https://doi.org/10.53656/math2021-5-6-som



# SOME METHODOLOGICAL GUIDELINES ON THE CREATION OF EDUCATIONAL GAMES ON "COMPUTER MODELING"

**Dr. Krasimir Harizanov, Assoc. Prof.**
*Konstantin Preslavsky University of Shumen (Bulgaria)*

**Abstract**. In the present study some ideas related to the development of educational games in the classes of "Computer Modeling" are presented. Attention is paid to some features in the creation of this type of games when using the block environment Scratch. An exemplary realization of an educational game based on the educational content of "Computer Modeling" is considered.

*Keywords*: computer modeling; game-based learning; scratch; e-learning; interactive education

## Introduction

With the introduction of the new curricula in "Computer Modeling" for 3rd and 4th grade, a number of challenges arose for the modern teacher. Some of them were related to building computer skills, and others to specialized practical training aimed at teaching this discipline. This led to the publication of a number of articles, textbooks and manuals in which the authors share their good practices and methodological guidelines related to the specifics of the new subject.

Some of the main goals set in the Computer Modeling curricula are related to the ability of students to use a "software environment through which they create tests, puzzles, games and control robotic devices" (Computer Modeling Curriculum 2017). In the section "Creating educational games" in 4th grade, students must create their own educational games with the help of a specific visual environment for block programming. Combined with interdisciplinary connections, these games "in a fun way, can create an environment for mastering, consolidating and testing knowledge in different subject areas and age groups" (Kaseva, Tuparova, Tuparov 2020).

## Educational games in computer modeling training

The purpose of creating an educational game in the computer modeling classes is for the student to apply all the acquired knowledge so far related to the block en-

vironment and to unite them in a common independent project. Preliminary preparation for composing this "type of task requires it to have content that is related first to the didactic goals and objectives, and then to the plot that is reproduced in it" (Garov, Todorova 2019). For each game it is necessary to plan resources (characters, sets, sounds), rules, variables and final conditions under which the game ends.

Depending on the time available to the teacher to achieve the expected results on the topic, two approaches are known in practice. The first, when the teacher has more time, then the creation of the game starts from the beginning. And when it is limited by time, then part of the game is pre-created and students work on it.

The topics of the educational games depend on the teacher's judgment, according to the type of lesson and the learning content. They can have both a fun game character and be related to "specific lessons from the study material" (Spirova 2018). When choosing the plot, script and condition of the game, "it is important how exactly it can be used for educational purposes. In order to receive really effective and motivating training, the teacher should have a number of competencies" (Pavlova, Marchev 2021).

**An example of an educational game**

The article discusses an example of the educational game "Underwater Adventures", suitable for classes in "Computer Modeling" for 4th grade. The main character is a diver who must collect at least 50 points to successfully complete the game. But to collect these points, he must beware of the blue fish, which will take him 2 points if he touches it, as well as the dangerous octopus, which, in addition to jumping when touched, will take 1 life. If he collects 50 or more points, the text "Excellent, you succeeded! " is displayed, and if the number of lives becomes 0, the text "End of the game!" is also displayed for 2 seconds. At the start of the game, the player starts with 5 lives and 0 points. In creating this game, the following steps can be followed:

**Preliminary preparation**

In this activity, an analysis must be made of how long it will take the students to complete the task on their own. Due to the specifics of working in a computer room and the different competencies of students, sometimes it is necessary to provide in advance part of the solution of a problem. Here, the sprite octopus character code can be created in advance (Fig.1) to be demonstrated and explained during the lesson to provide time for the main objectives provided for the lesson.

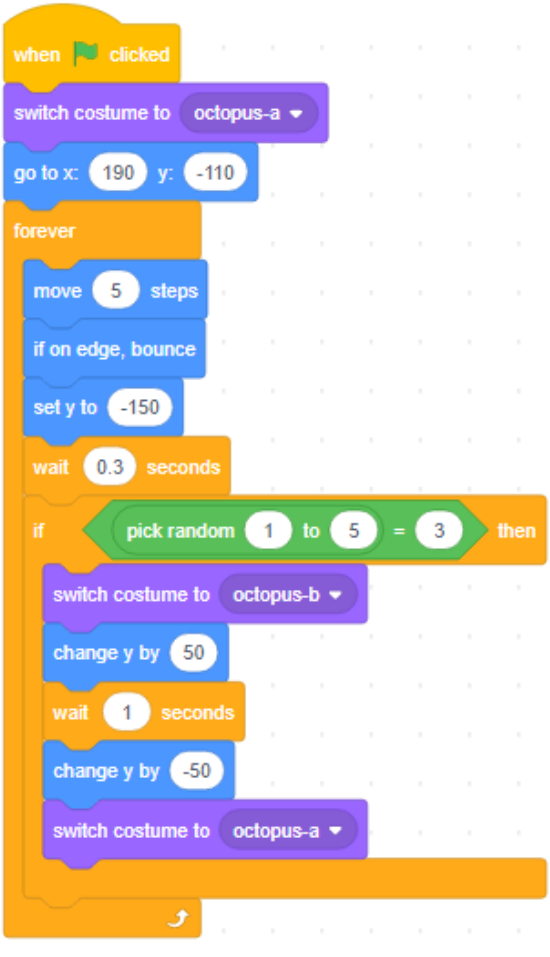


**Figure 1.** Realization of the sprite Octopus code

**Step 1**

Set a suitable background for the plot of the game and choose characters with their costumes. In this case, the background "Underwater2" was chosen from the background library, and the sprites "Diver2" and "Fish" with size 60, as the main characters in the game.

**Step 2**

Coding the main actions of the characters. In this game, the coding can begin with the movement of the three fish on the stage. Because their movements are

uniform, they can be copied and easily distributed. Their movements are related to passing through the stage in 10 steps, and when they touch the edge, turn in the opposite direction (Fig. 2). At this stage, the coding of the sprite "diver" can be realized at the level of movement on the stage, using the check of the block "key… pressed?" (Fig. 3). For the respective direction. All characters must have the property of the Direction of movement Left / Right to turn in the opposite direction and move again.

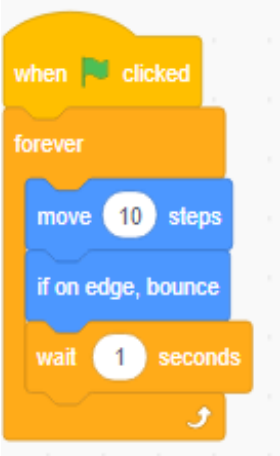


**Figure 2.** Code of the sprite Fish


**Figure 3.** Code of the sprite Diver

**Step 3**

Determining the number and names of variables. In this task, the variables will be two, with the variable "points" storing the result accumulated so far, and the variable "lives", the remaining lives of the character until the end of the game.

**Step 4**

Defining the rules for changing the values of the variables "points" and "lives". As mentioned earlier, all the movements of the characters except the diver character are linear and cyclical. Therefore, the change in the values of the variables will be determined by the movements of the character sprite "diver". This conversion was achieved by checking the "Does it touch…?" Block. When the sprite "diver" character touches one of the moving fish, a message is sent to the respective character via the "broadcast message…" block. The content of the messages is identical, including updating the points, the temporarily touched fish to hide and appear in any position (Fig. 4).

If the sprite "diver" character touches the sprite "octopus" character, then the number of lives in the variable must be reduced by 1, and wait 0.5 seconds. This wait is added to allow time for the octopus character to move without taking more of the diver's life (Fig.5).

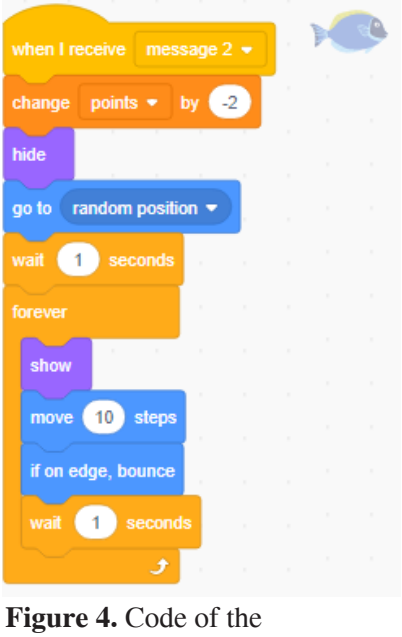


**Figure 4.** Code of the sprite blue fish

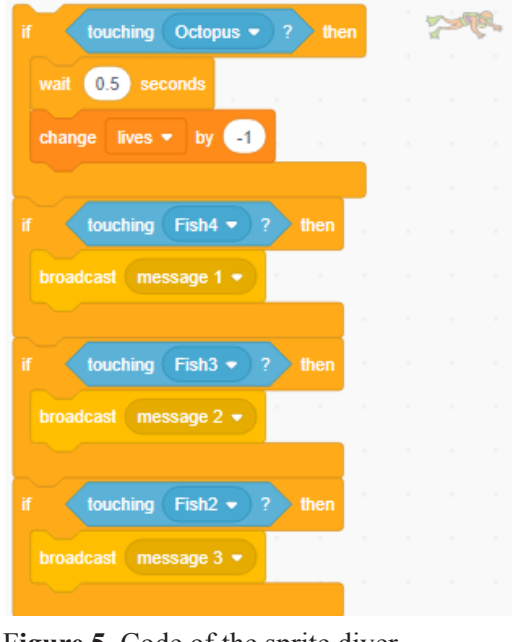


**Figure 5.** Code of the sprite diver

**Step 5**

Defining the checks that end the game. In this game, two options are planned for its end. One is to check if the number of points has become more than 50, and the second is to check if the number of lives has become equal to 0. For each of the cases, as stated in the game condition, a text is displayed for 2 seconds with the corresponding text, and the use of the "stop all" block terminates the actions of all characters in the game (Fig.6).

**Conclusion**

The article discusses some guidelines to address the creation of educational games in the classes of "Computer Modeling". An example of how knowledge from other subjects can be adapted in the discipline is considered, an important aspect of modern education. Game tasks in training can be presented and improved, some basic skills for working with the Scratch environment, created for different types of tasks. Educational games can be a good prerequisite for students to develop their logical and critical thinking and have a better preparation in the next level of education or to include them in competitions and Olympiads.

**Acknowledgments.**

This article was supported in part by a project РД-08-111/02.02.2021г. – "Innovative technologies in learning mathematics and information technology" from the Research Fund of the University of Shumen Bishop Konstantin Preslavsky for 2021.

**ЛИТЕРАТУРА**

Гъров, К., Тодорова Н., „Образователни игри и приложението им в обучението по „компютърно моделиране", научна конференция *„Иновационни ИКТ за дигитално научноизследователско пространство по математика, информатика и педагогика на обучението"*, 7 – 8 ноември 2019 г., Пампорово, България, 77 – 92.

Касева, М., Тупарова, Д., Тупаров, Г., „Един сценарий за образователна компютърна игра по математика за I клас", юбилейна международна научна конференция *„Синергетика и рефлексия в обучението по математика",* 16 – 18 октомври 2020 г., Пампорово, България, 265 – 270.

Спирова, М. „Мястото на игрово-базираното обучение в училище", *XI национална конференция „Образованието и изследванията в информационното общество" 2018*, 41 – 46.

Учебна програма за IV клас по компютърно моделиране, https://mon.bg/upload/13767/UP9_KM_ZP_4kl.pdf, последно достъпен на 20.07.2021.

**REFERENCES**

Garov, K., Todorova N., 2019. Obrazovatelni igri i prilozhenieto im v obuchenieto po kompyutarno modelirane. *Nauchna konferentsiya „Inovatsionni IKT za digitalno nauchnoizsledovatelsko prostranstvo po matematika, informatika i pedagogika na obuchenieto“* [7 – 8 noemvri 2019 g., Pamporovo, Bulgaria], 77 – 92.

Kaseva, M., Tuparova, D., Tuparov, G., 2020. Edin stsenariy za obrazovatelna kompyutarna igra po matematika za 1. klas, *Yubileyna mezhdunarodna nauchna konferentsiya „Sinergetika i refleksiya v obuchenieto po matematika“* [16 – 18 oktomvri 2020 g., Pamporovo, Bulgaria], 265 – 270.

Spirova, M., 2018. Myastoto na igrovo-baziranoto obuchenie v uchilishte. *XI natsionalna konferentsiya „Obrazovanieto i izsledvaniyata v informatsionnoto obshtestvo”*, 41 – 46.

Uchebna programa za 4 klas po kompyutarno modelirane, https://mon.bg/upload/13767/UP9_KM_ZP_4kl.pdf, [viewed 20.07.2021].

Pavlova, N., Marchev, D., 2021. Games in mathematics and science education. *Knowledge*, **46(**2 Education), 317-322. ISSN 2545-4439/1857-923x

✉ **Dr. Krasimir Harizanov, Assoc. Prof.**
ORCID ID: 0000-0002-5783-8328
Konstantin Preslavsky University
Shumen, Bulgaria
E-mail: kr.harizanov@shu.bg