Position Paper on Physics Education

The European Physical Society emphasises the important role that Physics Education plays in today’s society, and contributes to the promotion of physics education and a physics education system in Europe based on best practice and supported by appropriate physics education research.

A prerequisite for a sound industrial base in Europe and for the promotion and development of new technologies is inspiring and effective teaching of science in general, and physics in particular, at all levels in the educational system.

Science in general and physics in particular is one of the basic elements in our culture that sustain our communities. It is also a prerequisite for basic job skills and in many of our daily functions. Science and physics are also the foundation for the high technology revolution seen in our societies and the way such technologies influence other societal challenges such as the environment, energy supply, and communication and production technologies.

This requires a physics educational system with two important dimensions, one capable of delivering science and physics to all in elementary schools and especially in secondary schools (preuniversity), the other a tertiary research based educational system capable of training the next generation of scientists in ever increasing numbers, both for advancing science and for the needs of industry.

In the preuniversity educational system appropriate teacher training and in-service support are the most important factors. Didactics and curriculum development are central issues, both depending on advanced educational research. Science and physics teaching involves complex factors ranging from cognitive-, pedagogical-, didactics- to curriculum development. An important factor in sustaining student numbers is an improvement in the gender balance in physics studies at secondary school level.

The European Physical Society notes that it is crucial to

- maintain and improve the quality of physics teaching and educational research at all levels across Europe, and to
- ensure rapid deployment of the results and best practices of educational research and experimentation, with regular contacts between educational researchers and the physics teaching community.
EPS calls on the national physics communities, on physics departments in universities and other institutes of higher education, as well as on national and European policy makers, to promote active research in physics education, in particular pilot projects for developing novel contents and methods; which should include the judicious use of new media. Associated with these research efforts there should be initiatives for improved training of specialists in physics education, including doctoral programmes and opportunities for further academic qualifications.

Tertiary level physics education, primarily taking place in universities, is an integral part of the European Higher Education Area (EHEA), the analogue of the European Research Area (ERA). The aim of EHEA is a harmonisation of the higher education systems in Europe, facilitating better utilization of available resources, better opportunities for students to study abroad and to connect the European educational area more strongly to employment. The Bologna process prescribes the development of EHEA.

The European Physical Society

- welcomes the Bologna process and the creation of EHEA, providing scope for greater European cooperation and development in higher education, benefiting both European and foreign students
- warns against overregulation of degrees and their component parts, stressing the need only for a general framework – “light touch regulation”
- recommends expression of learning outcomes and competencies in general terms without over prescribing each learning module
- stresses that physics learning is cumulative, it cannot be broken down into modules to be chosen completely free. In particular the early years of a physics degree will contain many compulsory modules, which are necessary prerequisites for later work.

The Bologna declaration describes a three-level educational system, at bachelor, master, and doctoral level.

The European Physical Society recommends that

- Bachelor degrees in physics should have a large common content to facilitate student mobility between universities and countries, both during and after the bachelor programme
• Masters degrees need to be more varied and involve specialisation in particular areas of physics or combinations of physics with related disciplines
• Doctoral degrees should not be modularized or expressed in specific learning outcomes/competencies, except possibly for some minor components.

To support these recommendations EPS will
• inform physics professors, lecturers and teachers of what is happening across Europe
• promote the establishment of a EuroBachelor label in physics as quality mark for bachelor degrees to assure national or European regulators about the degree quality
• promote the dissemination of educational pilot projects in physics to further best-practice
• endeavour to avoid inappropriate competition between funds for physics research and physics education research.