Analysis of BitBots: Alternative entry into robotics

Target Group:	From the 5th grade (middle and high school)
Duration:	< 1 teaching unit (introductory method)
Subjects:	Digitale Grundbildung (Digital Basic Education), Computer Science
Curriculum relevance:	Digital Basic Education: Orientation 1. (5th grade) describe the principle of input, processing and output by way of example using the components and functionality of a digital device. Production • (5th grade) comprehend, execute and independently formulate clear instructions for action (algorithms). • (7th grade) use examples to understand elements of computational thinking and use them to solve problems. • (8th grade) [Note: The introduction serves as an aid for them learning this] Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.
Competencies/ Learning Objectives	• Structured description of programs • Training of observation and analysis skills • Intuitive and verbal description of programs in pseudocode
Required prior knowledge	• In principle, none – with programming experience, the descriptions tend to become more precise. • Previous experience in programming the micro:bit or introduction to algorithms can be helpful.
Computer science concepts	Coding, programming
Type of teaching material:	Worksheet, Programs
Required files:	• SW_AA_BitBot_Analysis (Analysis Worksheet) • SW_LO_BitBot_CodeSnapshots (Overview of all programs) • SW_M_BitBot_xyz.hex (6 analysis programs)
Other utensils:	Writing utensils, micro:bits and BitBots
Social form:	Individual and partner work (or teamwork)
Sources:	AHS curricula: https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10008568 (Last access: 02.01.2024) Digitale Grundbildung: https://www.ris.bka.gv.at/Dokumente/BgblAuth/BGBLA_2022_II_267/BGBLA_2022_II_267.pdfsig (Last access: 02.01.2024) All images CC-BY-NC-SA Informatik-Werkstatt 2024 or other sources
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Preparation:

Six (or more) micro:bits must be prepared in forehand with the corresponding programs (*SW_M_BitBot_xyz*). These need to be marked differently with stickers to relate each micro:bit to its program. Furthermore, annotations can be taken in the (printed) overview of all programs (*SW_LO_BitBot_Codesnapshots*).

The file *SW_AA_Analysis* must be printed out for each student (or group).

This material provides an alternative introduction to robotics and the programming of micro:bits and BitBots. Programming micro:bits as prior knowledge does not have to be available. In this case, however, it is recommended to start with the micro:bits alone after the start of the lesson and then move on to the BitBots.

Illustration 1: Prepared micro:bits with markings (CC BY-NC-SA Informatik-Werkstatt)

Material for teaching programming with micro:bits can be found here: https://www.rfdz-informatik.at/microbit/

Use/handling:

The students form small groups analysing one of the BitBots together. Based on their observations, they take notes and descriptions of the program as precisely as possible using the worksheet. It is possible to ask for pseudocode as a default. Depending on the time and speed of the groups, the BitBots can also be exchanged.

After this analysis phase, the students' results will be discussed in plenary. In doing so, the texts will be searched for control structures, such as "Repeat until …" or "If…. then…".

The phase ends with an explanation of the control structures and observations, which can also be found in computer programs.

Tips and tricks:

- Of course, editing, expanding or using the programs is possible. It is also possible to analyse other robots.
- Before the analysis phase, the learners can also perform unplugged algorithms with the help of the "human-robot" **(Menschlicher Roboter)**. The human-robot can help students to recognise better and write down the control structures later on.
  Material on our material fair (Materialbörse) about this topic can be found here:
  https://www.rfdz-informatik.at/der-menschliche-roboter/
  https://www.rfdz-informatik.at/der-menschliche-roboter-voruebung/