Handbook of Research on Cross-Disciplinary Uses of Gamification in Organizations

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Chapter 21
Studying Thracian Civilization Through Serious Games and Storytelling

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ABSTRACT

This chapter presents a novel learning approach for studying ancient Bulgarian history, civilization, and their cultural heritage, namely the Thracian civilization, through storytelling and serious game combinations. The chapter also provides an overview of serious educational games, digital storytelling, and game development tools that can be used to present ancient history and their cultural heritage. The combination of storytelling and serious games successfully helps instructors to motivate student learning, stimulate their curiosity, and make them interested. The authors developed a game editor and a game portal that facilitated the game's development by applying game templates, layout styles, and question pools.

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INTRODUCTION

The knowledge society and knowledge-based economy signifies a new era for education and training, aiming at replacing old-fashioned time / place / content-predetermined learning with a just-in-time / at work-place / customized / on-demand process of learning by new ICT-based tools (Bontchev et al., 2016; Pavlov et al., 2007). Ubiquitous learning is aimed to provide learners with content and interaction anytime and anywhere (Hwang et al., 2008; Nussli & Oh, 2021). Current technology-enhanced learning points to the investigation and the deployment of practical learning methods and scenarios for creative thinking, learning-by-doing and learning-by-authoring, engaging learners in more active participation during the perception of knowledge (Draganov et al., 2015). The main challenges during the training material development imply the following questions:

- How to increase motivation, engagement, and improved learning outcomes?
- What learning methods can be used to attract learners in more active participation in the learning process?
- What tasks could be interesting and attractive and could stimulate learners' desire to work?

Serious games become an important modern-day educational method, which reflects both the current state of technology and the learners' social profiles. Serious educational games provide a novel way to transfer knowledge, which can especially attract young people by using interactive multimedia technology. They could provide tools for better understanding, creative thinking and engaging young people in more active participation during the perceiving of knowledge. The technological revolution gives innovative learning tools to the teachers and the possibility to deploy new learning approaches for deeper understanding and better demonstration of the learning content. Serious games represent a power tool to seek creative and logical thought, problem-solving, as well as develop a variety of skills and competencies to the learner.

Digital storytelling learning method successfully helps instructors to motivate students learning, stimulate curiosity, and to make them interested. Combination of storytelling and serious game represents a novel learning approach. The new strategies for teaching and learning point to the investigation and the deployment of workable learning methods and scenarios for better understanding of the learning content and engagement learners in more active participation during the perception of knowledge (Slavova-Petkova et al., 2016).

The serious game development requires a flexible tool for developing, managing, and presenting games. We developed a game editor and a game portal for creating various games (Connolly et al., 2012). The server-based solution can facilitate the game development by applying game templates, layout styles and question pools. It also supports the development of game packages for multiple languages and multiple platforms (Web and mobile). The games can easily be customized for various learning domains. Complex games can be composed from several so-called mini-games and the tool also supports the evaluation of the user answers and organizing competitions (Georgieva-Tsaneva et al., 2018).

The main objective of the chapter is to present how serious games can be applied in teaching humanities in primary school. This chapter presents a novel learning approach for studying the ancient Bulgarian history, civilization and their cultural heritage and the Thracian civilization in particular by storytelling and serious game combination.

The rest of the book chapter is organized as follows. The background section provides an overview of serious educational games and digital storytelling. Then factors related to the learner experience and content understanding issues are presented. The subsequent sections introduce the applied game development tools and the games transferring knowledge on ancient civilizations lived on the area of present Bulgaria. Future research directions are also shown. Finally, the chapter is summarized in the last section.

BACKGROUND

Serious Games/Gamification

Serious games represent an intensively studied topic in the literature (Hamari et al., 2014; Marzullo & Oliveira, 2021). The literature review of the empirical experiences related to computer games shows that the game-based approach is being used for learning in many different areas, the players like to use it to acquire new knowledge and find it motivating and enjoyable (Connolly et al., 2012).

Serious games represent an innovative way in technology-enhanced learning to perceive new knowledge in an entertaining and engaging way (Mortara et al., 2014). Abt introduced the term "serious game" for the first time and described the utilization of situations in and outside the class room in his book "Serious games" (Abt, 1970). He described "serious game" as a "game having explicit and carefully crystalized educational purpose, as the main goal is not entertainment". Although computer games were originally developed for entertainment, the primary goal of a serious game is something else (Michael & Chen, 2005; Djaouti et al., 2011).

Games created for educational purposes can attract attention, support learning-by-doing and learning-by-authoring, inspire creative thinking and engage users in an active participation during the perception of knowledge. Games with educational purposes can provide the same psychological experiences as other games do. The intrinsic motivation for learning plays a key role in "making learning fun". The motivation can be encouraged by seven factors: challenge, curiosity, control, fantasy, competition, co-operation and recognition, which are all present in the games (Malone & Lepper, 1987). The serious games can successfully assist, facilitate and support to achieve the effective goal of the learning process while the users acquire new knowledge, skills, and/or attitudes (Huotari & Hamari, 2012). A literature overview of computer games and serious games illustrates the increased interest in the positive impacts and outcomes of these games, furthermore, the term "serious games" has become mainstream during the last ten years, and it is used interchangeably with "games for learning" (Boyle et al., 2016). The modern education can be characterized as personal, fun, collaborative, relevant, multimodal, technical and open-minded, where gamification can be treated like a tool to provide the above features (Guzik et al., 2015). In this context, the educational games are effective both in transferring knowledge and in entertainment. Learning experiences based on games have unique particularities such as fun or engagement due to their game-based nature (Caballero-Hernández et al., 2017). Serious games can elicit significant engagement from learners and further to the effectiveness of the learning process. Education based on serious games generates good levels of comprehension and unconscious processing of content of relatively great difficulty.

Serious games are widely applied in cultural heritage and history domain as well (Mortara et al., 2014; Draganov et al., 2015; D. Paneva-Marinova et al., 2017). In a maze game, the students use different skills, competences, and experience to solve the mini games and reach the target (Bontchev et al., 2016). The

integration of information and communication technology (ICT) in the ancient history curriculum by means of game playing, interactive interface, visualization, video, and animation allows to present the material in a fun and accessible way (Slavova-Petkova et al., 2016). This integration will make it easier to explain connections, relationships, and influences among ancient civilizations; to demonstrate the continuity of ideas, despite the demise of entire nations, and will improve the students understanding of the evolution of civilization. Serious games play an important role in providing the young learners with orientational literacy and an ability to apply their knowledge in activities different from those practiced at school (D Luchev et al., 2016).

Although gamification approach also applies game elements in non-gaming contexts it can be differentiated from serious games (Deterding et al., 2011; Galetta, 2013; Patrício et al., 2018). Gamification refers to the use of parts of game design elements while serious games represent complete games with educational purpose. Gamification applies game elements to encourage users' enjoyment and engagement while performing jobs or solving problems (Robson et al., 2015). Gamification can enhance various skills including co-creation (Ind & Coates, 2013), collaborative innovation (Patricio et al., 2020a), design thinking (Patrício et al., 2020b), etc.

Storytelling

Digital storytelling is the practice of using digital technologies to tell a short story (Robin B.R, 2008). Like traditional narratives, digital stories focus on a subject and feature from a particular point of view. What distinguishes digital storytelling is the inclusion of digital images, text, audio narration, moving image (video), and music. These multimedia narratives tend to be short (2–10 min), personalized reflections which use still pictures or videos of personal artefacts to create short evocative stories/plots. Such digital narratives are an extension of traditional storytelling, providing engaging stories, which can be shared within social/leaning communities.

Digital Storytelling is employed in a range of contexts and for a variety of purposes: self-awareness or discovery; narrative (knowledge management) in businesses; facilitating group understanding; engagement of marginalized sections of society; subject learning and development of subject, cultural or societal resources (Benmayor, 2008; Petrucco & De Rossi, 2009; Roby, 2010). The digital story genre is perhaps most frequently associated with the telling of personal stories, often of cultural or historical importance to the author (Lambert, 2010). Such stories often focus on interesting experiences, memories of some past event or person or personal journeys to overcome challenges or achieve goals (Gunter & Kenny, 2008). Robin (Robin B.R, 2008) identifies two other types of digital story – one that informs or instructs and one which examines historical events. We will focus on a story based on historical facts aiming to improve knowledge understanding and to make and educational application of digital storytelling.

Kenny (2007) argues that classroom practice that combines use of digital media with the art of story – leveraging both the skills and preferences of digital age students and the inherent human interest in story – is a potentially powerful pedagogy. Digital storytelling can be used to engage, inform, explore and transform, and thereby lends itself to educational contexts. Indeed, as shown by (Yuksel et al., 2010) world-wide survey investigating the use of digital storytelling to support learning. The digital storytelling is used in educational contexts not only to develop subject area knowledge, writing skills, technical skills, and presentation skills, but additionally reflection, language, higher level thinking, social, and artistic skills are also developed.

Digital storytelling, when well-conceived and executed, provides an engaging and powerful account of a 'story' – be it informative, imaginative or reflective. While any well-formed story should achieve this, the integrated visual and audio nature of digital storytelling is particularly potent to generations who have grown up in a social and multi-media world. The nature of the engagement goes beyond mere entertainment, although the value of fun in educational contexts is not to be underrated; using digital storytelling in the curriculum can afford real educational advantages (Roby, 2010). Firstly, the multi-media nature makes the content of the digital narrative more accessible to technology-centric students, many of whom are alienated from traditional textual forms (Gunter & Kenny, 2008). Secondly, as researchers such as (Burmark, 2004) have shown, the combination of text integrated with visual images enhances student understanding. The visual component, especially where of a personal nature, helps situate the story within a recognizable context. According to Bruner's theory of situated cognition, this increases the time that students can retain and understand information (Kenny, 2007) as well as enabling students to better organize information into manageable chunks. Thirdly, the multimedia nature of digital stories encourages active listening.

The stronger educational benefits could arise when students become involved as active learners in the authorship of digital stories. Creating their own digital stories, whether personal, informative or imaginative, requires the student to engage with the structure of storytelling. In developing the story, students must understand the basics of narrative structure as well as grammar. For example, students will need to consider dramatic tension, pacing and narrative flow. Further, as (Ohler, 2005) advocates, authoring of digital stories provides a powerful opportunity for students to develop critical media skills.

Appropriate combination storytelling with game can make the learning content interesting and desirable for the students (Slavova-Petkova et al., 2016; Vasileva et al., 2014).

The chapter presents below several serious educational games for improved understanding of history, habits and culture of the ancient civilizations on the Balkan Peninsula. The learners' engagement with these methods and tools is pursued, aiming to provide more active knowledge perception and understanding.

SERIOUS GAMES, LEARNER EXPERIENCE AND CONTENT UNDERSTANDING

Factors Related to the Learner Experience in Serious Game: Content Understanding Issues

Computer games are attractive for the wide public. When the gamer is a learner, or has learning purposes in the environment, "one size fits all" solutions are not enough to satisfy his/her needs. Different learners have different learning needs and preferences that (should) affect the learning function outcome. Learners expect from the game to play, "personal game facilitator/instructor" and not a "classroom" behavior, where their personality and needs are known and taken into account.

There are several benefits of thinking about and trying to understand learning preferences:

- People learn most effectively when the strategies used are closely matched with their preferred learning style.
- Sometimes we can improve our learning by knowing what our strengths are and then doing more of what we're good at.

- Often we can improve our learning by knowing what our weakness are and trying to enhance our skills in these areas.
- Different situations and learning environments require different learning strategies, so it's best to have a large repertoire from which to draw.

The authors' research practices point to some factors that should affect even more the learning activities in a serious game, such as:

- The space in which learning takes place, its aesthetics and mood, user interfaces, visual elements, input devices, interaction with other learners / mentors, possibility of dynamic changing of the learning place, even its realism.
- Interactivity and the learner immersion in the learning place.
- The "interplay" between the learner and the learning's narrative or the learning place as a whole.
- The learnativity content model - the concept of assembling content into higher-level objects, as it is defined by (Wagner, 2008).
- The set of challenges the learner will face within the learning space; Synchronization of the challenges with the ability of the learner.
- Keeping interests by:
  - Implementation of multiple difficulty settings for the different learners.
  - Usage of non-trivial learning objects – applied games, puzzles, stories, conundrums, *etc.*
- Transforming the boring learning activities in a fun and adventures. The quality of the learner experience – whether learner enjoy working with the e-system, or whether they find it frustrating.
- Setting awards for the efforts – Reward the learners for skill, imagination, intelligence and dedication.
- Enhancing the motivation by encouragement, diversity, and extended curiosity.
- Eventually, conscious awareness of the learning as a key engine for the future success.

It could be also mentioned the provision of creative experiences, learning-by-doing and role-playing scenarios.

The key issues that developers had to take into full consideration concerned the game architectural design and the methodology. One of the larger challenges could be faced is how to select and present only the most salient information so as not to overwhelm students with too many facts, names, and dates, as textbooks tend to do. Furthermore, the creators need to relate historical data by means of both text and image, used on equal terms as sources of information. They must aim to train students to view visual images analytically and understand that architecture and objects (such as the archeological finds featured in the game) also communicate about the history, religion, and daily lives of the people of the past, often revealing information not otherwise accessible (Rousseva, 2018).

Challenges During the Game Developments

Major problems appeared during the design of the game software solutions, closely capturing the above discussed factors. Some of them concern the communication between the learner and the game environment. Other are related with the formal presentation of the subjective issues such as learner' skill, imagination, motivation, intelligence, dedication, *etc.* Moreover, in order to provide effective forms of

personalized learner experiences the focus must be on the design of the interaction per se as an integral part of the whole system. There is a need to develop multi-modal mixed initiative interfaces that draw on a range of user information seeking models. The requirement is thus for research to develop theories of interaction which underpin the design of applications and vice versa and which go beyond issues of simple elicitation, presentation and feedback.

Developing a computer game is a time-consuming task and requires large amount of resources. It is a challenge to shorten the development time and reduce the costs by applying proper tools and methodology. High-level learning content is also crucial for the success of the project and the content developers should be motivated to timely deliver it.

GAME DEVELOPMENT

This section presents game development tools we applied to create serious educational games.

Game Development Tools

The games target a large set of devices – PCs, notebooks, mobile phones and tablets, smart TVs and VR devices. This is the reason for choosing a web technology for its implementation. One of the most popular, well developed and documented libraries for 3D in the web – THREE.JS – was used for the development of our game engine. Open source, based on WebGL (a technology, which utilizes the graphic card of the devices) and HTML Canvas, it is powerful and its performance offers close resemblance to the feel of the native games for the particular device.

THREE.JS supports most of the 3D elements needed for the development of a game: scenes, cameras, meshes, animations, loaders (imported from variety of 3D object file standards), player controls (first person, device orientation – for VR, orbit, point, *etc*.), a large set of lights and shadows, material types, shaders, access to the OpenGL using GLSL language, *etc.*

Most of the objects and meshes for the game (rooms, walls, mini-game elements) were designed using Blender, and exported to GLTF format - (GL Transmission Format) – the most efficient format for loading 3D objects in a web environment.

As a result, the game becomes very lightweight. Additionally, all textures and graphics are optimized for web and for devices with limited network bandwidth.

Apart from classic 3D representation of the games, we have added the ability to play the game using VR glasses (*e.g.*, cardboard ones with mobile phones, along with some pointing device like a Bluetooth mouse, a keyboard or a joystick) and anaglyph glasses (red/cyan filter glasses, usable with any standard display) in order to make the game more immersive and more realistic.
Several tools were implemented to accelerate the game development process:

- Game Template Developer. A game template consists of the mini-game logic files and the list of necessary parameters with their types.
- Game Editor. The editors can select game templates, question-answer combinations and styles to create a mini-game by using the Game Editor.
- Game Publisher. A game package containing multiple mini-games can be created by using the Game Publisher.

- Game Portal. The players can select game packages, play any of them and see their scores on Game Portal.
- User Management. In the user management area, the administrator of the system can see and manage the user.
- Question pool. Question pools contain questions along with the correct answers. The questions are randomly selected from the pool when the user plays the game.

The layout of the games can be easily customized by using style sheets. The application of HTML5 together with CSS3 technology have made it possible to set up various style sheets containing layout parameters which can be used to display the games in an appropriate form (color, fonts, background, etc.). The implementation of the games supports using multiple languages by applying translation keys. The games development is accomplished in HTML5 and JavaScript. The games can run on multiple platforms (Web and mobile). For more details on the implemented game server, see (Márkus et al., 2018).

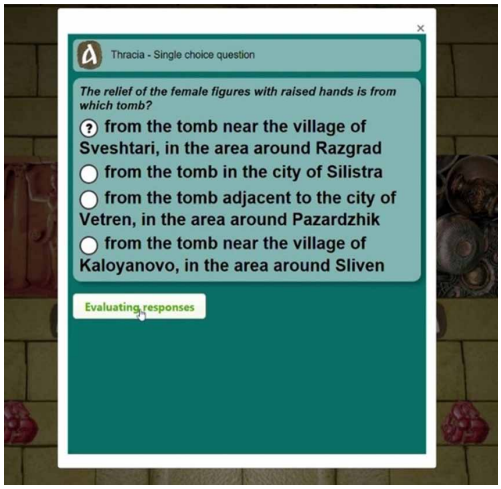
Main Educational Mini-Games

Complex games can be composed from several so-called mini-games (e.g., puzzle, multiple choice, memory game, crossword etc.) The interactive game types we applied in serious educational games. are as follows:

Multiple-Choice Question

The well-known multiple-choice questions represent the simplest mini-games which can be used to check the knowledge of the player in an easy way. An example is depicted on Fig. 1 from the "Thracians" serious game (Márkus et al., 2018).

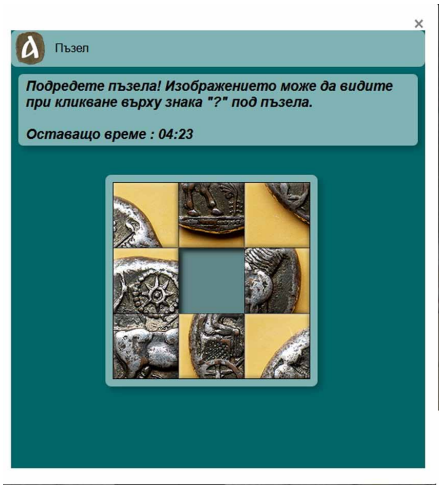
Figure 1. Multiple-choice question Source: "Thracians" serious game



Sliding Puzzle

A picture is cut into small square tiles. The starting screen of the puzzle contains the tiles arranged in random order with one tile missing. The objective of the puzzle is to move the tiles to their right position thereby restoring the original picture. Tiles can be moved by using the empty space. The puzzle exists in two sizes with different difficulty levels. The easier version has 3×3 tiles, whereas the more difficult version has 4×4 tiles (Fig. 2).

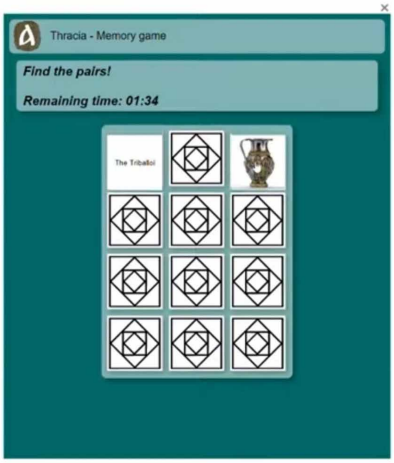
Figure 2. Sliding puzzle Source: "Thracians" serious game



Memory Game

Cards containing pictures are located along a grid. Initially, the cards are laid face down and two cards are flipped face up over each turn. The objective of the game is to turn over pairs of matching pictures (Fig.3).

Figure 3. Memory game Source: "Thracians" serious game



Matching

Given the names of some terms, locations and persons. The aim is to match pairs of the predefined items (Fig.4).

Figure 4. Matching Source: "Thracians" serious game

Crossword

The word puzzle contains definitions related to the life of the poet (Fig.5).

Figure 5. Crossword Source: "Thracians" serious game

Word Search

The user has to find meaningful words in a square of letters (Fig. 6).

Figure 6. Word search Source: "Thracians" serious game

Blind Map

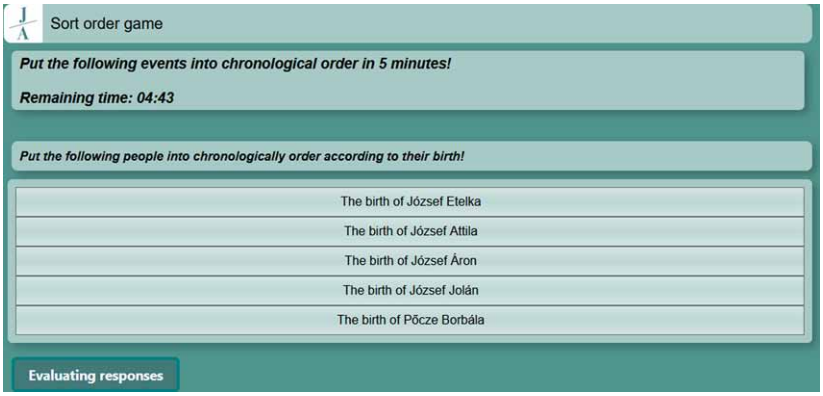
The user should find locations on a blind map containing no names (Fig. 7).

Figure 7. Blind map Source: "Thracians" serious game

Ordering

Events are given in random order. The objective of the game is to put them in chronological order (Fig. 8).

Figure 8. Ordering Source: "Attila József" literature walk



SERIOUS EDUCATIONAL GAMES

This section presents serious educational games with the purpose of transferring knowledge on ancient civilizations lived on the area of present Bulgaria.

Thracians Serious Game

The serious educational game *"Thracians"* is focused on life, beliefs and traditions of the Thracians (a group of Indo-European tribes inhabiting a large area in ancient Eastern and South-eastern Europe) and is drawn on ancient primary sources, on architecture and artefacts unearthed during archaeological excavations and on research by Bulgarian scholars. Exploring the chambers of the structure excavated beneath Ostrousha mound (in the Valley of Thracian Kinds near the town of Kazanlak, Bulgaria), learners will discover and retain knowledge about key characteristics of Thracian culture as known to us from the excavated and studied Thracian tombs, heroes, and sanctuaries, and from the weapons and treasures uncovered inside or outside these structures (Desislava Paneva-Marinova et al., 2018).

The proposed combining of storytelling and serious games for a better study of the Thracian history and civilization is *the base of the following learning scenario:*

Established Goals: To learn the concepts, facts and specifics for the Thracian civilization, focusing on the lifestyle, beliefs and traditions of this ancient people living on the Balkan Peninsula.

The Content of the Thracian Story

The first part of the story is related to the Thracian tribes, their nature and costumes, traditions, manners, different areas of high achievements, place of habitation, *etc*.

The second part of the story presents Tomb traditions and rituals of the Thracians and their beliefs for the life after death.

The third part presents the military power of these glorious ancient wars.

The fourth part is dedicated to the Heroon building that honors the memory of a deity ruler, a prophet hero, who restores harmony in the tribe when an annual ritual is performed in his honor. This is the very key for the Thracians because some of their tribes used to immortalize their rulers, priests and heroes and worshiped them as demigods.

The fifth part of the story presents treasures, feasts and abundance that accompany the everyday life of the Thracian kings and their deputies. This ancient civilization was glorified with its vast handmade and unique riches.

The last part of the story reveals the mysteries around the Thracian gods that were worshiped at that time.

The data and facts provided in the story derive from ancient documents, architecture, artefacts found during archaeological excavations, and from scholarly research by Bulgarian specialists.

The story is told through a serious game representing a labyrinth of rooms. The game will take you through the rooms of the building uncovered beneath the Ostrusha Mound, located in the Valley of the Thracian Kings near the city of Kazanlak. All of the objects, drawings and reliefs are real and were discovered at the time of the archaeological excavations made by scientists. Their position in the building's rooms is the creative decision of the team who prepared the story and the game, but the main purpose is to tell the Thracian story in the most realistic way. A great number of educational mini-games are available; completing them successfully will allow you to visit the next chamber of the building.

The Thracian game scenario: There are six rooms through which you need to pass: "Thrace", "Tomb", "Armory", "Heroon" (a temple to an immortalized tribal chief, priest, or hero), "Treasury" and "Sanctuary". In order to enter the sixth and final room, "Sanctuary," you need to visit the other five, successfully complete all of the games and receive pieces of Thracian treasure as prizes.

Implementation

The first version of the game is available in Bulgarian and the multilingual version is under development. The player can play in a virtual 360º panorama environment consisting of seven scenes, one of them is external the others are internal. The rooms include Thrace, Treasury, Heroon, Armory, Sanctuary and Tomb.

The technological implementation of the storytelling&game solution was done by the team from the Institute for Computer Science and Control, Hungarian Academy of Sciences (MTA SZTAKI) under the joint project "Development of Software Systems for Multimedia and Language Technologies" of Institute of Mathematics and Informatics, Bulgarian Academy of Sciences and MTA SZTAKI. MTA SZTAKI team developed a special tool for multilingual and multi-platform game development, management, and presentation (Márkus et al., 2018).

The starting point of the game is outside of the tomb and the player can enter through a door. The player can move and turn in the virtual environment and look around. Each room has several pictures, descriptions, games and doors, see Figs. 9 and 10 for a sample room. The pictures and descriptions help to solve the interactive minigames. The doors are initially closed and they can be opened by solving the minigames assigned to them. The colors of the symbols indicate the status (solved, unsolved) of the minigame in the given room. The players can see the next room through the open door. The goal of the game is to solve all minigames and get into the Sanctuary.

Figure 9. The Thrace room Source: "Thracians" serious game

Figure 10. The Heroon room Source: "Thracians" serious game

Aquae Calidae Serious Game

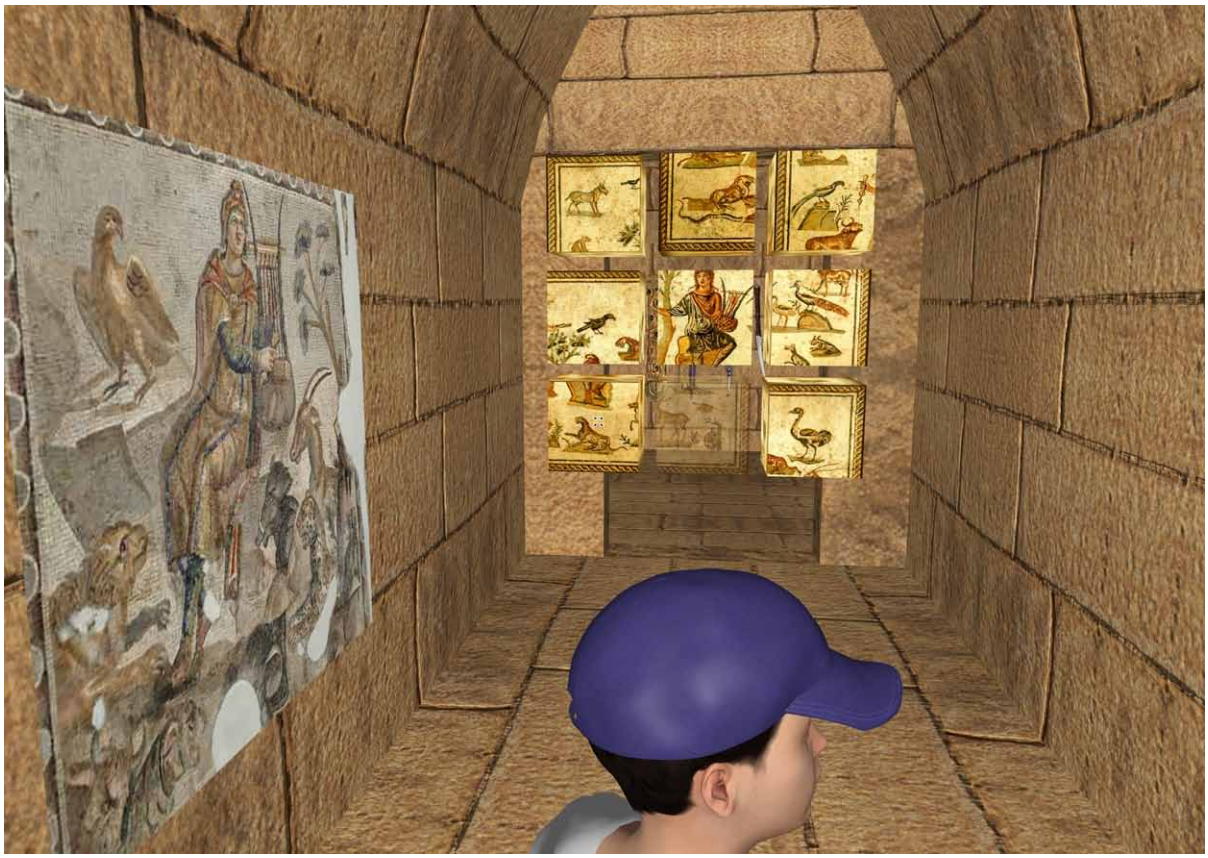
Aquae Calidae is situated in the ancient region of Thrace, near the Black Sea. The history of Aquae Calidae (Therma, Thermopolis) is related to the famous hot mineral springs at the site and covers a long period of time from the 1st millennium BCE to the 16th century CE. It is linked with events from the history of Ancient Greece, the Roman and the Byzantine empires, the Medieval Bulgarian state, the

Crusades and the Ottoman empire, and was visited by famous historical figures. The rich history of the place makes it possible to develop related educational games (Detelin Luchev et al., 2020).

The "Aquae Calidae" serious game is an inspiring and entertaining way for primary-school students to meet the ancient civilizations on the Balkan Peninsula, offering active participation during the learning process and encouragement for creative thinking. This learning resource combines a number of digital tools for serious game development including virtual reality, 3D of archaeological excavations, interactive gaming components for effective knowledge acquisition, etc.(Zlatkov et al., 2019).

Through immersion in the virtual 3D reality of the complex, learners are able to play intuitive mini-games and improve their historical knowledge and understanding of the ancient inhabitants and civilizations of the Balkan peninsula. In the game, the player initially encounters the Thracian ruler Rhoemetalces II, king of the Sapaeans and the Odrysian Kingdom from 18 to 38 CE, who presents the story of how the temple of the goddess Demeter was built near the magical springs of Aqua Calidae. The player visits a hall with artefacts of Thracian treasures from the period, and, in gaming mode, acquires crucial aspects of the Thracian culture and civilization. The game is mostly centered on the heyday of Aqua Calidae under the rule of the Roman emperors. In the beginning of 1st century CE, Emperor Nero issues a decree for the initiation of the construction of the Roman thermae at Aqua Calidae, where the water was thought to have magical powers. The Nero's decree for the building of the thermae is presented

Figure 11. Thracian Sanctuary screen A Source: "Aquae Calidae" serious game



in the game in its authentic form – engraved on stone. The game follows the development of the thermae into a desirable place for the subjects of the Roman Empire thanks to its healing hot springs. Later emperor Trajan builds a big thermae complex with an area of 5000 m^2. The Roman emperor Septimius Severus (293-211 CE) organizes in Aqua Calidae the athletic games Severia Nymphea, in honor of the Three nymphs. Justinian the Great, the emperor of the Eastern Roman Empire (527-565 CE) reinforces the thermae with massive, fortified walls. This is part of the centuries-old history of the archaeological complex Aqua Calidae and the region, and subsequent versions of the game are planned to present its history during the Middle Ages and the Ottoman period.

The first part named "Thracian Sanctuary" tells the story of the hot mineral spring near to the ancient city of Aquae Calidae as a sacred place for Thracians in the first millennium BCE. The historical information on the Thracian tribes in the area, as well as their lifestyle, traditions and customs are illustrated. Screens from the first part of the game are depicted on figures 11-13.

Figure 12. Thracian Sanctuary screen B Source: "Aquae Calidae" serious game

The second room is called "Severa Nimphaea", named after the celebrations and sport games, organized by Roman emperor Septimius Severus (209-211) in the town of Aquae Calidae. The room explains the

Figure 13. Thracian Sanctuary screen C Source: "Aquae Calidae" serious game

important role of the mineral springs and the surrounding settlements as places for building the Roman towns in the conquered new province. During the reign of Emperor Trajan (98-117), the crucial Roman Road Via Pontica was built and Aquae Calidae became an important stop on that route. Its location was marked on the very first Roman maps of the region.

FUTURE RESEARCH DIRECTIONS

The further investigations in the above-discussed domain point to a wide variety of directions:

- To create of workable methods and tools, aiming to increase and generalize the learner experience in the digital culture educational platforms (*incl.* digital games). Moreover, creative learner experiences will support the effective on-line learning through the game.
- Contextual techniques for personalizing learners' experience in the educational gaming platform.
- Wider context-dependent use of digital cultural resources in the game.

- To develop of new digital and transmedia storytelling solutions for learning purposes, creation of interactive virtual exhibitions, gaming and gamification, virtual worlds, live simulations, animations, interactive media previews.
- Multimodal interfaces and intelligent visualization of complex information relying on enhanced learner experience and usability (*incl.* user-centric visualization and analytics, real-time adaptable and interactive visualization, real-time and collaborative 3D visualization, dynamic clustering of information, *etc.*), *etc.*

Moreover, the serious game design and improvement of the learner' experience in the changing cases would not be restricted by the available technologies, platforms and tools. The field has great potential for innovations especially in our world of active imposition of e-devices, e-literacy, and e-content. The focus will be in the research and exploitation of new or emerging technologies (*e.g.,* 3D, augmented and virtual reality, visual computing, smart world, environments and devices, media convergence, social media, *etc.*) for the development of innovative products, tools, applications, and services for creative digital content production, usage and management. The aims are to transform and customize the valuable parts of mankind's cultural and historical ancestry into digital assets, whose integration and reuse through research-lead methods has high commercial and non-commercial potential for learning and cultural institutions, tourism, creative and media industries.

CONCLUSION

A key factor of developing games in the domain of cultural heritage is to preserve valuable historical knowledge and share it with the next generation in a suitable way (Georgieva-Tsaneva, 2019). The integration of ICT in the primary school ancient history curriculum allows – by means of game playing, interactive interface, visualization, video, and animation – presentation of the material in a fun and accessible way. It makes it easier to explain connections, relationships, and influences among ancient people, events, and history. It could improve the students' understanding of the evolution of a civilization. The virtual panoramic tour of historical place mimics the feel of the actual tour of the site. The user interface could be personalized. The first-person point-of-view interface and the high-quality textures and graphic images, used for the creation of the game, offer an authentic and exciting exploration experience. The basic mapping of the site is augmented with realistic interactive 3D objects, avatars and light shade effects. The mini-games' graphic outlook is designed to be smoothly incorporated in the environment. The user experience is enhanced by adequate in-game media effects.

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KEY TERMS AND DEFINITIONS

Learning Service: A functional unit that refers to the management of training activities and/or processes in the software platform.

Learning-by-Authoring: A learning approach, which lays down on experiences resulting directly from the learner' authoring actions.

Learning-by-Doing: A learning approach, which lays down on experiences resulting directly from the learner' own actions.

Mini-Game: A short computer game contained in a more complex game.

Personalized Content Observation: A technique for customizing the user content exploration and usage in a software environment.

Serious Game: Computer game with educational purpose.

Technology-Enhanced Learning: Application of electronic communication and computer-based technology in education.