SDI ADDRESSING IN EDUCATION

SDI IS A HOT TOPIC IN THE EDUCATION AREA, INGO SIMONIS EXPLAINS WHY.

Do you remember the old days? A teacher stood in front of the class, lecturing for hours while the students tried to follow. Based on the idea of instruction and systematic knowledge transport, students were forced into the role of the passive consumers. It worked in case of pure transfer of facts but usually failed if the newly achieved knowledge should be put into action. It was difficult to transfer the knowledge from the learning situation to real world scenarios: The knowledge was sluggish. Things changed a lot during the last decades. Empowered by the integration of the so called New Media into the classrooms, the problem oriented approach became more and more popular. E-learning modules were and are currently under development and provide a solid base for self-learning and the integration into classroom teaching (blended learning).

SDI and the Educational Sector

Spatial Data Infrastructures are one of the hot topics within the GI research domain since several years. Commercial SDIs appear in the GI market sector; the spatial data infrastructure of North-Rhine Westphalia, in Germany (called “GDI-NRW”), being only just one example, gathers more than 100 participating institutions. Although commercial off-the-shelf products are available as the building blocks of SDIs, the setup process as well as the maintenance of an operational SDI still requires a profound SDI-knowledge.

The educational sector has recognized these developments. In consequence, SDI has become part of modern GI curricula. One of the major challenges the educational sector is faced with, is the rapid development process of the SDI sector. Though Web Services are widely adapted those days, the GI specific part is undergoing frequent changes and forces in the same way a rapidly cycled reviewing process of teaching material. Overall, three different problem areas can be

Learning and Teaching

Nowadays, learning is understood as a self-active constructive process within a dedicated plot and context. Five fundamental features of teaching are:

- Learning is an active process. Effective learning is only possible if the student is involved actively. Necessary prerequisites are motivation and interest.
- Learning is a self-directed process. The attempt to become familiar with a content area makes it necessary to control the own learning process by the student.
- Learning is a constructive process. Knowledge can only be obtained and made usable if it – in the first step – can be integrated in already existent knowledge structures successfully and – in the second step – can be interpreted on the basis of individual experiences.
- Learning is a situative process. Knowledge has always references to situations and context.
- Learning is a social process. The acquisition of knowledge frequently occurs in interaction with other people. If this is the case learning takes place in a definite learning culture. Knowledge content as well as values and attitudes will be negotiated interactively.

Teaching SDI

Interoperability issues in general and SDI in particular are very complex issues to teach. The range from principle architectural models to specific data exchange protocols is broad and the number of used techniques high. To provide a valuable seminar in SDI, a lot of preparation is necessary to develop optimal teaching material. Making use of commonly produced e-learning modules may help to
keep the preparation time within reasonable limits. Based on the key process features of constructive, problem-oriented learning, we have to consider the following design principles and its corresponding SDI specific aspects while developing learning modules as building blocks of SDI teaching:

- **Authenticity and example of use.** Any virtual learning modules should be shaped in a way that allows dealing with real world problem scenarios.
- **Multiple contexts and perspectives.** The virtual e-learning modules should be shaped in a way that allows viewing specific content and situations from multiple points of view. Multiple contexts and perspectives allow acquiring new knowledge that could be applied in other situations or problems more easily.
- **Social learning arrangements.** The virtual e-learning modules shall provide a high level of social learning arrangements to foster cooperative learning and problem solving. The development of learning- and practical training communities should be pushed.
- **Information- and construction supply.** The virtual learning modules should contain concrete instructions and strategies how a specific task might be addressed and a specific problem could be solved. It is important that these instructions do not seduce into simple “absorb and reproduce”, but suggest to actively self-directed knowledge construction.
- **Instructional guidance and support.** Learning in virtual environments always requires instructional guidance and support.

All of those principles lead to two major requirements: First of all, we need modules of high quality that are revised frequently to reflect current changes within the SDI research and market sector. Secondly, we have to support practical work within class or – for distant learners – in the home environment, which makes a reasonable number of Web Services and corresponding clients necessary. Those have to provide a vital GI infrastructure that builds the basis for self-initiated learning. Real world scenarios require authentic data that has to be stored and made accessible by Web Services without any restrictions.

Setting up and maintaining Web Services or servers in particular if the services shall reflect the latest changes in interface design – is an extremely labour expensive task. The same applies to learning modules. Didactically rich modules are very costly during the production phase. Though some of them may provide rather static content, the majority will have to updated on a tight schedule.

In the following, we propose an infrastructure for GI Education that shall help to overcome most of the aforementioned problems.

**Infrastructure for GI Education**

Sound e-Learning is expensive; and expensive e-Learning is not necessarily suitable. When e-Learning emerged a couple of years ago, many projects were funded on European, national, and regional level. Nowadays, funding programs expire and experiences were made. Based on own experiences and many discussions, e.g., at EUGISES conference 2004 in Villach, Austria, we observe the following impediments:

- The strength of e-Learning is in supporting (inter-)active learning. However, we can find examples, where e-Learning is considered as uploading presentations to a server.
- Updating contents is especially expensive in rapidly changing topics as standardized SDIs – teaching materials will be outdated within a year. After terminating a funded e-Learning project, many institutes lack of an appropriate business model for updating contents or even operating the developed e-Learning environment.
- Teaching GI interoperability and Web Services require access to usable data and software. Often, this is a limiting resource, being not available or too expensive.
- SDI sub-topics like the standardization process of GI web service interfaces or communication protocols and encodings contain a lot of and rapidly changing knowledge that a single GI institute can hardly keep track on.
- Funded e-Learning projects often develop stand-alone solutions of platforms, concepts, and contents in parallel. We consider this as an ineffective use of resources.
- GI institutes only can overcome these impediments by sharing resources in networked cooperation. Organizations and initiatives, e.g., GITTA-Swiss Virtual Campus, GI-Multimedia for a new interdisciplinary course of studies, and UNIGIS, developed e-Learning platforms and contents in such networks. Although appreciating the collaborative approach, impediments remained, for example, limited or fee-based access, or high expenditure for using e-Learning contents.

Therefore, the Institute for Geoinformatics initiated the ALFA project eduGI.LA with four Latin-American and three European partners. Amongst other, the project developed a prototype for the exchange of e-Learning courses, which currently is being implemented in a follow-up project.

Our core idea is the effective sharing and re-use of know-how and resources in a non-fee business model. We think that the following key elements can be adapted by other cooperated e-Learning initiatives:

- Networked cooperation saves resources by establishing and operating a common e-Learning platform.
- Each network partner provides an e-Learning course topic according to his/her competence. This assures a deep know-how for developing the course as well as the know-how for future updates.
- The network agrees on course topics that are needed by the partners. The networked cooperation provides access to international GI know-how and new topics that the receiving institutes could not offer to their students by own resources.
- An exchangeable course is developed by strictly using existing resources, e.g., by mere translation of a Portuguese e-Learning course to English, or by adaptation of a regular course’s digital material to e-Learning requirements.
- The receiving institutes have almost no work with receiving an e-Learning course, because the providing institute executes the entire course and is responsible for students’ supervision and exams. The adaptation of external teaching materials to an institute’s own needs omits.
- The provision of e-Learning courses is on a non-fee exchange basis.

The prototypical development and the starting phase of its implementation by the eduGI.LA consortium showed so far, that our approach is capable to overcome the above described impediments. Final results will be presented in 2006.

**Conclusions**

SDI is an emerging topic, which is important for society and economy. It became established in modern GI curricula, and there is a growing experience in teaching SDI. One of the core problems is the rapid progress of SDIs changing specifics like interface design or data encoding that forces frequent updates of major parts of the teaching material.

We think it crucial to share know-how and resources in order to provide a high-quality and up-to-date teaching without putting a heavy financial burden on a single institute. Only networked cooperation in educational infrastructures is capable to address these needs. The non-fee business model of the eduGI.LA consortium highlights features of an educational infrastructure, which address the effectiveness and cost-saving use of resources.

**Additional Information:**
GI-Multimedia (www.geoinformation.net) UNIGIS (www.unigis.org) ALFA project eduGI.LA www.eduGI.net/eduGI.LA

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