Inquiry, Collaboration and Reflection: The CoReflect project

Dr. Eleni A. Kyza, Lecturer in Information Society, Cyprus University of Technology
Eleni.Kyza@cut.ac.cy ◇ www.coreflect.org ◇ info@coreflect.org

Science in Society — SEVENTH FRAMEWORK PROGRAMME

Problem Statement

- European students show a declining interest in science education (Sjøberg & Schreiner, 2006).
- There is an urgent need to reform science education in Europe (Osborne & Dillon, 2008).
- Reforming science education is a complex task as many variables are at play simultaneously.

Some of the reform implementation problems targeted by CoReflect are:

- The lack of customizable, inquiry-based innovative teaching materials at European level.
- "Lethal mutations" -that is, reformed documents that are incorrectly used by teachers and teacher-student needs that are not properly understood by researchers.
- Not much research exists on the adaptation processes that could support the successful implementation of science education best practices from one cultural context to another.

CoReflect is a three-year (2008-2011) research and development project funded by the FP7 program *Science in Society* (contract 217792). At the level of the project, there are three main goals:

- To develop and empirically validate a web-based collection of innovative, inquiry-based learning environments.
- To establish and study a model for the development of sustainable inquiry digital curricula, involving researchers, scientists, and practicing teachers.
- To explore the adaptation process through which best practices can be adapted and transferred from one national or cultural context to another.

- The development of the inquiry-based learning environments of the CoReflect project serve as a testbed for science education research, both at the individual partner level and at the CoReflect team level.
- At the individual partner level, several areas of broader interest to the science education community are being pursued, such as students' argumentation, evaluating the credibility of data, students' worldviews of science, teacher inquiry, etc.
- At the CoReflect level, the CoReflect team is examining the effectiveness of the learning environments being developed, and students' motivation as a result of their engagement with each of the learning environments.
- As a group, the CoReflect team is examining, comparing and contrasting the Local Working Groups' design process and the learning environments' adaptation process from one country to the other.

Ask us about key concepts in CoReflect

Digital libraries · Collaboration · Conceptual Building Blocks · Reflection · WWW · Local Working Groups · Participatory Design · Design-based research · Learning environments · Scientific inquiry · Knowledge-Sharing Workshops · Socio-scientific problems · Adaptation processes · STOCHASMOS

Inquiry

Seven inquiry-based learning environments are currently being developed by each Local Working Group on the following topics:

- Biotechnology
- Global Warming
- Nicotine Addiction
- Living Kingdom
- Fog and Humans
- Ethical and scientific issues in astrobiology
- Water quality and human activity

- Each of the topics is presented to the students through problem-based learning, using a driving question to guide their investigation and a scenario.
- The inquiry-based learning environments are hosted on the STOCHASMOS (Kyza & Constantinou, 2007) learning and teaching platform. STOCHASMOS allows teachers to author their own web-based materials or customize environments designed by others. The platform is suited to online investigations which include rich data, offering the tools for focusing on evidence-based and explanation-driven inquiry.
- The STOCHASMOS students' environment consists of two main areas: the inquiry environment and the WorkSpace. Most of the reflective scaffolding supporting students' reflection-in-action and collaborative work can be found in the STOCHASMOS WorkSpace. STOCHASMOS also offers several tools to support students' online, context-based collaboration and ongoing assessment by the teacher both in the inquiry environment and in the WorkSpace.
- Figure 1 shows the Biotechnology environment's driving question and scenario while Figure 2 shows a screenshot from the Biotechnology Learning Environment's WorkSpace.

Fig.1 The Biotechnology scenario

Fig.2 Students' reflective workSpace

- The learning environments address a range of ages, from elementary to high school.
- Tools such as the graph generation tool allows students to ask questions of data; graphs are automatically generated for them, so that they can focus on the conceptual aspect of the task. An example of such a graph can be seen in Figure 2.
- Scaffolded template pages in the WorkSpace provide guidance through articulation prompts and boxes so that students can engage in self-regulated inquiry.
- The representational tools of STOCHASMOS support articulation and reflection between the members of each group.
- Each LWG is designing an activity sequence that details activities surrounding the use of the web-based environments.
- Some activity sequences include hands-on experimentation in addition to the work on the computer.
- The role of the teacher is extremely important in supporting activities on and off the computer.
- Each environment will be available in English and two other languages.

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Collaboration

- **Students** work in groups (usually of two or three) in each of the learning environments.
- The representational tools of STOCHASMOS support collaborative learning.
- Collaboration across groups can be supported by the technological tools: groups can be paired up and share each other's work in the WorkSpace, and provide context-based feedback.
- Collaboration also happens at the level of the **Local Working Groups**, which have been paired up to provide detailed comments to each other about their learning environment.
- Each learning environment will be implemented twice by their LWG –after several rounds of peer-critiquing it will then be implemented by the collaborating Local Working Group.

Reflection

- One of the unique characteristics of the CoReflect project is the emphasis on integrating reflection in the process of **student inquiry**.
- We define reflective inquiry as students' engagement in planning, monitoring, and evaluating their inquiry process and outcomes.
- Research has shown that students are challenged when they are asked to take initiative of their own learning process to solve problems.
- Reflection-in-action can help students make sense of what they are doing and can, thus, support the development of students' self-regulation.
- We also value reflection as a methodological tool to further our own inquiring into the project processes.
- As a result we are engaged in **action research**, seeking to examine our own design efforts in the context of the Local Working Groups.

Learn more about the CoReflect project by visiting www.coreflect.org!

Talk to us at the CoReflect symposium at the EARLI 2009 conference.

The symposium is titled "Participatory design of web-based learning environments: Challenges and Responses"

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