EARLY Teaching Scenario

Topic: Speed experiments with AIRBLOCK

Aim(s): Students learn how to:

- Measure distance, time and speed
- Programme a robot with a block-based programming tool
- Engage in problem-based learning

Skills pupils develop during the scenario: connect to curriculum →

The National Curriculum for Polish primary schools (Physics) states that by the end of class 8, students should be able to:

- Extract phenomena from the context, name them, and indicate factors relevant and irrelevant to their occurrence
- Carry out selected observations, measurements and experiments using their descriptions
- Distinguish between the concepts of track and distance
- Use the concept of speed to describe the rectilinear motion
- Calculate its value and convert its units
- Use the relationship between speed, distance and the time it was travelled in the calculations

The course components that are trained in this learning scenario are as follows:

- Measuring time, distance and speed
- Conducting experiments to find out the relationship between them
- Using a robot for this purpose
- Problem solving
- Collaboration

Target group: pupils in primary school (grades 3 - 4)

Age of students: 9 - 10 years old

Number of pupils: maximum of 10 in a class subgroup

Duration (estimated time/number of lessons): 3 x 45 minutes

Prerequisites (necessary materials and online resources):

- AIRBLOCK
- Mobile devices with MakeBlock App installed
- Meter tapes, meter sticks and a laser distance meter
- Stopwatches
- Markers for marking distances in the environment

Introduction to the scenario *(incl. possible applications, alternatives and risks)*

AIRBLOCK is a small aircraft made up of one core master module and six power modules that are connected magnetically. These components can be assembled in different ways in order to build a variety of other DIY devices and programme them with a handy Makeblock App. An airblock flying vehicle is as easy to build as it is easy to break when it hits a wall or a ceiling. However, in such a

case all the light parts fall apart and then are easy to assemble again. This scenario takes advantage of the Airblock's construction which facilitates experiments without concern for its possible damage. Its main purpose is to consolidate students' understanding of the concepts of speed, distance and time.

Before the program begins (preparatory work for teacher)

- Make sure that students have downloaded MakeBlock App on their mobile phones
- They should know how to connect it with Airblock to be used in the following lessons
- Let them play with the app so that they are familiar with the robot controller (very intuitive and easy to use interface)

The main part of the scenario (3 lessons)

Lesson one: how to measure distance, time and speed

- Demonstrate the use of traditional tools (meter tape and meter sticks) and a modern one (laser distance meter) on selected distances in the classroom. Explain different uses of both for measuring small objects at hand and distances between points difficult to reach.
- Divide the class into smaller groups and let them measure various distances in the classroom. They should measure small and larger distances, in particular the height of the classroom. This is a good opportunity to revise distance measurement units (mm, cm, m).
- Demonstrate the use of a stopwatch. In smaller groups students measure the time they take to walk from one corner of the classroom to the other and then across larger distances in the hall or in the yard. This is a good opportunity to revise time measurement units (sec, min).
- Introduce the idea of speed as distance/time. The walking exercise can provide good examples for the students to grasp the concept. Refer to standard teaching materials, if needed, to ensure that all students come to the Airblock experiment phase well prepared: able to calculate the speed at which an object travels across a selected distance.

Lesson two: how to navigate Airblock

- Airblock is easy to use: via the MakeBlock coding app, students can control their robot with instructions they program themselves.
- Demonstrate how to programme the robot with this short tutorial that we developed to facilitate the learning. The steps will need to be consolidated with individual students using their mobiles to follow the procedure.
- First ask them to install and open Makeblock App on their devices.
- Then they go to „Menu" and choose the right robot (Airblock in this case), then „Create", drag „BUTTON" and drop it on the working area, press „BUTTON" and menu on the right will appear, then press "Code". Now the students can start coding by dragging and dropping blocks from the menu on the left.
- They should first learn how to turn Airblock on and off.
- Changing directions and values they practice taking off and landing as well as short flights around the classroom, possibly with different stunts.
- It is likely that the aircraft will fall apart a couple of times - the students should finish the exercise assured that this isn't a problem, the Airblock can be easily reassembled and made ready for the following experiments.

Lesson three: discovering at what speed Airblock can fly

- In this problem-based lesson the students are challenged with the above question. In their Makeblock App they can only define the time Airblock can fly in a given direction but its speed has to be calculated. They have to discover how to do this. The teacher's help may be essential to guide them to a possible solution, which is likely to look as follows.
- In smaller groups students plan the experiment: they decide what distances they will programme the aircraft to fly. The tracks can be both horizontal (from one corner of the classroom to the other), vertical (from the classroom floor to the ceiling) or diagonal (from bottom to upper corner on the opposite side of the classroom - a challenging tract to code).
- The next step is to measure these distances in meters and write them down.
- Then the students programme Airblock to fly these distances and record the time it takes in each case (in seconds). Many attempts may be required in this fun and playful activity.

- When the distance and time are given it is easy to calculate speed, isn't it? In theory yes, but now the students have to demonstrate this understanding and calculate the actual speed of their small aircraft. This will be an average speed and its value approximate so the experiment also lets the teacher introduce the concepts of exact and estimate values, useful both in maths and natural sciences.
- Depending on the class level the students analyse and compare the data from their experiments.
- The results can provide input to follow-up maths and physics lessons.

Learning outcomes
Students will be able to:

- Measure distance, time and speed
- Activate and navigate a simple robot
- Grasp the relationship between distance, time and speed through experiments with the robot's movements
- Record and analyse the data from the experiments
- Engage in problem-based learning in cooperation with peers