ABSTRACT
This paper presents the pedagogical design, the technical development and initial findings of the educational program “From the Ancient to the Modern Tablets”. Targeting at primary and secondary school students, this project aimed at creating immersive multimedia eLearning experiences about the book history as well as its future. The main aims for the students were to: motivate and promote the early literacy and extracurricular reading; establish cognitive links between writing, books and acquiring knowledge with technology; and possess the basic digital skills when using a tablet. The project experience consisted of a playful library tour, an interactive game-based digital storytelling activity with game elements followed by a collaborative creative hands-on activity as an open-door two-week institution-wide initiative called “Schools go to the University”. The advanced technologies combined with engaging pedagogical methods enabled a cost effective yet rich learning experience. Utilizing the avatar psychology power, the visualization and simulation affordances of 3D immersive eLearning environments and the appeal of storytelling and game-based learning, the “gamified” blended narrative on the book evolution enabled learning as embedded and context-generated. The students were asked to help a digital agent, an avatar, on his quest in the 3D computer-generated virtual environments. With the help of this avatar, which was controlled by an LIC staff member, the children travelled back in time. The realistic environments allowed students to immerse themselves and experience aesthetics, architecture, clothing and the culture of the time as well as explore spaces, see samples and experiment with interactive objects related with the respective studied technological advancement or milestone. At the same time, appropriated soundtrack scores enhanced the atmospheric tension and feeling of immersion. These virtual environments were developed cost effectively in Second Life. In each step, students were encouraged to demonstrate their knowledge, understanding and critical thinking skills related to technological advancement through age-specific questions and quizzes grouped into large teams so as to actively participate in the game. In the second part, students worked in small groups of three to five pupils to discuss, decide and collaboratively create digital artefacts inspired by the book history. These groups used simple multimedia software in a modern tablet to produce impressive drawings. At the end of the program, the teachers evaluated their students’ activities and performance by responding in an online questionnaire. The program proved out to be very popular among schools; the high engagement level created enthusiastic students’ responses and learning behaviours that enhanced their perspectives on the book history.

Categories and Subject Descriptors
K.3.1 [COMPUTERS AND EDUCATION]: Computer Uses in Education – Computer-assisted instruction (CAI)

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Design, Economics, Experimentation

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Digital storytelling, 3D Virtual Immersive Learning Environments, Gamification, Library, Second Life

1. INTRODUCTION
The Library and Information Center (LIC) of the University of Patras sees as an integral part of its mission to stay accessible to and collaborate with schools so as to support teachers in their learning ventures with their students. This mentality is aligned with the function of Libraries in the 21st century as “third places” [20], [16] that facilitate learning in multiple ways.

In 2012, the University of Patras decided to launch a new institution-wide initiative called “Schools go to the University” and invited all interested departments to design and offer short educational programs suitable for primary and secondary education schools. All programs were communicated to schools of the Prefecture of Achaia. Interested schools could arrange visits for one or several class to any programs during a specified Spring open-door two-week period.

Responding to this invitation, LIC designed the educational program “From the Ancient to the Modern Tablets”, an immersive playful multimedia learning experience about the history and future of the book that combines digital storytelling, 3d virtual immersive learning environments and gamification.

In the following sections we will present the pedagogical design, the technical development and the formative assessment results of the educational program.

2. THEORETICAL BACKGROUND
2.1 Digital Storytelling
Storytelling is a universal and diachronous medium for knowledge and wisdom transfer across cultures [3]. Digital storytelling uses visual and auditory elements to deliver valuable experiences. Music and sound effects can accompany the narrative to add atmospheric tension to the experience. Digital storytelling is a
compelling method to construct and organize learning both for children and adults [19]. It can be used both as a teacher strategy and as an organized student individual or group project. Van Eck [22] argues that narration and storytelling are two of the most powerful instructional strategies. As Baer [2] points out “stories allow us to learn from the experience of others without having to face another person’s personal consequences”. McAdams [15] has argued that the human behavior is being guided by narrative construction. Also storytelling has been found to be an effective method to increase retention. Adval & Wyer [1] have demonstrated that people tend to remember facts more accurately if they encounter them in a story rather than reading them in a list.

2.2 Game, Gamification and Play

Another latest addition to the educators’ arsenal is motivation enhancement through games, gamification and playful design. During well engineered, immersive games children and adults experience the state of flow as the optimal state where between boredom and anxiety utilizing an ever changing through achievement balance between challenge and skills [4]. As such games can be used as appropriate learning experiences according Vygotsky’s zone of proximal development [14]. Games have been frequently used to enhance and facilitate learning [10], [21]. Story and digital storytelling is a game mechanic in games to provide a compelling narrative. One common form of digital storytelling applied in games is “The hero’s journey” [11]. Gamification is the incorporation of game mechanics and elements in a non-gaming context [7]. Schiller (1875) pointed out that play is the expenditure of exuberant energy. Gamification, games and play as such are distinct strategies to incorporate the element of fun in the learning process [7].

2.3 3D Virtual Immersive Learning Environments

3D Virtual Immersive Learning Environments (3D VIEs), also called 3d Virtual Worlds or multi-user virtual environments - MUVEs are three-dimensional computer-generated virtual spaces that enable educators to enhance both attendance-based teaching [18] and distance learning [6], [13] by applying socio-constructivist instructional methods such as situated and experiential learning [5], [9]. More specific, 3d VIEs are a flexible learning tool to utilize storytelling so as to create simulated [8] and game-based learning experiences [12].

The Library and Information Center (LIC) of the University of Patras offered the first open course series in 3D VIEs in Greek higher education in the frame of a project called “Open Workshop on Information Literacy”. As a result, the creators of the program received a national seal of good digital teaching practice [17].

In this instance, we used 3D VIEs as a digital medium to narrate a transmedia story, visit various virtual environments and immerse learners into different times and civilizations.

3. PEDAGOGICAL DESIGN

After a series of unstructured interviews and consultations with primary school teachers, the following learning objectives were identified for the program “From the Ancient to the Modern Tablets”:

- to motivate extracurricular reading and promote of early literacy;
- to establish cognitive links between writing, books and acquiring knowledge with technology;
- to possess introductory user skills with a tablet; and
- to practice team collaboration.

One important challenge was to avoid the passivity that students face when they presented with mere facts. So we regarded active user engagement as a critical success factor. Thus, to maximize the students’ excitement and engagement while offering program with high learning quality, we decided to construct the program around selected game mechanics. The experience consisted of two stages:

a) a playful library tour,

b) an interactive game-based digital storytelling activity with playful elements, followed by
c) a collaborative creative hands-on group reflection activity.

At the first stage and upon arriving in the Library, students participate in a 30-minute playful tour that features various game mechanics such as team play, competition, challenge, quests, choices, surprise, curiosity, and expression.

At the second stage, in the Library’s seminar room, the students were asked to assist a digital agent, an avatar, on his quest through a series of 3D Virtual Immersive Learning Environments (3D VIEs). The display was visible by all students via a video projector. With the help of this avatar, which was controlled by a LIC instructor, children traveled back in time and visited simulated 3D virtual environments. The realistic environments allowed students to immerse themselves experiencing aesthetics, architecture, clothing and the culture of the time as well as explore spaces, see samples and experiment with interactive objects related with the respective studied technological advancement or milestone. At the same time, appropriately timed soundtrack was woven into the story to enhance the emotional depth and feeling of immersion. The activity highlighted the following milestones of the book history:

- Storytelling and ancient cave drawings 32000 BC
- The invention of writing and ancient clay tablets 3500 BC
- Linear A & B script 1450 BC
- The invention of the alphabet 1200 BC
- Papyrus and the Great Library of Alexandria 200 BC
- Byzantine/Roman Scriptorium and the systematic copy of manuscripts in monasteries 600 AD
- The invention of the movable type 1040 AD
- Modern Library 1980 AD
- Tablets and e-books 2014 AD

In each stop, students were encouraged to demonstrate their knowledge, understanding and critical thinking skills related to each milestone through age-specific questions and quizzes as they were divided into two teams so as to actively participate in the game.

Each team scored a point when they were able to answer questions or make valid and useful observations around each milestone. The duration of the storytelling activity was 45 minutes.

An example of game activity was the Phoenician Alphabet Challenge, designed for 2-6th grade. The two student teams were
challenged in turns to identify the correct temporary letter by observing a matrix of selected Phoenician letters.

During the third project stage, students were divided in small groups of three to five pupils. After a brief demonstration of the tablet’s use, each group had the challenge to discuss, decide and collaboratively create digital artifacts inspired by the previous book history experience. The creative task had duration of 30-40 minutes. These groups used simple multimedia and image editing software in a modern tablet to produce completely diverse and impressive drawings (see images 1 & 2). The tablets were leased to LIC temporarily by the University of Patras’ Human - Computer Interaction Group. The best drawings from each school were showcased in LIC’s website.

Image 1: Students’ drawing (2th grade): “Phaistos Disk”

Image 2: Students’ drawing (4th grade): “We love books” (in Greek)

The visited 3D VIEs were placed or adapted in the following islands in Second Life:

- University of Washington’s Museum of Virtual Media
- Museum Island
- Alice Academy
- Ancient Alexandria
- International Spaceflight Museum

The 3D VIEs contributed essentially to the learning experience in the following ways as they

- depicted the civilization’s architecture, natural environment and aesthetics,
- showed clothing and appearance of a representative of each milestone (through the avatar’s clothing and skin),
- visualized objects and notions not available in the physical life, e.g. the arrangement of scrolls in the Great Library of Alexandria,
- demonstrated through programming how inventions worked (e.g. movable type)
- included objects to be used as prompts during the game (e.g. the Phaistos disk)

The role of the avatar [23] was also equally crucial to the design of the experience as it contributed an additional playful element beyond its functional role in the 3D VIEs. Through the use of appropriate animations, the digital agent responded to students’ answers, action suggestions or other surprise events in the storyboard demonstrating emotions and sound effects. This non-anticipated behaviour entertained the students widely and provided flair of interactive show during the experience.

4. TECHNICAL DEVELOPMENT

For the second project stage we needed to use appropriate 3D virtual immersive environments (3D VIEs) that we either designed and produced or adapted existing 3D VIEs in the platform of Second Life. The new 3D VIEs were developed in-home cost effectively by LIC’s 3D Virtual Worlds Expert in University of Patras’ space in Second Life. The existing 3D VIEs were used and adapted temporarily with permission by their creators and administrators. In total, the following 3D VIEs were used during the experience:

- Lascaux France prehistoric cave (see image 3),
- Ancient Babylon & Mesopotamia,
- Ancient Greece,
- Ancient Egypt,
- Byzantine monastery,
- Typography machine,
- Space age.
5. INITIAL FINDINGS OF THE ONGOING CASE STUDY ASSESSMENT

As this is an ongoing research project, we only present some initial findings. At the end of the project last stage, the teachers are called to evaluate the experience’s design, layout and activities, as well as the reactions, behaviour, emotions and performance of their students by completing an online questionnaire. The questionnaire followed a 5 preferences Likert scale. There were 28 teachers who participated in the study. The initial findings suggested that 81% of the teachers confirmed that children acquired new skills (answers: agree & fully agree); 85% affirmed that the experience added to the students’ positive mentality towards books and reading; 85% of the teachers estimate that the experience helped children assume a positive attitude towards books & reading (answers: agree & fully agree); 98% found 3d VIEs useful for facts recall & history understanding.

During the interviews, the teachers suggested that:

“I have never seen my class so quiet and concentrated as when they attended this program”

“You exceeded teachers’ & students’ expectations; you have captivated children’s interest and they enjoyed the program greatly. The whole visit to the Library was so alive.”

Overall, as the program went viral among teachers, it is rather popular as more than 1500 students from 20 schools (ages: 7-15) have participated in and learn about the book history and future by having fun.

6. CONCLUSION

3D Virtual Immersive Environments combined with engaging pedagogical methods such as scaffolding enabled LIC to produce a cost effective yet rich learning experience for schools which could not otherwise afford to travel to the actual places. Utilizing the avatar psychology power, the visualization and simulation affordances of 3D virtual immersive learning environments and the appeal of storytelling and game-based learning, LIC designed and developed a “gamedified” blended narrative on the book evolution where learning is embedded and context-enabled. The program is now very popular among schools. Its high engagement level created enthusiastic students’ responses and learning behaviours.

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8. REFERENCES


