Demonstrator # 20

Oscillation and waves

TEACHER NOTES

Activity title:

Oscillation and waves

Theme:

Electromagnetic waves

Student age:

15 years

Ti8e:

100 min

Scientific content

gives needed science background (concepts, definitions, laws etc) including pre-requisite knowledge required and science concepts developed in the activity, includes relevant students' difficulties,
Concepts: waves, propagation, analogous/digital system, graphic representation, dependent variable/independent variable,
Elementary and basic skills: observation, identification of variables, practice graphic representation, registration and use of registered data

Learning Objectives

At the end of the lesson pupils will be able to:

- identify the main components of the digital system by using a scheme to measure some physical and biological parameters;
- explain the role of main components of such a system starting from previously learned knowledge in physics, computer science and biology.
- explain on the basis of physical principles and laws transformation ways of the electrical signals in analogues type signals, as well as their distance transmission by means of an wireless network in order to be analyzed with computer systems;
- investigate the properties of different physical systems using virtual instruments including acquisition data system;
- analyze and compare the results presented as graphs and interpret them;
- Present in oral or written way clearly and accurately their activity and the finality of the experiment.

Inquiry based character of activity

highlights the IBSE character of the activity, specifies a type of inquiry and lists inquiry-based skills (for details, definitions and terminology to use see 'Short guide for designing inquiry-based teaching materials')
Guided Investigatiom; Blended Investigation

Applied Technology (if necessary)

Needed Materials

- **Materials:** Accelerometers, INLot, computers, observation sheet
- **time**: 100 min

Methodological Guide

describes method, student learning activities (discussions, investigations, data analysis, reflections etc.) and leading questions, includes a suggested time outline

Anticipation

- Teacher will communicate in advance the theme of the experiment and will establish the groups of pupils in such a way that each group could realize and present a scientific written essay, a poster or a PPT presentation having as theme one of the following:
    1. Electromagnetic waves (features, classification)
    2. Emission and reception of electromagnetic waves
    3. Applications - wireless networks
    4. Transformation in electric signals of analogical ones
    5. Respiration' mechanics
    6. Heart's rate and physical effort

Building new knowledge 1 teaching hour

- Pupils present their work (mentioned before) at the beginning of the teaching hour offering in this way both a theoretic point of view about electromagnetic waves and updating and reviewing the knowledge needed in order to practically accomplish the experimental sequence and look for the conclusions. 30 min
- Defining the problem, hypothesizing *How does the physical effort influence the biological parameters*? 10 min
- Recognizing and study of the technical apparatus by the pupils: the system is introduced by the teacher, the steps of the experiment are also discussed together with the questions and answers concerning the practical aspects that might appear during the experiment and the data registration and transfer; also the roles for each pupil in its group is discussed now.

Pedagogy and teaching sequences

- Experimental setting design: two volunteer pupils will take, one after other, the accelerometers (arm, leg and T-shirt) and then they will do some simple warming-up exercises: rapid walk with small steps (3min.), easy running (3min.), rapid running (3min.). Science the system promotes the wireless transmission of data at 150 m distance the exercises may take place in the sport hall or on the sport facilities of school. 10 min.
- Experimental investigation with accelerometers, base station and laptop and register of the desired parameters' evolution in time: space coordinates, heart rate, respiration rate. 15 min
- Pupils will analyze and interpret the registered data, transfer them and work with theme in graph form, interpreting the results. 30 min.

Reflection/Consolidation

Pupils will present oral or written their activities, the main result of the experiment and will fill in the Experiment Sheet (hypothesis confirmed or not).

Assessment

provides suggestions how to asses the activity, preferable with concrete questions and expected student answers

- ✓ Compare two graphics of the motion in the case of speed running test at sport class
- ✓ Graphic modelling of the real contest motions
- ✓ Oral, conversation
- ✓ Writen ending sheet

STUDENT WORKSHEET

Activity title:

Electromagnetic waves

Introduction

states a driving (research) question and outlines objectives

Thinking about the question

if needed provides information about the science addressed

Materials needed

if needed provides list of materials
mechanical school kit, sensors, soft

Safety

If needed lists warnings and cautions concerning the investigation

Investigation

Depending on the type of inquiry involved provides guidance on how to carry out the investigation
Pupils organized in groups realize the experiment /experiments proposed with the system of accelerometers

Analysis

If needed suggests analysis that can help interpret data

Experiment Sheet

Name

Inquiry' theme

Hypothesis Describe what are you expecting to learn by doing this inquiry.

Experiment's design

Describe briefly the experiment

Describe materials and the experimental settings. Make a scheme (figure) of the experimental device, name each component and describe its role

Which are the main steps of the experiment?

Variables recognition

What will you observe and/or measure?

Which are the factors that may influence the experiment's result?

Make a figure or write down your observation during the experiment.

Data interpretation - Conclusions

Analyses the graphs obtained with the data gathered from the experiment. Draw conclusions both quantitative (by using the data registered) and qualitative (phenomenological observations, descriptions).

When or what for could you use the results of this experiment?

Propose other settings in order to use the same devices.

Further investigation

If needed provides suggestions for a next possible investigation or additional, deeper investigations

Assessment

If needed includes student assessment