

# Re-Telling History: A Web-based Educational Video Game for Teaching History

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**Abstract.** *World War Web* is an online, strategy Web-based educational video game for teaching history. The web orientation facilitates the integration of the game in an online course for either distance learning or blended learning. Additionally it has been developed according to current standards and specifications from the e-Learning field, which allows a complete integration of the game with Learning Management Systems. The educational value of the game has been enhanced with a powerful and flexible in-game question system. In combination with a flexible design, it allows the reuse of the games for teaching different ages and historical periods by simply re-configuring the game-server.

**Keywords:** Educational video games; E-Learning; Game-based learning; IMS QTI; Learning Management System; SCORM; Strategy video games; Web-Based Learning; World War Web.

## 1 Introduction

Game-based learning is a trend on the rise in the Technology-Enhanced Learning (TEL) field. The interest in studying the educational potential of video games has rapidly increased, built upon the relation between the motivation and engagement provided by games and learning [1]. Other works such as [2-5] have pointed out several traits of video games that are aligned to learning. Some other traits of videogames that have been considered adequate for supporting learning are their relation to constructivist principles [6], their promotion of situated-learning or that they allow players to explore the game world by trial and error with a very short feedback cycle [7].

One of the knowledge areas where game-based learning has been applied is history. Diverse strategy games such as the *Civilization*<sup>TM</sup> saga have been used as learning tools that allow students to study historical facts from a different perspective [8]. The problem is that instructors usually find these game-based learning approaches difficult to integrate in the classroom, as it requires planning game sessions, installing

the software or even conducting debriefing and evaluation sessions to check what the students are actually learning.

An approach to solve this problem could be to integrate the games in the so called Learning Management Systems (LMS), such as *Moodle*<sup>TM1</sup>, *Sakai*<sup>TM2</sup> or *ILIAS*<sup>TM3</sup> [9]. The use of LMS in educational organizations has increased a lot, not only for distance learning but also as a complement for traditional classes (what is usually known as b-learning). Besides, LMS provide numerous tools and functionalities to support learning in many ways. However, the integration of video games in LMS is a challenging task due to their opposite nature (LMS are Web-based but games usually are desktop-based and platform-dependant). Besides modern LMS are being developed according to standards and specifications (e.g. ADL SCORM [10] or IMS Learning Design [11]), fostering interoperability and platform independency. This is an issue that should also be taken into account.

In this paper we present *World War Web (WWW)*, a strategy Web-based game that aims to help in the integration of video games in LMS. The key behind WWW is that it combines the flexibility and low development cost of Web-based games such as the *OGame*<sup>TM4</sup> with the suitability of strategy games for learning history. This is also enhanced with a flexible in-game question system. The answers of the questions can be sent to a LMS for processing so instructors are relieved of conducting debriefing sessions. As a consequence WWW is a tool that instructors can easily integrate in their online courses. Finally, WWW has been developed in compliance with standards and specifications fostering interoperability between multiple LMS.

This paper is structured as follows. In section 2 we discuss some general issues about e-Learning and educational games, analyzing the main lines of related work that are the base of this contribution. Then in section 3 we describe the WWW game in detail. Finally in section 4 some brief conclusions and future lines of work are presented.

## 2 Educational Games and e-Learning

In this section we will discuss three aspects that are relevant for the integration of educational video games in Learning Management Systems, especially for the history domain. Firstly, in section 2.1, we will discuss about the potential of Web-based games, which is a key point for our work. Secondly, in section 2.2 we give a brief scope of what e-Learning standards are and why they are important for the integration of video games in LMS. Finally, in section 2.3 we discuss other applications of strategy educational video games in the history domain, extracting the features of the genre that are suitable for education.

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<sup>1</sup> <http://moodle.org/>

<sup>2</sup> <http://sakaiproject.org/portal>

<sup>3</sup> <http://www.ilias.de/>

<sup>4</sup> <http://www.ogame.de>

## 2.1 Web-based Games

During the last years the paradigm of Web-based video games has arisen, renovating the underlying basis of an industry, which is usually reluctant to accept new concepts. Web-based games such as the *OGame*, which has been for several years on the top of the list of the *most popular German online games* published by *Nielsen/Netratings*<sup>5</sup>, have obtained a great success in spite of their low-cost graphics and artistic appearance. This verifies the idea that a game does not need a massive development budget to engage players if the game mechanics are designed properly, what is a crucial issue in educational contexts where money is usually scarce.

However, their low development cost is not the only argument supporting the value of Web-based games for e-Learning environments. Web-based games are OS-independent, which allows interoperability between platforms. They are easy to deliver, as they just require a Web browser, and to maintain, as updates are only installed on the server-side. Moreover they do not require users to install any software on their computers (even they do not require complex communication protocols or browser add-ons, just HTTP). The relevance of this issue increases in educational settings, as some times computer labs in educational organizations have restricted administration privileges for installing new software.

All these advantages make Web-based games appropriate not only to promote game-based learning in e-Learning environments, but also to mobile and ubiquitous learning, as most of modern mobile devices (e.g. PDAs or Pocket PCs) support HTTP and incorporate their own Web-browsers.

## 2.2 Standards and Specifications in e-Learning

One of the problems that the academic community identified in old e-Learning systems is the lack of interoperability between different platforms. Therefore the investment in developing learning content was unprotected, as the migration to other platform (or even just an upgrade to a newer version) could lead to loose all the learning content stored. Thus a lot of efforts from diverse organizations have been spent on developing specifications and standards that could guarantee content interoperability. As a consequence new kind of learning content, such as educational video games, should take into account those specifications.

One of the most complete specifications is ADL's SCORM [10]. SCORM allows the creation of structured instructional packages (i.e. Shareable Content Objects or SCOs) that can be easily deployed on a SCORM-compliant LMS. In loose terms, SCORM defines a model for packaging, structuring and annotating the content with meta-data for later retrieval (Content Aggregation Model). It also defines a communication protocol between LMS and SCOs in order to exchange valuable data about the student, how is her/his performance on the achievement of the learning goals, etc. Moreover, SCORM defines a model for the sequencing and navigation of the activities in the course (i.e. Sequence & Navigation Model). The IMS Question and Test Interoperability (QTI) specification [11] defines a general model for the

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<sup>5</sup> <http://www.gameforge.de/content/view/101/28/lang,en/>

exchange of questions and exams between different systems. It provides a data model which defines questions structures, assessments and results, all of them associated together on an XML that essentially defines a language for interchanging questions and other assessment material.

### 2.3 Strategy Games for Teaching History

The use of strategy games for teaching history is not a new concept. Several authors, motivated by the high realism that games like the *Age of Empires*<sup>TM</sup> achieved, have used *Commercial-Off-The-Shelf* strategy games in real history courses [8, 12]. The fact is that although strategy games are not really accurate to the historical facts they give students the chance to analyze how critical decisions may affect the course of history [13].

A good example is the *Civilization* a family of turn-based strategy computer games which first issue was developed by *MicroProse*<sup>TM</sup> in 1991 and later for *Firaxis*<sup>TM</sup> and *2k Games*<sup>TM</sup>. It is based on the historical period which goes on a macro-scale from the prehistory to the present day. The player must guide successfully the civilization to achieve glory, taking decisions about how to develop the country. Players learn through the analysis of the consequences that their acts have on the in-game world. For instance, players can adopt a belligerent attitude and promote research in order to obtain the nuclear fission bomb. However, before players can launch it over enemy targets, they will first have to make breakthroughs in physics (i.e. nuclear fission) and avionics (i.e. long distance bombers). In this manner they understand how research is a crucial point for war.

In addition, all of these breakthroughs are then categorized in the game's extensive *Civipedia*, giving players some scope and background detail for the historically accurate research their particular civilization is undertaking.

Several papers have described how *Civilization* can help on an educative process. In [8] the author described a full learning experience, in which a full history course was taught using *Civilization III* as a base platform. In addition, Dr. Shawn Graham, a professional archaeologist and professor developed a simulation using *Civilization IV* to support teaching history of the Roman age. After having a discussion with a student on how the history could be different under certain premises he suddenly decided to use *Civilization IV* to motivate his students, which is described on Planet *Civilization*<sup>6</sup>. Finally, *Civilization III* was used by *BitCasters*<sup>TM</sup> to develop a mod in order to teach Canadian history. The mod can be downloaded for free from their web site<sup>7</sup>.

As analyzed in this section, strategy games have good traits for teaching history as a complementary tool. The key point behind them it is not the realism in graphics that these games have, but the game rules that control the advance of the player in the game, which support the learning process above described.

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<sup>6</sup> <http://planetcivilization.gamespy.com/View.php?view=Articles.Detail&id=33&game=4>

<sup>7</sup> <http://www.historicanada.com/>

### 3 The World War Web Approach

In this section we describe in more detail World War Web, a strategy online game for teaching students about history, and which has been set around the Second World War (Figure 1).

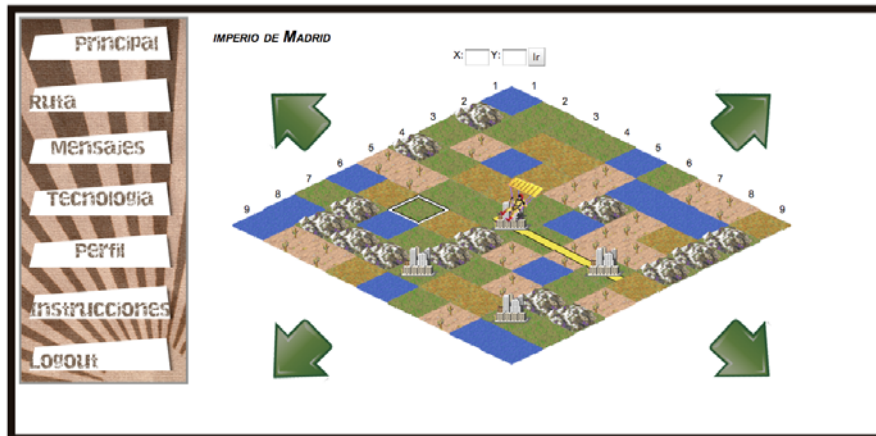


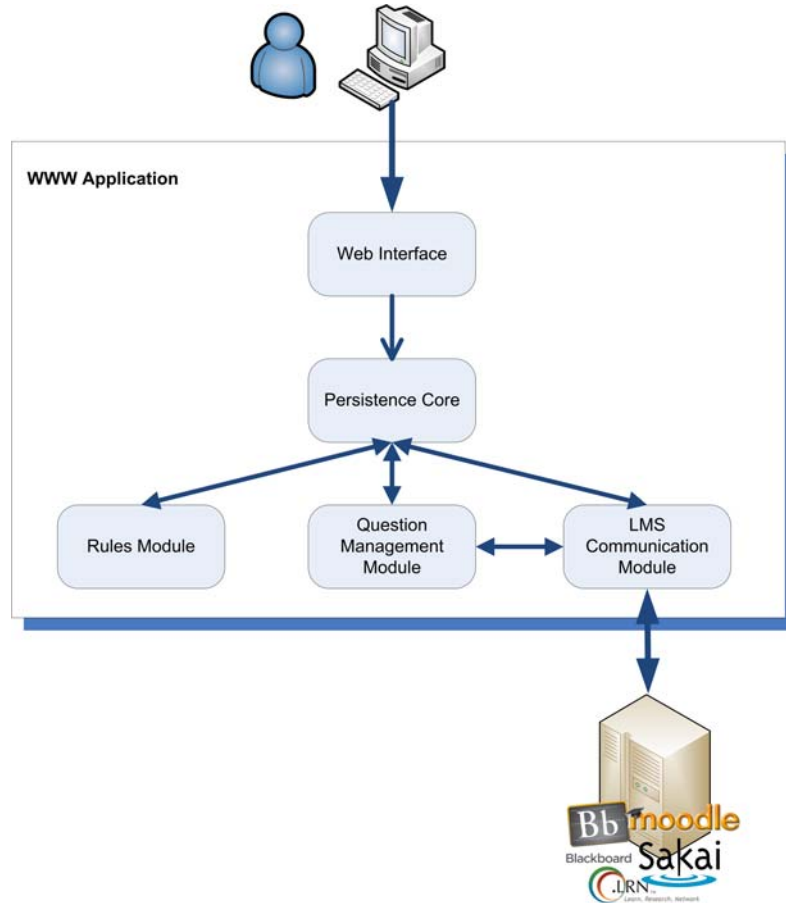
Fig. 1. Main view of the WWW game.

WWW aims to balance fun and educational value. The ideas presented so far were taken into account to bring an educational game which can be easily played, with expert knowledge through a user-friendly interface. As the game is set on a certain period of time we provide an accurate definition for each entity in the game. For instance, we can create a Panzer division if we are playing with the Germans, and we will then read some historical features of this military unit. Or we can choose our political systems between communism, capitalism and a military state.

On the other hand, the game includes a Question-Answer system to evaluate the knowledge of the users, using QTI. The idea is to use the motivation inherent to all the video games to make a learner of the player. When the user is going to perform a crucial operation within the game, the system displays a question. If the question is correctly answered the user will get rewards.

The game supplies instructors with an easy interface to change all the entities abovementioned, and related to the Second World War context. In fact, a teacher or user of this system could easily change the description of units, buildings, civilization and technologies, historical facts and therefore adapt it to a new and different context. World War Web can be used as an editor to create online-web based games which can be applied to an educational process.

### 3.1 General View of the Architecture



**Fig. 2.** Modular architecture of the World War Web game.

World War Web was developed using Java technologies in order to maximize the maintainability, extensibility and robustness of the resulting implementation. Particularly, a multi-tier organization has been adopted (Figure 2), where the following tiers can be distinguished:

1. Web interface: We used Google Web Toolkit<sup>8</sup> (GWT) to create an interactive HTML-based user interface. GWT allowed us to provide the application with a richer interface in comparison to typical Web-based games, tackling in this manner the lack of highly cost 3-D graphics.

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<sup>8</sup> <http://code.google.com/webtoolkit/>

2. Persistence core: real-time tier that stores the current state of the game and a list of requests received from the interface that must be processed when the next turn starts.
3. Rules module: updates and modifies the state of the game according to a set of time-triggered rules based on the Civilization IV™.
4. Question system: Stores and manages questions for the students [14]. Using <e-QTI> we can assure compatibility with another questions servers bases on the QTI standard.
5. LMS communication module: allows the game to connect to a LMS and transmit information about the answers of the questions provided by the students for assessment purposes. It uses SCORM as communication protocol.

The following subsections offer additional detail about the most relevant components.

### **3.2 The Rules Engine**

The definition of the games are based on the Civilization IV, but adapted to the web nature of WWW. This is a key aspect since, as discussed in section 2.3, the educational value of strategy games is mostly supported by their rule systems. Besides the rules of a strategy game are one of the most difficult parts to fit globally on a game. Reusing something that has been broadly tested, and where the factors of production, war or economy are well balanced simplified the task.

However, there are some significant differences between Civilization and WWW. Civilization is a desktop application which needs to be installed based on a computer in order to play it, and is based on a turn-based game we need to adapt it if we want to deploy on a browser. Civilization IV requires a continuous presence of the user at the keyboard in order to give all the commands: movement of the units, construction of the buildings, selection of the technology, etc. Each turn requires the intervention of each user in order to advance the game, giving the control of the system to the next player.

To solve this, and to adapt into a web context, we changed the turn-based paradigm into a real-time system. We transform every single turn in a certain period of time, and based on this premise, we do not require every single instant the presence of the user in front of the computer. The users submit their actions (if any) for each turn, and the timing and turns are controlled by the game server.

### **3.3 The Question System**

When the students perform some actions, the question system proposes a question from a repository that must be answered correctly in order to go on. In addition to the educational value that it provides (forcing students to learn the most relevant aspects of history), it has a direct effect on the game as when students select the right answer they get an additional bonus. This is an extra push for motivating the students.

For instance, consider a situation where the student is promoting an attack to other country. Based on the attack algorithm, the system calculates which unit results victorious, and how many damage they receive in the combat. Then a question is presented to the student and the final result is adjusted accordingly. The questions are formulated as a multiple-choice test with a single valid option. If the user chooses the right answer he or she will receive a bonus during the combat.

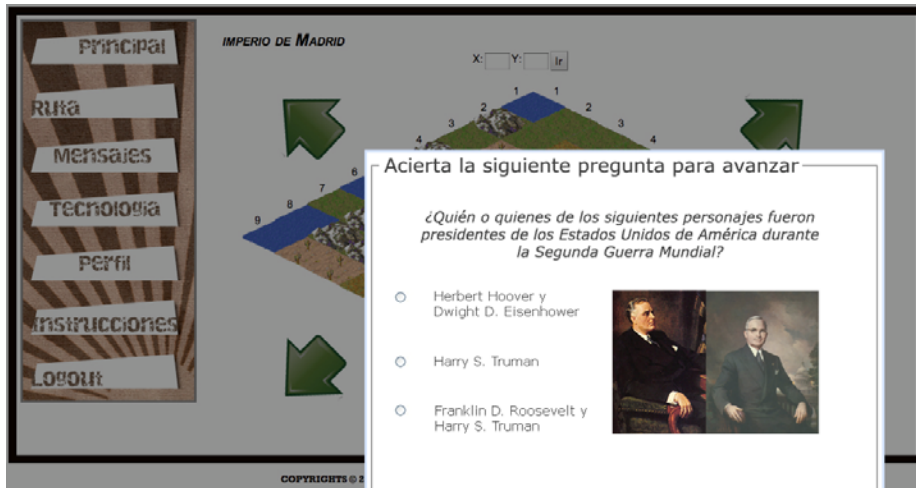


Fig. 3. Example of in-game question about the Spanish Civil War.

The question system is built according to the QTI specification, which adds interoperability to the project and allows that instructors could reuse existing questions.

### 3.4 LMS communication module

The answers of the questions can be sent to a LMS for processing and attachment of the results to the student's profile. In this manner instructors will not need to plan debriefing sessions or additional tests to check the learning outcomes of the students.

The communication is established using SCORM, which defines the necessary data models and communication interfaces to allow the communication between content being executed on the student's computer and the LMS. It should be noted that, unlike traditional SCOs (Shareable Content Objects), the SCORM module is actually located in the game-server, and communicates with the LMS which could be on a different machine. The same game server can open multiple connections to the LMS for the different users playing the game.



## 4 Conclusions and Future Work

LMS and educational video games are two important tools in Technology-Enhanced Learning that would benefit from their mutual cooperation. On the one hand game-based learning would help to make the online courses more attractive and motivational for the students, who would also benefit from the other well-known advantages that video games can provide to learning. On the other hand e-Learning systems, which use has increased exponentially during the last decades, can be a perfect vehicle to promote the general adoption of game-based learning in the educational system.

In this paper we have depicted how a Web-orientation for designing educational video games and the use of e-Learning specifications may facilitate the achievement of the aforementioned integration. As the World War Web online game depicts, it is possible to achieve a similar learning value compared to other well-known desktop-based approaches but without requiring any kind of installation and with a smaller development cost. In this case the WWW game can be as helpful as Civilization IV or The Age of the Empires to teach history, with the additional value that the question system and the flexible design provide.

However, the WWW approach still needs further elaboration and testing. On the one hand the implementation of the SCORM and QTI specifications must be reviewed and improved to allow a more detailed communication between the game and the LMS. On the other hand, we aim to develop a configuration tool for the game in order to help instructors to adapt the game for teaching different historical ages more easily. In this manner the game could really be used as an engine to create online Web-based educational strategy games. Finally we plan to test the WWW game in a real course with real users in order to measure the effectiveness of this approach in terms of learning outcomes.

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