

"Current results in physics and new methods in Physics education"

Teacher Professional Development (TPD) course by Eotvos Lorand University,
Budapest, Hungary
(for Physics teachers in upper-secondary school)

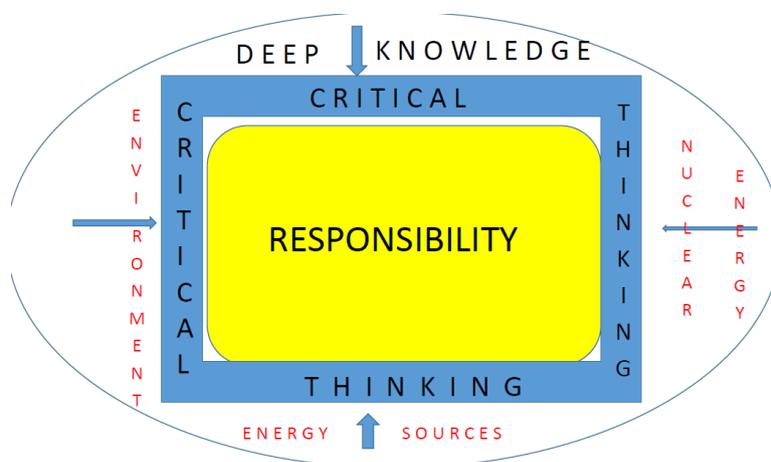
Overview:

In Hungary, the integration of social issues in Physics education on secondary level has a long-standing tradition. However, the SSIBL Framework provides a complex methodological repertoire about this topic and is therefore an important asset for in-service teacher education. The Framework requires research and innovation activities – capacities that our in-service training program intends to develop. Adaptation of the Framework on secondary school level depends on previous knowledge and experiences of students, their interests, social skills and attitudes. In order to disseminate the Framework, we have accredited a new in-service teacher training course and integrated it with the program of the Graduate Program on Teaching Physics. The new course described here provides an introduction in SSIBL methodology and also develops research and innovation skills of teachers.

The major objective of the course is to provide appropriate contents and methodology to teach about current results of Physics, a fast growing field of research through the three pillars of the Framework. All methods and educational tools are provided for teachers ready for use at school. The course presents Physics as an evolving field, introducing major phases in research history. We show that this is an open field where there are a lot of emerging issues for research, besides basic laws of science. We pay much attention on the discussion of current, socially relevant problems and provide their scientific background to support informed decision making as citizens.

A lecture series provided by the Graduate Program of Physics Education supports this methodological approach and completes the new course. Participation in this course prepares teachers to join the doctoral program but is also useful for those teachers who do not intend to proceed with their studies, but need information on new developments in the field of science they teach. The in-service course involves a modular component: teachers may select, according to their interests, one of four modules providing scientific grounding, which include four disciplines each.

The pedagogical model we developed to support the introduction of the SSIBL Framework is the model by Peter Tasnadi for socially relevant Physics education (Fig.1.):



Specific objectives (SO) of the TPD course

- **SO1:** through an analysis of the existing curriculum and teaching guides for Physics education according to components of the SSIBL framework, identify socially sensitive issues of the Hungarian Core Curriculum that can be embedded in teaching of Physics on secondary level;
- **SO2:** identify connections among current research in the field of Physics and some social issues related to areas of contemporary research and its results;
- **SO3:** understand the pedagogical relevance and innovative character of the SSIBL Framework; reflect on the various elements of the SSIBL framework and on the teaching skills required for these elements to be implemented in school; be able to integrate it in teaching programs, relying on good practice examples of the PARRISE consortium; be able to identify unique qualities of this approach as compared to traditional pedagogical approaches;
- **SO4:** evaluate your innovatory lesson plans and teaching tools: assess the success of the implementation of the SSIBL activities;
- **SO5:** critically reflect on the regional and local Physics curricula and propose means for future improvement, in terms of both the SSIBL project, the enactment of the pupils' SSIBL activities, and the results of New Physics.

Detailed description of the TPD course

Duration	Objectives	Description of activities	Materials	TPD model approach
8 lesson hours	SO1, SO3.	Discussion of ideas for socially sensitive scientific questions, developing suggestions for experimenting with the methodology in Hungarian schools. Presentation of the new European educational model: the Socio-Scientific Inquiry Based Learning (SSIBL).	Materials for the oral presentation: [A1-A3], [A4], [A5-A7], [B1-B3].	Teachers as learners, developers, leaders, and researchers
8 lesson hours	SO2, SO3.	Hands-on experiments about the concept of waves, cyclones and fronts, their equation of motion. Climate related issues. Physical aspects of global environmental issues.	Experimental materials, [B4-B8].	Teachers as learners, developers, leaders, and researchers
8 lesson hours	SO2.	The role of physics in understanding certain topics of biology and its social relevance. Presentation and group discussion on the relevance of biology in physics teaching with special emphasis e.g. on the effects of polarized light and on the phenomenon and consequences of light pollution.	[B3], [B9-B11], [A8].	Teachers as learners, developers, leaders, and researchers

8 lesson hours	SO4, SO5.	Presentation and discussion about the comparison of historical and present day view of atomic and astrophysical processes including nuclear issues.	[B1], [B3], [B12-B13], [A9].	Teachers as learners, developers, leaders, and researchers
8 lesson hours	SO2, SO5.	Hands-on experiments: Individual demonstration of renewable energies, including photovoltaic and wind energy.	Experimental materials, [B14], [A10-A11].	Teachers as learners, developers, leaders, and researchers

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References (background material):

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Overview of the TPD evaluation

Teachers were supposed to

- develop educational materials using the SSIBL framework (topics e. g. astronomy, modern physics, microphysics, chaotic dynamics, teaching strategies of classical physics, historically outstanding experiments in physics, relativity and cross-curricular aspects of physics and chemistry);
- prepare a pedagogical essay on challenges, success / failure and future prospects of using the framework

Content analysis of the pedagogical essay written by the teachers on challenges, success / failure and future prospects of using the framework – The essay had to discuss the following issues:

Q1: Challenges in the course of implementing the SSIBL framework

Q2: SSIBL pillars in learning materials developed by the teachers

Q3: Impact of SSIBL use on student motivation to engage in social issues as informed, active citizens and their performance in Physics

Q4: Adaptation of SSIBL methodology to better suit the Hungarian educational situation

Participating teachers acquired knowledge and developed skills in

- acquired a scientific grounding for discussing current results of physics and their relevance for society.
- preparing learning activities, tools and materials in Physics using the SSIBL framework;
- teaching the course module content on current results of physics and related social issues;
- using ICTs in developing tools, conducting measurements and simulation based experiments;

Another option for course assessment was to sit for an oral and / or written examination on the course material and earn university credit points that may be validated during doctoral studies in the PhD program for Physics Education at the Graduate School for Physics of ELTE.