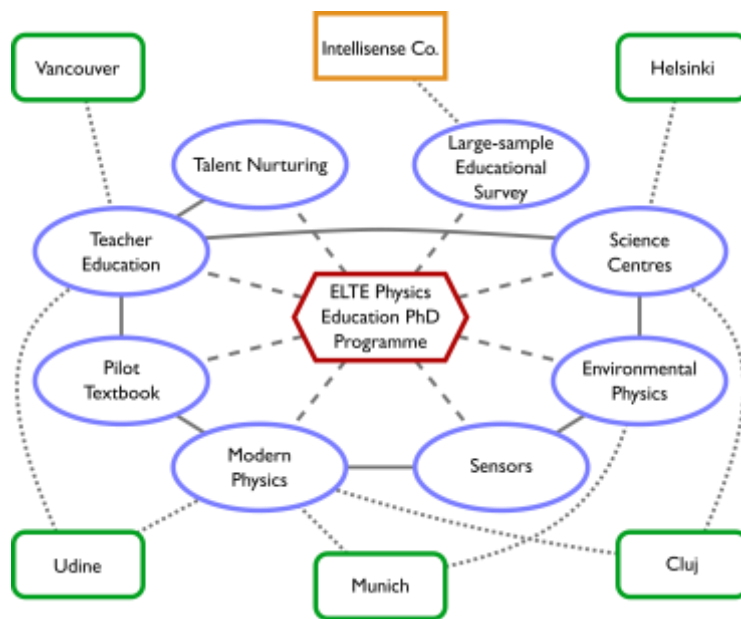


MTA-ELTE Physics Education Research Group

(2016-2020)

Introduction

The organization of the research group is based on the Physics Education PhD Programme at Eötvös University (ELTE), Budapest. The group operates in a network, each of the schoolteachers in the group pursuing their research as voluntary extra work in their own school, maintaining communication with other members of their team. The diagram below shows the structure of the network: the blue ellipses represent the teams of teachers, the green rectangles show the international relations and the orange one represents the software developer partner. The diagram also indicates the links within the network.



Goals and objectives

The *Environmental Physics workgroup* aims to provide guidance and resources to teachers in the treatment of environmental phenomena. The main topics addressed by the team are large-scale atmospheric and oceanic phenomena, the physical background to the energy problem, including renewable energy sources, the teaching of the physics behind the greenhouse effect, global warming, and climate change, as well as the ways to incorporate the achievements of modern astronomy and space research in science teaching.

The *Modern Physics workgroup* focuses on the teaching of modern particle physics and nuclear physics, materials science, semiconductors, nonlinear and chaotic phenomena, as well as collective behaviour and complex systems. The team lays special emphasis on lending variety to the application of computer simulation in teaching. They aim to combine the pieces into a coherent whole that arouses students' interest but also preserves the principal ideas of the underlying physics.

The *Pilot Textbook workgroup* examines nationwide and worldwide trends of textbook evolution, and develops a new concept for a textbook in experimental physics. They aim to balance the content of

traditional physics textbooks between a brief printed text (a “framework book”) that only contains the basics, and a webpage that supports the learning process in a variety of ways.

The *Large-Sample Educational Experiments workgroup* aims to recruit a large number of participating teachers who represent the entire spectrum of secondary education and are capable of testing educational innovations and of using the methodology of data analysis. The actual large-sample survey (with several hundred students) investigates the effectiveness of a piece of modern motion simulation software.

The *Teacher Education workgroup* conducts a comparative study of the state of initial training and continuing professional development of physics teachers in Hungary and abroad, in order to initiate best practices suited to local conditions. They develop classroom resources and teacher support material, aiming to provide guidance for participants in courses on subject teaching methodology at all levels. In addition, the team also addresses the problems of the large number of students admitted to the university with insufficient knowledge, in need of motivation and academic upgrading.

The *Science Centres and Extracurricular Physics Education workgroup* explores the possibilities for teaching and learning outside the classroom, from a perspective of physics education. They survey the science centres, interactive exhibitions and “unconventional physics lessons” nationwide. They identify the age group and subject area for which these exhibits and activities are appropriate, and develop detailed educational programmes for teaching physics outside the classroom.

The *Talent Nurturing workgroup* aims to develop and promote the methodology of a new gifted education programme that extends the learning environment beyond the classroom into an international dimension. Their research is based on international physics competitions (IYPT, ICYS) that do not only support the learning of physics but also improve several other essential 21st-century skills. To support gifted education, the team aims to develop practices and resources applicable in all Hungarian schools.

The *Sensors workgroup* intends to bring the world of smart tools, sensors, and microcontrollers closer to schools. One cannot avoid teaching about their physical backgrounds and the use them as tools in physics education. Their goal is to create a receipt book of experiences and good practices that can be used by teachers and pupils not receptive to the subject.

The *Babes-Bolyai University, Cluj, Group* aims to strengthen links between the communities involved in physics teaching and subject methodology, to exchange experience in the areas of gifted education and science popularization. The team also aims to conduct joint surveys on the teaching of collective behaviour and complex systems as well as the teaching of environmental issues.

The *University of Udine Group* aims to establish a staff exchange programme with the University of Udine (Università degli Studi di Udine). The main topics of joint research are new methods of teaching selected areas of modern physics, the interpretation of experiments in modern physics from a new perspective, and the didactic issues raised by the teaching of environmental physics.

The *University of Munich Group* aims to establish a staff exchange programme, including mutual visits to events, with the Chair for Physics Education (Lehrstuhl für Didaktik der Physik) and with the local community of physics teachers. The main focus of joint research will be teaching and learning with ICT, the application of sensors, and the teaching of environmental physics.

The *University of Helsinki Group* aims to establish a staff exchange programme with the Unit of Science Center Pedagogy operating within the Department of Teacher Education of the university, and to conduct joint research on teaching and learning outside the classroom, on discovery learning and problem-based learning of science, and on the teaching of topics subject to social conflict.

The *University of British Columbia Group* aims to establish a staff exchange programme with the Departments of Physics and Astronomy and of Curriculum and Pedagogy, and to conduct joint research on physics teacher education, the design and implementation of physics experiments, undergraduate physics teaching, and physics outreach.

Links:

<http://fiztan.phd.elte.hu/fiztan/kutcsop/index.html>

<http://csodafizika.hu/fiztan/kutcsop/index.html>

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