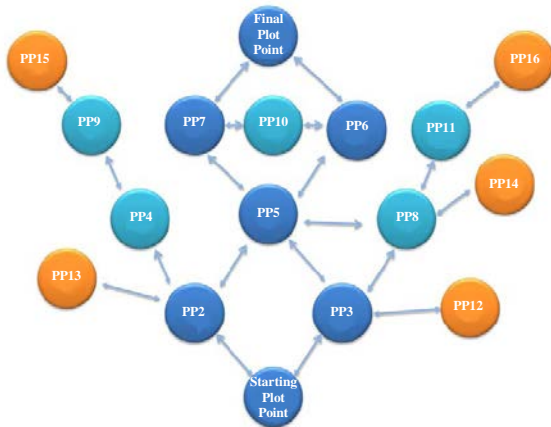


Figure 4. Plot points: required (blue), optional (light blue) and side quests (orange)

All those steps of design were applied on TimeMesh scenarios. As an example we show the Maritime Discoveries scenario.

Maritimes Discoveries

Differences in Present Days
 The Madeira Island was considered a threat to Europe for it has been controlled by pirates and mercenaries for centuries. The threat is due to the possession of nuclear material by the pirates.

Overall Goal (how to fix difference)
 Development of marine navigation instruments for construction of maps to support overseas expansion. With the draw of the territories discovered, it was possible to set new ways for trade, language and religion and access a new resources.

Keys Events/Locations
 Leadership of prince D. Henry, the navigator, on Order of the Cross of Christ
 Navigation School of Sagres
 Discovery of Madeira and Porto Santo islands
 - Key Characters (Non Player)
 - Dialogue
 - Item Exchange
 - Event requirements
 - Exit / Progress (s)
 - Slide Quests (mini games)
 - Items /Knowledge Gained

Event Order
 Chronological: Leadership of prince D. Henry, the navigator, on Order of the Cross of Christ, Navigation School of Sagres, Discovery of Madeira and Porto Santo islands

Narrative
 Narrative details go here

Figure 5. A partially complete example scenario

The context of Discovery Maritimes starts with the discovery of Madeira Island. The ships returning to Portugal were attacked by pirates and never reached Lisbon. Therefore this island became a pirate base over several centuries, without any Portuguese sovereignty. It grew into an independent country with nuclear power. Madeira is now threatening to attack Europe with nuclear missiles. The main task is to go back on time and to guarantee that the map with location of island arrives safe to Portugal.

The learning objectives of this scenario are:

- to understand what the Maritime Discoveries meant to Europe in terms of resources, economics, social issues;
- to become familiar with all the science and technology (instruments, techniques, etc.) that were required to accomplish these nautical innovations
- to know the main European navigators and the main fact related with this epoch;
- to understand the political reasons and motivations between European countries at that time.

This scenario has four scenes: the King’s Court, the pirate ship, the Sagres school of navigation and the navigators ship back to Madeira. On the first scene it is important to know the description about the discovery of Madeira and its facts and actors. Next, the second scene occurs inside a pirate ship where the main objective is to recover a map in the Capitan’s cabin. The recuperation of the map is not all successful because the map loses a piece of vital information which must be rebuilt in the school of navigation. Finally, after reconstructing the information by means and techniques available in fifteenth century, a ship is sent to the island Madeira and starts a new settlement.

When each scene starts, the player is presented with a small intro to explain the context. Each scene has an estimated time of 45 minutes.

4. EVALUATION

A simple evaluation question for any educational software can be: does the student learn with this product, what he/she is supposed to? Therefore, benchmarking educational software is a complex task that involves a complete evaluation process that requires a holistic approach where an evaluator, in order to understand the way students learn, must relate that with the learning objectives and determine how and whether those objectives were achieved with the educational software.

Evaluating Game-based Learning adds new criteria to assess the effectiveness of the software. It must be motivating, enjoyable and create pleasure in the learner/player in order to build his/her knowledge without really being aware of the learning process.

The testing and evaluation methodology was divided in 3 stages: Alpha, Beta and Gamma testing. Each of these stages has its own objectives, from formative to summative. They are applied in different moments of the development to improve the final product.

In this article we are focussing on the final stage of the evaluation methodology and specifically on the use of the game in a very particular context. During a major event organized in the scope of the SELEAG project, the APEL GameFest 2011, at the APEL School in Madeira, about 68 students of 5 different schools, aged mostly between 13 and 14 years, played the scenario of Maritimes Discoveries.

Most of the students (88%) were from the 7th and 8th school grade, therefore they had previous knowledge of the Historical period and facts addressed in the game. The evaluation protocol started with a diagnostic questionnaire to assess student's motivation for history and for playing the game (Knowledge Test 1 and Motivation Questionnaire), and a post game questionnaire for student's view of the game and their acquired knowledge (Knowledge test 2 and Satisfaction Questionnaire).

The use of questionnaires allows getting quick data from the beta testers and players. This way they are able to report immediately their impression, just after finishing the scenario. It is based on a mixture of adapting heuristics for evaluating playability of games [19], heuristics for usability evaluation for history educational games [20] and questions base on the factors identified by Garzotto [21] in the paper "Investigating the educational effectiveness of Multiplayer Online Games for Children".

The comparison between the diagnostic and post game results highlights the learning effect.

4.1. Result of Questionnaires

The analysis of the results was structured around the full set of the gathered data (the complete group of students) and the sex distribution. Age and school grade was strongly centred in a certain age (13, 14 years) and school grade (7th, 8th) to allow a valid cross-sector analysis.

The diagnostic questionnaire was meant to assess students' motivation for computer games, their interest in History and their perception on their own competence in that class. The domains of analysis are competence, interest and motivation for computer games and the results can be seen on next graphics. Questions were based on a 7 point Likert scale from 1 (min.) to 7 (max.).

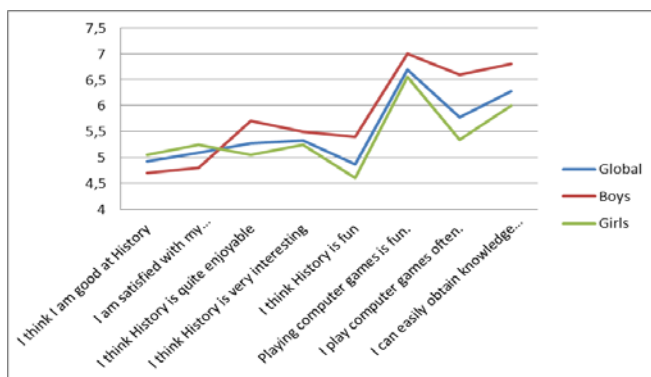


Figure 6. Student motivation, competence perception and game interest

In general, students are not enthusiastic about History and they don't think they are overly competent in it. It is interesting to see that boys are not as confident of their History knowledge as girls but they actually like it more and find it more fun than girls. Boys are also clearly more used to play games.

The diagnostic and post game Knowledge questionnaires were the same. All the students had already knowledge of the main historic topics related with this era so it was expected to have good results already in the diagnostic stage.

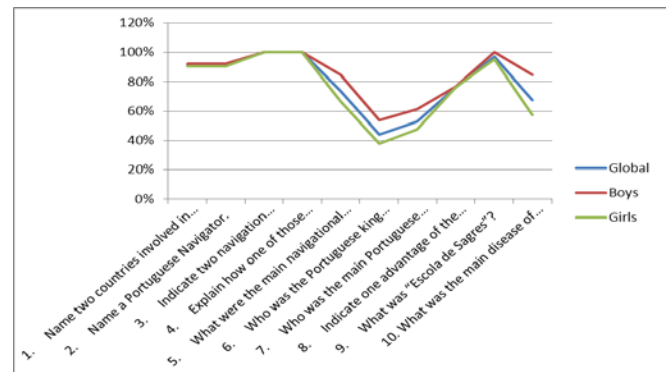


Figure 7. Pre-game knowledge test

In general, answers gave high results (correct answers). However, there were two questions where all had difficulties but girls in particular struggled: knowing the Portuguese King (João I) that led the start of the Discoveries and the main Portuguese figure (D. Henrique) at that time. Questions which were not so fact-based had good results. Girls struggled also on the identification of the main disease of sailors.

The post game results do not show a very strong difference with the first knowledge test because the results were already quite good. However in the few questions were students initially failed there was an increase of correct answers, which shows improvement.

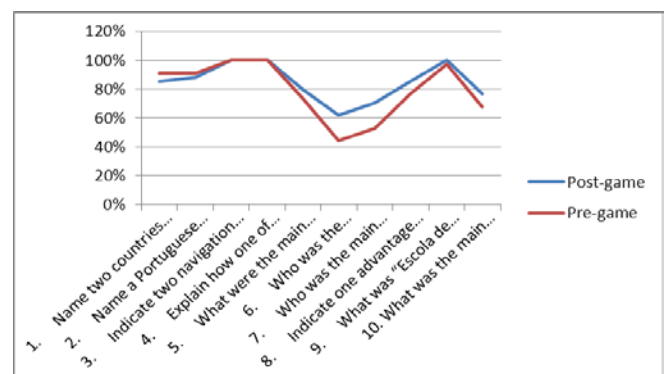


Figure 8. Comparison of pre and post knowledge

There were also a few cases of worse results after the game. That can be attributed to students being tired after the game and not paying full attention to the questionnaire.

The post game questionnaire also analyzed student's satisfaction with the game, namely in terms of enjoyment, perceived competence and user experience.

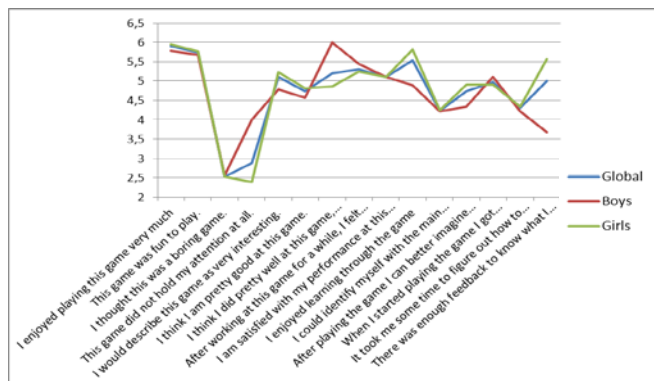


Figure 12. Satisfaction

The game was not as attractive to boys as it was to girls, probably due to the boys' larger experience with games, which made them have higher expectations. They would also expect to have much more support during the game. Girls were much more connected with the learning aspects, particularly in what concerns the understanding of the Discoveries era.

5. CONCLUSION AND FUTURE WORK

The game TimeMesh was developed to aid the learning of multidisciplinary curricular contents about Europe's history.

The game design was created by applying the method of layered event structure, through three scenarios with four scenes each one about important moments of Europe's history. This framework has various learning elements such as interaction with other players, clear and worthwhile goals, leveling up and shared experiences.

The assessment and evaluation of game highlighted three important aspects: the participants showed motivation and interest on the game; they benefitted from the game in what concerns learning; finally, they showed a great satisfaction with the game experience.

The evaluation of the use of TimeMesh demonstrated that this game is already a significant learning tool about European citizenship. The extended use of the game (more than 5.000 users, so far) reinforces this idea.

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