Supporting Learning Programming Using Educational Digital Games

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1 INTRODUCTION

- Digital games are often used in education
  - ➢ They can increase students' motivation, enhance acquisition of different skills and provide chance for repeated practice and prompt feedback (Wouters and van Oostendorp, 2016).
- Educational digital games can be used for acquiring programming skills since students learn various programming concepts and constructs (Kazimoglu et al., 2012).
- Games for learning programming encourage good programming practices by facing the player with different challenges or visualize the operation of some algorithms (Giannakoulas and Xinogalos, 2018).

2 DIGITAL GAMES FOR LEARNING PROGRAMMING
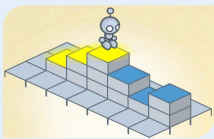
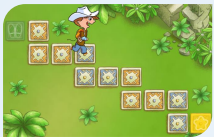**LightBot**
- A robot is guided around 3D maze in order to light up the blue tiles.
- Presented programming concepts: sequence, loops and conditions.

Dragon Dash
- A dragon needs to collect treasure while avoiding treacherous obstacles and foes.
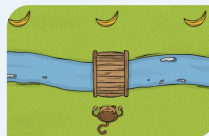- Introduces instruction, sequence, and conditions.

Run Marco!
- Marco or Sophia run through the jungle to collect jewels.
- Concepts that can be learned: sequence, loops, variable and conditionals.

Code Monkey
- Monkey has to collect bananas, and a turtle helps him in solving more complex tasks.
- Introduces : sequences, conditions, events, operators, and functions.

May's Journey
- A girl needs to fix a collapsing world by solving secrets.
- The concepts that are taught: instructions, sequence, loops, variables, conditions, and operators+

CodeCombat
- A hero needs to get jewels and avoid spikes and ogres.
- The concepts that are taught: methods, parameters, object property, arrays, objects, and advanced techniques.

3 DIGITAL EDUCATIONAL GAMES

- Digital educational games (https://degames.uniri.hr/) is a project funded by the University of Rijeka that will explore the possibilities of application of GBL
- The main goal is to increase the motivation for learning programming skills in primary school.
- Contemporary pedagogical-technological framework for learning programming concepts in schools will be developed.
- The Design Based Research approach will be used to evaluate the proposed framework and will be implemented in three iterations:
  1. The game will explain just one programming concept.
  2. The game will be adjusted according to the obtained results and new concepts will be added to the game.
  3. The entire framework will be tested.

4 CODING4GIRLS PROJECT

- Coding4Girls (https://www.coding4girls.eu/) is an Erasmus+ project that aims to promote the development of programming skills among girls through digital games.
- Target groups are students between 10 and 15 years who learn the basics of programming.
- The GBL will be combined with the design thinking approach.
- To attract girls additional game features will be implemented.
  - ➢ Sharing results on social media, including photos from social media in the game environment, etc.
- Design thinking pattern will be integrated into the game.
  - ➢ At the beginning of each chapter, a real-life problem will be presented and students will discuss and share the ideas of possible solutions.
  - ➢ After brainstorming phase, each of the students would start the loop of challenges and Snap! exercises necessary to solve the given problem.

Inventory Management (Variables - Data types, Data structures)
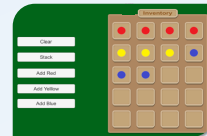
Stepping Game (Sequence of statements)

Slot machine (Operators-Random)

Map of game environment with mini-games

Game environment

5 CONCLUSION

- Playing digital games is the favorite activity for many students, which is why digital games have become popular for educational purposes as well.
- The digital game can offer various possibilities for learning and one of them is to learn programming concepts in primary school.
- Applying digital games in education makes possible to avoid negative stereotypes associated with programming.
- Educational digital games can help overcome the gap between male and female participation in computer science education and careers.

REFERENCES

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Kazimoglu, C. *et al.* (2012) 'A Serious Game for Developing Computational Thinking and Learning Introductory Computer Programming', *Procedia - Social and Behavioral Sciences*, 47, pp. 1991–1999. doi: 10.1016/j.sbspro.2012.06.938.

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