



Digital Support for Inquiry, Collaboration, and Reflection on Socio-scientific Debates

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“Digital Support for Inquiry, Collaboration, and Reflection on Socio-scientific Debates”

Motivation

The citizens of modern societies are increasingly being asked to deal with socio-scientific issues and make informed decisions on the basis of scientific data. However, research suggests that European students show a declining interest in science education creating an urgent need to reform science education in Europe. The task to reform science education is formidable, as there are many complex variables at play. Some of the difficulties can be identified at the local, within-country level: among others, these include established instructional practices that are resistant to change, old-fashioned textbooks which were first shaped in the industrial era, challenges in reaching a consensus as to what the goals of science education ought to be today, and challenges in supporting student and teacher learning of the reformed ideas. Even though work about the local challenges has been accruing in both sides of the Atlantic, there is little work that discusses the challenges in transferring best practices in science education. These challenges span across countries and can become barriers in successfully transferring best practices from one context to the other; their research is crucial at European level, as they may be related to cultural and national differences between European states.

Project CoReflect

Project “*Digital Support for Inquiry, Collaboration, and Reflection on Socio-scientific Debates*” (CoReflect, www.coreflect.org) seeks to explore mechanisms for addressing some of the local problems in science education today, and is examining the transfer of empirically-validated successful practices to other contexts. CoReflect is a three year research and development project (2008-2011) funded by the FP7 Science in Society program, activity 5.2.2 Young People and Science.

Three main assumptions guide the CoReflect work: First, there is little availability of innovative, research-based inquiry environments, at European level, that can support students’ development of scientific literacy; second, science education researchers and teachers often develop pedagogical materials irrespective of the conversations occurring in each community; and, third, little research has been conducted at European or even global level, of the factors that may foster or hinder the adaptation of best practices from one context to another. CoReflect has been organized around these assumptions as the project seeks to develop:

- An empirically-tested, web-based library of interactive, inquiry environments, which can be modified at the teacher level. The development of these learning environments are guided by science education research findings and each team’s design-based research. The final digital library, which will be hosted on the STOCHASMOS learning and teaching platform (Kyza & Constantinou, 2007), will be made available in English and two other European languages and will incorporate digital and printed materials for students and teachers.
- A model for interdisciplinary teams working together to develop, implement, and validate innovative learning environments in science education. Each CoReflect partner has organized a Local Working Group (LWG), consisting of researchers, teachers and scientists; through frequent meetings over the period of three years, each Local Working Group

member contributes their respective expertise, as the Group develops an inquiry-based learning environment on a socio-scientific topic. The idea behind Local Working Groups is to help create learning environments that are research based, scientifically sound, and take into account pedagogy, as well as cultural, operational, and functional constraints.

- Collaboration between countries and contexts, at the Local Working Group level. Three collaborating Local Working Groups (cLWGs) have been created, which will work together to translate and adapt each other's learning environment. Both environments will be implemented in the collaborating countries, thus providing an indication for the success of the adaptation process. This work will lead to the identification of the factors that influence the transfer of successful innovative curricula from one context to another.

Summary of the work conducted during the first 18 months

Four main objectives were outlined at the onset of the CoReflect project. These objectives were to:

1. Develop and empirically test a multi-lingual and multimodal web-based library of inquiry learning environments, integrating reflection as part of the learning process.
2. Contribute to fostering participating students' interest in, and understanding of, socio-scientific issues that preoccupy modern societies.
3. Develop a mechanism for spreading the crucial attributes that make the design of interactive learning environments about socio-scientific topics *and* their classroom implementation effective in existing isolated pockets of practice, taking enough care to overcome the systemic, cultural, organizational and language barriers that impede transfer of educational programs from one educational system to another.
4. Engage a network of university-school-educational authority Local Working Groups in a series of research studies on specific aspects of the classroom implementation of web-based inquiry-oriented science teaching and learning environments, such as the role of student reflection in facilitating inquiry processes and the importance of collaboration in investigating hypotheses using actual scientific data.

During the first eighteen months of the project, CoReflect has progressed well towards achieving its goals. Beyond WP1: Project management, the work of the project has been organized around seven WorkPackages. WP2 has supported the project members in building common ground on the important concepts that unify the work conducted by each partner separately: learning in science, inquiry, scaffolding, motivation, understanding, reflection, socio-scientific issues,

and collaboration. In the context of the work conducted in this WorkPackage, the Local Working Groups have come together, exchanged ideas, and received peer feedback on their work. Three such Knowledge-Sharing occasions have been planned, one during each year of the project. Two Knowledge Sharing Workshops have already successfully taken place.

WP3 has supported the development of the web-based, inquiry learning environments. The web-based learning and teaching platform STOCHASMOS is used to support the development and hosting of these pedagogical content modules for inquiry-based teaching and learning. STOCHASMOS has been localized to support the authoring of web-based learning environments in the local languages of the partners; the platform is now fully available in seven languages (Arabic, Dutch, English, German, Greek, Hebrew, and Swedish). With the exception of one partner, who serves as the dissemination coordination partner linking practicing teachers outside of the Local Working Groups with the project, partners are engaged in design-based research to support learning by inquiry.

Seven Local Working Groups involving university researchers, practicing teachers, educational authorities, and scientists have been formed. Between the first (Month 1) and the 18th (Month 18) months of the project, each LWG has been engaged in the development of digital, web-based reflective inquiry learning environments to facilitate students' engagement with project- and inquiry-based investigations in science. The existing learning environments address socio-scientific issues and seek to support the development of students' understanding of scientific practices, while motivating them to engage in science learning in a meaningful way. Seven learning environments have been developed in a local language and English on the following topics:

- Biotechnology
- Global Warming
- Nicotine Addiction
- Sustainability
- Astrobiology
- River pollution
- Impact of fog on human life.

A driving question guides students' inquiry of the socio-scientific problems under investigation. Suggested activity sequences and teacher guides have also been developed by each LWG to accompany the web-based learning environments.

The classroom implementation of the CoReflect learning environments has been guided and documented at the project level by the procedures established through WP4. Each learning environment has been piloted locally in authentic classroom environments. Following design-based research data were collected during the pilot implementations and each Local Working Group is revising the learning environments based on the data collected during the implementation. Following this revision, each environment will be implemented for a second time in the local country, and subsequently a third time in a collaborating country to explore

issues of transfer. Attention has been given to carefully documenting the enactment and adaptation phases.

Students' motivation to learn and conceptual understanding are important criteria of success for the CoReflect learning environments. As such, WP5 monitors and guides the process of collecting research data that will serve to improve and validate the learning environments. At the same time, WP6 supports the examination of the adaptation process, which will take place during the second half of the project.

A website has been developed and is regularly updated with information on the project. At the same time, several dissemination efforts are under way, targeting teachers (both at the local and international level), educational authorities (such as Ministry of Education or state representatives and school-administration liaison people), and researchers. Two CoReflect symposia have already been presented at European conferences, such as EARLI 2009 and ESERA 2009.

Expected final results and potential impact

The project has been having an impact even during the first 18 months, both on participating teachers and for students. For *participating teachers* the project has served as an informal professional development mechanism, introducing them to inquiry-based learning and new technologies. The learning environments being developed offer *students* a new perspective on learning, by allowing them to undertake a problem-based approach to learning and providing a motivating context in which learning can take place.

In the long term, the project seeks to contribute to informing research, practice and policy making, as these three aspects relate to science learning. The CoReflect consortium is developing motivating scaffolded learning environments for students, supporting materials for teachers, thus presenting an important perspective on how to engage key players in reforming science education through inquiry in Europe.

Project consortium

CoReflect brings together eight partners:

- Cyprus University of Technology (Cyprus, Coordinator)
- University of Cyprus (Cyprus)
- Ben Gurion University of the Negev (Israel)
- The University of Twente (Netherlands)
- Kristianstad University (Sweden)
- Leibniz University of Hannover (Germany)
- University of Thessaly (Greece)
- The Association for Science Education (United Kingdom).

For more up-to-date information on the project's progress please visit the project website.