Teaching programming concepts through gamification using the Sphero Bolt

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Abstract
Learning programming is becoming increasingly important in schools, especially due to the steady advance of digitalization. However, teachers often lack motivating and interesting learning material. For students, learning to program is often associated with learning complicated syntax and getting a simple text output. But programming could be pretty fun and motivating, straight from the beginning. In this workshop we present an approach to teaching and learning programming in an interactive, motivating and playful way. Our approach is based on our experience in teaching programming skills to children of all ages at the Informatics Lab at the University of Klagenfurt.

Keywords
programming concepts, gamification, block-based programming, Sphero Bolt, Informatics Lab.

1. Introduction and Motivation

Teaching programming, or at least teaching the core concepts of programming, is anchored in the curriculum of the subject basic digital education in Austria[1], which is designed for students between 10 and 14. Especially in this age group, it is pretty hard to motivate the students to learn programming. For students, learning to program is often associated with learning complicated syntax and getting a simple text output. But programming could be pretty fun and motivating, straight from the beginning. The motivation could be achieved by using interesting equipment and motivating tasks. In our Informatics Lab at the University of Klagenfurt, we are teaching informatics and its key concepts to children. There we learned that it is not enough to teach things like programming correctly. It should also be motivating. And for children it is the most motivating if the first steps are easy to understand and they are getting results as soon as possible. The goal of our workshop is to support the learning and understanding of programming concepts like branches, variables, loops and functions through gamification, using the sphero bolt and its block-based programming environment.

2. Learning programming concepts using the Sphero Bolt

Teaching Programming is a pretty complex matter, especially if you are using a text-based programming language. The students are focussing on syntax problems and the results are not really exciting at the beginning. In our Informatics Lab we are following a different approach on teaching programming, we use block-based programming at the beginnig. If you use languages like scratch, the novices could focus on the key concepts of programming, like branches, variables or loops and don't need to consider the syntax. These languages are also designed for quick results, so a program of three or four blocks could already have a visible result. The second part is the gamification. Gamification in programming courses has been recognized as a prospective technique that could improve student participation as well as impact learning in a positive way[2]. We use it in a way, so the result of the programming task is a playable game. Some of these could be programmed with a few lines of code and the students are highly motivated at the end for two reasons. First they can play a game they programmed on their own and second, they want to learn more techniques for writing new games. We found the Sphero Bolt[3] pretty useful for teaching programming concepts. Its environment is using block-based programming with optional switch to JavaScript and there are many possibilities developing motivating mini games.

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