

Science Teacher Education by the Cross Regional TEMPUS-Project SALiS

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SALiS is a cross-regional project funded within the TEMPUS program of the EU. SALiS (Student Active Learning in Science) envisages strengthening the capacities of the partner institutions from the EU, Georgia, Moldova and Israel in the capabilities to promote contemporary science education by investments in reform in science teacher training. The focus is to support societal relevant, inquiry-based and student-active science teaching and learning. SALiS aims at innovating science teaching through a better inclusion of inquiry-based and student-active experimental learning in science classes by investing in pre- and in-service science teacher training. This paper provides an overview about the course of the project and its initial achievements.

Introduction

Student Active Learning in Science (SALiS) is a cross-regional project funded within the TEMPUS-program of the EU from 2010 to 2012. SALiS involves partners from Germany, Bulgaria, Ireland, Moldova, Georgia and Israel. The purpose of the project is innovating science teaching by implementing modern and effective strategies in science teacher education. The focus of innovation is strengthening inquiry-based science education with a high degree of student activity, hands-on and minds-on.

On the base of the theoretical framework of SALiS (Kapanadze, Janashia, & Eilks, 2010; Kapanadze et al., 2011), science teacher training modules and materials are thought to be developed and applied in SALiS-trainings in all the SALiS countries. To maintain sustainability, SALiS seeks to implement reformed science teacher training modules into the teacher training curricula in the beneficiary countries. The curricula are thought to introduce prospective and in-service teachers to well established practices of inquiry-experiments, open lab work, problem-solving activities and forms of collaborative and cooperative learning. SALiS intends to promote especially open and inquiry-type lab-work as one of the foundations of modern curricular and methodological approaches in science teaching (Hofstein & Kind, 2012).

Innovations in the beneficiary countries were also thought to contribute to reform by implementing infrastructure for more hands-on and laboratory activities in

pedagogical courses in science teacher training, and implementing the culture of low-cost- and microscale-experimentation in science teacher training by equipping respective labs accordingly. In the end, SALiS aims at raising motivation in science learning, allowing students gaining higher order cognitive skills, promoting more effective learning of science concepts, and to contribute an advanced understanding of the nature of science (Kapanadze et al., 2011).

Background

The recent *Trends in Mathematics and Science Studies* (TIMSS) and the *Program of International Student Assessment* (PISA) have shown substantial deficits in science education both in OECD countries and elsewhere. The studies not only revealed the deficits in the knowledge base of the students in science but also a lack of understanding the nature of science, the grasp of scientific methods, poor understanding of scientific concepts, ideas, methods, and lack of comprehension of the societal, political, and epistemological role of science. TIMSS and PISA underline the importance of quality in pre- and in-service teacher training programs for achieving high outcomes in science. Georgia, Israel and Moldova have participated in those international studies with unsatisfactory results. The overall ranking of the students from all of those three countries are below the average thus revealing the needs in the upgrade of teacher preparation policies and practices.

Another noticeable trend in the countries mentioned, as in many countries all over Europe, is the declining enrolment of students to the studies of science and engineering in higher education (EU, 2004). One of the important determinants for the low motivation of the students to enter the education programs in science on the tertiary level is the level of teaching at the secondary education level. The trend is alarming in the context of the overall increase of the student population at the European level. The Lisbon agenda calls for a young generation being deeply engaged with the study of science and technology to form the knowledge-based economy of the future. This goal will hardly be achieved without substantial foundation in science promoted by modern science education.

SALiS intends reducing shortcomings in student motivation to study sciences and wants to promote a broader approach to science learning in schools. SALiS is grounded on the principles of Inquiry Based Science Education (IBSE) (Kesner & Hofstein, 2007). IBSE has proved its efficacy in increasing students' interest and attainment level while stimulating teacher motivation. IBSE is also found to be beneficial to promoting girls' interest and participation in science activities. Finally, IBSE and traditional deductive approaches are not mutually exclusive and when combined help to accommodate different mindsets and age-group preferences.

Whereas the science education community mostly agrees about the benefits of IBSE, the reality of classroom practice in the countries participating in SALiS is different. IBSE methods are not widely implemented for various reasons. The barriers experienced in putting inquiry teaching into practice are closely related to teachers' basic values and beliefs about teaching and learning as well as on teachers' skills for

inquiry based teaching. It seems that teacher training is lacking to make the teachers skilful and open-minded to apply IBSE-based pedagogies in the science classroom.

Course and Achievements

SALiS was developed collaboratively by Ilia State University in Georgia (applicant and coordinator) and the University of Bremen in Germany. The EU team brings a rich expertise in curriculum development and teacher training for science teachers into the project. Expertise is available on IBSE, societal-oriented science education as well as alternative pedagogies and laboratory techniques for practical work in science education.

SALiS Partner Universities are:

1. Ilia State University, Georgia (applicant and coordinator)
2. Akaki Tsereteli State University, Kutaisi, Georgia
3. University of Academy of Sciences of Moldova, Chisinau, Moldova
4. Institute of Educational Sciences, Chisinau, Moldova
5. Academic Arab College of Education, Haifa, Israel
6. University of Haifa, Israel
7. University of Bremen, Germany
8. Free University of Berlin, Germany
9. University of Limerick, Ireland
10. University of Plovdiv, Bulgaria

The central component of SALiS is the joint development and implementation of science teacher education infrastructure, curricula and pedagogies. A training program for the academic staff in the beneficiary countries as being the future trainers of teachers of science has been developed in collaboration between the EU partners and SALiS participants from the TEMPUS area. The program includes the philosophy, application and demonstrations of teaching science actively. The materials provided by the European partners include a guide and data base of low-cost- and microscale-experiments. Low-cost- and microscale-experiments are used as a strategy to allow 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 to do students' lab-work under low costs, with low risks, and aiming at an environmental-friendly waste treatment later on in their schools (Poppe, Markic & Eilks, 2011). Respective one-week-trainings were conducted in all the beneficiary countries. Two trainings for teacher trainers from the beneficiary countries have been conducted by the European partners in Limerick (Ireland) and Berlin (Germany). Respective lab facilities for teacher training were equipped and were put into operation into the science teacher training programs.

The Georgian institutions have been piloting the SALiS courses in the spring semester 2012. Trainings have been held in Georgia, involving both partner institutions. Besides teacher trainers from the partner institutions a third regional university, University of Batumi, has been involved to spread the impact. In Georgia,

the trainings have also included people from the decision making bodies, e.g. persons from the National Curriculum and Assessment Centre, responsible for development and the implementation of the curriculum on the national level. Both Moldavian partners have developed curricular frameworks and course syllabi for implementing SALiS in their teacher training programs (pre- and in-service) The Institute of Educational Sciences has undertaken review of the National Curriculum for Secondary Schools in Moldova and connected the findings to reforms intended by SALiS. Initiatives for the development of science teaching and modernising school science curricula were started. The Moldavian partners have also contributed to the development of school curricula. Both Israeli partners have been revising their existing teacher training curricula in the light of SALiS project. The SALiS laboratories were put into operation and contribute to reform in science teacher training. Joint science teacher training days were implemented in both partner institutions from Israel.

Summary

In all partner institutions SALiS trainings have been conducted for pre- and in-service science teachers. Staff in all universities has been trained in implementing SALiS materials in teacher training programs, thus contributing to long term capacity building and sustainable implementation. Networks of EU-institutions and partners from the TEMPUS countries were established and cooperation and knowledge transfer is planned even beyond the funding of the SALiS project. Many materials were published under www.salislab.org and will be helpful for the training of science teachers in the future within the SALiS partner universities and beyond.

References

- EU (2004). *Europe needs more scientists – Report by the High Level Group on Increasing Human Resources for Science and Technology in Europe*. Brussels: EU.
- Hofstein, A., & Kind, P. (2012). Learning in and from science laboratories. In B. Fraser, K. Tobin., & C. J. McRobbie (Eds.), *International handbook on science education* (pp. 189-207). Dordrecht: Springer.
- Kapanadze, M., Janashia, S., & Eilks, I. (2010). *From science education in the soviet time, via national reform initiatives, towards an international network to support inquiry-based science education - The case of Georgia and the project SALiS*. In I. Eilks & B. Ralle (Eds.), *Contemporary science education* (pp. 237-242). Aachen: Shaker.
- Kapanadze, M., Janashia, S., Makashvili, M., Eilks, I., Stuckey, M., & Markic, S. (2011). *Promoting student-active and inquiry-based science learning by the project SALiS*. In: Proceedings of the 9th ESERA Conference, Lyon, lsg.ucy.ac.cy/esera/e_book/base/ebook/strand3/ebook-esera2011_KAPANADZE-03.pdf.
- Poppe, N., Markic, S., & Eilks, I. (2011). *Low-cost-techniques for students' labwork in science education - A guide for teachers*. Bremen: SALiS.