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Editorial

Experiments in Physics Teaching and Learning

The first issue of volume eight consists of four parts. In the first part, there are five papers related to the focus topic of this issue: experiments in physics teaching and learning. The second part includes two Varia papers. In the third part, there is an interview with Prof. Michael W. Apple, one of the distinguished editorial board members of the present journal and a respected researcher in the field of education, while the fourth part consists of two book reviews, one of which is related to the focus topic of this issue.

The present issue focuses on experiments, which play an important role in physics teaching and learning. Numerous studies have demonstrated the positive effects of experiments on physics learning. Experiments are a powerful tool for visualising physics phenomena. They provide a starting point in the construction of knowledge, so it is important to use them in the classroom. It is well known, however, that experiments in the classroom are mostly based on demonstrations and are not performed often enough by the students themselves, even though it has been established that by experimenting students learn how to accurately observe, measure, record measurements, compare, order, state and test hypotheses, discuss and interpret results, etc. These competences are transferable to other science fields, as well. Experimental work influences skills, concept development and cognition, understanding of the nature of science, and attitudes towards science.

If we want teachers to include experiments in teaching physics, they have to be properly trained. The rich theoretical part of the article by Claudia Haagen-Schützenhöfer and Birgit Joham entitled *Professionalising Physics Teachers in Doing Experimental Work* presents the didactical perspective of experiments, the importance of experimental work in the classroom, and ways to promote learning about science and, finally, doing science. In the empirical part, the authors present a study examining teachers' beliefs about the function of experiments in science teaching and their meaningful implementation in the science classroom.

Preservice teachers have to learn to design, carry out, analyse and evaluate experiments on different topics covering the learning objectives from the curricula on different levels of education. Astronomy is an interesting topic for students of different age groups, but experiments in this field are complex. In the paper *Determination of the Size and Depth of Craters on the Moon*, Vladimir Grubelnik, Marko Marhl and Robert Repnik present an example of observation of the Moon undertaken without professional astronomic equipment, as well as

analysis of photographs using simple calculations that lead to specific results: the lateral size and depth of craters. The experiment was carried out by a group of preservice primary school teachers during the elective subject Astronomy and then evaluated. The results indirectly show that it is appropriate to implement the presented activity in the secondary school physics classroom.

University faculties often enable teachers to bring their students to the faculty to carry out a number of simple and complex experiments. The first example of such activities is presented in the paper by Marie Snětinová, Petr Kácvovský and Jana Machalická entitled *Hands-On Experiments in the Interactive Physics Laboratory: Students' Intrinsic Motivation and Understanding*. The authors discuss experiments in different forms as a tool for increasing motivation. Two types of experiments are presented: so-called projects, which their faculty offers to upper secondary students, giving students an opportunity to undertake hands-on experimental work in the Interactive Physics Laboratory; and physics demonstration shows. In the empirical part of the article, the authors focus on assessing student feedback about their immediate attitudes towards these two projects, with an emphasis on motivation. In the paper's conclusion, the authors highlight the fact that, while experimenting in the Interactive Physics Laboratory, students feel the need to invest significantly more effort and experience more tension than when watching demonstrations. However, students do not see a difference in the usefulness of undertaking practical work and watching demonstrations, despite finding the former more demanding.

The second example of collaboration between a university faculty and secondary schools in carrying out experiments is presented in the paper *Let's Repair the Broken Galileo Thermometer* by Marián Kireš. The author gives a detailed account of the experiment and the research. The activity for students includes an experimental problem about repairing a broken thermometer using tap water instead of ethanol. The students' understanding of the physics behind the experiment was evaluated and self-assessment was administered. Most of the students reported that they learned how a Galileo thermometer works. The author demonstrates the advantages of experimenting in science centres of this kind. At the same time, however, he points out certain issues with teacher education, and with the available support in methods and working materials.

The last paper in this focus issue is written by Robert Repnik and Milan Ambrožič and is entitled *Practical School Experiments with the Centre of Mass of Bodies*. It consists of a presentation of experiments for 8th and 9th grade students of Slovenian primary schools, and an evaluation of the experiments with four different groups of students. The research findings suggest that the implementation of group experiments about the centre of mass was motivating

for all four groups of students. In addition to the knowledge gained, the authors identified satisfactory motor skills in individual students working in groups and good geometrical reasoning.

Another feature of the present issue is an interview with Prof. Michael W. Apple, prepared for publication by Janez Krek. Prof. Apple's most important monographs include *Ideology and Curriculum* and *Official Knowledge*, which are included on the international list of the most important books of the twentieth century in the field of educational science. At the same time, Prof. Apple is ranked among the fifty most influential contemporary authors in this field. In 2016, he received an honorary doctorate from the University of Ljubljana. To honour this event, we are publishing an extensive interview with Prof. Apple.

The Varia section includes two contributions. The first, *Taxonomy of Teaching Methods and Teaching Forms for Youth in Non-Formal Education in the National Youth Council of Slovenia* by Vesna Milošević Zupančič, presents non-formal education in youth work, emphasising the central role of experiential learning and learning in groups. The author discusses the teaching forms and methods found in non-formal education for young people in youth councils on a national level in Slovenia.

The second paper in the Varia section was written by Seyyed Hatam Tamimi Sa'd and Fereshte Rajabi is entitled *Teaching and Learning Vocabulary: What English Language Learners Perceive to Be Effective and Ineffective Strategies*. The authors present the results of research with students exploring Iranian English language learners' vocabulary learning strategies and perceptions of vocabulary learning, as well as Iranian English language teachers' vocabulary teaching strategies.

This issue of CEPS Journal also includes two book reviews. Neja Benedetič's review of the book *Multiple Representations in Physics Education* (Volume 10 from the series *Models and Modelling in Science Education*), edited by David F. Treagust, Reinders Duit and Hans E. Fischer (Cham: Springer, 2017, 322 pp., ISBN 978-3-319-58912-1), presents a recent publication in the series of Springer monographs covering different aspects of the use of multiple representation in science education. It is shown that different representations allow students to be introduced to a physics concept from different perspectives, combining graphs, text, mathematical formulas, schemes, gestures, etc. into a whole. However, the authors also point out that the teacher has a crucial role in using multiple representations and enabling students to establish a correlation between different representations.

The book *Teacher Education for Multilingual and Multicultural Settings*, edited by Elgrid Messner, Daniela Worek and Mojca Peček (Graz: Leykam,

2016; 199 pp.: ISBN 978-3-7011-0361-4), reviewed here by Karmen Mlinar, provides an interesting and systematic insight into the theoretical and practical issues of European multicultural and multilingual settings, as well as offering a series of proposals for improving teacher education programmes.

The new issue of the CEPS Journal brings a variety of papers from various education research fields, reporting and discussing several open research questions. We believe that the information available in this issue will encourage reflection on the research problems addressed and raise new research ideas.

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