

# THE SWISS VIRTUAL CAMPUS PROJECT GITTA – A MULTI-DISCIPLINARY, MULTI-LINGUAL LEARNING PLATFORM FOR GEOGRAPHIC INFORMATION TECHNOLOGY

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### ABSTRACT:

The broadening interest in spatial information is rapidly raising the demand for sound but nevertheless flexible education in Geographic Information Systems & Technology (GIST). The Swiss Virtual Campus Project GITTA (Geographic Information Technology Training Alliance) aims at providing modular web-based learning material for GIST education in Switzerland. This paper presents the strategies and technologies which have been developed to achieve this goal.

The GITTA consortium unites the majority of institutes from Swiss Universities and Universities of Applied Sciences teaching GIST. It encompasses members from three different language regions and from different application domains. The development of homogeneous content and the creation of consistent and sustainable learning material in such a heterogeneous environment posed some major challenges and required that special attention was directed to the didactical model and the underlying technology.

It was decided to develop a didactically sound content structure based on XML. The GITTA XML structure combines and extends existing e-Learning concepts and standards. The use of XML technology for modelling the didactical framework of GITTA allows the enforcement of the content model through XML validation tools. All the decentrally developed learning materials are stored on one central server using the publishing framework Cocoon (The Apache Cocoon Project). XML transformations enable the on-the-fly transformation of the GITTA contents to different presentation formats. Through the consequent use of XML technology it is ensured that the learning material is sustainable and that it can easily be adapted to different layouts and to future usage scenarios. A number of GITTA modules are now operational in up to four different languages, which demonstrates the viability of the chosen approach.

### KURZFASSUNG:

Das immer breiter werdende Interesse an Informationen mit Raumbezug lässt auch die Nachfrage nach gutem und flexiblem Unterricht im Bereich der Geografischen Informationssysteme und –technologien (GIST) wachsen. Das Swiss Virtual Campus Projekt GITTA (Geographic Information Technology Training Alliance) hat zum Ziel, modulare webbasierte Lernmaterialien für den schweizerischen GIST-Unterricht zur Verfügung zu stellen. Dieser Artikel präsentiert die Strategien und Technologien, die eingesetzt wurden, um dieses Ziel zu erreichen.

Das GITTA Konsortium vereint die Mehrzahl der Schweizer Universitäten und Fachhochschulen, die GIST unterrichten. Dies bringt Mitglieder aus drei verschiedenen Sprachregionen und aus unterschiedlichen Fachgebieten zusammen. Die Erstellung von einheitlichen und nachhaltigen Inhalten und Lernmaterialien in einem solch heterogenen Konsortium stellt einige grosse Herausforderungen und erfordert, dass dem didaktischen Konzept und den verwendeten Technologien besondere Aufmerksamkeit geschenkt wird.

Es wurde entschieden, eine modelbasierte Inhaltsstruktur auf der Basis von XML zu definieren. Die GITTA XML-Struktur vereint und erweitert existierende e-Learning Konzepte und Standards. Die Verwendung von XML-Technologien für die Modellierung der didaktischen Struktur von GITTA erlaubt die Überprüfung des Inhaltsmodells mittels XML-Validierungswerkzeugen. Alle dezentral entwickelten e-Learning Materialien sind in einem zentralen Server gespeichert. Dazu wird das Publishing Framework Cocoon (The Apache Cocoon Project) verwendet. XML-Transformationen erlauben eine On-the-fly Transformation von GITTA-Inhalten in unterschiedliche Formate. Mit der konsequenten Verwendung von XML-Technologien können nachhaltige und einfach erweiterbare Lernmaterialien erstellt werden. Eine Anzahl von GITTA-Modulen sind bereits in Verwendung in bis zu vier verschiedenen Sprachen. Dies zeigt, dass der gewählte Ansatz einen gangbaren Weg darstellt.

## 1. INTRODUCTION

Geographic Information Systems & Technology (GIST) is spreading into a wide range of disciplines dealing with spatially related problems. This has formed an increasing demand for broader access to educational material in this sector. The Swiss

Federal Initiative 'Swiss Virtual Campus' SVC (<http://www.virtualcampus.ch>) aims to employ the advantages of new information and communication technologies for educational purposes. The SVC programme was started in 2000 for an initial 3 years period of time and includes more than 50 different e-learning projects. Responding to the needs of easily

accessible GIST teaching material, the SVC project GITTA (Geographic Information Technology Training Alliance, <http://www.gitta.info>) wants to create modular web-based learning material for basic and specialised study programmes in GIST.

### 1.1 Project Partners

The GITTA project consortium unites the majority of institutes from Swiss Universities and Universities of Applied Sciences teaching GIST. It encompasses members from three different language regions and from different application domains, including geomatics, geography, cartography, forestry, civil engineering and landscape architecture. The main motivation for collaborating in the GITTA project lays in exploiting synergies, increasing the teaching capacity and improving the quality of courses. This is done by developing and redesigning learning material on a modular basis that offers high flexibility in time and content, adaptable to the students needs.



Figure 1. Locations of the GITTA project partners in Switzerland (University of Zürich, University of Fribourg, ETH Zürich, EPFL Lausanne, University of Applied Sciences (FH) Murtens, FH SUPSI Manno and FH Rapperswil, KOGIS Wabern)

## 2. ORGANISATION

### 2.1 Premises

The GITTA project has been started with the following premises defined.

- A complete curriculum accepted by all partners needs to be designed and developed. GITTA shall not be a single course but cover a complete GIS education. The original project proposal planned to create learning material for 31 ECTS (European Credit Transfer System) points.
- The materials shall be useable for distance and blended learning and teaching. Theory and practical elements need to be included.
- Modularity and flexibility in form and in regards to content need to be maintained.
- A sound didactical concept shall be developed and implemented in suitable IT structures.

### 2.2 Information

The flow of information and their management are central elements of a project of this scale. Important is the easy access to all relevant and current information and documents like, for example, news and discussion boards, tutorials or manuals. In GITTA this is achieved by the use of a common BSCW-Groupware Server (BSCW 2004).

The project progress is efficiently monitored through monthly reports of all partners. Additionally, the partners meet once a month on a fixed date to discuss the progress and problems. Specific internal workshop are arranged for the continuing education of content authors or IT personnel.

Experience revealed that face-to-face meetings are the preferred way for passing resolutions. However, virtual environments like, for example, desktop collaboration software, are used preferably for informal collaboration and information exchange.

### 2.3 Distance

In GITTA not only spatial but also professional, linguistic and cultural distances are to be bridged.

The spatial distance is rarely a problem as Switzerland is quite small. However, professional distances emerge when trying to develop a single curriculum which all the different institutes from the different universities can agree to. The didactical and structural approach chosen in GITTA allows to compose a course from single lessons. This makes it possible to use the material in different ways.

The linguistic distances in the project team are bridged by using English as the official project language. Nevertheless, each author writes the learning materials in his or her own language and later translation is needed.

Interesting differences can be found from a cultural point of view. The learning and teaching scenarios in different language regions of Switzerland and on different institutes differ considerably. The partners, however, find these differences interesting and gain from them. Tolerance is not just a phrase but has to be applied.

### 2.4 Time

Bridging the previously mentioned distances results in some loss of time and it is difficult to keep to the planned timeframe of the project. Discussing problems and finding consensus among all partners is often difficult. Additionally, the effort for translating material, the initial effort for developing a suitable IT structure (described below) and the ongoing effort of creating interactive learning elements had been underestimated.

### 2.5 Organisational Structure

The GITTA consortium with its 11 partners is one of the most extensive and most heterogeneous of all SVC projects. The creation of the learning materials is spread over different project groups according to their subject area. For an efficient distribution of the organisational tasks between the partners several boards have been established which define functions and responsibilities. Additionally, a set of rules of operation have been agreed upon.

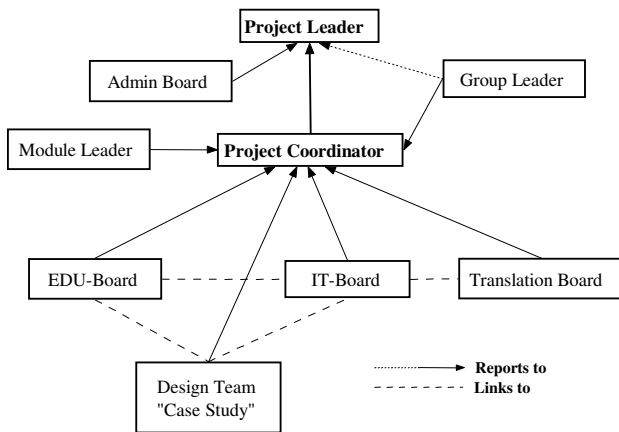


Figure 2. GITTA Organisational Boards

The practice shows that this organisation is very important even though it operates not always as anticipated. The reason for problems can be located in the complexity of the project, the heterogeneity of the consortium and the amount of learning material to be developed.

In addition to this internal structure the GITTA project is also networked into external information and organisation structures like, for example, the network of all SVC projects, the SVC mandates (e.g. edutech for the technical aspects) and the e-learning competence centres of the different universities.

### 2.6 Development of Learning Material

The process of developing a common curriculum and creating the learning material was divided into different design steps.

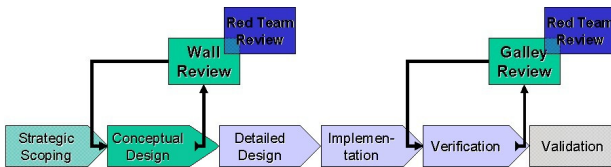


Figure 3. Process Model of GITTA Material Development

Using this process model for the design and development of GITTA content ensures that the materials are homogeneous and acceptable for the majority of project partners. This is important as the materials shall build a pool of resources and not just be used by its designer but by as many project partners as possible.

## 3. DIDACTICS

The development of e-learning material follows similar didactical principles as those used in the production of traditional learning material. However, in comparison to traditional face-to-face learning the material needs to be structured in a way that allows the students to orientate themselves without much help and make most use of it. Additionally, it shall be possible to use the materials created within GITTA for distance and blended learning purposes. The didactical structure, therefore, needs to be as flexible as possible to suit all the needs but nevertheless be simple in application and use.

### 3.1 Modular Structure

Because of the high level of flexibility needed in the creation of different courses for different institutes GITTA is modularly structured into Levels, Modules, Lessons, Units, and Case Studies.

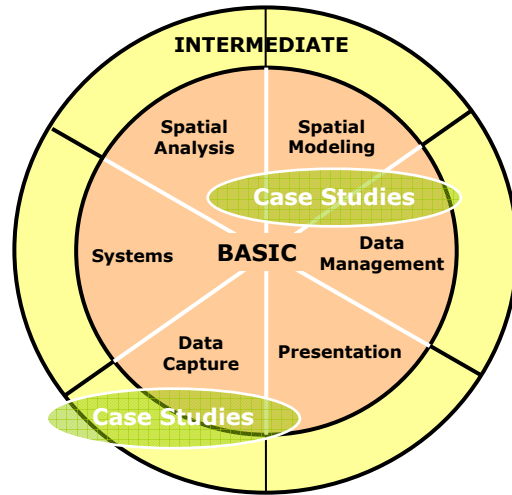


Figure 4. Modular Structure of GITTA

**Level:** The level is an organisational structure. It was planned to create three levels (Basic, Intermediate and Advanced) in GITTA but time constraints allow only to develop the levels Basic and Intermediate.

**Module:** A module is a thematic and organisational course unit. Modules are named according to the typical GIS tasks ranging from modelling to presentation.

**Lesson:** A lesson is the smallest independent learning/teaching unit. It is supposed to be self-contained and follows the didactical structure outlined below. All the lessons together build a pool of learning material from which different courses can be arranged.

**Unit:** Units are sub-divisions for a sensible structuring of a lesson.

**Case Study:** Case Studies are complex real-world problems without a given solution. They accompany the different modules at the two levels and allow to directly transfer theory into practice.

The level and module structure is merely an organisational structure which helps to manage and overview the different lessons.

### 3.2 Didactical Structure of Lessons

To be able to develop homogeneous content GITTA uses the ECLASS schema (adapted from Gerson 2000) to organise its lessons. That allows to define a didactically meaningful structure for each lesson.

**Entry:** The 'E' equals to the introductory statements made before each single lecture in a class. Entries shall, for example, show what is to be discussed and in which context the lesson fits. It may give an explanation why this topic is being introduced and the historical perspective of the thematic.

**Clarify:** The 'C' represents the main part of a unit and explains the key concepts. In this section the facts about a specific topic are presented. GIST concepts are conveyed depending on the module the lesson belongs to.

**Look:** The 'L' allows the students to review examples or samples that further explain what is being taught in this lesson. It defines the main points made in the clarify part through illustrations, animations, videos, etc.

**Act:** The 'A' is to encourage the students to practice what has just been learned. It is equivalent to the classical lab exercises and hands-on workshops. It is an important integrative part of the on-line learning course as it actively engages the students and may allow to do group work and share work between students.

**Self Assessment:** The 'S' gives the students the opportunity to test for themselves what they have learned. It is important that this section also includes automated (e.g. for quizzes) or manual (e.g. peer reviews or tutor) feedback.

**Summary:** The second 'S' stands for the final part of the lesson which summarizes and concludes. It reiterates the main points of the lesson and may also give further expectations.

These main elements of ECLASS are further subdivided to allow the inclusion of, for example, text, tables or multimedia elements. These elements have been developed adapting parts of the LMML (Learning Material Markup Language) framework (LMML 2004).

The GITTA Case Studies follow a specific case study structure which is not explained here. They present a more or less real world problem to students and make available background information and spatial data. There is not a single correct solution but the solution finding skills of the students are trained.

#### 4. TECHNOLOGY

The structure described above allows to create learning material that is flexible in use. However, a way needs to be found how this structure can be kept as flexible and nevertheless strict in practice. Thinking about 11 different partners developing content decentrally makes one wonder how a similar look and feel for all the materials can be realised.

After an evaluation of different commercial and OpenSource e-learning platforms it has been found that none of them were able to satisfy the demands. The main shortcomings are the lack of a formal content model and the inflexible and typically proprietary content storage. Additionally, the process of creating the learning material shall be kept as simple as possible.

Based on these results it was decided to develop a model-based content structure based on XML. This decision was influenced by the considerable experience of several GITTA members in the platform-independent, model-based modelling and exchange of spatial data.

##### 4.1 GITTA XML Structure

GITTA employs the open standard XML and its co-standards to implement the didactical structure outlined above. The project benefits from the use of XML technology as a base for the technical implementation in a number of ways. XML is software and hardware independent and allows the enforcement of the content model through XML validation tools without a need for lengthy content development manuals. Therefore, the decentralised development of content is made easier and more consistent. Additionally, the materials are independent of a specific e-learning platform but can, nevertheless, be used in

combination with a e-learning platform like, for example WebCT.

As XML is a Markup Language it has been possible to add additional information to a GITTA lesson in form of metadata information. These information help the tutors when assembling a course out of different lessons.

##### 4.2 Storage and Presentation

All the decentrally developed learning materials are stored on one central server using the publishing framework Cocoon (The Apache Cocoon Project 2003). Cocoon employs the idea of separating logic, content and presentation.

**Logic:** The logic are the instructions for Cocoon how to handle, for example, the different files, the presentation, the navigation on the created HTML pages, etc.

**Content:** The content is all the developed learning materials stored in files and folders. Each e-learning lessons consists of a single XML file. It contains all the text information and references to multimedia or other additional files which are stored in designated folders.

**Presentation:** The presentation are the XSLT (Extensible Stylesheet Language Transformation) files and instructions for the on-the-fly transformation of the XML content to different presentation formats like HTML or PDF.

As the GITTA structure does not include student administration the course management system WebCT is used for student access to the learning materials. WebCT provides a complete set of teaching and learning tools for course development, delivery and administration. GITTA uses WebCT for student administration, the display of content stored on the Cocoon server, its the discussion board and quizzing functionality. However, GITTA is not tied to this specific e-learning platform but could easily be used in combination with another system.

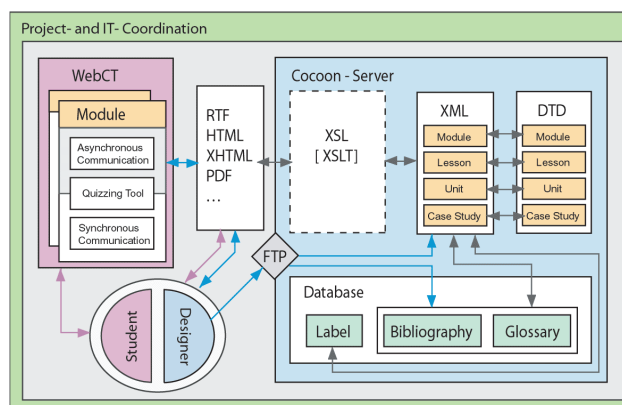


Figure 5. Technical Implementation of GITTA

Through the consequent use of XML technology it is made sure that the learning material is sustainable and that it can easily be adapted to different layouts and to future usage scenarios.

##### 4.3 ELML – eLesson Modelling Language

At the time of writing the GITTA XML structure is revised on behalf of the SVC Mandate Edutech. The improved GITTA XML structure, now named ELML – eLesson Modelling Language, will then be available together with a documentation and example data for free use and adaptation for other e-learning projects.

The revision of the GITTA XML structure includes the change from XML DTD to XML Schema which gives some more flexibility in defining the model. However, the basic structure of lessons and units organised by the didactical model of ECLASS is maintained. ELML allows to describe content and structure of e-learning materials independently of a specific e-learning course management system. The affiliated metadata part including, for example, general information about the lesson, a bibliography and glossary section, facilitates the creation of self-contained e-learning lessons that are useable in different learning and teaching scenarios.

## 5. RESULTS

A number of GITTA lessons are now operational in varying courses at different institutes in up to four different languages. This demonstrates that the chosen approach is viable and the created e-learning materials are flexible and useable in different learning and teaching scenarios.

The screenshot displays a web browser window with the following content:

- Page Title:** GITTA - Geographic Information Technology Training Alliance
- URL:** http://www.gitta.info/studieren/basic/DBMS/Concept
- Section:** 1.2.1. Three-Schemes Architecture
- Text:** Knowing about the conceptual and the derived logical scheme (discussed in unit Database Models, Schemes and Instances) this unit explains two additional schemes - the external scheme and the internal scheme - which help to understand the DBMS architecture.
- External Scheme:** A external data scheme describes the information about the user view of specific users (single users and user groups) and the specific methods and constraints connected with this information. (Zielsetzung)
- Internal Scheme:** The internal data scheme describes the content of the data and the needed service functionality which is used for the operation of the DBMS. (Zielsetzung). Therefore, the internal scheme describes the data from a view very close to the computer or system in general. It completes the logical scheme with data technical aspects like storage methods or help functions for more efficiency.
- Diagram:** A flowchart titled '3-Scheme-Architecture' showing the relationship between 'Real World', 'Conceptual Scheme', 'Logical Scheme', 'Internal Scheme', and 'Stored Data'. It also includes 'External Scheme' and 'Application' boxes.
- Caption:** Three-Schemes Architecture
- Text:** The right hand side of the representation above is also called the three-schemes architecture: internal, logical and external scheme. While the internal scheme describes the physical grouping of the data and the use of the storage space, the logical scheme (derived from the conceptual scheme) describes the basic construction of the data structure. The external scheme of a specific application, generally, only highlights that part of the logical scheme which is relevant for its application. Therefore, a database has exactly one internal and one logical scheme but might have several external schemes for several applications using this database. The aim of the three-schemes architecture is the separation of the user applications from the physical database, the stored data. Physically the data is only existent on the internal level while other forms of representation are calculated or derived respectively if need is. The DBMS has the task to realise this representation between each of these levels.

Figure 6. Screenshot of a GITTA lesson in HTML

The GITTA project includes professional evaluation of the created material through a didactic specialist. The students are asked to fill in a questionnaire after they have finished learning with GITTA lessons.

The evaluation shows that learning with GITTA materials is highly accepted. This is especially true for content that requires high interactivity and for practical and technical content. The main advantages mentioned are the possibilities to interact with software and tools and the student's ability to freely choose when to work with the material. On the other side, some critical comments refer to the student's time management and the discipline needed as being a nuisance. For learning mainly facts and theoretical aspects of a topic most students would prefer to have face-to-face lessons.

## 6. CONCLUSIONS

GITTA is a big and heterogeneous consortium of different partners which imposes major challenges especially on the organisational level but also in terms of collaboration and curriculum definition. Nevertheless, the cooperation of the different partners results in valuable new experiences across borders of professions, languages or cultures.

For the operation of the project it is important to have sound organisational structures and strict rules. Experience has also shown that regular face-to-face meetings are essential. The challenges posed by the multi-linguistic aspects of the project are not yet fully solved. Especially the maintenance of learning materials in up to four different languages might create some problems.

The didactical schema and its realisation in XML has proved it serves as a suitable mean to decentrally create learning materials that look and feel all about the same. The structure is now revised and documented for Edutech and will be freely available for other e-learning projects to use.

The future of GITTA is not yet fully decided. Certainly, all the project partner will use lessons, of the learning material pool that has been created, in their courses. Additional possibilities might include cooperation with other similar e-learning projects or opening up the materials for free use (OpenContent Scenario). However, these approaches will also pose some new challenges like, for example, the introduction of versioning of content and versioning control.

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