

PHYSICS EDUCATION

Adaptation of Young Physicists Tournament problems for upper secondary school level

supervisor: doc. RNDr. Marián Kireš, PhD. (marian.kires@upjs.sk)

study form: full time

Annotation: Each year there are interesting and unconventional problems solved within the Young Physicists Tournament (YPT). Students solving these problems develop their knowledge and inquiry abilities. There is a limited number of schools involved into the competition within afternoon activities. The problems as solved by students who present and discuss their research project changing the roles of presenter, opponent and reviewer. This system offers great opportunities to implement some elements also in regular physics education. The main goal of the thesis is to implement selected YPT into upper secondary school level in the form of laboratory exercises. The PhD student is expected to select problems for specific topics that are suitable for development of inquiry skills, adapt them into the guided inquiry level and design educational materials both for students and teachers. Consequently, the pedagogical research will be designed to test the developed activities and materials at schools.

Design and verification of physics education scenarios for Future Classroom Lab

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study form: full time

Annotation: The design of the educational environment for active learning as well as the scenario of educational activities is given considerable attention in expert groups [1], [2], [3], [4], [5]. The pillars of active learning are teaching methods, didactic technologies and educational space. In the theoretical part of the dissertation, the task of the doctoral student is to map current knowledge about the contribution of active learning to the development of skills and understanding. Systematically process actual research studies on educational strategies in the environment of the Future Classroom Lab (FCL). The practical part of the work is the design of scenarios of educational activities for the FCL and their pilot verification by didactic research in the operation of the Experiential Science Center at UPJŠ in Košice at the level of high school students. The expected benefit of the work will be the dissemination of the FCL concept and own findings in the community of physics education stakeholders in Slovakia.

Interactive methods and technologies in teaching physics of the microworld

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study form: full time

Annotation: The thesis is focused on physics education research in the new curriculum (content and approaches) in teaching physics using the latest interactive teaching methods and digital technology. The new curriculum should more reflect the current scientific knowledge and technological progress as traditional. At the same time, it should provide the necessary foundation for future natural scientists and engineers, who will be working on such problems as the design of new conductive materials, data storage of high density and access speed, new communications technologies, nanoscience and nanotechnology, alternative energy sources, quantum computers,

computer drug design, and modelling of complex systems involving extreme climatic and geophysical phenomena.

The work of a Ph.D. student will be concentrated on a study, selection, and preparation of educational activities in physics of the microworld, supported by experiments. The main goal will be the research dealing with the implementation of the new content in the micro-world physics in the school curriculum with subsequent analysis of the impact and effectiveness of selected methods and technologies.

Model of teaching University introductory physics course

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study form: full time

Annotation: At University level there are mostly traditional teaching methods based on lectures used. However, after the implementation of curriculum reform there is a significant decrease in the level of students' knowledge and skills that enter University. The current situation calls for changes in education, concerning the first physics courses that students take part, in particular. These changes should lead to higher students' engagement in their own learning implementing interactive methods even during the lectures shifting the traditional way of teaching to more active learning environment. The thesis is aimed at analysis of students' level of understanding and skills before they start their University study, development of activities based on interactive approach, their implementation and analysis of their efficiency.