

Science Through Outdoor Activities KLiC Scenario in Turda Salt Mine



Summary:

A new approach in science education can be developed through integrating modern technologies in learning activities. Thus, science teachers designed and implemented KLiC Scenario in Turda Salt Mine that is a new approach on teaching gravitational acceleration through an informal activity. This was done by using the KLiC system during a trip to Turda Salt Mine that allows Physics to become closer and more friendly to the pupils, by involving them in experiential, active learning situations.

Aims:

At the end of the learning activity the students will be able to improve and develop the competences of:

- formulating hypothesis
- realize experiments, by using KLiC system
- finding and analyzing information and data
- communication and interpersonal relationship

Main activities:

The Romanian teachers designed and implemented a scenario in an informal environment to study the gravitational acceleration by means of the experiment with a gravitational pendulum (experiment existing in the upper secondary physics syllabus) on the platform of the salt mine entrance (outside) and then in the deepest area of the salt mine.

Narrative:

The informal learning activity designed and implemented is significant because it exploits creatively the pupils' knowledge concerning the concepts of: movement, acceleration, interaction. It offers to the pupils the opportunity to test their own scientific hypothesis and their applicability in new learning contexts. In order to measure the gravitational acceleration, the technology used was InLOT system that consisted of: leg and arm accelerometer, base station – collect all transmitted data, user interface, software.

Step 1. Determination of the gravitational acceleration value, through the experiment with a gravitational pendulum on the platform, in front of the salt mine entrance.

Step 2. Brainstorming session

Students express their own hypothesis, referring to the expected value of gravitational acceleration inside the salt mine, on the following issues:

- Will the value of gravitational acceleration increase or decrease?
- Why?

Step 3. The students and the teachers go down into the salt mine. The students do again the experimental determinations of the gravitational acceleration, to the deepest point (112 m).

Step 4. Discussing the initial hypothesis

- Analyze the significance of the obtained experimental results
- Which of the predictions/ expectations were

fulfilled?

- Causes that influenced/ produced these results

Step 5. Reflection

Graphs interpretation: The gravitational acceleration decreases as the height increases, respectively, the gravitational acceleration increases as the depth increases. Students are asked to reflect on the following question: Is "the gravitational constant" really a constant?

Step 6. Evaluation - Students worksheet

During the outdoor activity, the students filled in a

personal worksheet, referring to:

- Their expectations
- Description of the experiment
- Description of the materials used
- Determination of the values of gravitational acceleration on the entrance platform and inside the salt mine
- Factors that could influence the results of the experiment
- Quantitative data and the qualitative observations

End user: 14 – 15

Involved actors: secondary school teachers, researchers, curriculum developers.

Location: Turda Salt Mine

Turda Salt Mine is an entertainment area and a history museum of salt mining at the same time.

Connection with the curriculum: The Physics syllabus for secondary school in Romania, unit "Interactions", envisages to teach the concepts of gravity force and gravitational acceleration. At this

age, the gravitational acceleration is presented only as a physical constant, without any other details. The characteristics of this parameter and the factors that influence it are difficult to understand by the secondary school pupils.

Languages available: Romanian, English
Where to find the application or case: Casa Corpului Didactic Cluj

Evaluation parameters:

- The ability to use technology, in order to improve his/her own

investigation and results

- The ability to enounce and review the scientific explanations and models, using logic and experimental evidences
- The ability to recognize and analyze explanations and alternate models

Duration: 3 hours

Additional information or resources:
www.ccdcluj.ro, www.ea.gr/ep/klic/scenarios.asp, www.salinatorda.eu, www.inlot.eu

Teachers' Competencies

1	subject matter/content knowledge	x
2	nature of science	
3	Multidisciplinary	x
4	knowledge of contemporary science	
5	variety of (especially student-centred) instructional strategies	x
6	lifelong learning	x
7	self-reflection	x
8	teaching/ learning processes within the domain	x
9	using laboratories, experiments, projects	x
10	common sense knowledge and learning difficulties	x
11	use of ICTs	x
12	knowledge, planning and use of curricular materials	x
13	Information and Communication Technologies with Technological Pedagogical Content Knowledge	x



Mapping best practices with main principles

1. Building interest in natural science phenomena and explanations:

As the teachers are creative and use experiments and new technology tools, the students are motivated to understand the phenomena and their curiosity is exploited.

2. Building up informed citizens: Students understanding the nature of Science & Science in society:

Being involved in experiments, the students formulate and review the scientific explanations and models, using logic and experimental evidences. They become scientifically literate, informed citizens because they formulate their conclusions and argumentations by means of physics scientific language and concepts in real contexts.

3. Develop multiple goals:

- understanding big ideas in science including ideas of science, and ideas about science
- scientific capabilities concerned with gathering and using evidence
- scientific attitudes

The inquiry based scenario presented above help the students to be flexible thinkers because they recognize and analyze explanations, evidence and data. Thus they understand that science is important in their every day life.

4. Understanding students' concepts and learning style about of science phenomena:

Helping the students to ask questions, to operate with scientific concepts and to use new technology in their experiments, they will be able to solve problems on science phenomena.

5. Relevance of the content to daily life of students:

The activity took place in natural environment, starting from the key-question if the gravitational constant is really a constant. The students understood that daily life raise questions and science can answer if they have the proper skills.

6. Understanding science as a process not as stable facts. Using up to date information of science and education:

To memorize facts and information is not the most needed ability. The scenario presented give the students the opportunity to investigate in real life environment, to gather and use information, to understand and control reality. In order to get the best results, orientated discovery and new technology were used.

7. Activities for gaining knowledge, not for entertainment, nor for simple imitating of results:

The students are curios, active, involved and serious in accomplish their tasks. The trip to Turda Salt Mine had a specific goal and a specific question to answer related to gravitational constant.

8. Doing science: experimenting, analyzing, interpreting, redefining explanations:

The approach on this activity was orientated discovery, that means: to colect data by using adequate technics and instruments, to describe an object in its relation with other object (pозition, movement, direction, simetry, space disposal or shape), to propose an explanation based on observation, to formulate a logical explanation about cause/ effect relations between the data obtained from an experiment.

9. Assessment: formative ~ of students' learning and the summative ~ of their progress:

During the outdoor activity, the students filled in a personal worksheet, referring to: their expectations, description of the experiment and materials used, determination of the values of gravitational acceleration on the entrance platform and inside the salt mine, factors that could influence the results of the experiment, quantitative data and the qualitative observations.

10. Cooperation among teachers and with experts:

The curriculum developers and researchers designed and delivered an in-service training program for Physics teachers. During this program, the teachers learn about KLiC system and KLiC scenarios. Then, curriculum developers, together with the teachers designed an outdoor activity that was implemented by the teachers who worked in peers. Experts and curriculum developers gave the feedback concerning the effectiveness of the activity.