Tytuł projektu

Implementacja metod bazujących na dociekaniu w nauczaniu fizyki

Project title

Implementation of inquiry-based teaching methods in physics

Dyscyplina /Area of science

Nauki fizyczne

PROJECT DESCRIPTION

Project goals

- To design and developed tools and teaching scenarios based on modern information and communications technologies (ICT) for implementation of inquiry-based teaching methods in physics
- To design research tools necessary to study the effectiveness of developed methods at school/university level
- To test the effectiveness of developed methods at school/university level

Outline

The crisis in teaching Science requires a real and effective implementation of previously developed didactic concepts, like constructivism, cognitivism and inquiry-based teaching. The Rocard's Report [1] (commissioned by the European Union in 2007) showed that the number of graduates in physical sciences in the Netherlands, France and Germany fell by 40 – 50% between 1994 and 2003. The similar tend is observed in Poland recently. The title of that report sounds significant: "A Renewed Pedagogy for the Future of Europe". The report identifies the main causes of decreasing interest in physical sciences and it suggests some solutions. In particular it points out that the main origins of the problem can be found, among others causes, in the way science is taught. As a remedy the report suggests reversal of school's science-teaching pedagogy from mainly deductive to inquiry-based methods. While the traditional education generally relies on the passive transmission of the knowledge from the teacher to the student, in the inquiry-based teaching the student is much more active because his/her knowledge is built up using an experiment / observation to solve problem-based tasks (see e.g. [2]). The latter methods are consistent with the requirements of modern society to use efficient methods of learning, with emphasis on scientific method, not based primarily on the teaching of scientific findings, but the constructive development of new knowledge based on empiricism and research [3, 4]. Since this kind approach involves real phenomena in

teaching process, it is particularly suitable for physics - physics should not be separated from the reality as it is usually done in classroom practice when using traditional teaching methods. Despite a widespread belief that inquiry-based learning is more effective in Science than traditional lecturing, the real implementation of these methods in classroom is very rare. Two reasons could be identified: (*i*) the teachers are not prepared for unconventional methods (that are in general unfamiliar for them) and (*ii*) there are no tested tools and prepared teaching scenarios. While the solution to the first problem is a long-term education of teachers at the University level, the solutions to the second problem can be tested effectively through the scientific research. The rapid developments of information and communications technologies (ICT) as well as a diversity of available multimedia provide powerful possibilities to create very effective (and attractive) teaching tools for inquiry - based methods [5].

The main goal of this thesis is to design and developed tools and teaching scenarios based on modern ICT for implementation of inquiry-based methods to be used during physics lessons. The prepared tools and scenarios will be tested at school/university level in order to verify their effectiveness in the teaching process.

Work plan

1. Design of teaching tools and scenarios for inquiry-based teaching with the use of ICT
2. Develop of research tools to study the effectiveness of designed tools and scenarios
3. Test of effectiveness of designed tools and scenarios at school/university level

Literature

[1] M. Rocard et al., *Science Education Now: a Renew Pedagogy for the Future of Europe,* High level Group on Science Education (m. Rocard), Europeean Commission, Directorate –General for Research, EUR 22845 (2007), https://ec.europa.eu/research/science-society/document_library/pdf_06/report-rocard-on-science-education_en.pdf

[2] J. Dostál (2015). *Inquiry-based instruction : Concept, essence, importance and contribution.* Olomouc: Palacký University, ISBN 978-80-244-4507-6, doi 10.5507/pdf.15.24445076

[3] P. A. Kirschner and G. Erkens, *Cognitive tools and mindtools for collaborative learning*, Journal of Educational Computing Research, 35, 199-209; 2006

[4] D. Hodson, *Laboratory Work as Scientific Method*, Journal of Curriculum Studies 28, 115-135, 1986.

[5] K. Służewski, G. Karwasz, *Multimedia w dydaktyce fizyki*, w *Edukacja a nowe technologie w kulturze, informacji i komunikacji*, Wydawnictwo Naukowe UMK, 2015, 355-374

Required initial knowledge and skills of the PhD candidate

- ➔ Analytical thinking
- ➔ Eager to learn

➔ Knowledge about general physics ➔ Knowledge about basic didactics of physics ➔ Eager to work hard
Zgłaszający projekt/ Author of the project

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Proponowani promotorzy i mentorzy/prospective supervisors
1) promotor główny/ main supervisior

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2) promotor pomocniczy / co-supervisor