



## **Micro: Bit as a Tool for Improvement of Education**

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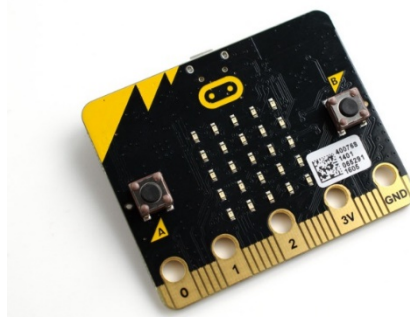
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**Abstract:** Technical education and Computer science education is easier to understand and more meaningful to learn using new teaching materials. This paper describes the use of miniature Micro: bit computers, developed by the British company BBC, in cooperation with several technology companies, with a purpose to increase the number of technologically educated people. Paper presents possible use of Micro: bit in teaching technical and informatics education and its impact on the development of digital competence. Micro: bit is already used in schools in the UK and part of teachers in Serbia had the opportunity to get acquainted with characteristics of this device. It is shown how students can try out the programming in the Microsoft Block Editor. Another benefit of this mini-computer is getting to know the basics of robotics. The curriculum in primary education enables the use of such tools in teaching process. Use of this tool and others, similar to it, in work with students, creates the atmosphere in school that is oriented towards new technologies. The simplicity of this mini-computer allows the student to become familiar with different professional challenges that can help them with choosing a future profession.

**Keywords:** BBC Micro: Bit, Teaching tool, New technologies, Primary education, Technical and informatics education

### **1. Introduction**

Modern society expects from education to prepare future citizens of the world for the technology that will be used in the future. Also, no one can predict which way technology will develop and prosper over the next 10, let alone 50 years. In the mid-seventies of the last century, the average person could not have guessed that the technology will be publicly and widely available, that in many areas man will be replaced by computers or robots, that many professions will almost disappear and a new one will appear, that will make some individuals very rich in a very short period. The auto industry has invested a lot of money so that innovative technologies improve various aspects of this area □ .



**Figure 1:** Image BBC micro: bit

The innovation of teaching materials enables students to use modern technology, which will help them to make themselves familiar with new developments that are rapidly alternating. The company BBC in collaboration with several

companies engaged in technology, has developed a small device called the BBC Micro: bit. Figure 1 shows the image of this device. Over a million students in the UK use this device, and its use in schools become part of the curriculum.

Education today should prepare students for life in a world with everlasting change.

Learning about the information technology enables students to:

- knows how that to search, assess the relevance and reliability analyses systematise information in electronic form using the appropriate ICT resources (equipment, software products and e-services),
- know how to express themselves in electronic form using appropriate ICT resources, including multimedia expression and expression with elements of formally defined notation used for the characteristic means of ICT (E.g., address, requests, commands, of the formula, and the like procedures. Expressed in appropriate notation),
- know how to play, organise and formats information using ICT and opportunities to use ICT resources in an efficient manner,
- knows how to choose appropriate ICT resources, when solving problems, as well as to adapt the way of problem-solving capabilities of these ICT assets,
- use ICT for communication and cooperation efficiently,
- recognizes the risks and dangers in the use of ICT and about responsible treat.

Table 1 shows **Error! Reference source not found.** a part of the Scottish curriculum related to Computing science contexts for developing technological skills and knowledge.

**Table 1:** Computing science learning outcomes in the Curriculum for Excellence Technologies: experiences and outcomes **Error! Reference source not found.**

Understanding and analysing computing technology <b>Error! Reference source not found.</b>	<b>Early</b>	I understand that sequences of instructions, to control computing technology, are used. I can experiment with and identify uses of a range of computing technology in the world around me.
	<b>First</b>	I understand the instructions of a visual programming language and can predict the outcome of a program written using the language. I understand how computers process information.
	<b>Second</b>	I can explain core programming language concepts in appropriate technical language. I understand how information is stored and how key components of computing technology connect and interact through networks.
	<b>Third</b>	I understand language constructs for representing structured information. I can describe the structure and operation of computing systems which have multiple software and hardware levels that interact with each other.
	<b>Fourth</b>	I understand constructs and data structures in a textual programming language. I can explain the overall operation and architecture of a digitally created solution. I understand the relationship between high-level language and the operation of the computer.

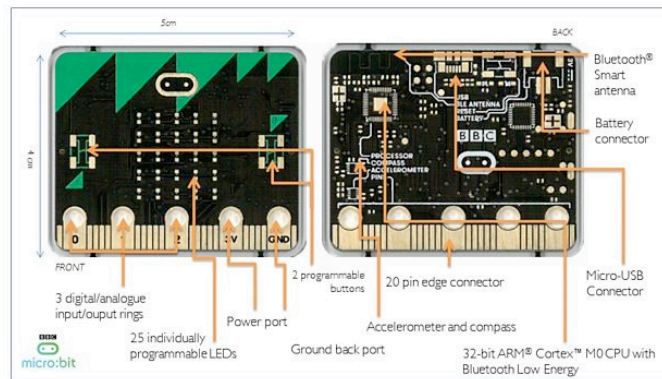
This device is designed to help students aged 8 to 13 years to become familiar with algorithmic thinking, science, especially with coding, programming, game development and robotics. Such devices, where the students have the opportunity to create their specific content, stimulate creativity and develop the entrepreneurial spirit. One of the most important roles of the BBC micro: bit is to introduce students to the way games are developed. So we have a chance to show students that creating a game is not just entertainment, but the commitment and creativity.

## 2. Basic Features of Device

BBC micro: bit is a small device that can be placed in a pocket, cost of its production is low, and because of the size of the device, its transport is easy, and it is accessible to a large number of students. Most important characteristics of the Micro: bit □ device are:

- 25 red LEDs to light up, flash messages, create games and invent digital stories.
- Two programmable buttons activated when pressed, so it can be used as a game controller, or pause/skip songs on a playlist.
- On-board motion detector or “accelerometer” that can detect movement and tell other devices that you are on the go. Featured actions include shake, “tilt” and freefall. Turn the micro: bit into a spirit level. Light it up when something is moving. Use it for motion-activated games.

- A built-in compass or “magnetometer” to detect in which direction you are turned, to detect your movement in degrees, and where you are. It includes an in-built magnet, and it can detect certain types of metal.
- Bluetooth Smart Technology to connect to the internet and interact with the world around you. Connect the micro: bit device to other micro: bit devices, other devices, kits, phones, tablets, cameras and everyday objects all around. Share creations or join forces to create multi-micro: bit masterpieces. Take a selfie. Pause a DVD or control your playlist.
- Five Input and Output (I/O) rings to connect the micro: bit to devices or sensors using crocodile clips or 4mm banana plugs. Use the micro: bit to send commands to and from the rings, to power devices like robots and motors.

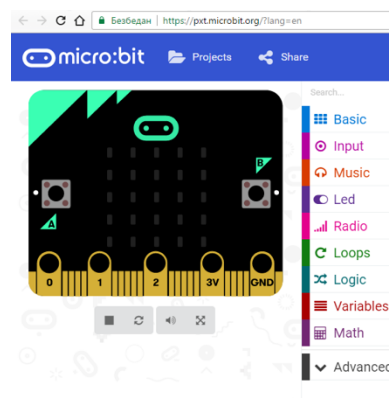


**Figure 2:** The BBC micro: bit front and back □

### 3. Options for Programming

Using micro: bit in the classroom can contribute to development of the following ICT topics: creating simulations of physical systems; make algorithms that respond to different inputs and give different outputs; solving the same problem using various tools and coding languages; storing and manipulating data; introduce to students Boolean logic and operators; connecting multiple computer systems together and using technology in art. Students can use this device in a very simple way with good guidance by the teacher. Microsoft developed web application and hosting service, all micro: bits share a one website and users can choose which code they will be use. Programming is allowed in:

1. JavaScript editor makes it easy to program micro: bit in Blocks and JavaScript, along with great new features like peer-to-peer radio. (Fig. 3.)



**Figure 3:** Show JavaScript editor

2. Python editor (Fig. 4.) is perfect for those students who want to move their coding skills further. A selection of snippets and a range of premade images and music helps student while coding.

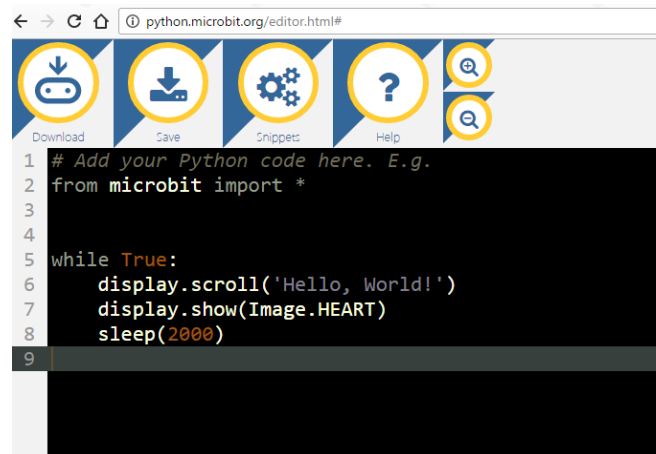


Figure 4: Show Python editor

Before a student compiles micro: bit script he can run it using the micro: bit simulator, after successful simulation transfers code on a device and starts using it.

## 4. Application in Computer Science Education in Primary Schools

The overall objective of teaching informatics and computer science is that students are trained in the use of computers and acquire skills in the application of computers in everyday life, exploring the basic concepts of informatics and computing, developing interest in the use of computers in everyday life and work, training for computer work as well as encouraging creative work on the computer.

In primary education, within the subject informatics, students have the opportunity to independently create a project that is either part of the contents of a subject that is taught during the training or other content that they can choose independently. Drafting terms of reference – Micro: bit, should be set as a target. For the realisation of the project task, students use the knowledge acquired in the course Informatics and Computing. The project can be implemented individually or in groups of two to three students. If working in a group, the teacher should clearly define the tasks and unities for each student that he/she will work on independently. The assumption is that school has a Micro: bit device and that students have internet access.

A teacher instructs students on how they can explore the possibilities of Micro: bits and then directs them to the Instructions on the safe use of Micro bit **Error! Reference source not found..** (Fig. 5.)



Figure 5: Part of the instructions on the safe use of Micro: bits.

The teacher also instructs students about **Error! Reference source not found.**

**Requirements** - A laptop or PC running Windows 7 or later, or a Mac running OS X 10.6 or later, or a smart phone or tablet, An micro USB cable to connect computer and BBC micro: bit to access to the Internet **Error! Reference source not found.**

**Accessing the BBC micro: bit website** - There are lots of tutorials and information on the website.

**Connecting to the computer and coding micro: bit** - Student can connect their micro: bit to the computer with a USB cable. On the website, student can choose the editor that they would like to use for coding. When they finish their script, they can press run to see it play on the on-screen simulator.

**Compiling script** – By clicking compile in the editor, script is converted into a .hex file that can be transferred and executed BBC micro: bit. If student wants to compile a different script he or she should click on My Scripts, select the wanted script, click edit and compile.

**Transferring the file to BBC micro: bit** – Student should drag and drop the .hex file onto your micro: bit drive. The LED on the back of micro: bit flashes during the transfer which only takes a few seconds, once transferred, the code will run automatically on your micro: bit. Once the transfer of a file is finish to the BBC micro: bit, the BBC micro: bit can be disconnecting from the computer.

**Power supply for BBC micro: bit** - When BBC micro: bit is not connected to the computer, it needs 2xAAA batteries to power supply.

**Using phones and tablets** – Student can find out how to use the BBC micro: bit App to connect it with their phones and tablets.

Teacher will, in the process of monitoring project development, talk with students about the concept of copyright, draw attention to ways of sharing digital materials, i. e. methods of downloading other people's material and setting up their material on the Internet. The number of available hours teachers need to deploy in a way that most of the hours are devoted to project development. Recommended are six to eight hours for these activities. Teachers should monitor students in their work and encourage them to work independently. The project should be displayed and presented to the whole class Presented results should be commented and analyzed, together with students, as well as talked about the difficulties that students encounter during the project and in what ways they have overcome them.

## 5. Conclusions

The digital world has until recently been a small part of our lives, clearly separated from the "real" world, in which, out of obligation or for fun, relatively few were leaving and staying relatively short, as far as a commercial obligation for adults required, or parties for young people. Today digital world pervades our overall living and working space to the extent that digital illiteracy dramatic handicaps and marginalises an individual. Use of Micro: bit in teaching process is designed so that student independently creates in the digital world and becomes familiar with the basics of programming, as well as finds information that will enable him to continue to learn independently.

BBC Micro: bit should not be considered as a mean by which student will master programming, but as a device used for setting foot in the world of programming and thinking about own future professional development.

In the 12th Century, it was mostly the clergy who could read or write, but increasing administration made literacy much more widespread (everyone began keeping books). All professional men (doctors, lawyers, surgeons, scribes, schoolmasters), 20% of tradesmen, as were many freeholders, were literate. Mortimer estimates that general literacy was 20% in the towns, 5% in the countryside □.

Nowadays, so many centuries after, the same can be claimed for computer literacy. It is a necessity for anyone who wants to develop professionally, learn or simply operate in the analog world that is more and more pervasive with digital. [9,11,12,13]

Students should be encouraged to create their first system, something never built before, in order to spark their interest.

□

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