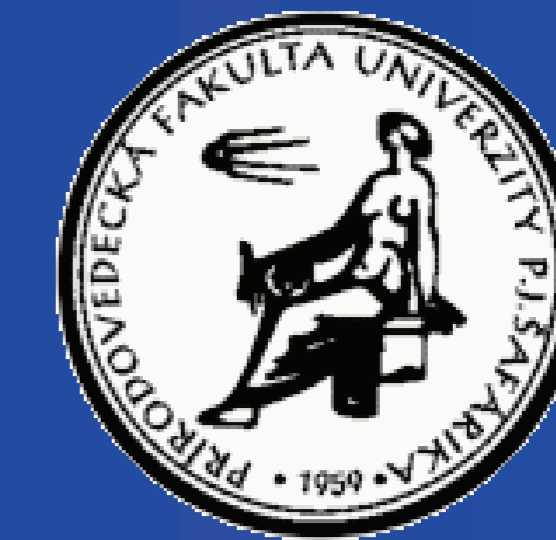


Inquiry-based education in physics at Slovak secondary schools

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ABSTRACT

The education in Slovakia currently faces the new curriculum reform that is running at all basic and secondary schools from 2009. It brings great changes into the educational system. There is currently a two-level model of Slovak schools control. The state curriculum defines the basic principles and goals of education while the school curriculum gives schools an opportunity to fit the interests of the particular school and its students. In science education, in particular, the main attention is paid to the scientific inquiry with emphasize to the students active independent learning. In order to meet these goals students should carry out activities that lead to the construction of new knowledge and development of inquiry skills that they can use in other aspects of their lives. Especially in physics education, these activities are mainly connected to wide range of experimentation at various levels of inquiry. However, these goals require providing teachers with materials that they can use in the class to support this way of teaching and learning. Regarding this fact we accepted the offer to participate at the international 7FP project Establish that's main idea is to prepare materials and train teachers in order to enhance Inquiry-based science education (IBSE). Several of the activities on the topic of Sound developed within the project have been trailed in the class. The contribution presents the Slovak curriculum in physics with regard to IBSE and discusses the experience gained by implementing IBSE activities in the class.

IBSE IN THE SLOVAK CURRICULUM IN PHYSICS

From 2009 the **national educational reform** is running in Slovakia that implies many changes. In science education, in particular, the main attention is paid to **scientific inquiry with emphasize on students' active independent learning**. As a result, students should carry out activities that lead to the construction of new knowledge and development of inquiry skills that they can use in other aspects of their lives. The main objectives in physics education are determined within six areas, namely **World around us, Communication, Science knowledge, Scientific inquiry, Data processing, Experimentation**. There are many elements of IBSE included mainly in the last three areas in the curriculum (see tab.).

Scientific inquiry	Data processing	Experimentation
<ul style="list-style-type: none"> •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 including the procedures 	<ul style="list-style-type: none"> •To organize, present and evaluate data in different ways •To transform data presented in a form into another form (including calculus, tables and diagrams) •To identify possible trends in data •To create predictions based upon data •To suggest conclusions based upon data •To use knowledge to explain conclusions 	<ul style="list-style-type: none"> •To follow written or oral instructions •To select and use safely the experimental setup, materials and technology appropriate for measurement •To carry out the experiment safely, to record data gained by observation and measurement •To use appropriate tools and technology to collect data •To work and cooperate in groups

HOW SLOVAK TEACHERS CURRENTLY TEACH PHYSICS?

Although the curriculum is now built on the basis of IBSE elements, the implementation into teaching is difficult:

- the reform has brought a **significant reduction of number of lessons** devoted to physics. IBSE requires time to carry out activities
- **lack of instructional materials based on IBSE principles**, teachers left alone without any support:

teachers use old textbooks and teach less content the old way

enthusiastic teachers prepare materials by themselves and try to teach differently

- **teachers not educated in the field of IBSE**, not aware of the IBSE methods in order to promote conceptual understanding, active learning and regular feedback and discussion.



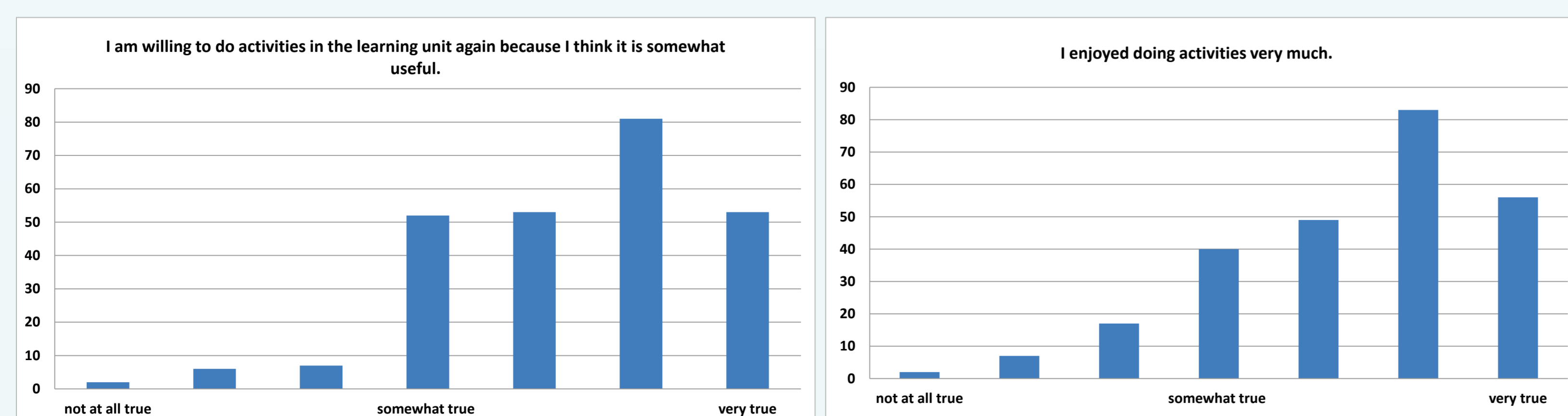
Fig.2 Students carrying out activities on Sound unit developed within the Establish project



Fig.1 Students experimenting with sound

FIRST EXPERIENCE WITH IMPLEMENTATION OF IBSE ACTIVITIES

Within the Sound unit developed by ESTABLISH project there were several activities implemented into physics teaching. The diagrams show pilot results from two classes (25 and 29 students) from two standard grammar schools (Kežmarok and Poprad) that come from the school year of 2011/12.



CONCLUSIONS

The results of questionnaires show positive attitude of students towards IBSE. However, students and even teachers are not used to such way of teaching. The successful implementation requires a consonance of several elements from which the well-educated teacher is considered the most important. That's why much attention must be paid to his education and his self-confidence in IBSE methods.

PROJECTS HELP TO PROMOTE IBSE

Within the 7FP project ESTABLISH

Instructional materials are produced and adapted to national curriculum

In autumn 2011 there was an **in-service teacher training** running with 19 teachers of secondary schools who participated in 4 days course (12 hours) to understand what and why to use IBSE in order to get familiar with the IBSE methods.

Within the national project **Modernization of education at basic and secondary schools**

543 physics teachers participate at 5 days course aimed at the use of IBSE methods enhanced by digital technologies



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