Projekt współfinansowany w ramach programu Unii Europejskiej Erasmus+

Mathematics
Cycle I Upper primary school
Understanding graphs and relationships

Topic 2	**We describe motion using graphs**
Duration	2 lessons (90 minutes)
Class/Age	The teaching cycle is intended for students in the final years of primary school who are not familiar with the concept of functions, and we do not introduce this concept during the cycle (grade 7-8).
Objective	*The aim of this module is to develop an **intuitive** understanding of types of relationships and their graphs.* 1) Creating and interpreting graphs in the context of movement analysis at the intuitive level 2) Developing an understanding of graphs 3) Developing an intuitive understanding of unambiguous relationships between variables 4) Developing co-variation reasoning
Description	Students create and examine graphs describing changes in distance over time using embodied experiments. During the lesson, students use the EMPE sensor together with the EMPE software. The sensor measures the distance to the nearest obstacle, and the software shows a real-time graph of changes in this distance over time. Students are involved in embodiment experiments by walking with the sensor and analysing the graphical interpretation of their movement. They have the opportunity to create and observe multiple graphs of different shapes, and they also perform reverse activities – they move in such a way as to reflect the movement shown in the graphs provided, and they interpret and analyse different movement graphs.
Teaching aids	- EMPE sensor with software - desktop computer or laptop with a web browser - projector screen - projector - work sheets for students

During the lesson, the teacher and students use the EMPE sensor with EMPE software developed as part of the EMPE project. Instructions for using the sensor can be found on the project website (https://empe.uken.krakow.pl).

TOPIC 2. We describe motion using graphs

LESSON PLAN

This lesson is experimental in nature, and the measurements in the first part are to be carried out outside the classroom (on the stairs).

We continue the numbering of activities from Cycle I, Part 1.

Activity 6. Task about stairs

Activity 6a)

Individual work. We ask students to solve *the task about stairs* (Fig. 7) from Worksheet 3 on their own. The task is designed to test their intuition in understanding graphs.

***The task about stairs**:*

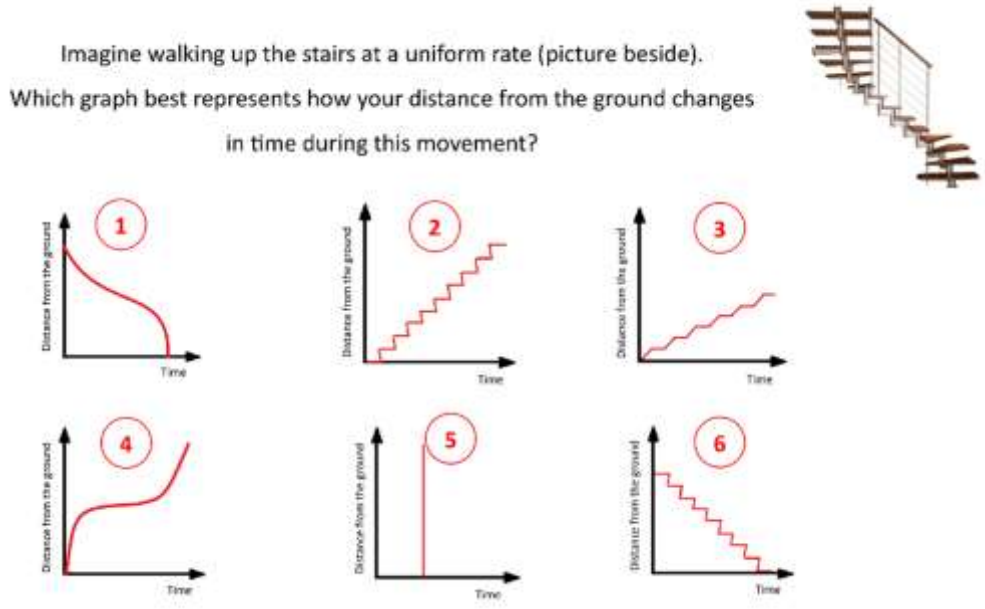


Figure1. Worksheet 3, Activity 6, Task about stairs.

Activity 6b)

We conduct an experiment of walking up stairs while measuring the distance from the ground with a sensor. A laptop will be required. We record the course of the experiment.

Comment. During the experiment, walk up the stairs very slowly and at a steady pace. Depending on the construction of the stairs, it is sometimes easier to measure the distance from the ceiling. In this case, discuss with the pupils how the distance from the ground and from the ceiling will change when climbing the stairs and when descending them.

Students should discover that the graph of the distance from the floor when walking up the stairs will be similar to the graph of the distance from the ceiling when walking down the stairs.

Activity 6c) Analysis of walking up stairs

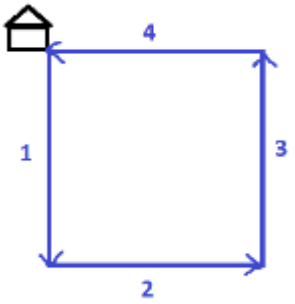
Students analyse the shape of the graph in the classroom. They give the correct answer to the staircase task. They explain why answer 3 is correct and why answer 4 can also be considered correct if we analyse the process of climbing only one step of the stairs.

Activity 7. Task about Mr Novak

Activity 7.1

Individual work. We display the task about Mr Novak on the screen. We ask the students to answer question a) from Worksheet 3.

Mr Nowak left his house and walked around his square-shaped property at a steady pace, as shown in the picture: Solve the following tasks.



a) How did his distance from the house change at each stage of the walk? Describe as accurately as possible.

1.....

2.....

3.....

4.....

b) Sketch a graph that illustrates, in your opinion, Mr Novak's distance from his house during the time of the walk.

c) Design and conduct an experiment illustrating Mr Novak's movement and draw the graph created using the sensor.

Activity 7.2

Students present their designs and we carry out the one that is easiest to implement.

Comment. For example, you can draw a square on the floor in the classroom (or use the graphics on the school floor in the classroom, corridor or gym). One of the pupils stands on a corner holding an object (in the photo, a cushion – Figure 8), from which we measure the distance by moving along the sides of the square.

Figure2. Taking a measurement – Mr Novak's walk.

The graph that the pupils should receive is shown in Figure 9.

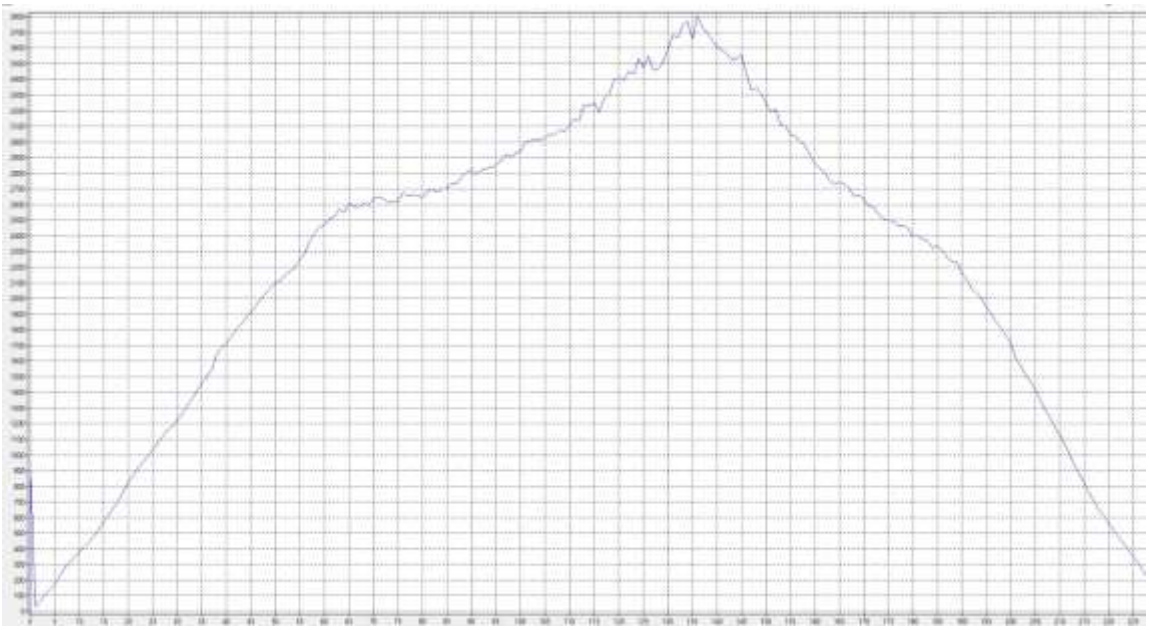


Figure3. Graph – Mr Novak's walk along the edge of the square

The pupils redraw the graph on their worksheets.

Comment: At secondary school level or in gifted primary school classes, you can continue the discussion by pointing out why the graph representing changes in distance during movement along sections 2 and 3 is not linear (see scenario for secondary school, cycle I, version B).