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The Ozobot and education of programming

Rostislav Fojtik^a *, University of Ostrava, 30. Dubna 22, Ostrava, 70100, Czech Republic

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Abstract

This paper aims to show the possibilities of teaching programming using the Ozobot. The survey shows that teachers skip teaching programming. Teachers often consider teaching programming unnecessary and schools would not be them into thematic plans ever marshaled. This situation is often attributed to the fact that many teachers do not know the appropriate procedures and methodology for teaching the basics of programming and algorithms. Teachers at some schools have already started to use appropriate applications such as Scratch, Logo, code.org and others. For teaching, it is advisable to use only software tools but also the hardware. We used a case study and we verified the teaching of programming a robot Ozobot. It turns out that Ozobot is not only suitable for small children, but also for older pupils.

Keywords: Case study; mobile technologies; programming; a questionnaire; an observation; the virtual world

* ADDRESS FOR CORRESPONDENCE: Rostislav Fojtik, University of Ostrava, 30. Dubna 22, Ostrava, 70100, Czech Republic
E-mail address: rostislav.fojtik@osu.cz / Tel.: +420 603 167 678

1. Introduction

Teaching programming for elementary and high schools in the Czech Republic is often ignored. In subjects on the teaching of science usually prefers user access and control the teaching of specific programs. In many schools still appears to devote more effort in programming. This effort has the support of the Ministry of Education, Youth and Sports expressed in the Strategy for Digital Education in 2020 (<http://www.msmt.cz>). More extensive teaching program in primary schools often prevents the teachers themselves. One reason is that many programming deemed complex and alone with him during his studies had problems. The second reason is that teachers feel that they conducted training program should use the same tools and methods with which themselves met during their studies. An important task for the development of teaching programming in elementary and secondary schools, teachers demonstrate new approaches to programming, and especially to acquaint teachers with modern methodology and tools.

2. Teaching programming in elementary schools

We conducted a survey among teachers who have studied the first year of the extension studies Elementary and Secondary Schools. Using some teachers were asked about their attitude to teaching programming.

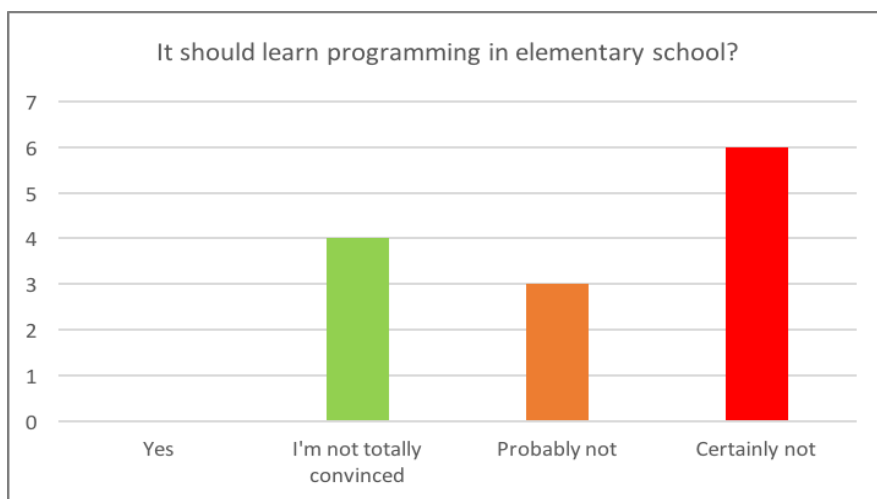


Fig. 1. It should learn programming in elementary school?

Most of the 13 respondents are rather against the teaching of programming in elementary school. All respondents completed one semester of programming. Specifically, the subject Basics of programming in which the use of the Java language. Given that only 31% of respondents have original credentials courses in engineering or science, it is understandable that respondents often regarded as complex programming. Respondents have not passed the subject didactics of informatics and many have the notion that programming can be taught just like in college with classical programming and scripting languages.

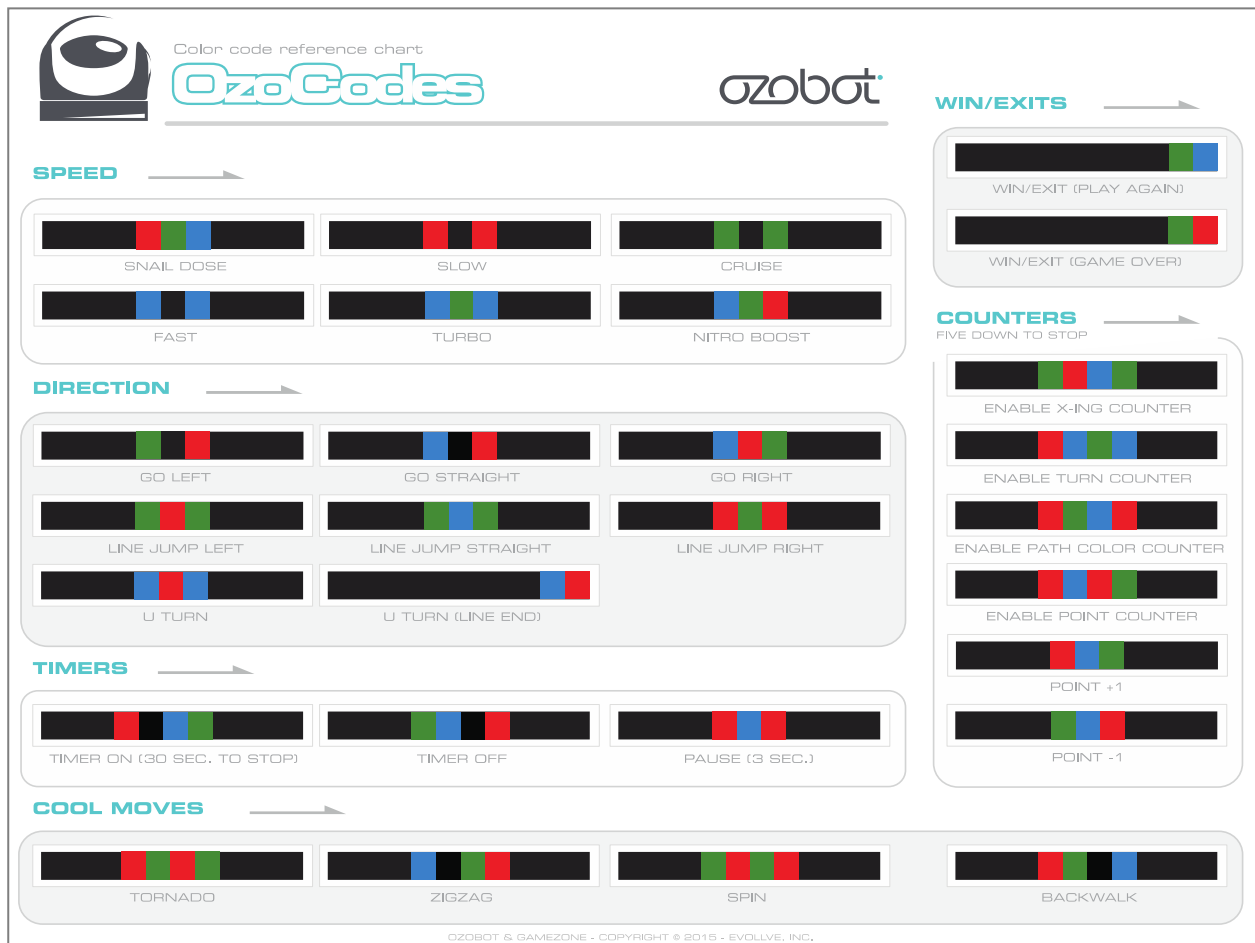
Asked whether the programming should be taught at a grammar school rather against only 23% of respondents, 46% of respondents said yes and 38% of respondents are more for. 77% of the respondents knows no appropriate tools for teaching programming in elementary schools. The survey results, it is very important to familiarize teachers with the appropriate tools and methods of teaching programming.

3. Robots in teaching programming

Currently, teachers have not only available software tools such as Robot Karel, Logo, Scratch, Baltie or code.org, but they can also use hardware devices, such as robotic kits, drones and robots learning. In a world in teaching successfully used aids such as Lego robots, sphere, or Ollie Ozobotn ([https:// co leengraves.org/2015/11/19/the-great-robot-showdown-ollie-vs-sphero-vs-dash/](https://co.leengraves.org/2015/11/19/the-great-robot-showdown-ollie-vs-sphero-vs-dash/);Garcia-Penalo, Rees, Hughes, Jormanainen, Toivonen & Vermeersch, 2016).

3.1. Robot Ozobot

One of the ways to approach teaching children the basics of algorithms and programming a robot Ozobot (<http://ozobot.com>). It is a small interactive toy that by their sensors recognize the different colored lines. Ozobot is a small robot weighing 17 g, but the robot offers users many options. The first is the use of commands that are a combination of lines of color (color code language) (Hanson, Baldauf & Hassell, 2009; <http://rcetatt.blogspot.cz/2016/07/campers-explore-programming-apps-with.html>). It uses the color black, green, red and blue. Just paper and alcohol markers and kids can create lines along which the robot runs. Another way to control a robot is to use the website <http://ozoblockly.com/>. The site offers editor commands, which is a bit like Scratch tools, for example. Commands are divided into five groups according to their difficulty. Users can easily compile your program monitor and record using light sensors directly into the robot



(<http://www.techlearning.com/blogentry/10525>).

Fig. 2. Commands for the robot Ozobot (<http://portal.ozobot.com>)

While watching the children in the classroom were identified following benefits applications Ozobot:

- No occasional recognition problems created using color markers,
- prepared lines and robot commands are always correctly identified,
- it is not necessary to print tasks,
- errors in the drawings can be repaired.

Disadvantages applications Ozobot:

- The need for every student to own a tablet with a sufficiently large display,
- pupils neprocvičují motor skills as well as working with felt pens,
- tasks may be due to screen size contain only a limited number and dimension lines.

The second mobile application control program is Ozobota OzoGroove. This is an app that will teach robot "dance". User added to the timeline commands to the robot and together with the soundtrack robot created program after reading dancing - moves according to preset parameters and color flashes. The advantage of the application is a fun form of work with a robot that children very much and may also serve in the introduction to teaching as a motivational tool. Applications can be used successfully only on larger tablets, but also on smart mobile phones.

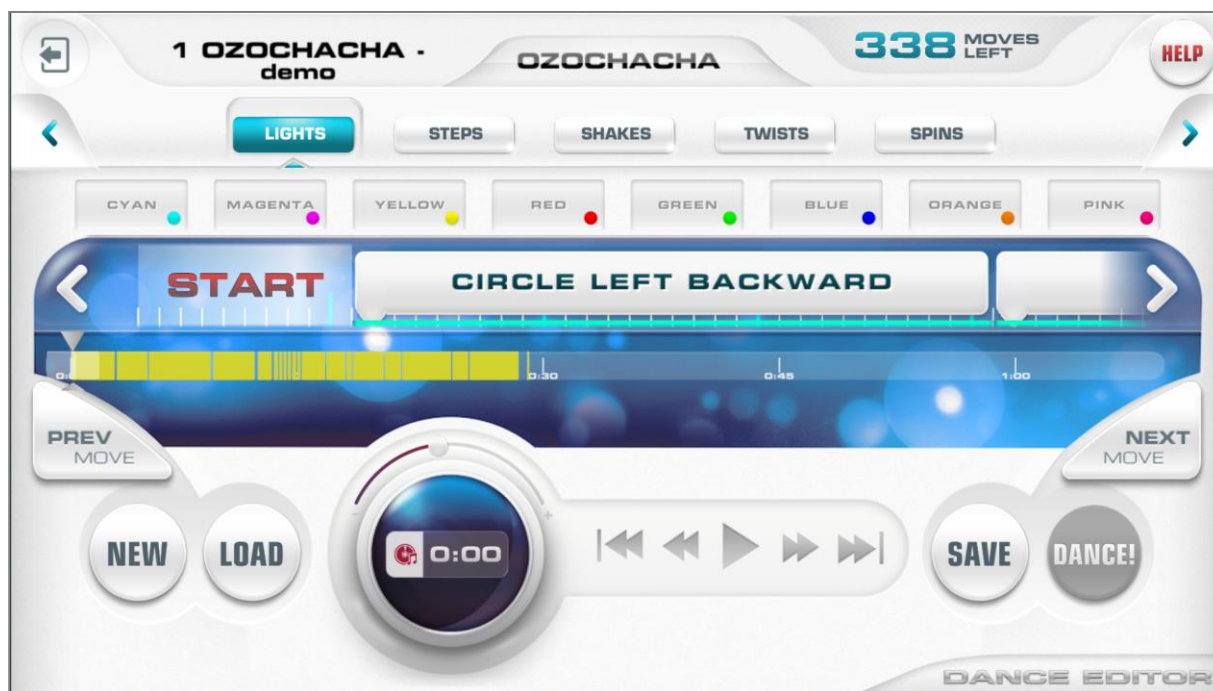


Fig. 4. The application OzoGroove for iPhone

Both applications are free for tablets with OS Android or iOS.

4. Teaching with Ozobot

4.1. Monitored groups of pupils

To verify the use of a robot Ozobot opportunities for teaching programming was carried out case study. Four different groups of students learn to work with Ozobotem 2.0 Bit. Children create their codes, such as painting, as well as folding instructions on <http://ozoblockly.com>.

First group was a group of six students 8-10 years old. Two of them were girls and four boys. There were four meetings of 1.5 to 2 hours. Three meetings were devoted to drawing commands, the fourth meeting of students assembled simple programs on the website <http://ozoblockly.com>.

The second group consisted of seven pupils aged 11 to 13 years old. It was three girls and four boys. Teaching programming were devoted four lessons after 1.5 to 2 hours. The first two meetings for children to learn to control Ozobota using cartoon commands. The next two lessons, pupils create programs using the website <http://ozoblockly.com>.

The third group were college students teaching science. As in previous years, were students at the beginning of the course Teaching Science asked whether he thinks that the pupils at the primary school should teach programming. All six students consistently argued that teaching programming to elementary school does not belong. Programming would be admitted only after-school clubs. Students often admit that they have had difficulties in completing the courses focused on programming and would therefore prefer in their future teaching career teaching programming to avoid. They changed their attitude to teaching programming only after becoming familiar with the tools Karel, Logo and Scratch. Students most enjoyed working with the robot Ozobot.

The fourth overall population was a group of twelve boys aged 11 to 17 years. In this group, none of the boys in his spare time, cared about programming and robotics. The boys tried to control a robot by drawing colored lines and subsequently suggested solutions pre-assignments.

4.2. Results

Objective of case study was to determine how the kids to teach programming using Ozobota react and what will their passion in creating programs. While watching the students, we are also focused on how long it will take to master and control the robot programming.

Ozobot offers less opportunities than the Lego robots. Lego robots can conduct a variety of operations and can be modularly assembled. Ozobot can move only according to the prescribed program, and the light in the range of predefined colors. How did during lessons turned out, this limitation may be on the other side an advantage. For some children to work with Lego robots can seem difficult and complicated. Controlling the robot Ozobot all participants understood very quickly. In all experiments, there was no need to elucidate on the control and programming. All participants were able in just a few minutes to work independently.

The first examples that participants usually suggested solutions, focused on familiarization with the robot and its control. Children drew a line and let the robot to move according to them. Then the children were shown commands using colored lines. Children tried again just how the robot responds to the command. Subsequently, children were presented ready tasks, which were to be added using colored markers appropriate commands. They were used basic examples, which are available at <http://portal.ozobot.com/lessons/type/lesson>. For teachers it is advantageous to use these collections of examples, as they are clearly described methodically and offers tasks properly collated from the most simple to the complex. The aim of the study ingested tasks was to add commands to the layout so that the lines Ozobot booby overcame obstacles, chose an appropriate route and the specified starting the finish. The picture number 5 is an example of the assignment, in which the robot must be

out of your house to get to the store. Entering been translated from English into Czech. Older study participants similar examples invent themselves.

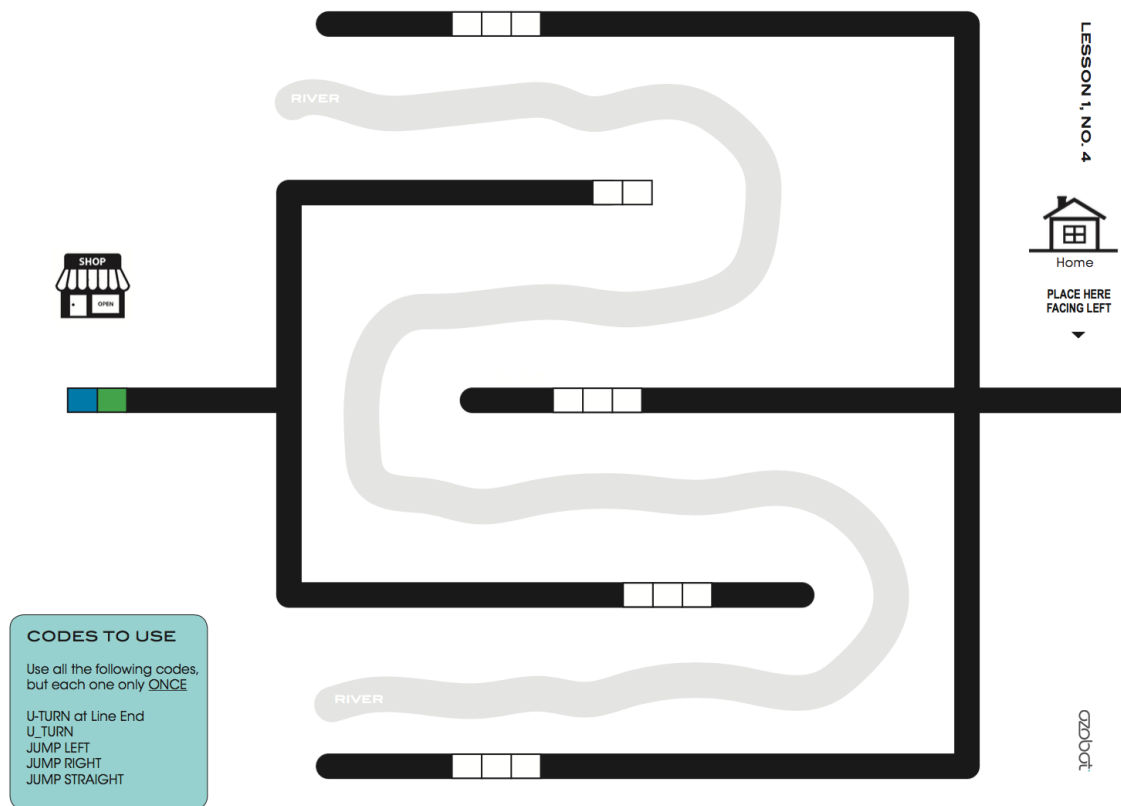


Fig. 5. The example for pupils (<http://portal.ozobot.com>)

All monitored groups began to form commands by drawing lines. For smaller children, this stage contributed not only to a better understanding of the work to the robot, but also resulted in improvement in motor skills of children. It turned out that many children have problems with drawing lines. Among the most common mistakes when drawing the children were:

- The lines did not correspond to its width requirements,
- transitions between colors were tightened, the colors were white spots,
- colors overlapped over one another,
- colored lines in commands were too long.

Some children learn to properly draw lines and individual orders up to an hour. The children had difficulty understanding what commands to use, but to draw them so that the robot is recognized. Markers also caused some problems. Ozobot sometimes does not recognize green. The situation improved after a while, when the ink on the paper dried up a bit. The company manufactures Ozoboty recommends their special pens with which the robot have fewer problems with recognizing colors. Line drawing showed most benefit thick markers with a flat ending width of about 4 mm. Markers with a thin rounded tip and are inappropriate. Drawing issues had children when using mobile applications on tablets.

The results demonstrate that application Ozobot tablet is preferable to use the pre-assignments. Children only supplement the required commands. Any errors can be easily repaired, and the robot has no problems with recognizing colors. The individual entries are not needed to print. We

discovered that the award should not be copied. Many copying machines reduce the quality of the black and the robot then he does not recognize. Children had to re-line the font outline black marker. Drawing lines and color commands using markers promotes greater creativity of children. Drawing lines need not be limited to size limitations screen tablet. Children can draw on larger paper sizes, or combine multiple lines on paper. Another advantage is the possibility that all children worked independently. We are not dependent on the number of tablets available. Pens and papers can be provided for all participants. If we have robots less than the children, it does not interfere with work. At first the children draw lines and commands and subsequently tested how the robot will react. Because they work at different speeds, there is no problem with lending a robot.

Start with drawing lines proved suitable even for college students. The goal was for students to know how Ozobots used subsequently in the teaching work. As we expected, the students very quickly processed presented challenges. Students showed their inventiveness when creating tasks with the story. The robot had to drive through designated points and perform tasks.

The second level of work with the robot featured Ozobot create code using the website <http://ozoblockly.com>. Program code is formed similarly as in the case by scratch. Commands are divided into five groups according to their difficulty (<http://techaeris.com/2015/06/25/ozobot-bit-introduces-kids-stem-programming-via-blockly/>; <http://ozoblockly.com>). The first group includes simple motion commands, lighting effects and time intervals. Icons commands only contain graphic symbols and it is suitable for even the youngest children. Other groups include statements with text descriptions. Descriptions and the environment is still only in Polish and English language. While teaching children the English language complained. If students were unable themselves to translate any of the orders, they asked the teacher. Before the work was necessary to set the monitor to a higher brightness and calibrate the robot, otherwise Ozobot not loaded properly crafted program. Children prefer to work with a tablet than a desktop computer. The touch screen of sufficient size (at least 10 ") pupils comfortably accounted programs that make them better accue to the robot. They put the robot on the tablet. When using classical screen whose screen is vertical, the children had sometimes several minutes hold Ozobots monitors. Especially for smaller children it was sometimes a problem. Sometimes children moved much with the robot, and it was necessary to start loading the program again.



Fig. 6. Ozoblockly.com (<http://ozoblockly.com>)

By monitoring teaching in these groups can be stated that all participants work with Ozobotem fun. They demonstrated high motivation and boys from the fourth study group, who are otherwise uninterested programming. The children did not need to force to resolve the problem. On the contrary, they themselves can create your own drawings with the commands themselves and examine what the robot using specific commands. Children develop at creating and solving their imagination and many have indicated that normally is drawing tired. Children draw happy for robot. Ozobot is therefore also a suitable tool for the development of certain motor skills and for teaching programming without children had to sit at the computer.

5. Conclusion

Case study confirmed that Ozobot is one of the possible appropriate tools for teaching the basics of algorithms and programming. Robot brings to the learning process as much needed motivation. Teaching the robot is also sufficiently explanatory and simple at the same time. All participants were case studies in a very short time be able to understand commands create color and work independently. The advantage was also the possibility of teaching programming without the need to use a computer. In the first stage of education requires only Ozobot, paper and markers. On the other hand, can be used in addition to desktop computers and modern mobile devices such as smartphones and tablets.

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