



Physics education in Slovakia

Marián Kireš

Pavol Jozef Šafárik University in Košice
Faculty of Science



Outlines

Declarative role of physics at our school system

Why school reform doesn't work

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Where we need to help

Lack of physics teacher

Enhancing the scope of physics teaching

School physics laboratories

Let's promote physics in society





Declarative role of physics at our school system

Physics as a teaching subject

International Standard Classification of Education

ISCED 0	Pre-primary education
ISCED 1	Primary education <i>physical content as a part of subject „Natural science“</i>
ISCED 2	Lower secondary education <i>Physics, Biology, Chemistry = thematic field: Human and nature</i>
ISCED 3A	Upper secondary education (Gymnasium) <i>Physics, Biology, Chemistry = thematic field: Human and nature</i>



Declarative role of physics at our school system

Physics as a teaching subject

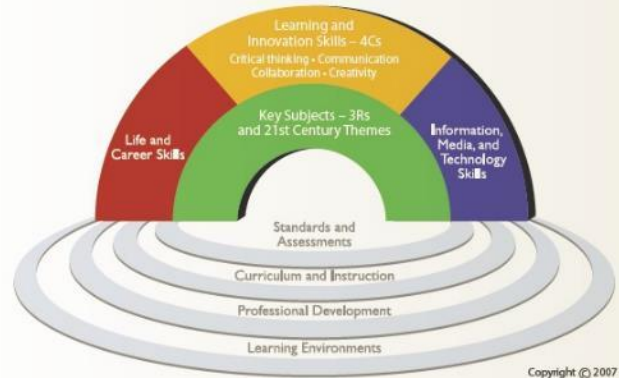
Main objectives

- A. World around us
- B. Communication
- C. Science knowledge and ideas
- D. Scientific inquiry
- E. Data processing
- F. Experimentation

D. Scientific inquiry

at the end of the course student should be able:

- to formulate a problem, research question, that can be answered by experiment
- to formulate a prediction,
- to test a prediction,
- to plan an appropriate experiment,
- to formulate a conclusion according to observation and experimentation, to comment on measurement errors,
- to formulate the validity of conclusions based upon a series of measurements,
- to evaluate the overall experiment





Why school reform doesn't work

Physics as a teaching subject

<i>Lessons per week</i>	6th	7th	8th	9th
Elementary school	1	1	2	1
	1st	2nd	3rd	4th
Gymnasium	2	2	1	

in total **30 weeks** per school year

Suggested topics of Physics (upper secondary level)

Observation, measurement, experiment	(4+40 lessons)
Force and motion	(18 lessons)
Energy around us	(18 lessons)
Electricity and magnetism	(20 lessons)
Periodic phenomena	(15 lessons)
Electromagnetic waves and particles of microworld	(20 lessons)



Why school reform doesn't work

- insufficient equipment of schools with teaching aids
- lack of time for active pupils' work in science subjects
- low motivation of teachers
- poor support and teacher readiness for innovative teaching
- insufficient focus on developing of pupils' skills
- ...





Current challenges for better future

Inquiry based science education

Inquiry involves:

- making observations;
- posing questions;
- examining sources of information;
- planning investigations;
- reviewing what is already known;
- using tools to gather, analyze, and interpret data;
- proposing answers, explanations, and predictions;
- communicating the results.



5E 7E

Engage/Elicit

Explore

Explain

Elaborate/Extend

Evaluate



Current challenges for better future

Inquiry based science education

The levels of inquiry-based activity differ by the amount of teacher/material guidance, student independence and developed skills.

Types of Inquiry (Wenning, 2005):

- Interactive discussion /Interactive demonstration
- Guided discovery
- Guided inquiry
- Bounded inquiry
- Open inquiry



In science education the “inquiry” approach is connected mainly with **all kinds of experimentation.**

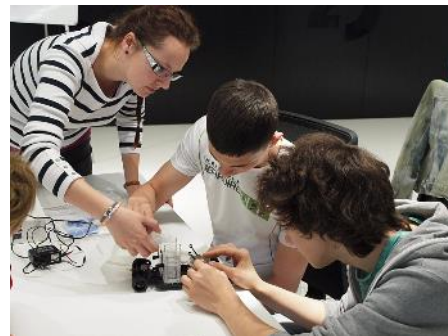


Current challenges for better future

Scientific literacy and skills development

Basic components of scientific literacy:

- scientific conceptions,
- scientific attitude to reality,
- **scientific (inquiry) skills.**



- identify a problem to be investigated
- formulate a hypothesis
- design exp. procedures to test the prediction
- conduct a scientific experiment;
- collect meaningful data, organize, and analyze data accurately and precisely
- apply numerical and statistical methods to reach and support conclusions
- using available technology, report, display, and defend the results of an investigation



Current challenges for better future

Education for information society (National project IT Academy)

Innovation of STEM education

- new curriculum teaching materials (800 lessons)
- implementation of IBSE (teacher training and support)
- focus on scientific skills development and conceptual understanding



IT Science Lab (at 90 schools)

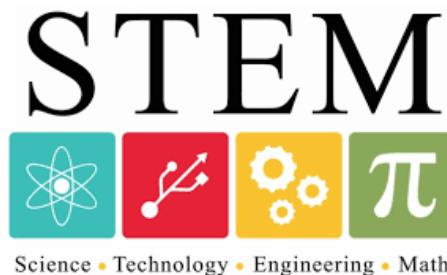
School directors (principals) training

New teaching subjects

Informatics in Science
Internet of Things

Special classes for IT and Science education

Wide range of supportive activities (science camps, competitions, lectures, ...)





Where we need to help

Lack of physics teacher

- status of teachers in society
- motivation to become a teacher
- improving the conditions for teacher work



The need to increase the scope of physics teaching

- total number of school hours
- division of classes for labwork

School physics laboratories

- Digital technologies in education
- Real experiments – computer based measurements



Let's promote physics in society

Popularization of science

Key stakeholders

General public

Parents

Pupils and students



Thank you for you support