E-LEARNING MATERIALS IN GIS-TECHNOLOGY AND CARTOGRAPHY – TOWARDS AN OPEN-CONTENT SOLUTION

Marion Werner[1], Susanne Bleisch[2], Joël Fisler[3]

[1] Institute of Cartography, Swiss Federal Institute of Technology (ETH)
CH-8093 Zürich, Switzerland – werner@karto.baug.ethz.ch
[2] Department of Geomatic Engineering, Basel University of Applied Sciences (FHBB),
CH-4132 Muttenz, Switzerland – s.bleisch@fhbb.ch
[3] Department of Geography, University of Zürich (UNIZH),
CH-8057 Zurich, Switzerland – fisler@geo.unizh.ch

ABSTRACT

Today there is an increasing importance and demand for spatial information with rising tendency. Staying abreast of technical changes we have the need to undertake the creation of apprenticeship, dealing with Geographic Information Studies and Cartography. The laptop is a quasi standard for today's students. Taking this into account we can also benefit from new web technologies in the apprenticeship. With this prevision we started generating a multimedia enriched course in 2001, named GITTA [Geographic Information Technology Training Alliance]. With the upcoming year 2004 we got granular to GITTA's potential and could formulate far-reaching development targets to make the course even more attractive. The main development targets now concentrate on enhancing the didactical XML framework and realising a concept towards offering the GITTA materials to an interested community as open-content.

1 GITTA – STATE OF AFFAIRS

GITTA, initiated by the Swiss Virtual Campus in 2001, is an interactively programmed, IT-based and multilingual pool of learning materials that can be used for different courses within Geomatic- and Cartography Studies, Environmental- or GI Sciences. The course has a modular structure with two levels and case studies in addition. All the institutions involved with the project have adopted the basic level. The intermediate level enables students to expand their basic knowledge and case studies provide in-depth, project-related work in relevant fields of application.

The GITTA learning units were planned to partly substitute the ex-cathedra teaching and enhance the education quality. Since there is the possibility of working with new technologies in university education, we take the benefit to motivate the students via this additional channel. The 11 GITTA partners, covering various types of higher education, have now the possibility to use the comprehensive and mainly finished contents. Their application is broadly spread and also the way it is used. Some use it in a stand-alone scenario and can benefit from the online course in having enough time for giving feedback. Others offer GITTA-lessons during lectures, to enrich contents with interactive elements and even a few other partners are going to establish a new blended-learning teaching concept with GITTA contents. The main focus concentrates on the added value GITTA comprises with its interactivity allowing a better reception and internalisation of the learned materials.

For the derivation of an appropriate method of resolution for the course conception and the surrounding, the education and the analysis of the didactical surrounding was the main point of interest: Not the technical establishment came first, but a didactical concept to form a base. GITTA worked problem driven, not technology driven. A requirements analysis and a profile for the expected audience has been set up. Then learning targets were formulated and a time- and resource analysis has been carried out. This was followed by enquiries on considerable didactical models.
The result of these researches lead to a modified version of M.Gerson's proved an tested (1) ECLASS structure [Entry, Clarify, Look, Act, Self-Assessment and Summary]. Taking into account, that we have to cope with a quite inhomogeneous learner group and that the e-learning materials should suit most situations, this system offered what GITTA's skeletal structure needed: Modularity as well as flexibility.

XXII International Cartographic Conference (ICC 2005)

ISBN: 0-958-46093-0

A Coruña, Spain, 11-16 July 2005
Hosted by:
The International Cartographic Association (ICA-ACI)
Produced by Global Congresos

Those insights were the starting point for considerations concerning the technical implementation. With the restriction to a very low-budget for maintenance, nevertheless a promising solution in terms of sustainability had to be found. GITTA's answer on this was in taking the auspicious, trendsetting option of designing its structure with XML that left also further development potential open. Thereto compatible is an open-source Cocoon server for hosting the web-course, freely available and also based on XML and XSL technologies.

With the official end of the project in June 2004, about 80% of the planned contents were finished and can be accessed via individually chosen learning-management-systems (LMS). One such system provided by the Swiss government for all Swiss universities is WebCT. The ETH Zurich, the GIUZ and the FHBB makes use of this learning platform at the moment, whereas GITTA is platform-independent and easily transferable to any other system or even access via link, integrated on a web-page. Actually the lessons are linked and accessed from WebCT, because asynchronous discussion boards can be integrated as interactive form of learning from- and with each other and synchronous communication in a chartroom helps clarifying situations directly while learning with GITTA materials. Especially when GITTA materials are used in the stand-alone mode, the learning management system is of good help in organising the course that distributed parties, students as well as tutors, can act in a uniform area. Other helpful functionalities the course-user makes use of, are tracking functions that give quantitative feedback about the frequency the course sites are visited and qualitative feedback about the assessments that have been done.

GITTA's Improvement Potential

The Swiss Virtual Campus mandate Edutech (4) were the first, seeing the future potential in GITTA's technical framework. With their help, GITTA could firstly focus on improvements on the technical level. Connected to those changes of the structure, various following SVC projects can make use of it and GITTA got the potential for further financial development support from the SVC until 2006. During this maintenance phase, GITTA was focussing on final improvements on the technical level, to be followed by issues on the organisational and content level in the future.

Technical improvement issues:

- The deeply nested DTD [Document Type Definition] structure in the early version of GITTA was hard to learn for authors and complicated to get into after a pause, by having no detailed documentation. An easier and documented substitute based on the modern XML Schema standard was the solution and could be defined within a new developed markup language called eLML [e Lesson Markup Language].

- Semantic tags were mixed with representational tags in the old DTD structure. In eLML a separation could be generated.

- Instead of depending only on the complicated Cocoon server solution, eLML now also offers possibilities to write lessons with simple XML Editors. Thanks to the use of the latest XSLT 2 possibilities, these lessons can be exported into multiple HTML pages (conforming the IMS Content Package standard) or PDFs without additional need for server software.

- GITTA needed a database for the administration of lesson labels. Beneath that, the glossary and the bibliography data were held in the database which was complicated and expensive at once. With eLML, as will be presented in chapter 2, also this problem could be solved and additional external databases are not needed anymore.

Organisational improvement issues:

- The GITTA materials are developed and used from Swiss universities of applied sciences and universities or federal institutes of technology, but their curricula's are varying due to individual identity emphases and individually varying claims.

- Those different types of universities who make use of GITTA materials serve different user groups. Beneath the different user groups between the universities, inhomogeneous groups exist in every course, due to a varying mixture of students coming from various minor subject university-courses for e.g.. Additionally a difference in the user group will come up with the newly initiated Bachelor- and Master study system.

Content improvement issues:

- The net is a new media in apprenticeship and the web-course development a pilot project, also in content creation, since the scientific teaching personnel is familiar in teaching ex-cathedra courses but not yet in accompanying online teaching or acting in an blended teaching mode. Traditionally effective ways of teaching transferred into the web-course area make some techniques ineffective.

- The group of content creators was very widely spread and of large amount, depending on the large committee. Their contents vary in quality, mostly affected by the differing level the topics are teached at the universities.

- GITTA units were often packed with detailed text phrases, too long in duration for computer-based-learning units and not including the whole possibilities that are offered by the variety of media in teaching.

- GITTA's modular structure offers complete lessons that concentrate on one specific topic. This makes it flexible in exchanging teaching materials. On the other hand it makes it difficult to built bridges between the topics and their relationship by trying to avoid redundancies, as a following problem out of the different scenarios of course-usage.

- Copyright issues haven't been discussed in the first place, because there was no particular need. GITTA was meant for internal use and building synergies between the partner universities. Time passed and conditions as well as development possibilities changed. A solution for making the materials copyright conform and Metadata transparent for everyone has to be found when tending towards open-content development.

Experiences show that the development of homogeneous content and the creation of consistent as well as sustainable learning materials in a relatively heterogeneous environment imposes some major challenges.

In this paper we will deal with the enhancements that have been undertaken on the technical level and which have been gathered in the new markup language eLML. The improved technical system gives the chance for adaptations on the organisational and on the content level. These improvements will be shown exemplarily on GITTA's data presentation module situated at the Institute for Cartography at the Federal Institute of Technology in Zurich and how it will be implemented in the upcoming Bachelor- and Masterstudy system. Finally some hints on the lessons learned during developing this online course and aspects of upcoming work in the future will round this report.

2 GITTA'S TECHNICAL ENHANCEMENTS

2.1 eLML

The eLesson Markup Language eLML has been developed out of the tested and proven GITTA XML structure based on ECLASS as described above. The XML application eLML is defined in XML Schema and allows describing e-learning content which are modular on a lesson level. The eLML package also contains XSL transformations into different output formats, such as HTML or PDF. The eLML documentation and an example e-learning lesson, and also possibilities to adapt eLML for other projects. eLML is an open source community project hosted at sourceforge.net. The use of eLML in different e-learning projects within Switzerland ensures that the user community is big enough to keep eLML up to date and enhance it so that it will also be useable for future projects.

eLML Lessons
eLML allows describing e-learning lessons completely. This means that a lesson does not only contain the learning contents but also additional information such as a glossary, a bibliography, and a Metadata section (Figure 1). This allows the creation of a pool of self-contained e-learning lessons that can be combined to courses for different needs and courses. An eLML lesson should take the students no more than about 1 ½ - 2 hours to complete. Every lesson can be subdivided into one or several units. Each unit is structured according to the ECLASS principle. However, while this structure shall animate to consider didactical aspects while creating e-learning content, it is not meant that every single lesson needs to follow strict the ECLASS structure. Many different teaching and learning scenarios can be implemented with eLML.

On a deeper level each ECLASS element is structured by several content elements that allow the detailed description of the e-learning contents, such as images, animations or simple text paragraphs. While some of these elements remind of HTML, it is sensible not to use HTML but to be able with XML to strictly separate the content from the presentation.

This ensures that different authors working at different institutes are able to create lessons that adhere to the same style without the need to write lengthy style guides.
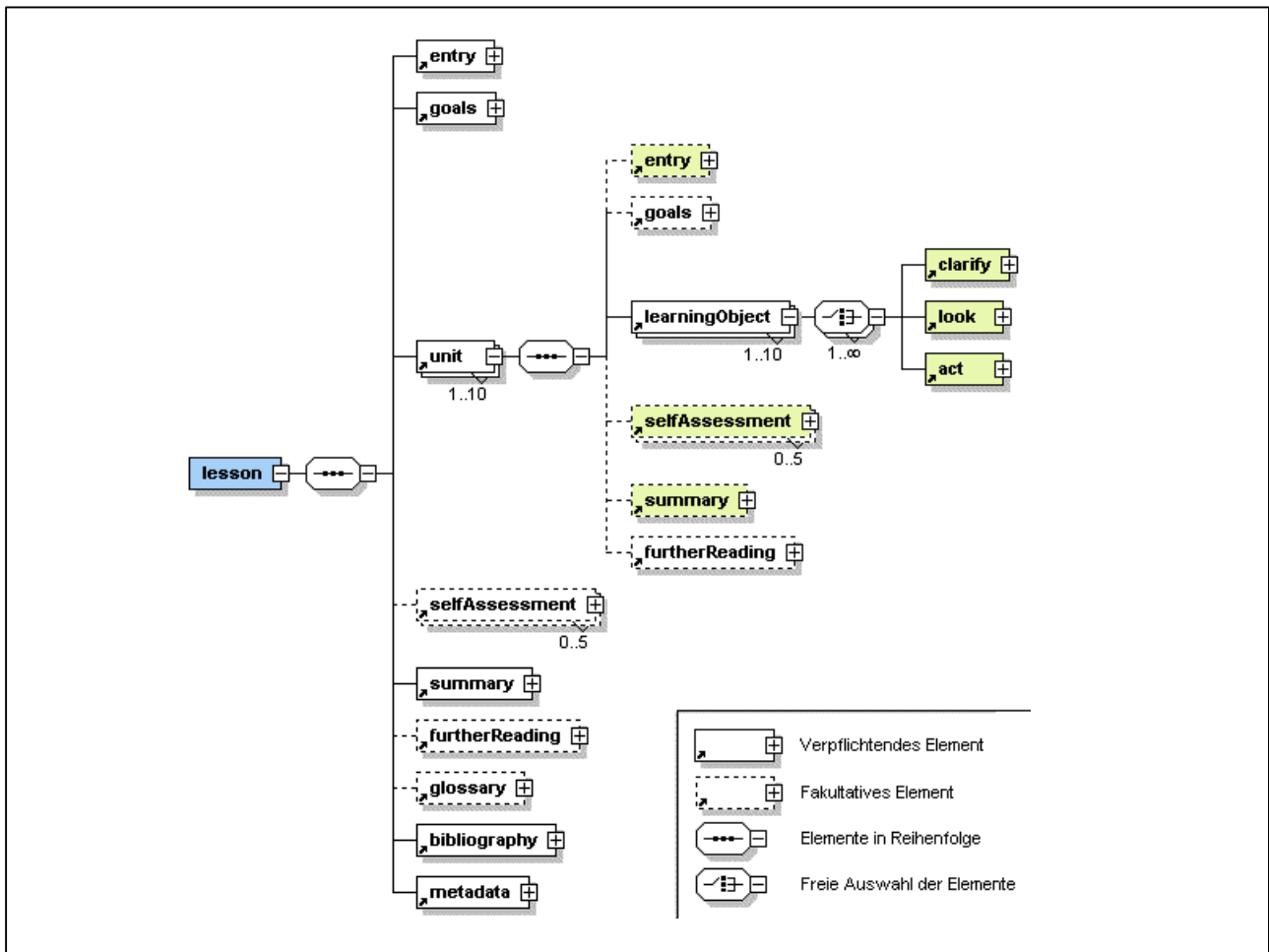

Fig. 1: eLML Lesson Structure

Lessons created in eLML can be used in several different ways. One possibility is to transform them into HTML and use them stand-alone on a web server. Another possibility is to export the HTML pages as an IMS Content Package based on the specification (2) mentioned in the reference. This content package can be imported into a learning management system supporting this specification and used there in conjunction with additional tools such as discussion boards, chats or quizzes. The content is then totally integrated into the LMS and there is no need for an additional web server.

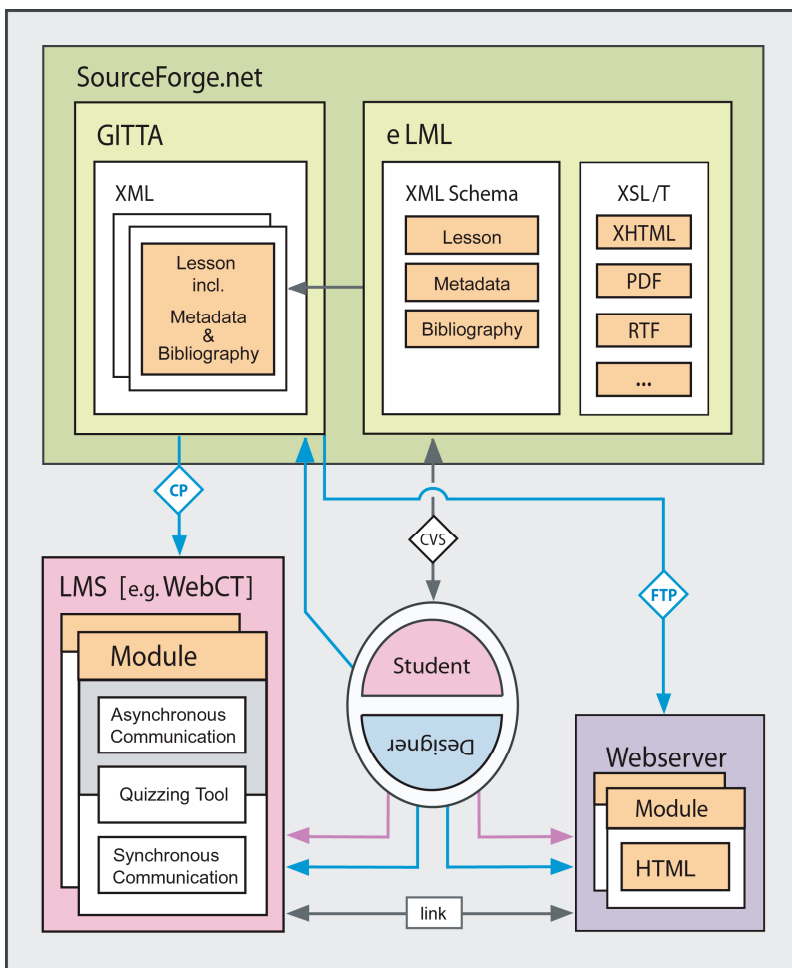## 2.2 GITTA towards Open-Content Materials

In GITTA about 50 lessons have been developed so far. Several of them are used regularly, while others would need enhancements. To ensure a broad usage and enhancement of these materials it is decided to open up GITTA for others to use. The first steps before GITTA lessons can be published under an open content or creative commons (3) license is to clarify all copyrights that might exist for texts or images used within the lessons. This is especially a problem for lessons or case studies that make extensive use of external data. After clarifying the rights and the, if need be, adaptation of the contents it shall be possible to publish the GITTA lessons under a license that allows the usage of them not only for GITTA consortium members.
Besides the legal copyright problems also the attitudes of GITTA members may be a source of problems. When opening up GITTA content it is no longer ensured that lessons which one author has created are used in the originally planned way. Anybody will then be allowed to update and modify lessons as long as the original source is cited. But it might not be acceptable for some authors that their work is modified without their explicit consent. Additionally, the GITTA members will have to cope with the fact that competing institutions are able to use the same e-learning materials.

Nevertheless, the steps in direction open contents are needed as only a big user group ensures that the contents can be kept up to date. It has already be shown that even within the GITTA consortium ways for the adaptation of contents need to be found so that the lessons stay useable for different needs. The encoding of GITTA lessons in eLML provides a sound and flexible structure that will allow the implementation of different scenarios for the future.

Technical Structure

From a technical point of view, an open content structure for GITTA can be realised without big difficulties. GITTA lessons are based on the open source technology eLML Similar to sourceforge.net used for the publishing of eLML, a creative commons repository could be used for storing and publishing the GITTA content. There people can use them and also participate in the GITTA users and development community. Many users of the materials would ensure that lessons are kept up to date and maybe also are enhanced. Authors who would like not only to use GITTA lessons but would also like to work on them will be able to apply and get writing rights on the project contents.

With eLML the contents can be transformed into different formats, such as HTML (stand-alone or as IMS Content Packages (CP)) or PDFs (see fig. 2). HTML or PDF pages can be used on a web server. Students (see pink arrows in fig. 2) may access the web servers and the modules on it directly or via a link from the learning management system (LMS). The latter has the advantage that the students can be administrated and managed in the LMS and also the additional tools of a LMS, such as discussion boards or quizzing functionality can be used. If lessons are transformed in IMS Content Packages, then those can directly be imported and used in a LMS. Tutors (see blue arrows in fig. 2) using GITTA lessons can access sourceforge. net for working on them and also on eLML.

Fig. 2: The Technical Background and
Realisation of GITTA with eLML

3 LEARNING CARTOGRAPHIC SKILLS WITH GITTA

3.1 Cartography-Course

The GITTA learning materials consist of basic and intermediate modules next to case studies accompanying the course material and deepen it. Figure 3a and 3b show the entire program GITTA offers on lesson level. The specially marked area lead to the cartographic course material (blue rectangle). The abbreviations in brackets indicate the language it is available (FR – French; EN – English; DE – German; IT – Italian). The translation is depending on the demand. Should any partner would like to use the materials, he would need to initiate and do the translation of the lesson needed.

Geographic Information Technology Training Alliance

1.1.3. Lessons

BSM

1. Overview of modeling process (FR)
2. Spatial Perception and Modeling (FR)
3. Fundamental Spatial Concepts (FR)
4. Spatial Information and its Properties (FR)
5. Digital Models (FR)
6. Conceptual Modeling (FR)

BDM

1. Introduction to Database Systems (DE) - (EN) - (FR)
2. Database system concepts and architecture (DE) - (EN) - (FR)
3. Logical modeling: the relational data model (DE) - (EN) - (FR)
4. Relational Query Language (DE) - (EN)

BDC

1. Overview of sources and methods (EN)
2. Primary sources and methods (EN)
3. Derived sources and methods (EN)
4. Metadata and quality (EN)

BSY

1. What is a GIS? (EN)
2. What do we need to work with a GIS (EN)?
3. Into the market (EN)

BAN

1. Analysis concepts (DE)
2. Discrete spatial variables (EN)
3. Continuous spatial variables (DE)
4. Terrain analysis (DE)
5. Spatial queries (DE)
6. Accessibility (DE)
7. Suitability (DE)

BPR

1. Presentation and visualization needs (EN)
2. Layout design settings / graphical semiology (EN)
3. Cartographic data representation (EN)
4. Generalization of map data (EN)
5. Topographic Cartography (EN)

Figure 3a: Content of the GITTA materials on basic level; an excerpt of the internal GITTA authors area on http://www. gitta.info/author.html. The abbreviations in the lesson overview stand for: BSM - Basic Spatial Modelling; BDM – Basic Data Modelling; BDC – Basic Data Capture; BSY – Basic GISystems; BAN – Basic Analysis; BPR – Basic Presentation

Intermediate

IAN

1. Introduction IAN Intermediate (EN)
2. Discrete Spatial Variables Intermediate (EN)
3. Continuous Spatial Variables Intermediate (EN)
4. Terrain Analysis Intermediate (EN)
5. Accessibility (only static analysis) Intermediate (EN)
6. Suitability Intermediate (EN)
7. Spatial Dynamics (EN)
8. Error Propagation (EN)

IDM

1. Concepts II (EN)
2. SQL II - DDL and complex queries (EN)
3. Object Oriented Database Concepts (EN)
4. Object-relational DBMSs (EN)
5. Geodatabase systems (EN)
6. OpenGIS SFS (EN)

IPR

1. Statistics for Thematic Cartography (EN)
2. Techniques of thematic mapping (EN)
3. Mapping with GIS and Cartographic Software (EN)
4. From GIS data sets to Cartographic Presentation (EN)

ISD

1. Spatial partitioning and indexing (EN)
2. Structures for data compression (EN)
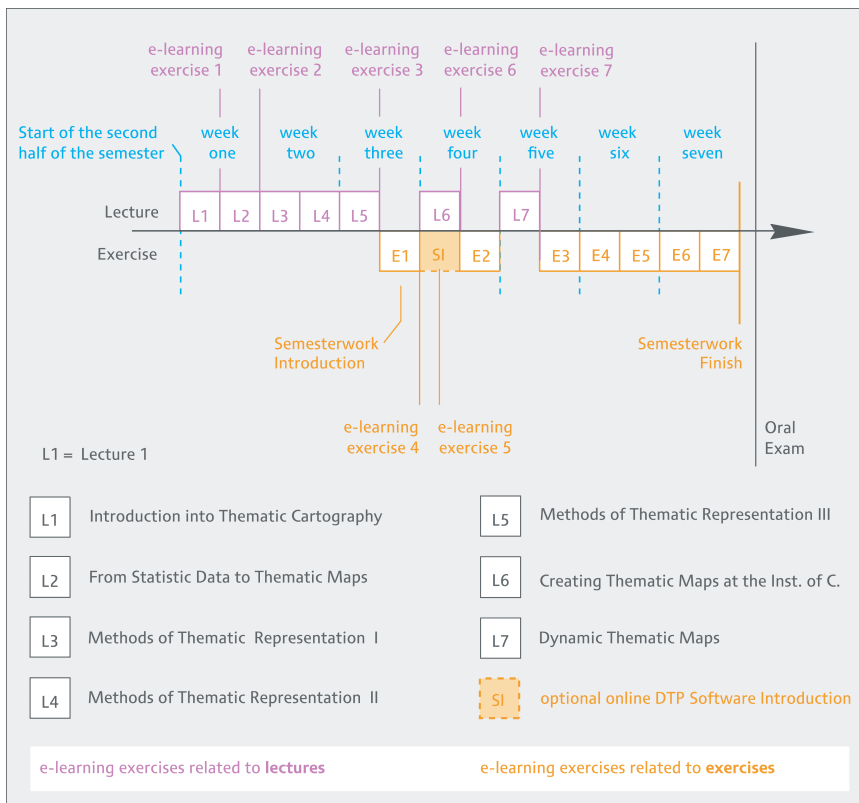3. Object Oriented Modelling (EN)
4. Information systems engineering (EN)

Case Studies

1. Intro to Case Studies (DE)
2. Vergleichende Analyse von Gewaessereinzugsgebieten (DE)
3. Industrielehrpfad (DE)
4. GIS Hochwasserschutz (DE)
5. SNP Habitat (DE)
6. Zonenplanrevision Rueti nach Gemeindefusion (DE)
7. TouristMap (IT)
8. Expo 2002 (IT)
9. Find US Sites (EN)
10. CyberCafe (EN)

Figure 3b: Content of the GITTA materials on intermediate level and topics of the level-overlapping case studies ; an excerpt of the GITTA authors area on http://www.gitta.info/author.html. The abbreviations in the lesson overview stand for: IAN – Intermediate Analysis; IDM – Intermediate Data Modelling; IPR – Intermediate Presentation; ISD – Intermediate Systems Design (a combination of Intermediate Spatial Modelling and Intermediate Systems).

3.2 How to Implement GITTA Materials in Cartographic Education?

The Institute of Cartography offers Basic Cartography-, Digital Cartography- and Multimedia Cartography lectures as well as colloquia, practical exercises and courses for deepening cartographic knowledge. Since GITTA e-learning materials were available in 2003, they were integrated, formative evaluated by students and started to adapt. With the beginning of the wintersemester 2003/ 2004 the ETH adopted the Bachelor-Master system what means for us to begin teaching cartographic related courses with beginning of summer-semester 05. Thereby primary contents can be partly retain unchanged and on the other hand be extended by a new course on Thematic Cartography. This elective course will consist of seven weeks per four hours a week, divided into 2 hours lecture and 2 hours of practical exercises per week, illustrated in Figure 3. In terms of the university's Bachelor-Master-reform which requires the reorganisation and extension of contents, the e-learning materials we implement in the Basic Cartography Course need to be adapted and reorganised and contents for the Thematic Cartography lecture (formerly a part of GIS and Cartography) newly created.

Together with the new deployment scenario the place of learning and the method of learning- respectively learning-situation needs to be newly determined next to task sharing between the GITTA e-learning materials and the tutors (5). Would the e-learning contents stay isolated and un-adapted, the materials would remain unused (6). With the upcoming new course in Thematic Cartography we have the chance to develop a contemporary concept that references to factors of pedagogic-didactic design-success (5). This includes portraying the adequate learning theory, the integration into the curriculum, considering individual differences in motivation and learning styles of the student, the form of learning targets which should be supported by GITTA's e-learning materials as well as to the level of expedient interactivity to built in and at which position.

Fig 3: Concept for the Thematic Cartography course at the Institute for Cartography, ETH Zurich

The ETH is a presence-university so that e-learning in this situation can just mean a combination of traditional methods and media, added by possibilities of e-learning without cancelling presence-lectures. With this blended learning (7) concept the central component will still be the lecture, accompanied by a documentation covering each of the seven lecturing modules, chronologically ordered. Additionally in-between those lecture-script-blocks will be integrated the hints to e-learning units which tie up to the lecture's content. After an introduction into the online learning targets of each e-learning unit in the documentation, the link will guide the student to the right position and also back again. Each lecture-block description will also be extended by questions of understanding, helping the student in exam preparations to keep the focus. Beneath theoretical input concerning the lectures, the conceptual formulation of the semester work will be included beside theory for the practical exercises that accompany the Thematic cartography and links to literature and internet links offering help.

With the chance to create this new lecture, we expect to implement GITTA's e-learning units optimally into the social and organisational environment that motivates the students in their cartography studies.

4 LESSONS LEARNED - A field report

With GITTA, an online learning system could be created that covers 30 man-years of work. All 11 partners were highly encouraged to make contributions whether in technical design and development, graphical design and creating content. This was just possible within an interactively collaborating working group that consisted of different boards taking care of educational aspects, information systems, translations and case studies (8). Next to the directing organs, the authors were forming an own working group. Authors workshops of 1 to 3 days were taking place introducing new ideas, concepts and implementation guidelines, discussing module results and ways to enhance the course. Since most of the content originally planned for the basic and intermediate level is evaluated by the involved professors, students and different authors, lessons were integrated as accompanying material in the blended learning mode in the partner's presence-courses or even as online course-concept.

The first lesson learned on organisational level out of the integration are resulting difficulties in using the content in combination with the lectures of the partner universities. This means, every partner presence-university, has an own identity and therewith a slightly different way of teaching or setting focus points. An implementation that fits exclusively in all curricula is not possible as we see now at the Institute of Cartography, when implementing GITTA materials about Cartography in teaching. Our answer on that problem will be the creation of subversions and taking parts of the comprehensive content available to form a unit that fits into our curricula. Transferring the experience we made onto future situations, the project planning would need to be less enthusiastic in the way covering contents to be developed in a limited amount of time, as we learned that good content creation for e-learning in an multilingual environment needs a lot of it. On the other hand, even a deeper concentration on the content to be created would be a task. In the beginning that needs a deep look into curricula and the analysis of the potential materials to use in a blended learning mode. 'The salvation of the university's teachings is not, having all contents of teaching, world-wide and at any time ready for self-organised learning' (7), but 'deviate necessary components of an study-arrangement from general conditions of each upcoming didactical problem, .., and that the quality and efficiency of an study-arrangement arises when various elements of methodic- and media-processing are combined in a hybrid study-arrangement'(8). We can make use of new media as a new tool that widens the variety of teaching instruments and therewith building correct as well as consistent mental models in the field of interest. They may have the advantage to activate more pre-knowledge of the brain's text- and picture-base and so improve the performance of integration (5).

Beneath the technical and organisational improvement issues as mentioned in chapter 1, there are also some lessons we learned related to the content.
After concentrating on e-learning matters in the GITTA project group, the circle of users rise. On one hand on student side, the consumer, on the other hand, the teaching staff which use the e-learning material in semester-courses. E-learning is a new tool. With the situated learning approach, combining aspects of cognitive and constructive learning, GITTA tries to combine the acquisition of knowledge, the knowledge itself and its application (7, 9). The elements GITTA uses for this are the Clarify, Look and Act part. Clarify gives new explicit information followed by examples in the Look part to deepen the focus. The Act part, used after the Clarify and Look elements try to apply the just learned aspects in real situations. This structure element implemented before Clarify has then the function of motivation and activating pre-knowledge. Knowledge acquisition can also be given as task to explore. With the explication we can see that GITTA put attention to didactical aspects. Now there is the challenge to transfer these also into the ex-cathedra teaching sequences. A less abstract level of communication, but integrating student's contribution, e.g. developing mental models by discussing examples. That also means that the position of the lecturer changes to that of a tutor, motivating and leading students' into the learning-target direction. Sluggish knowledge should be activated and used, as well as transfer performances activated.

Another lesson on content creation, to be mentioned, lays in the quality. Different views of the various partners and institutes lead to varying quality, i.e. the level of content creation. Another reason for different levels of quality may lay in the resource: Team. In the beginning it consisted only of subject matter experts (SME) next to a project manager and IT-specialists with SME knowledge. Someone with e-learning knowledge who has a basic understanding of geo-information and its related subjects was missing, someone in the position of an instructional designer who accompanies the process of analysis of learning needs and goals as well the development of instructional materials and activities up to its evaluation stage. Some project members saw the missing knowledge GITTA may need and they participated in various courses to get the missing e-learning know-how. Soon, design guidelines, writing for e-learning guidelines and implementation guidelines were created and could be introduced to the other members. With the beginning of the main developments GITTA was then equipped with the know-how that would have been good having had right on from the beginning. So, some units are built up to comprehensively and too text-laden that need to be overworked but in review, most steps GITTA project staff did, lead into the right direction. We can see this in the didactical structure, its modularity or GITTA's sustainability.

REFERENCES

(1) **Gerson, M.** (2000): E-Class: Creating a Guide to Online Course Development For Distance Learning Faculty. Online Journal of Distance Learning Administration, Vol. III, No. IV (Winter 2000). Published by the State University of Western Georgia, Distance and Distributed Education Center. http://www.westga.edu/~distance/ojdla/winter34/gerson34.html (accessed April 2005).

(2) **http://www.imsglobal.org/content/packaging/index.html** (accessed April 2005).

(3) **http://creativecommons.org/** (accessed April 2005).

(4) **http://www.edutech.ch/** (accessed April 2005)

(5) **Blumstengel, A.** (1998): Entwicklung hypermedialer Lernsysteme (Developing Hypermedial Learning Systems), Dissertation; University of Paderborn, Germany; Wissenschaftlicher Verlag Berlin and http://dsor.uni-paderborn.de/de/forschung/publikationen/blumstengel-diss/ (accessed April 2005)

(6) **Glowalla, U., Häfele, G.** (1997): Einsatz elektronischer Medien: Befunde, Probleme und Perspektiven (Deployment of Electronic Media: Statement, Problems and Perspectives; in: Issing, L., Klimsa, P. (Ed.): Information und Lernen mit Multimedia (Information and Learning with Multimedia), 2. revised edition; Page 415-436; Beltz Psychologie-Verlags-Union; Weinheim, Basel

(7) **Reinmann-Rothmeier, G.** (2003): Didaktische Innovation durch Blended Learning, Leitlinien anhand eines Beispiels aus der Hochschule (Didactical Innovation with Blended Learning, guidelines considering an example taken from University), Publisher: Reinmann P., Bannert M., Mandl H., Severing E.,Verlag Hans Huber, Bern, Göttingen, Toronto, Seattle

(8) **Kerres, M.** (2001): Online- und Präsenzelemente in Lernarrangements kombinieren (Combining Online- and Presence Elements within Study-arrangements), chapter 4.5 in Handbuch e-learning: Expertenwissen aus Wissenschaft und Praxis (handbook of e-learning: expert knowledge from economy and practical experiences), edited by Hohenstein A., Wilbers, K., Köln, Deutscher Wirtschaftsdienst

(9) **Niederhuber, M., Heinimann, H.R., Hebel, B.** (2005): e-Learning basierte Fallstudien zur akademischen Ausbildung in der Geoinformatik: Methodisches Konzept, Umsetzung und Erfahrungen (e-Learning Based Case Studies for Academic Education in Geoinformation: Methodic Concept, Implementation and Experiences). Submitted for the 3. German e-Learning Symposium Informatik, 13.-16. September 2005 in Rostock, Germany

Additional Sources

GITTA project description: http://www.virtualcampus.ch/display.php?lang=2&pname=200128pres (accessed: April 2005)

GITTA project homepage: http://www.gitta.info/ (accessed: April 2005)

ELML project homepage: http://www.elml.ch/ (accessed: April 2005)

ELML on Open Source software development site: http://sourceforge.net/projects/elml/ (accessed: April 2005)