

PROMOTING STUDENT-ACTIVE AND INQUIRY-BASED SCIENCE LEARNING BY THE PROJECT SALIS

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Abstract: This paper gives an overview about the project ‘SALiS– Student Active Learning in Science’, funded by the TEMPUS program of the EU for 2010-2012. SALiS is a reform initiative for middle and eastern European countries to innovate science teaching and teacher education. SALiS seeks to overcome a centralized and teacher-centered paradigm in science education as it is still predominant in different countries of central and Eastern Europe. Intended change concerns more student-active and problem-based science education under inclusion of students’ hands-on and inquiry-based learning in the lab. Within an international network, ten partners from six countries work on establishing sustainable change i.e. in the training practices of prospective and in-service science teachers.

Keywords: science teacher training, curriculum innovation, inquiry-based science education, active learning, EU-projects

BACKGROUND

Science teaching pedagogies in many countries all over the world are still dominated by a teacher-centered approach. Although constructivism is widely accepted in science education research and theory, the practice in science classrooms in a lot of cases is still dominated by transmission oriented pedagogies of learning and instruction. This consideration is especially true for many countries in central and eastern Europe which are still on their way of reform from the communist time towards modern educational systems and practices (Kapanadze, Janashia & Eilks, 2010).

Anyhow, reform already started. But, reform in many countries in central and eastern Europe lacks by deficits in infrastructure and resources for scientific and educational exchange. That is why in cooperation of the Iliia State University in Tbilisi, Georgia, and the University of Bremen, Germany, the project initiative ‘SALiS - Student Active Learning in Science’ was launched in 2009. Together with further partners from Ireland, Bulgaria, Germany, Georgia, Moldova, and Israel, an application for a reform network was submitted to the TEMPUS program of the European Union. The project was successfully approved in summer 2010 and will be conducted 2010-2012 with ten partners from six countries.

SALiS aims at innovating science teaching through a better inclusion of inquiry-based and student-active experimental learning in science classes. The project intends to promote i.e. open and inquiry-type lab-work as one of the foundations of modern curricular and methodological approaches in science teaching (Hofstein, 2004; Hofstein & Lunetta, 2003; Kipnis & Hofstein, 2007). These approaches aim to raise motivation, allow students gaining higher order cognitive skills, promote more effective learning of science concepts, and to contribute an advanced understanding of the nature of science (Kapanadze et al., 2010).

Recognizing that the teachers are the core for any innovation in educational settings (Eilks et al., 2006), the project aims at innovating science teaching in the above mentioned sense by

improving teacher training. For the purpose described, all participating institutions are jointly developing modules and resources for science teacher training in inquiry-based science education. These modules aim on enabling pre- and in-service science teachers to strengthen hands- and minds-on student learning through innovative approaches to lab-work instruction, e.g. inquiry-type strategies, open lab tasks, or cooperative learning in the lab environment (e.g. Hofstein & Mamlok-Naaman, 2008; Kipnis & Hofstein, 2007; Witteck, Most, Kienast & Eilks, 2007).

RATIONALE

SALiS is jointly developing teacher training modules, school teaching materials, and a concept of implementation of SALiS via the use of low-cost lab equipment. A series of workshops is developed to train teachers and teacher trainers in central and Eastern Europe to apply and support constructivist teaching and learning scenarios, both in teacher training and school science education. Implementation of the training modules is supported by creating a collection of good practices from all partner countries and making them available to the other partners by translation and adoption. A web-based resource pool is made available in the different languages of the countries participating in the project offering teachers and teacher trainers material to innovate experiment-oriented and inquiry-based science education, e.g. in the field of low-cost-experimental techniques. A platform for exchange of inquiry-based and student-centered science lab activities for students in secondary schools and secondary science teacher training courses will be established.

Whereas respective facilities at least on a basic level are available in all SALiS partners from the EU countries, the project will strengthen the infrastructure in the six beneficiary institutions through equipping science laboratories for teacher training. SALiS is providing a concept of necessary infrastructure for respective teacher training labs. With funding from the EU necessary equipment for training teachers in SALiS-oriented and lab-based pedagogies feasible to the curricular targets of SALiS are installed. Detailed guides that describe the usage of laboratories in teacher training including questions of safety, logistics and maintenance issues are developed, and structures of curriculum materials describing lab activities for teacher training in the respective languages will be provided.

The idea behind establishing and equipping the SALiS-labs for science teacher training is to transfer already existing strategies from the EU partners in the use of lab equipment for promoting more effective strategies in science learning via students' inquiry-based lab-work in school science. I.e., strategies are implemented to base student active lab-work on low-cost lab techniques. Such techniques use everyday-life equipment on no or low costs for conducting experiments in science classrooms (Figure 1). The use of everyday-life equipment is combined with micro and half-micro approaches to reduce costs and demands for waste disposal, and the use of chemicals with low potential to be harmful or environmentally dangerous. Low-cost experiments are used as a strategy to allow for more student experimentation in science classrooms also under less well equipped conditions in schools in central and Eastern Europe. Thus, strategies are implemented allowing the teachers later on in their schools to do students' lab-work under low costs, with low risks, and aiming an environmentally friendly waste treatment (Poppe, Markic & Eilks, 2011).



Figure 1. Example of a low cost experiment developed by equipment from medical technology in the case of the Hofmann apparatus for the electrolysis of water. Low cost equipment (left) costs less 1 Euro, traditional glassware (right) is about 70-100 Eur.

IMPLEMENTATION

SALiS aims on creating the foundation for upgrading science education in many schools to a better level required for supporting the technological and innovative development of the society. Through the implementation of the training modules into pre- and in-service teacher training in all partner institutions the dissemination will become broad and sustainable.

SALiS aims on raising the qualification of staff for in- and pre-service teacher training courses concerning the SALiS philosophy by providing them specific trainings, but also by sharing experiences in good practice during placements in the partner institutions. Therefore, different training sessions have been organized by the partners from within the EU, in Limerick, Ireland, and Berlin, Germany. Staff members from the Central and Eastern European institutions were able to participate. The participants learned about good practices in pre- and in-service teacher training practices for future application of the skills and knowledge to the development of the curricular framework, course syllabi, lists of the experiments and lab equipment within their countries.

The SALiS Labs have been established in Moldova and Georgia. In Israel, partner institutions have enhanced their existing laboratories to suit the goals of SALiS better. The laboratories have included both more traditional equipment and that intended for training for the use for the low cost experiments in teaching.

Additionally, training courses for the teacher trainers and supporting laboratory staff from the beneficiary countries were launched. After an initial meeting with training sessions in spring 2011 in Bremen, respective one-week trainings were now made available in Georgia, Moldova and Israel during autumn 2011 driven by the whole SALiS consortium. Step by step the number of persons involved is raised by involving student teachers into the project to become part of the process of SALiS curriculum development and implementation through MA and PhD studies.

Via the curriculum development and exchange process, implementation of the SALiS training modules also takes place in pre- and in-service science teacher education within the participating institutions from the EU-countries. For this purpose, SALiS offers a collection of good practices, established science teacher training modules and builds up an international

platform to transfer and further develop respective approaches, materials and techniques (Figure 1).

The image shows the homepage of the SALiS web platform. At the top, there is a dark blue header with the SALiS logo in white and yellow, and the text 'Student Active Learning in Science'. To the right of the logo is the European Commission TEMPUS logo, which includes the European Union flag and the text 'European Commission TEMPUS'. Below the header is a navigation menu with links for 'Partners', 'Work packages', 'Contact', and 'Imprint'. The main content area features a large group photograph of project members standing in front of a building. Above the photograph, the text 'Welcome to SALiS!' is displayed. To the left of the photograph is a sidebar with a list of links: 'Home', 'Rationale', 'Calender', 'Materials for staff and teacher training', 'Resources for low-cost labwork', 'Local SALiS websites and teacher training centres', 'Related projects', and 'Members section'. Below the photograph, the text 'Copyright © 2011 SALiS' is visible.

Figure 2. The SALiS web platform (www.salislab.org)

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