

Educational Video Game for Valchan Voivoda

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Abstract: *The paper presents a brief scientific study of the capabilities of the APOGEE software platform to facilitate the automated creation of an educational video maze game. It presents the developed within Heritage BG project experimental educational video maze game dedicated to the work and legacy of Bulgarian rebel Valchan Voivoda and their impact on the historical development of Bulgaria in the first half of the 19th century.*

Keywords: Serious games, maze, game-based learning.



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1. INTRODUCTION

The availability of computers and mobile devices in classrooms, museums, and other cultural institutions is a prerequisite for using new media. Such media are digital (computer) games and, especially, serious games¹ that provide information, knowledge, and skills. Recently, computer games have proven to be visual media that present learning matter, didactic tasks, and virtual objects in an interactive and attractive way². In video games, both tangible and intangible cultural artifacts can be recreated³. The integration of such artifacts in entertainment and play⁴ contributes to a comprehensive gameplay immersion and a high commitment to the game storyline and content. Both so-called serious and entertaining video games can reflect elements of human culture and provide a transformative game⁵, enabling self-study in the game scenario. Educational games are a type of serious game used in an educational context and aimed at achieving specific instructional goals⁶. Although the learning process is usually unconscious to players, cognitive, motor, and social impacts can occur in the playing process. Thus, the ease of acquiring knowledge and skills during the gameplay is a motivation for using specially designed educational games.

Despite the advantages of educational video games, they are still rarely used in Bulgaria for many reasons. The main obstacles are the lack of such games and the scarcity of games with built-in specific learning objectives. Also, teachers usually encounter difficulties when trying to

create and use games as personal projects. They are hampered mainly by the lack of knowledge about the game creation process and insufficient programming skills⁷. These difficulties can be overcome if teachers have software tools with an intuitive and easy-to-use interface for video game creation. The scientific project APOGEE⁸ aims to build a software platform for the automated generation of educational video games⁹.

The paper presents the developed within Heritage BG¹⁰ project educational video maze game named "The Heritage of Valchan Voivoda." The game is dedicated to the life, ideals, and work of Bulgarian rebel Valchan Voivoda and their impact on the historical development of Bulgaria in the first half of the 19th century. The 3D maze game contains selected and processed text and multimedia historical content. The content presentation is through interactive boards and didactic mini-games in the maze halls. Mini-games are learning tasks that complement the knowledge of the interactive learning boards and can assess the mastery of players. The evaluation is according to gained points for correct answers and successful completion of mini-games.

The next section of the paper presents a concept of serious games for learning and particularly the rich educational mazes with embedded mini-games. The following two sections describe research methodology and the process of game design. The research ends with a discussion and conclusion where the implemented innovation and future work are outlined.

2. SERIOUS GAMES FOR LEARNING

In contrast with popular video games for fun, the main purpose of serious games differs from pure entertainment¹¹. Serious games have

a high potential for various applications, as they are suitable for different topics and age groups. For the majority of these games, learning is the main goal¹². They are especially appropriate for students from the so-called *digital generation* who can no longer be motivated only by a traditional teaching style. If the context and specific rules of serious games reflect the real-world facts, events, and processes, the obtained knowledge and skills can facilitate learning¹³. Also, entertaining details and interesting visual effects make video games an alternative that copes with the lack of interest in educational content¹⁴. The main stimulating factors in the games are overcoming challenges, reaching the next level, and achieving a high score. In serious educational games cases, these motivation factors support the overall learning process since achieving the game goals requires knowledge acquisition and its utilization in built-in didactic tasks (mini-game)¹⁵. Researchers claim that educational games help increasing motivation and interest in the learning content presented, but the extent to which learning effectiveness is affected varies¹⁶.

Recently, educational mazes were suggested as intriguing and promising video games for learning¹⁷. Traditionally, mazes are widely used in fun games and this makes them very suitable for interactive presentation of content, such as virtual museums and other similar interactive environments. They are applied in various 3D role-playing games focused on a specific scientific or cultural field¹⁸. The connection of the maze may correspond to the structuring of the learning material. The player can explore the educational content in the maze, choosing how to move in it and solving the learning tasks presented in the halls of the maze. In such a way, maze games can be combined with other built-in mini-games (e.g.

¹ Abt 1987.

² Prensky 2002; Kirriemuir, McFarlane 2004; Ritterfeld, Weber 2006.

³ Bontchev 2015.

⁴ Gee 2003.

⁵ Salen, Zimmerman 2004.

⁶ Michael, Chen 2006.

⁷ Terzieva, Paunova-Hubenova, Bontchev 2018.

⁸ <http://www.apogee.online/>

⁹ Bontchev, Vassileva, Dankov: 2019.

¹⁰ The research leading to these results has received funding from the BG05M2OP001-1.001-0001 project "Creation and development of "Heritage BG" Centre of Excellence", Operational Program "Science and Education for Smart Growth" 2014 – 2020, <https://www.nasledstvo.bg/>

¹¹ Abt 1987.

¹² Michael, Chen 2006.

¹³ Gee 2009.

¹⁴ Deterding, Khaled, Dixon, Nacke 2011.

¹⁵ Michael, Chen 2006.

¹⁶ Girard, Écalle, Magnan 2013.

¹⁷ Bontchev 2018.

¹⁸ Bontchev 2015.

puzzles, memory games, etc.) with complementary learning content placed in specific places, making them suitable for learning for any subject. On the other hand, mazes are suitable for personalization and adaptation – when moving from hall to hall; the player must solve additional learning tasks corresponding to his/her knowledge and outcomes. Finally, they may include intelligent computer players to assist the learner in solving didactic tasks.

There are identified four main types of mini-games embedded into maze halls¹⁹:

1. Question Answer Games:
 - Question to unlock the door to access another room
 - Quiz
2. Search games:
 - Find hidden or translucent objects
 - Memory development game (search for pairs of cards by images, texts, or other attributes)
 - Find words in a letter table
3. Arranging games:
 - Classification of objects by categories
 - Arrange objects by attribute
 - Arrange a two-dimensional puzzle with an image
4. Dynamic action games:
 - Rolling balls to map positions or objects
 - Shooting at moving inanimate objects

3. RESEARCH METHODOLOGY

The research question of this study is *how non-professional game designers can create educational video game applying a software platform for an automatic game generation*. The work methodology reflects practical problems in the process of creating an online educational video game. It includes all phases – from the initial planning

to the publication of the game. In addition, this involves a practical experiment with the game to evaluate its characteristics among target users – students and others interested in the topic. The methodology includes three main stages of the process of creating video games of the enriched educational maze type (Fig. 1).

Stage 1: Creating game scenarios and a model of an educational 3D video game with historical content dedicated to the life and work of Valchan Voivoda:

- Collection, selection, and processing of textual and multimedia historical content that is appropriate for integration into an educational 3D video game;
- Creation of game scenarios for an educational 3D video game that utilizes the collected content;
- Modeling of different types of mini-games (puzzles and quizzes) corresponding to the game scenario of educational 3D video game

Stage 2: Design, programming, and testing of the initial version of an educational 3D video game-maze with built-in mini-games in the maze halls, by applying the APOGEE game platform and the Unity 3D Editor²⁰:

- Choosing platform for game development – requirements for free, user friendly and extensibility
- Designing the gameplay process in the maze halls and the audiovisual layout of each hall of the maze and the built-in mini-games;
- Creating an XML description of the enriched maze (including different types of mini-games) and generating the maze in the Unity 3D editor;
- Testing and generation of desktop and online versions of the game.

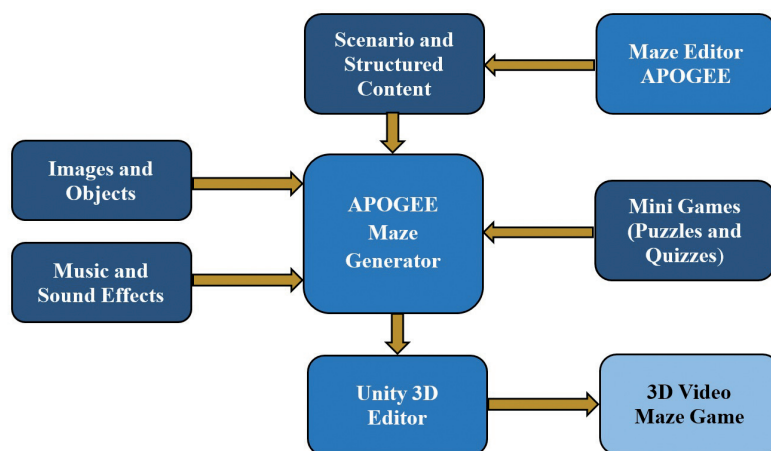


Figure 1. The process of creation of educational maze games

¹⁹ Paunova-Hubenova 2019.

²⁰ Bontchev, Vassileva, Dankov 2019.

Stage 3: Practical experiment with the final version of an educational 3D video game-maze (with mini-puzzle games built into the maze halls) and analysis and dissemination of the results:

- Creating a methodology for experimenting with an online video game (including the development of a questionnaire to assess students' attitudes);
- Organizing and conducting the experimental play session and survey with the final version of educational game-maze;
- Analysis of the obtained results.

The process of the creation of video game starts with a systematic study of sources. It involves formulating a specific keyword (Valchan Voivoda) followed by identification, selection, and critical appraisal of available sources, mainly on the Internet. After that, all resources found were reviewed and prioritized by authenticity, coverage, and accessibility. Thus, finally, the selected thematic resources were classified into four main groups: videos, clips and images (13), songs (9), myths and legends (7), and text sources (21). The latter are of three types: documentary (2), newspaper articles (12), and fiction (9). By using these resources, aesthetic and textual presentations were made in the halls and mini-games of the educational game for video maze for Valchan Voivoda.

4. GAME DESIGN

The educational maze game “Valchan Voivoda” is generated by the prototype of the software platform APOGEE. It was made using a manually created text document template, which recorded the information about the boards, the mini-games in each hall, and the questions about opening the door to enter in other halls. This game aims to promote the life and work of Valchan

Voivoda, so the facts and events related to it are presented through information boards, didactic mini-games, and visual objects. Thus, during the gameplay, the player gets acquainted with real personalities – heroes from Bulgarian history. The maze consists of eight halls, where the first – introductory presents the game rules and the maze structure. The other halls are dedicated to getting acquainted with the era of Valchan Voivoda and the chronological stages of his life and heritage that has left and which we can touch today (Fig. 2).

This educational video game features historically accurate information, 2D photorealistic images, and tools designed to encourage learning – quizzes and didactic mini-games. The maze game aims to reach the last hall by going through all ones while solving tasks, finding hidden objects, and answering the questions for opening the doors to the neighboring halls. The game ends when the player solves all mini-games of the maze he has passed through. Each hall of this educational game has several didactic tasks (puzzles) that present or assess knowledge. They are focused on facilitating memorization and supporting the learning process (acquisition of basic knowledge) on the subject. In this way, game activities provide educational content while players have fun. The game rules are as follows:

- The player has to go through all the halls, solving the tasks (mini-games) in each hall to be able to answer the question for unlocking the door.
- An unlocked door is open by clicking on it.
- The discovery of objects hidden in some halls gives additional points.

Figure 3 shows screenshots of the game, which present didactic tasks implemented as mini-games for finding hidden words in a table of letters and rolling balls with instructions to their corresponding rings or positions on the floor map.

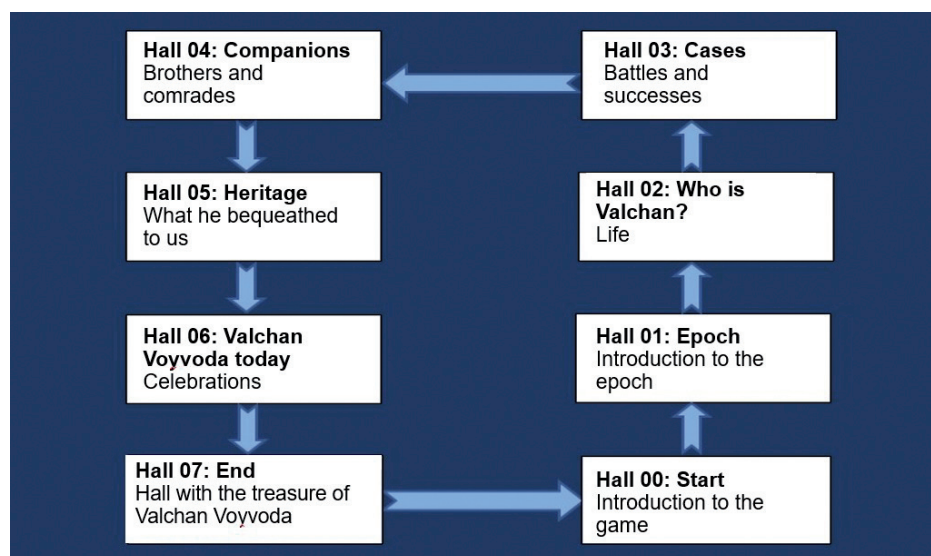
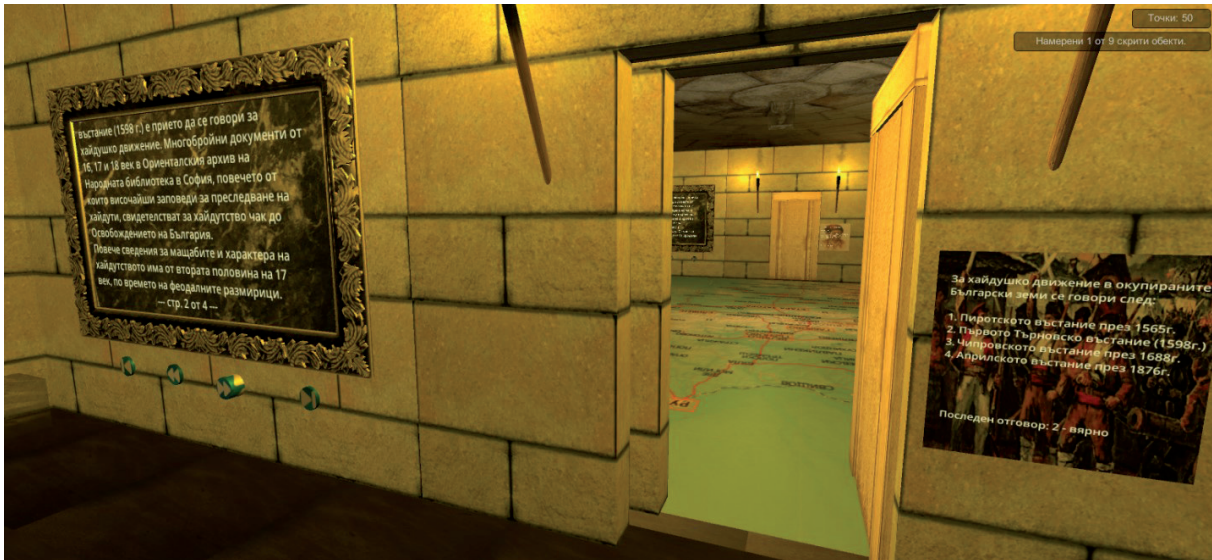


Figure 2. Map of the maze.



(a) A question for unlocking the door to the next room



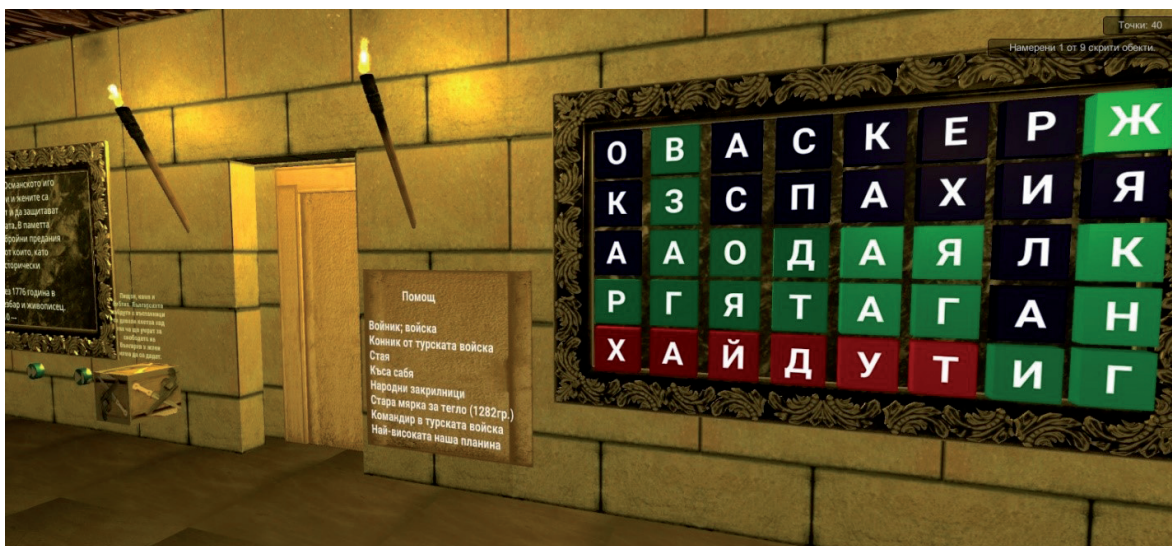
(b) Finding hidden objects in maze halls



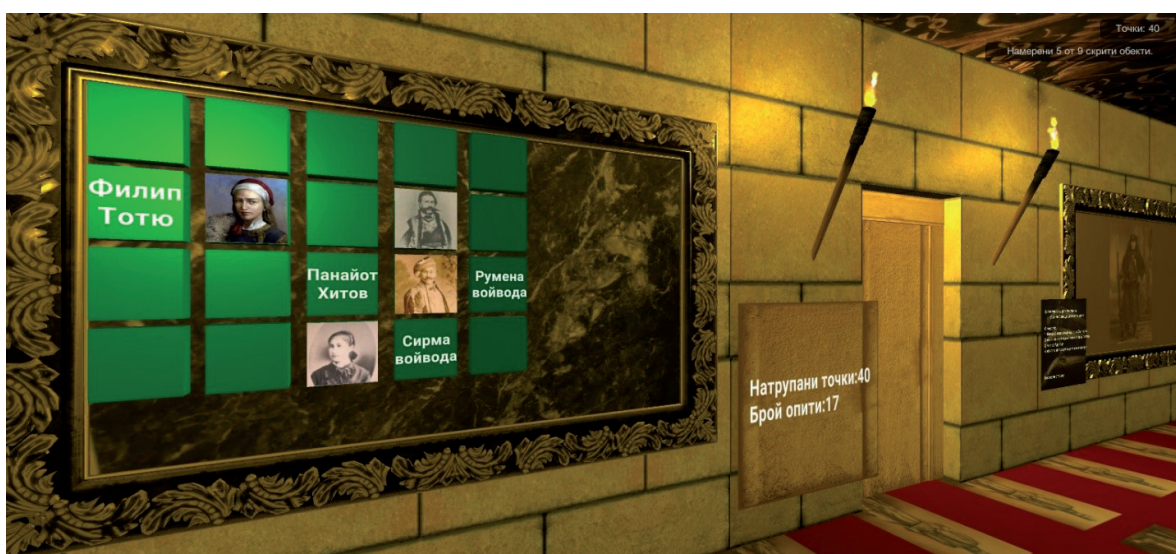
(c) Roll-a-ball to the correct position on the map



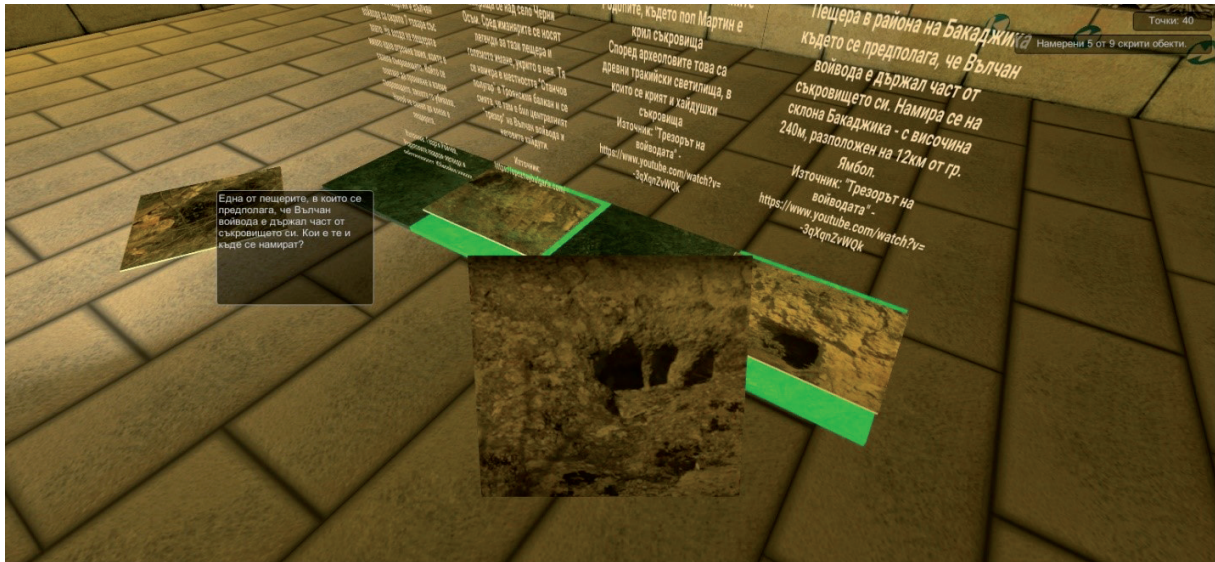
(d) Roll-a-ball to correct ring on the floor



(e) Word soup mini-game



(f) Memory (card matching) mini-game



(g) Ordering mini-game
Figure 3. Screenshots of the gameplay

5. DISCUSSION

Worldwide, there have been suggested various types of serious video games dedicated to the preservation and presentation of both tangible and intangible cultural heritage²¹. Unlike previous approaches, the methodology used for the educational video game about Valchan Voivoda represents several innovative contributions as follows:

1. First, of all, the game was created following an innovative methodology as explained in section 3. Instead of a manual construction of all the game elements, we have automatically generated this educational video game based on a formal XML description of the maze and embedded mini-games. The formal description of the maze games can be created in two ways:

- Manually – based on XML template;
- Automatically – generated in a graphical maze editor, managed by templates (XML schemas).

2. The automatic generation of educational video games like Valchan Voivoda allows easy addition and change of content and new didactic tasks in the form of mini-games, according to pedagogical goals of the educators.

3. The educational maze game provides a possibility to adapt the game difficulty and personalize the content of the game to the characteristics of the learner.

4. Within the educational maze, game designers are enabled to add virtual players to support the learning process of the real player, i.e. by providing some help about solving the mini-games or answering player questions.

6. CONCLUSION

Educational games have significant potential to change the way knowledge is acquired, as it is believed the games are suitable for engaging users of all ages. The difficulty is in creating such a game to achieve the desired learning objectives. The availability of a platform that facilitates this process is a motivation for a wide range of professionals to create games on various topics. The paper presented a brief scientific study aimed to identify the possibilities of the software platform APOGEE to facilitate the creation of an educational game of the enriched maze type. An experimental educational video game dedicated to the work and legacy of Valchan Voivoda was made using the platform and following the described methodology. The results show that the platform built within the APOGEE project can support specialists without programming experience effectively to create a full educational video game. The platform provides user-friendly tools for the development and automated generation of educational video games of type maze enriched with various mini-games.

Further, the research team surveyed students who play the initial version of the educational video game-maze “Valchan Voivoda.” They filled out a questionnaire about the mini-games built into the enriched maze and expressed a positive attitude. Results show that educational mazes with built-in mini-games are suitable for teaching pupils and students. The collected data are a reliable basis for future work on the design, development, and

²¹ Bontchev, 2015.

testing of the final version of an educational maze game, which will be designed for a wider audience of users. The future work includes the creation of new types of mini-games and new rooms dedicated to the legends of Valchan Voivoda. Next is an

integration of intelligent nonplaying characters to support the users by meaningfully answering their questions. Experimental game sessions for the game evaluation are planned when the final version of the game is ready.

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Образователната видеоигра за Вълчан Войвода

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Настоящата статия изследва възможностите на софтуерната платформа APOGEE за автоматизирано създаване на видеоигри за обучение по история. В статията е представена експериментална образователна видеоигра лабиринт, разработената в рамките на проекта „Наследство БГ“. Тя е посветена на делото и наследството на легендарния българин Вълчан Войвода. Методологията на изследването отразява практическите проблеми в процеса на създаване на онлайн образователна видеоигра. Резултатите от изследванията показват, че платформата, изградена в рамките на проекта APOGEE, може да подпомага специалисти без опит в програмирането при проектирането и създаването на образователни видео игри. Платформата предоставя лесни за използване инструменти за разработване и автоматизирано генериране на образователни видеоигри от типа лабиринт, обогатени с различни миниигри.
