GvSIG in the academic education of heterogeneous target groups – experiences in lectures, exercises and eLearning

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Abstract

Thanks to easier operability and a growing range of functions, open source products are increasingly being used in teaching GIS to students of various course programs. The elaboration of such courses poses the challenge of taking into account different study paths, allowing for student autonomy (e-learning), and choosing the right software. The article suggests answers to these questions by presenting the classes offered at the University of Applied Sciences in Deggendorf and the University of Passau since winter 2010/11 as well as ideas for future course offers.

Introduction

The versatility of GIS applications is a challenge for higher education teachers [5][8][10]. Technical and didactic aspects usually play a role: High license costs for students, lack of functions and data availability are a hindrance to the use of GIS within and outside the fields of geography and geodesy, whereas from a didactic point of view there is usually not enough time for conveying sufficient competency in the handling of GIS. Moreover, specific needs of students differ as a result of modularized courses and cooperation between universities. Open source products can help solve some of these problems: they reduce costs, they make the software widely accessible, and offer a growing variety of functions. Students can work with GIS on their own computer (e-learning), making them independent of set curricula and allowing for an individual focus tailored to their field of study [4][9]. The unlimited availability of the software allows students to proceed at their own pace and to follow their specific interest. However, the question remains to what extent e-learning should replace in-classroom teaching or merely supplement it [2]. This article presents a course that has been developed jointly by the Universities of Deggendorf and Passau within the framework of the Virtuelle Hochschule Bayern (vhb; Bavarian Virtual University) for different study paths. It uses the freely available software gvSIG and provides the option of combining conventional forms of teaching and e-learning (blended learning).

GIS Online Courses within the Framework of the Virtual University

The use of and demand for GIS in daily life has increased rapidly over the past years, making it more and more important in the field of education as well. As a result, GIS skills are essential today in fields such as location based services, geomarketing, positioning and navigation, electrical engineering, tourism, civil and construction engineering. Consequently, GIS has become part of the curricula of various bachelor and master programs in fields such as geography, computer science, resource and environmental management, tourism management or civil engineering. Providing a common set of courses for students of these different fields poses a formidable challenge, requiring an online course which allows for a maximum amount of flexibility, while at the same time guaranteeing shared standards of care and evaluation. The organizational framework for this is provided by the Bavarian Virtual University (vhb), which is a joint establishment of Bavarian universities that makes the subject-specific, technical, and didactic potential of universities throughout the state in the field of virtual teaching available to students independent of their location. The vhb portal (http://www.vhb.org, Figure 1) offers access to e-learning courses from almost all Bavarian universities to all students subscribed at Bavarian universities. During the courses, which usually takes place during the semester, students can ask specially trained online tutors for help. Constant improvement is further secured by student evaluation.

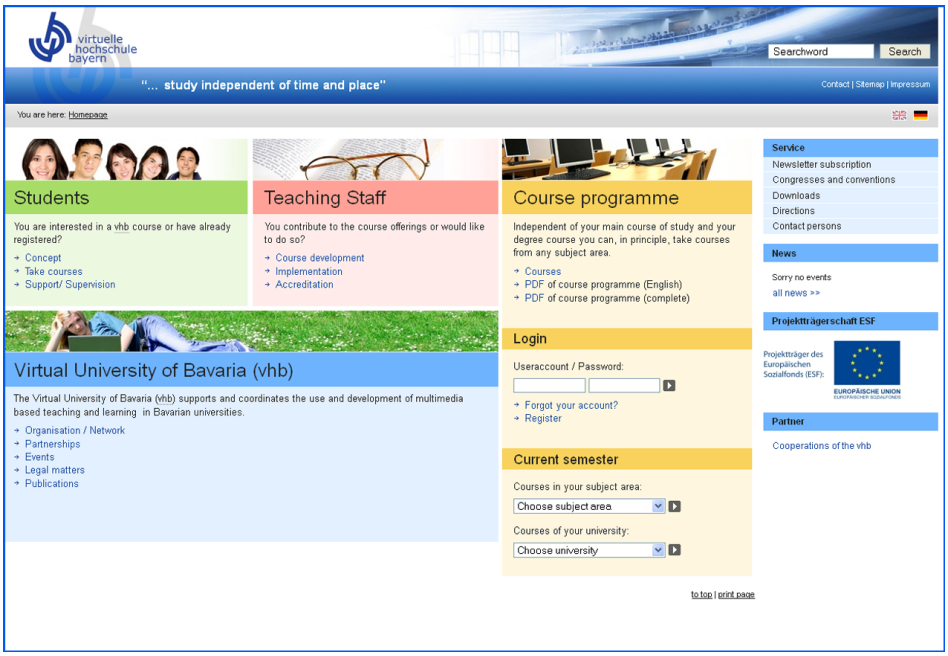

Figure 1: The Bavarian Virtual University (vhb) portal side – An e-Learning portal for all bavarian universities.

The course is offered in two different modes: (1) as a pure e-learning offer for students from all Bavarian Universities interested in the field of GIS and (2) as part of a blended learning course for students in Deggendorf and Passau where the e-learning material is amended by software training in a computer lab of the university.

Content of the modularly structured GIS course

Flexible registration and processing deadlines account for different semester periods, while the modularized structure allows for different focuses that go beyond the core curriculum. The course "Introduction to geoinformatics and geo-information systems" which is offered since winter 2010/11, caters to a wide array of study programs such as teaching, European Studies (both at Passau), computer science, civil engineering, environmental and resource management, media technology (all at Deggendorf), and tourism (Passau and Deggendorf)(Figure 2). The course is divided into ten basic chapters that must be completed entirely or partially depending on the study field. Further, intensive modules specialize in topics such as environmental information systems, Global Navigation Satellite Systems, GIS and tourism as well as GIS in school.

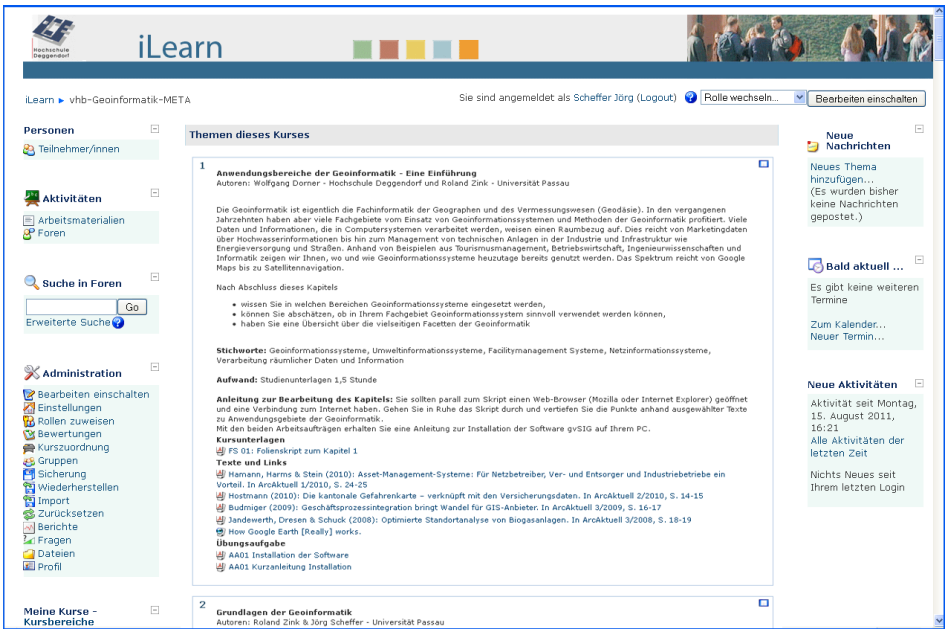

Figure 2: Screen with the first course module

The overarching goal is to offer to all students an introduction into the functioning and application of GIS and to teach them the use of GI software. Beyond theoretical knowledge on the definition and workings of GIS, cartography, data bases, or spatial analysis, students are required to deal with examples of practical application and to get a step-by-step grip on the workings of GIS. After completing the course, they should be able to use geographical data, do simple analyses and have an idea about the generation of spatial data (editing and georeferencing). The course uses the free and open source software gvSIG so that students can not only read the course material, but also do the practical examples on their own computer.

Criteria for the software and gvSIG

When conceptualizing the course it became apparent that a sole focus on theoretical aspects was didactically unsatisfying, and that it should be accompanied by practical examples as well as an introduction into GI software. The basic problem here is the general availability of student licenses for marketable GIS products. Students cannot be expected to purchase

software for e-learning, nor can every faculty or university provide it. The course has to be made available to students of all Bavarian universities, so a broad accessibility of GI software is necessary precondition. The solution lies in an open source or freeware product obtainable to every student with Internet access that can be used on a private PC without license restrictions. This software needs to meet a range of demands:

- Availability of basic analysis functions and operations on a data level – e.g., to display or import different data formats and the processing of vector and raster data.
- Basic GI operations and functions, mainly spatial analysis methods (e.g., buffers), georeferencing (Figure 3) and vectorizing as well as access to web services.
- Compatibility of the control concept with marketable software products in order to facilitate migration to other programs.
- Availability of the open source solution as a compiled and constantly updated version for common operating systems. What is needed is a community of developers that can warrant continuous updating and availability on different platforms.

Based on these demands we chose upon gvSIG, since it meets all the criteria listed and seems especially suitable for virtual forms of instruction. The convenient handling was confirmed in later evaluations, specifically in regard to the set tasks. The fact that the user interface was available in German proved an additional convenience for many users.

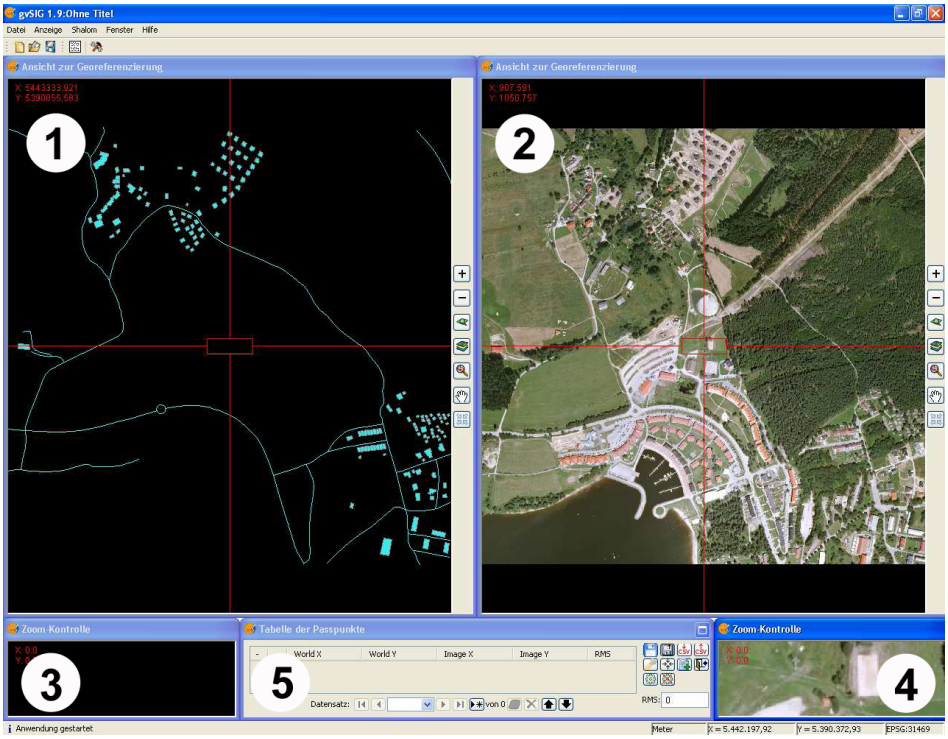

Figure 3: Example: Georeferencing with gvSIG. Besides screen casts also screen shots are used and numbered items and instructions indicate workflows and different elements of the interface.

However, the conceptualization and further development of the e-learning program also revealed some flaws which should be considered when using and teaching with open source software. Among these were a lack of reliability concerning the announcement and realization of release changes, the availability and functioning on different system software or OS versions, as well as stability in different runtime environments. However, these are problems that also happen with proprietary systems. In addition, some participants complained about the fact that the program is rather difficult to use for beginners. Despite all this, gvSIG has proven to be the right choice for e-learning programs.

GIS as Blended Learning

Learning management systems (LMS) such as Moodle are increasingly being used in the educational field and have become a well-established part of educational establishments adapting to the digitalization of information and learning [11][3]. In particular, it is the combination of e-learning and conventional teaching methods ("Blended Learning") which is in growing demand, and the function of virtual management systems is to be available to students beyond the classroom. They give them the opportunity not only of flexible study hours but also of communicating in a speedy and easy manner – via e-mail, forums, or wiki systems. The exchange of digital data is a further advantage. Students can retrieve course material at all times and process it on their own PC with the use of the right software. This combines the advantages of web-based forms of learning (being up-to-date, independent of time and place, allowing for individual study techniques and knowledge management) with those of the traditional classroom (sociability, personal encounters, learning environment). The modular system of the proposed course meets the demand of blended learning, since teachers can pick out singular topics and offer them as virtual courses or in the classroom, depending on the specific content. The course was offered now for the third time. Per semester between 100 and 150 students were enroled to the course. The majority of students used the blended learning mode (about 50-70%), due to the fact that the course is part of optinal and compulsory classes in Deggendorf and Passau. The success rate (defined as the ratio of participants and students finalizing all exercises) of students in the blended learning mode is significantly higher (70-80%) than in the e-learning mode (20-30%). Unfortunately it can not be distinguished between students choosing the course in e-learning mode with the will to finalize all exercises and those who use it in addition to GIS courses at other universities. Main questions and problems of students result from installation and stability problems as a consequence of different and in some cases also unsupported combinations of operating system, Java engine and gvSIG version. Ohern the other hand side the number of supported operating systems is higher than with most commercial software systems.

Conclusion

Our goal was the conceptualization of a flexible course that would meet the demands of different study fields and their respective performance criteria. The completed project is now available to students at all Bavarian universities as an e-learning course of the vhb. The dearth of courses offered in the field of geoinformation systems has thus been partly removed, especially for students not specializing in geography. Even though the different target groups often lack solid skills in geography, geoinformatics is gaining ground as an ancillary discipline, exemplified by the increasing demand for things like Location Based Services, geomarketing,

and environmental modeling. The constant spread of GIS to ever new contexts of application will not only increase the number of students but also necessitate a constant updating of the courses' content. The availability independent of locality of the different modules could lead to an international exchange, which would accelerate the spread of open source programs in the field of GIS even further.

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