"CREATE IT" - "SHARE IT" - "GAME IT": THE CASE OF A WEB-BASED DIGITAL PLATFORM FOR CREATING, SHARING AND DELIVERING GAMIFIED EDUCATIONAL SCENARIOS

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Abstract

For nearly two decades there has been an increased interest regarding the exploitation of digital games in both formal and informal learning contexts with educators mainly focusing on ways of integrating them into their everyday teaching practices and researchers investigating their potential use as effective learning environments. According to existing research, digital games can provide their users with meaningful, interactive virtual environments capable of supporting learning within the context of a range of learning theories. Nevertheless, there is a number of factors (e.g. implementation costs, time restrictions, demands of existing curricula) that may hamper the broad adoption of a Digital Game-Based Learning approach. Thus, there has been a shift of interest toward the "gamification" of (technology-enhanced) learning by either infusing a game-like character to performed classroom activities, or integrating game-like characteristics into the design and development of digital educational environments. In this emerging gamification context there have been attempts to develop interactive educational environments that incorporate a number of characteristics, typical to digital games, such as 3D virtual worlds, appropriate virtual representations, on-time and/or on-demand help, and on-demand game-like feedback. However, educational activities, in these environments, usually occur as part of pre-designed and fixed scenarios.

Given all the above, the aim of this contribution is to present a web-based digital platform, developed as part of an ongoing research project, for creating, sharing, and delivering gamified learning scenarios. More specifically, through the use of a built-in authoring tool, the proposed platform allows educators to create their own educational scenarios by defining a number of learning activities and their sequence. Each educational activity may be associated with learning objects retrieved from existing Learning Object Repositories (LORs), whereas gamification elements, available from a provided list, may also be used. Developed scenarios take the form of educational digital games delivered through a three-dimensional virtual world where the learner is represented by an avatar. Thus, depending on the learning needs, a number of gamified educational scenarios are available or can be created from scratch. By providing a detailed account of the employed design and development methodology, as well as the system's architecture, it is our intention to analytically present the platform from a technical point of view. However, there is also a specific focus on the underlying pedagogical framework that, among others, emphasizes the importance of fostering an expertise sharing culture by allowing educators to share their scenarios with peers, retrieve and use already developed ones, or even edit available educational scenarios, depending on the needs. Design choices at both the pedagogical and technical level have been documented on the basis of data derived from the users' needs analysis. Finally, with respect to the platform's evaluation, there has been a focus on the gaming experience and perceived learning effectiveness, from the learner point of view, as well as on usability issues, from the educator-educational designer point of view. In this context, evaluation results are used to shed light on the platform's capacity to effectively support the design and delivery of gameful learning experiences.

Keywords: Gamification, digital platform, educational scenarios, educational digital games, evaluation.

1 INTRODUCTION

Digital Game-Based Learning constitutes an independent research field within the wider context of Technology-enhanced Learning that has attracted significant interest because of the experiences that digital game playing offers, as well as the potential of digital games to contribute to the achievement of

a range of learning outcomes. Exploitation of digital games has been considered in both formal and informal learning contexts, with educators mainly focusing on methods of integrating them into their everyday teaching practices and researchers investigating their potential use as effective learning environments [1], [2]. According to Kirriemuir and McFarlane [3], digital games provide their users with meaningful, interactive virtual environments capable of supporting learning within the context of a range of existing learning theories. More specifically, the fact that digital games present challenges that require the adoption of trial-and-error approaches in order to be successfully overcome, as well as the employment of appropriate in-game representations that facilitate engagement at an affective level, provides opportunities for behavioural change and thus, learning that fits the behaviourist paradigm. Furthermore, the goal-oriented and rule-based character of digital games [4], [5] facilitates learning that is in alignment with constructivist learning theories by allowing for experimentation, exploration, and involvement in coordinated joint activity [6]. Existing literature abounds in research studies that have focused on the systematic investigation and measurement of learning outcomes (varying from the acquisition of domain-specific knowledge to the development of a number of skills) able to be achieved through the utilization of either general-purpose commercial, or specially-designed educational, digital games and as a result of engagement in the digital gaming activity. Educational digital games, particularly, or "serious games" as they are most frequently termed, are defined as games "*in which education -in its various forms- is the primary goal, rather than entertainment*" [7], and appear to have attracted the increased attention of formal educational/training establishments as a means to support and enrich the provided by them education/training.

Yet, despite the well-documented benefits of Digital Game-Based Learning, a number of factors, such as time restrictions, implementation costs, and demands of existing curricula, may hamper the broad adoption of a Digital Game-Based Learning approach. Thus, during the last few years, there has been a shift of interest toward the "gamification" of (technology-enhanced) learning that manifests itself as: (i) infusion of a game-like character to performed classroom activities, or (ii) integration of game-like characteristics (e.g. three-dimensional virtual worlds, appropriate virtual representations, on-time and/ or on-demand help, game-like feedback) into the design of virtual, interactive learning environments. Gamification definitions focus either on design considerations that target at a gameful (learning) experience, or on the gameful experience per se. To be more specific, Deterding et al. [8] define gamification as "*the use of design elements characteristic for games in non-game contexts*", whereas according to Huotari and Hamari [9], gamification refers to "*a process of enhancing a service with affordances for gameful experiences in order to support user's overall value creation.*" So, instead of considering the integration of digital games into the learning process, the aforementioned benefits of Digital Game-Based Learning are attempted to be gained through learning activities that have been permeated with the appropriate (depending on the learning needs and audience) game elements.

Within this context, the aim of this paper is to present a web-based digital platform, developed for the needs of a Greek research project, for creating, editing, sharing, and delivering gamified educational scenarios. To this end, after a thorough review and analysis of existing gamification practices we continue with the design methodology and description of the platform from a technical point of view by providing a detailed account of its architecture. Apart from that, by focusing on involved roles and the underlying pedagogical framework it is our intention to highlight the potential of the platform to nurture an expertise sharing culture among educators, as well as its contribution to the vision for a ubiquitous virtual school. Finally, through the presentation of the adopted evaluation methodology and especially of available evaluation results, we attempt to shed light on the platform's capacity to effectively support the design and delivery of gameful learning experiences, whereas suggestions for further research are being made.

2   BEST GAMIFICATION PRACTICES

The aim of this section is to present existing, best, gamification practices, mainly from the educational sector, so as to: (i) frame the context in which the design and development of the proposed platform has taken place, and (ii) reveal limitations of existing efforts. To begin with, "Khan Academy" (https://www. khanacademy.org/) is a web-based educational platform, targeting at students, teachers, and parents, that provides access to a large amount of content (related to a number of subjects and domains), as well as assessment activities, and has adopted various gamification techniques in order to support and enrich interaction with the digital content. An interactive map metaphor, which offers a sense of navigating and advancing within a virtual world, is used for visualizing available learning/ assessment resources and a proposed sequence for accessing them. Furthermore, the user is able to be provided with on-demand feedback that takes the form of game-like diagrams and charts, whereas

virtual prizes are awarded for quick and successful completion of undertaken activities. In case of not being able to complete an activity, the user has the option to request help, taking the form of a step-by-step wizard, and/or watch available instructional videos, as many times as necessary, without any negative effect to his/her overall assessment.

Similarly, "KnowRe" (http://www.knowre.com/) is a web-based platform that targets at the secondary level of education and especially at Mathematics learning. Availability of presentations with step-by-step problem solving instructions, instructional videos about a range of mathematical concepts and processes, contextualization of knowledge with help of real-world scenarios, and assessment activities followed by detailed feedback are key characteristics of the platform. Gamification elements that have been integrated into the design of the platform are the use of animation in the presentation of math concepts and their real-world applications, visualization of the sequence of accessed resources with the help of an interactive map, assessment activities that take the form of assigned missions/quests, and a reward system based on the use of appropriately designed virtual prizes. By taking into account the importance of assessment and especially the evidence it may offer for on-time, detailed feedback to the learner, the "PlayBrighter" platform (http://playbrighter.com/) allows for the gamification of the assessment process by providing the user with the appropriate tools. The user-educator is able to define the content to be assessed by selecting questions from an available repository or creating his/her own sets of assessment items. Assessment content is presented in the form of missions that are assigned to the user-learner as part of the plot of a game. The user-learner is represented in the virtual world of the game by an avatar and each time a mission is successfully completed (i.e. a question is correctly answered), points to be used for the configuration of the avatar are awarded. The status of the user-learner is available at any time with the help of detailed graphs.

Another characteristic case of a gamified, interactive learning environment is the platform that hosts the annual educational competition "Lysias" (http://www.lysias.gr/). The contestant-user of the platform gets actively involved in a scenario that includes seeking for and collecting virtual items (in a virtual world) each one of which is associated with questions of various difficulty levels. Apart from the correct answers that are awarded with points analogous to the questions' difficulty level, the user's response time constitutes another assessment criterion. Other game-like features of the platform are the option of on-demand help, as well as the availability of feedback anytime it is requested. Finally, it is worth mentioning the game-like, educational software application "Oikopolis" (http://www.pointblank.gr/en/work/oikopolis), which has been developed with the aim to nurture an ecological behaviour among school students. According to the educational application's scenario, the user is assigned the role of a kid-resident of a small town facing the problem of water contamination. Thus, through the employment of a role-adoption approach, the user becomes actively engaged in real-world problem solving, explores a virtual world in search of evidence, and is also able to propose solutions.

As made evident from the above described cases, gamification elements that have been utilized in the context of existing efforts are: (i) representation of the user with the help of a (customizable) avatar, (ii) on-demand feedback provided to the user with the help of detailed, game-like graphs and charts, (iii) adoption of an interactive map metaphor for visualizing available digital content, as well as proposed sequences for accessing and interacting with it, (iv) availability of help, in a variety of forms, as many times as it is requested and without any consequences to the user's assessment, and (v) employment of appropriately designed reward-based systems. Nevertheless, what most of the existing game-like, interactive learning environments have in common is that educational activities occur as part of pre-designed and fixed scenarios. The web-based platform that is presented in this paper embodies, on one hand, features typical to digital games, whereas its key, innovative characteristic is that it allows for delivering both pre-defined scenarios, developed at the design phase, that can be retrieved from a built-in repository, as well as scenarios that can be developed from scratch, with the help of an authoring tool, during run time.

3 DEFINITION OF RESEARCH PROBLEM AND DESIGN METHODOLOGY

The research problem, at which the development of the proposed platform targets, relates to the need for a ubiquitous virtual school, able to cater for the needs of both learners and educators by providing, anytime and at any place, rich learning experiences designed with the utilization of digital educational content that is available through existing Learning Objects Repositories (LORs).

The design and development of the web-based platform, taking place for the needs of a sixteen month Greek research project called "GameIt" (GameIt-Platform for Semantic Knowledge Management and Development of Interactive Educational Scenarios Using Advanced Multi-User Gaming Technology/

http://www.gameit.gr/), aims to improve existing, technology-supported, educational practices: (i) with the help of a Knowledge Integration System, (ii) by taking account of the well-documented benefits of learning that is based on the use of digital games or gamified, virtual learning environments, and (iii) by taking advantage of the interactions that occur in (either cooperative or competitive) multi-user, online digital games. Fig. 1 below presents in brief the philosophy of the GameIt platform.
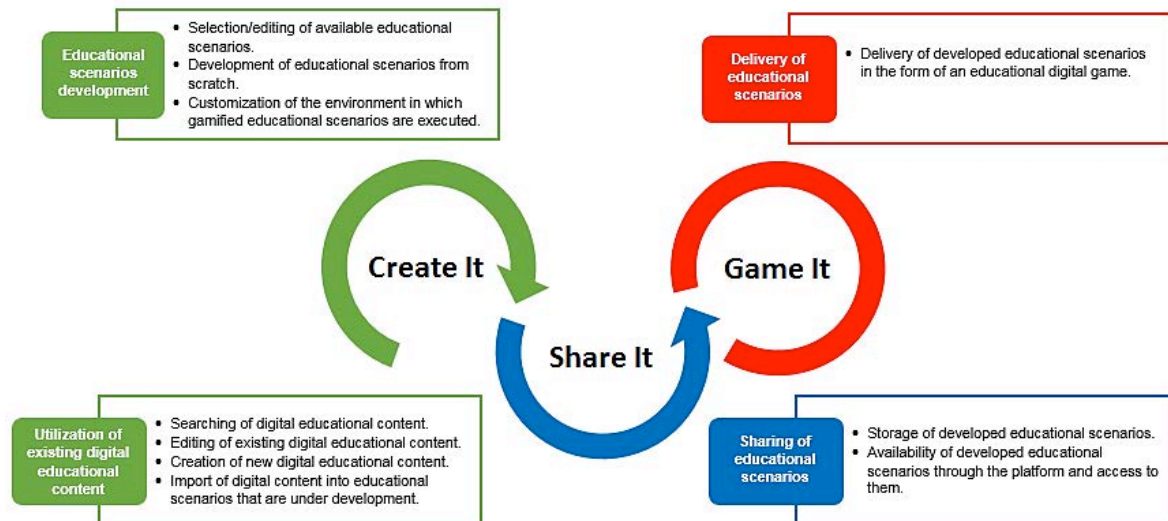

Figure 1: The philosophy of the GameIt platform.

The methodology that has been employed for the design and development of the GameIt platform is the waterfall model [10]. Table 1 below provides a description of the main design and development activities as they have been defined per work package of the project and in alignment with the phases of the waterfall model.

Table 1: Description of the research project's design and development activities.

Phases of the waterfall model	Work packages of research project	Description of main design and development activities
User needs analysis	• Analysis of users' needs • Detailed description of the system's specifications	• Investigation and analysis of the needs of users. • Description of the pedagogical framework and the platform's use cases. • Technical description of the Knowledge Integration System's specifications. • Technical description of the specifications of the gamified educational scenarios delivery system.
System design	Design and development of: • Knowledge Integration System	• Ontology development based on existing specifications and standards. • Description of the adopted educational methodology.
System development	• Educational methodology • Gamified educational scenarios delivery system	• Development of fifty (50), ready to be used, educational scenarios. • Development of the digital platform.
Evaluation	Evaluation of the digital platform	• Development of the platform's evaluation methodology. • Evaluation of platform and analysis of results.
Implementation	• Dissemination of evaluation results	• Execution of planned dissemination activities.
Maintenance	• Development of an exploitation plan	• Development of a detailed exploitation plan.

4   ANALYTICAL DESCRIPTION OF THE GAMEIT PLATFORM

4.1   Architecture and subsystems of the platform

The GameIt platform consists of three subsystems: (i) the Knowledge Integration subsystem, (ii) the Game Editor subsystem, and (iii) the Game Delivery subsystem. The development of each one of the above mentioned subsystems has been based on an object-oriented architecture, structured in three layers (Presentation layer, Application layer, Data layer), which may facilitate upgrades of the provided functionalities and each subsystem's maintenance. Table 2 below presents in short the three layers.

Table 2: Description of the layers that form the platform's architecture.

Layer	Layer description
Presentation Layer	▫ It is, in essence, the Graphic User Interface (GUI) of the system. ▫ It receives users' queries and redirects them, with the help of the appropriate methods, to the Application layer. ▫ Responses to users' queries are made available in a user-friendly format.
Application Layer	▫ Relates to available services and provided functionalities. ▫ The development of software components, at this layer, has been made with the use of .NET framework and mono develop.
Data Layer	▫ It is the system's database, which is completely isolated from all the other constituent parts and components of the platform. ▫ It is responsible for the storage of any kind of available information.

4.1.1   Knowledge Integration subsystem

The Knowledge Integration subsystem is at the core of the GameIt platform by providing functionalities for integrating and managing divergent, distributed (in existing LORs), and sometimes unstructured digital learning objects. Integration takes place at a semantic level with the help of ontologies that have been specifically designed for the purpose of unifying available educational and cultural digital content. At the physical level (Data layer of the employed architecture), the database of the platform contains only the necessary metadata and links to available digital content. Furthermore, the Knowledge Integration subsystem provides the user with functionalities for creating and characterizing new digital content, which can next be stored into the system's database.

4.1.2   Game Editor subsystem

The Game Editor subsystem is made up by a user-friendly Virtual World Editor supported by a Game Wizard that can be used for editing existing educational scenarios or developing educational scenarios from scratch. It allows for creating ready to be used educational scenarios, which in turn are executed in a three dimensional virtual world and as part of the plot of a game. In other words, the Game Editor subsystem of the platform is an authoring tool with the help of which gamified educational scenarios may be developed. Digital learning objects, available through the Knowledge Integration subsystem, as well as a range of graphic elements may be used and imported into the educational scenario that is each time under development. Educational scenarios are stored in a separate database as XML files that include information with respect to: (i) "where" and "when", in the three-dimensional virtual world, do the defined educational activities take place, and (ii) the learning objects and in-game events that are associated with the educational activities. All educational scenarios are available and ready to be executed, or edited, by users of the platform.

4.1.3   Game Delivery subsystem

The Game Delivery subsystem is a runtime environment for the execution of the developed gamified educational scenarios. From the end-user point of view, it offers opportunities for participating in a highly interactive, multi-user, online digital game with the aim to achieve the learning objectives of the underlying educational scenario. As part of their interaction with the gamified educational scenarios, users assume roles and can communicate with the support of appropriate tools. The GameIt platform, at its whole, is presented in Fig. 2 below.
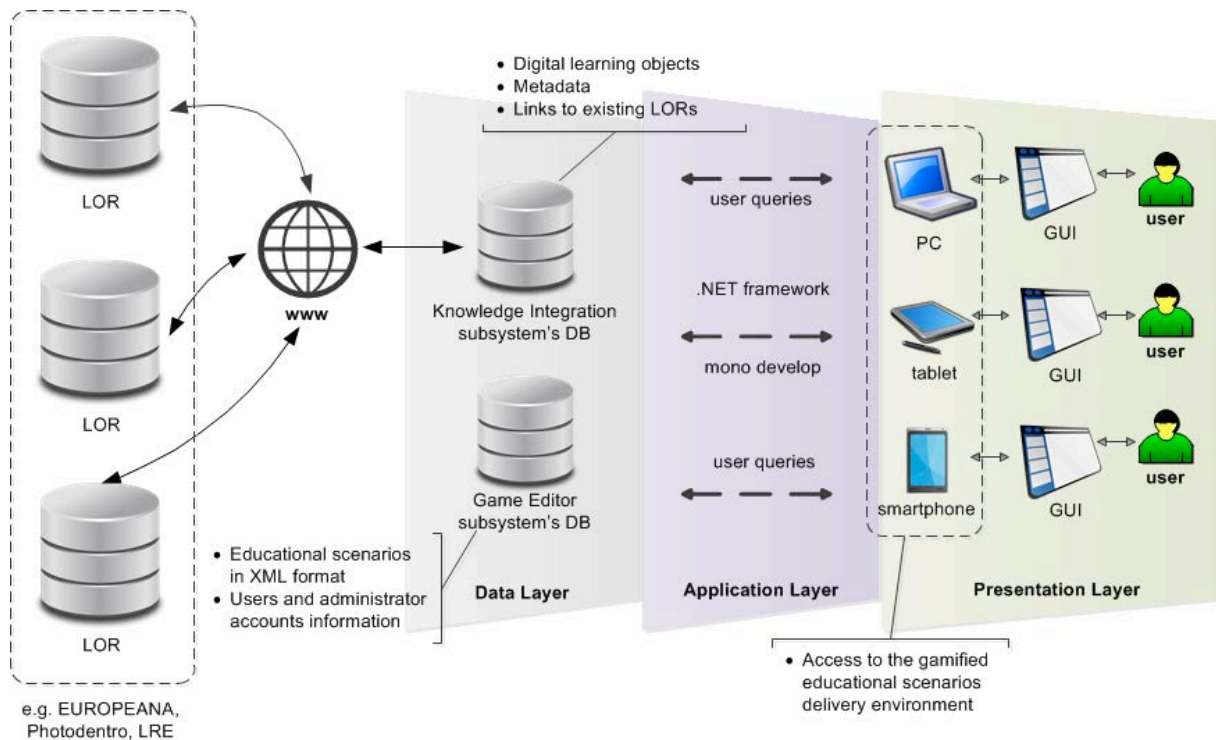
Figure 2: Diagrammatic presentation of the GameIt platform at its whole.

4.2 Roles and use cases of the platform

The roles that are associated with the use of the platform are: (i) Visitor, (ii) Player, (iii) Game Creator, (iv) Game Designer, (v) Knowledge Creator, and (vi) System Administrator. Involved roles, as well as brief descriptions of indicative use cases of the platform (i.e. roles description and access rights) are presented in Table 3 below.

Table 3: Roles and indicative use cases of the GameIt platform.

Role	Role description
Visitor	Visitor is any user that has signed in to the platform. The only rights assigned to this role are: (i) access to the platform's database, and (ii) search for learning objects.
Player	Players are mainly the learners who use the platform for learning purposes and are able to interact with the gamified educational scenarios delivery environment.
Game Creator	Rights assigned to this role are: (i) access to and utilization of already developed educational scenarios, (ii) editing of available educational scenarios by importing/ removing learning objects, and (iii) sharing of edited educational scenarios.
Game Designer	In addition to the rights of the Game Creator, the Game Designer is also able to create his/her own new educational scenarios with the help of the Game Creator subsystem. New educational scenarios can be shared with other users.
Knowledge Creator	The Knowledge Creator has access rights to the Knowledge Integration subsystem and can add new learning objects to the platform's database.
System Administrator	The System Administrator is responsible for issues related to the platform's operation (e.g. management of users' accounts and information related to them).

4.3 Pedagogical framework

The GameIt platform's underlying pedagogical framework has been defined on the basis of: (i) theoretical concepts related to the domains of Digital Game-Based Learning and Gamification, (ii) the

well-documented benefits of constructive alignment [11] (i.e. learning objectives definition – selection and description of the appropriate learning activities – assessment of achieved outcomes), (iii) a detailed definition of involved roles, and (iv) theoretical concepts related to the formation and operation of communities of practice. Furthermore, evidence from the user needs analysis process has also been utilized with the aim to inform the development of the pedagogical framework.

Apart from typical descriptions of the involved roles, which are necessary for the documentation of the platform from a technical point of view, the two basic user categories of the GameIt platform, given its focus on supporting and enhancing formal school-based education, are learners and educators. On one hand, the educator's profile is defined and informed by his/her cognitive background (e.g. studies, certificates, teaching subject, etc.) and ongoing professional development, models and methods used as part of performed instructional design, utilization of digital tools and services, and attitudes toward the adoption of a Digital Game-Based Learning or Gamification approach. On the other hand, learners have specific demographics and are characterized by their learning needs (driven by demands of existing curricula, the attended level of education, as well as personal aspirations) attitudes and habits regarding the use of technology for educational and/or non-educational purposes, and involvement in the digital gaming activity.

Digital Game-Based Learning and Gamification have provided guidelines for the design of a highly interactive environment in which executed activities are authentic and meaningful to the learner. This key design objective has been achieved by presenting users with a three-dimensional virtual world incorporating a number of characteristics typical to digital games. More specifically, learning activities take place on a virtual island where the learner is able to navigate with the help of an avatar. Through the use of advanced 3D graphics all visualizations become realistic, whereas there is potential for an interaction experience similar to that offered by contemporary digital games. The user can explore the virtual world and visit existing landscapes and buildings (laboratory, museum, castle, lake) that lie on the island, as well as experiment by interacting with virtual objects that have been attributed a number of characteristics. All learning activities, and their sequence of execution, are the result of a careful and detailed educational design, targeting at the achievement of well-defined learning outcomes, which is manifested by appropriately developed educational scenarios delivered through the platform.

On the other hand, the educator can be considered as the orchestrator of the actions that occur in the virtual world. Based on the development of fit-for-purpose educational scenarios, the educator defines learning activities, which can be associated with learning objects (e.g. instructional videos, text files, presentations, simulations, assessment quizzes, etc.) available through a built-in digital repository, as well as gamification elements (e.g. virtual prizes, progress bars, leaderboards, mini games, rules, challenges, virtual objects, etc.). Thus, every educational scenario constitutes an educational digital game able to be delivered through the platform. The development of the gamified scenarios is based on a template that serves as a guide to educators and helps them implement decisions regarding the selection of instructional methods, learning and assessment activities, learning objects, gamification elements, and graphic elements relating to the virtual island's configuration.

Finally, a key characteristic of the GameIt platform's underlying pedagogical framework is its emphasis on nurturing an expertise sharing culture among educators. The accomplishment of this objective has become feasible by providing educators with tools and functionalities that allow for: (i) developing educational scenarios from scratch, (ii) accessing, editing and creating copies of existing scenarios so as to meet different educational needs, and (iii) sharing educational scenarios. As a result, there is potential to facilitate the formation of communities of educators, fully aligned with the norms typical to communities of practice [12], in the context of which each member may have an active role to the development of a collective knowledge and expertise. Moreover, availability of the option to track all changes made to existing educational scenarios helps toward framing platform-enabled interactions into the appropriate ethics context.

5   USER NEEDS ANALYSIS

The development of the pedagogical framework, as well as the definition of all the involved roles, have been informed by a thorough process of investigating and analysing potential users' (i.e. learners and educators) needs. Adopted methods involved: (i) a survey, and (ii) interviews of teachers. The project phase of user needs analysis was implemented during the period May-June, 2014.

5.1 Presentation and analysis of survey results

The aim of the survey was to gather evidence regarding learners': (i) demographics, (ii) technological profile (e.g. aim and frequency of computer and internet use, use of portable devices and social media, etc.), (iii) gaming profiles (e.g. preferred game genres, frequency and mode of gaming activity, preferred gaming device, etc.), (iv) utilization of e-learning applications, and (v) preferences regarding the integration of gamification elements into educational environments. To this end, the survey was conducted with the use of appropriately designed questionnaires assigned to a total number of N_1=198 primary and secondary education students.

From the data analysis it was revealed that slightly more than 8 out of 10 students (83.7%) use their personal computer for internet browsing purposes, whereas more than half of the survey subjects (57.1%) stated use of their personal computer for digital game playing. It must be noted that playing games and online communication have been reported as the two most frequent internet uses (61.1% and 66.5% respectively). As far as internet access is concerned, almost every student (96.2%) has an internet connection at home, whereas a significant student percentage (16.2%) has internet access outdoors. Apart from personal computers, the respondents also reported the use of tablets (65.5%) and smartphones (51.5%) for various purposes. In an attempt to sum up the above presented findings, we may conclude that learners use a variety of digital devices (either portable or not) for activities of a social and cooperative nature and with digital gaming being one of the most frequently reported ones.

With respect to the characteristics that a "good" digital game should have, respondents' preferences varied with fun and high quality graphics being on the top of the list. Apart from that, the existence of clear goals (41.6%), the potential to explore a virtual world (37.1%) and discover (34.3%), cooperation opportunities and engagement in coordinated joint activity (34.2%), as well as avatar representations (31.4%) are also a number of game characteristics that are consider as important. Finally, significant input to the GameIt platform's design process was offered by provided responses with respect to the characteristics that an interactive learning environment should incorporate. The content was reported as the most important characteristic (37.1% of responses) with the environment's potential to adapt to its users' needs (34.5%) and its ease of use (33.7%) following.

5.2 Presentation and analysis of interviews results

The aim of the interviews was: (i) to investigate the attitudes of educators toward the development of a digital platform that allows for creating, editing, sharing and delivering gamified educational scenarios, and (ii) gather input for informing the platform design process. Interviews were conducted with the participation of N_2=14 teachers (50% primary education and 50% secondary education teachers). The interview was structured into three sections (sections A, B, and C). Section A targeted at shaping the participants' technology-supported teaching profile by including questions about digital services/tools that are used, and the game-like characteristics that they possess, and attitudes toward the utilization of portable devices and social media in everyday teaching practice. Sections B and C were specifically dedicated to platform design considerations, with the focal point of section B being the integration of digital games or gamification elements into the teaching process and section C being concerned with the investigation of characteristics that a LOR should have. Given the scope of the research project and its outputs, we continue by presenting data gathered from interview sections B and C.

The reasons that were reported as a rationale for the educational utilization of digital games were the following (in a descending sequence of preferences): (i) understanding, (ii) pleasure, (iii) assessment, (iv) multiple representations, and (v) potential for drawing links with existing knowledge. As far as the investigation of how digital games may support and enhance everyday teaching/learning processes, we present the following list of responses (from the most to the least frequent): (i) support in achieving a range of domain-specific learning objectives, (ii) pleasure, (iii) engagement in activities of increased difficulty, (iv) detailed feedback to the user, (v) availability of quiz-like activities, (vi) facilitation of between users interactions, (vii) clear goals, (viii) participation in learning activities that are interwoven with the plot of the game, (ix) easy to learn, (x) award of prizes in case of successful completion of activities, and (xi) use of avatar-based representations.

As mentioned earlier, the last section of the interview dealt with characteristics and functionalities that a LOR should have. First of all, all interviewees reported the importance of having a LOR connected to an interactive environment for delivering gamified educational scenarios, with 29% of them totally agreeing with the specific design consideration. Furthermore, 7 out of 10 teachers (71%) reported the potential to retrieve digital content from a LOR and use it for the creation of a gamified educational scenario as very important. Apart from that, 71% of participants consider the usability of a built-in LOR

as very important, 64% reported the importance of on-demand access to available learning objects, and 79% of the participants totally agreed with the availability of learning objects editing functionalities.

6   EVALUATION OF THE PLATFORM

The platform evaluation process targets at the investigation of the following two research questions:

- RQ1: How do users of the platform experience its use?

- RQ2: How do users of the platform perceive its learning effectiveness?

As far as the first of the above research questions is concerned, there has been a focus on the game-supported learning experience, from the learner point of view, as well as researching usability issues, from the educator-educational designer point of view. To this end, the evaluation methodology that has been adopted involves: (i) evaluation of the use experience of the platform, from all categories of users (i.e. learners and educators), through the lens of the design heuristics that have been derived from the user needs analysis, and (ii) investigation of users' attitudes toward the learning effectiveness of the platform. In this section we present a number of preliminary findings that were gathered from a pilot use of the GameIt platform conducted with the participation of N_3=48 elementary school students. The pilot took place at an elementary school located in the region of Naoussa, Greece, in March 2015. The evaluation was made with the use of a two-part questionnaire. The first part targeted at assessing the experience of interaction with the gamified educational scenarios delivery environment and was based on an appropriately modified, for the particularities of our research, version of the Game Experience Questionnaire (GEQ) [13]. It included a total number of 26 Likert-type questions (a 5-point Likert scale was employed), divided into the following six categories: (i) challenge, (ii) flow, (iii) negative affect, (iv) positive affect, (v) fantasy, and (vi) tension. The second part of the questionnaire related to the investigation of learners' attitudes toward the learning effectiveness of the platform. To this end, the second part included 15 Likert-type questions (a 5-point Likert scale was employed), divided into the following five categories: (i) motivation, (ii) cognitive development, (iii) expectations, (iv) effectiveness, and (v) overall learning satisfaction.

Results from the analysis of gathered data revealed a positive user experience. The element of challenge in particular was rated with a score of 3.26 out of 5. More specifically, almost 7 out of 10 users (68.75%) reported that engagement in the gamified educational activities facilitated their learning. Additionally, 81.25% of participants reported that it was not difficult to get engaged in the execution of the gamified educational scenarios, whereas the same student percentage (i.e. 81.25%) agreed with the statement that the presented game-like scenarios were interesting. The vast majority of students (nearly 9 out of 10) reported a low degree of required in-game effort, with this result being in full alignment with results regarding the gamified educational scenarios' degree of difficulty. Finally, a little bit more than 8 out of 10 participants (81.25%) stated that it was easy to achieve the assigned learning objectives.

As far as the reported, by participants, learning effectiveness of the GameIt platform is concerned, what was revealed is that active involvement of learners in the gamified educational activities offered an increased motivation for learning (the element of motivation was rated with 4.75 out of 5). More particularly, 87.5% of students reported that they liked using the gamified learning environment offered to them through the platform, whereas all of them stated that a game-like context for the execution of learning activities is more preferable than traditional teaching methods. It is also worth mentioning that more than 9 out of 10 participants (93.75%) consider interesting the potential for becoming engaged in problem solving activities that form part of a gamified scenario. Moreover, more than half (56.25%) of participating students believe that the offered game-like learning environment enables the application of existing knowledge, whereas 68.75% of them consider that their active involvement in the gamified learning activities helps toward a deeper understanding of subjects-related, domain-specific concepts.

7   CONCLUSIONS AND FURTHER RESEARCH

It is well known that ongoing and fast-paced technological advancements, along with the need for having access to knowledge anytime and at any place, shape a new, dynamic educational landscape. Within this context there have already been a number of significant initiatives with respect to delivering well-structured educational activities beyond the physical boundaries and time restrictions of school-based education. As far as the greek educational system is concerned, characteristic examples of such initiatives are the Digital School platform (http://dschool.edu.gr/) and the Photodentro LOR (http://

). However, contemporary learning theories pose special emphasis on the importance of offering contextualized learning activities that are authentic and meaningful to the learner. The GameIt platform provides both educators and learners with the opportunity to create and participate in gamified educational activities respectively, by taking advantage of a range of well-documented benefits of Digital Game-Based Learning and Gamification.

With the evaluation process being in progress and by taking into consideration the preliminary findings that have been derived from a first, pilot use we are in position to conclude that the proposed platform may effectively support the vision for a ubiquitous virtual school, able to cater for stakeholders' needs. Yet, apart from investigating learners' use experience and attitudes toward the use of the platform there is also interest in researching the platform's usability and perceived learning effectiveness from the educators' point of view. Further evidence will help us draw rigorous conclusions by shedding more light on the platform's capacity to effectively support the design and delivery of gameful learning experiences.

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