



# 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.

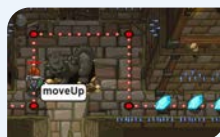


### May's Journey

- 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.



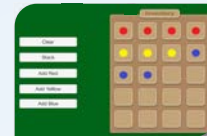
## 3 DIGITAL EDUCATIONAL GAMES

- 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:
  - The game will explain just one programming concept.
  - The game will be adjusted according to the obtained results and new concepts will be added to the game.
  - 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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