

VIRTUAL LANDSCAPES AND EXCURSIONS - INNOVATIVE TOOLS AS A MEANS OF TRAINING IN GEOGRAPHY

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ABSTRACT:

In addition to real field trips and education virtual field trips are an excellent tool to convey scientific knowledge concerning geography. This paper describes the scientific, technical and didactical approaches of the web-based virtual excursion in the real world of a former mining area. Numerous interactive functions and knowledge tests support the students' thinking and learning in a 3D and 4D world. The developed tools are highly interdisciplinary and contain geoscientific as well as remote sensing, cartographic and GIS knowledge. Multiple use, integration in widespread types of lectures, and self learning are possible and necessary. The procedure is an example of innovative knowledge transfer from theoretical topics to real landscape processes.

Qualified staff are needed to create and improve such virtual excursions and for supervision of students. The long-term sustainability of web-based teaching tools remains a challenge.

1. INTRODUCTION

In the last few years there a heavily increase and importance of well designed of importance of web-based e-learning tools in remote sensing, GIS, geomorphology (www.geoinformation.net, URL 1, www.gisteam.de, URL 2). Often the existing teaching material has been completely transformed to the web and includes the full content of this lesson. In some cases there is a huge number of screen text pages or poorly designed interactivity. From the special view point in geography we realise that the teaching material used for study lessons is mostly with separated image examples and is not related to a specific landscape. One of the most important and most difficult stepping stones in geosciences education is the understanding of landscape processes on different spatial and temporal scales. Field excursions are very useful and essential, but also cost money and are time consuming in education in geography. It is well known that students get a higher input through learning activities in real world applications and situations. For this reason there exist concepts for the combination of web-based multimedia e-learning tools and field-trip experiences in real landscapes using the virtual excursion method. The basic concept was developed by Gläßer and Thürkow (2004) for the highly dynamic coastal zone area "Darß" at the Baltic Sea within the project WEBGEO (www.webgeo.de, URL 3, Goßmann et al. 2003) and is used by members of the webgeo-network for other landscapes too.

2. OBJECTIVES

The good experiences with the developed techniques of virtual excursion in e-learning tools form the basis for the project Geovlex-geovisualisation, virtual excursion and virtual landscapes (www.geovlex.de, URL 4). The transformations of concepts, together with associated tools structures from the coastal zone area offers brand recognition. In contrast to the natural landscape of coastal zone areas with large nature protected areas and intense coastal processes, the new test site is a complete anthropogenic landscape, strongly influenced by heavy active mining and reclamation activities.

Using a very good scientific data base, visualization of historical and future processes is based on 4D realtime applications, networking of modules, applications, objects, and geoscientific themes

3. SCIENTIFIC, TECHNICAL AND DIDACTICAL APPROACHES

3.1 Scientific Approach

The test site is the abandoned lignite mining area "Goitzsche" near Bitterfeld, Central Germany. The strongly anthropogenic influenced area is close to the university and easy accessible during field trips. The selection of the area is appropriate for the following reasons:

A highly dynamic area due to reclamation activities and natural processes;

- ✓ Very well suited for demonstration of anthropogenic determined landscape with different goals for the future (nature protection, tourism, fishery...);
- ✓ Large amounts of geoscientific data acquired by our own research projects;
- ✓ Very good data base of multi- and hyperspectral airborne scanner data;
- ✓ High resolution laser scanner terrain model exists.

The main goal is the better understanding of natural and man-made features of landscapes and their development over time and space as a part of a particular ecosystem based on real geospatial databases and (WEB) GIS-methods concerning a real landscape. Figure 1 shows the geoscientific content and the geoscientific methods for the 3D and 4D visualizations and animations. The design and programming of web-based teaching and learning tools to convey scientific knowledge in geography is realised within the virtual excursion in a real landscape (Fig. 1). The numerous interactive functions and examinations support the student's three-dimensional understanding and learning by doing. Visualization of three-dimensional topics (using real x, y, z-coordinates in virtual landscape models from the field trip area and visualization of four-dimensional processes for spatial analysis based on GIS animations) increases the understanding and the motivation of the users enormously.

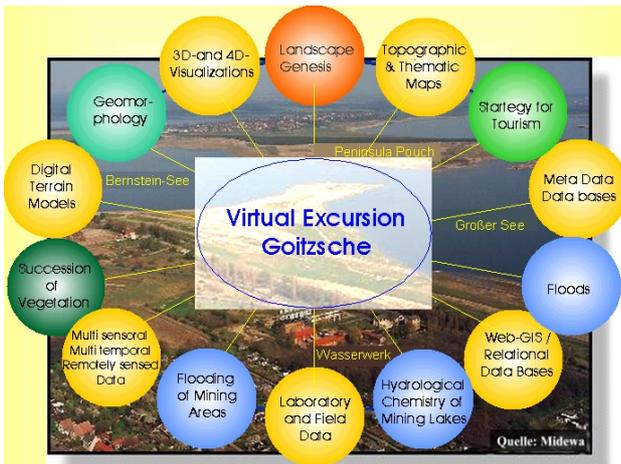


Figure 1: Interdisciplinary Themes in the Virtual Field Trip Goitzsche-Bitterfeld

The virtual excursion can be employed with various choices:

- ✓ Guided tour of all excursion points with general information on each subject;
- ✓ Guided tour to:
 - Succession processes in the mining area;
 - Hydrochemical and and hydrobiological properties and development of the residual lakes during the flooding process;
 - Exteme flood in August 2002 of the Elbe and Mulde rivers and there influence on the mining area;
 - Touristic routes at the present and for the future (Fig. 2, 7);
- ✓ Free selection of the tour points or particular modules.

All tours were supplemented with interactive usable maps, multitemporal multispectral and hyperspectral remote sensing data, high resolution digital laser scanner model (Fig. 3,7,8) and analytical data from field work. Basic digital image processing of remote sensing data is integrated for the specific contents of the excursion goals. So there is a link between the geoscientific and the different spatial models as well as methods of spatial analytical methods in a landscape and all components complement one another. These new concept guarantees a real interdisciplinary education.



Figure 2: Start Site – Virtual Field Trip Portal (URL 5)

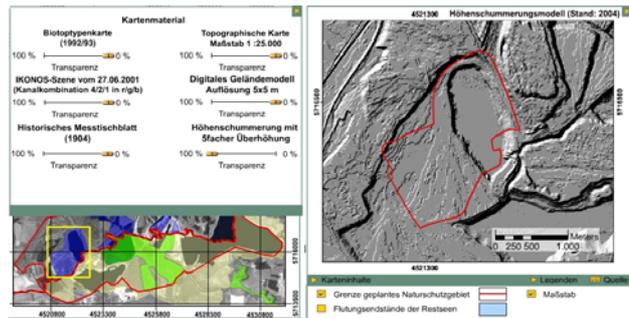


Figure 3: GIS based Field Trip Material with High Interactivity (URL 6)

3.2. Technical Approach

The web information system is based on freely available up to date open source software and GIS products for a global use. The GIS-Product ArcGIS and image classification program, Erdas/Imagine and Envi are used to process the basic spatial raster and vector data of the field trip areas. Landscape models and real time applications are based on the software products World Construction Set and Virtual Nature Studio. No commercial learner platform is used in the project. To enhance the success of learning by doing, we programmed our own learning environment based on the open source data base MySQL in use with PHP and the Apache Webserver. Figure 4 shows the networking of the programmed database applications to manage glossary entries, spatial maps and data, metadata, photos, animations, videos, learning modules, virtual field trip navigation, and so on as a learning environment.

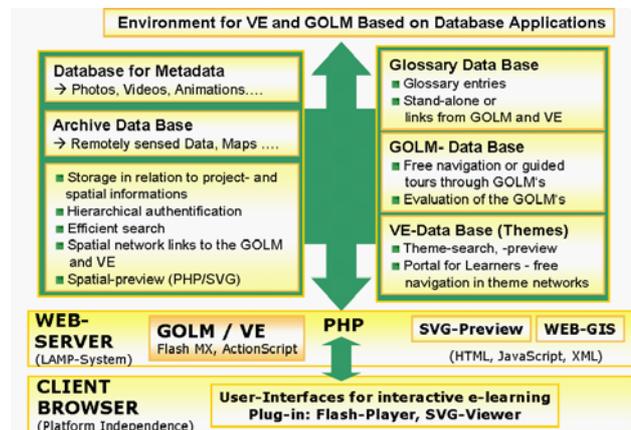


Figure 4: Environment for Virtual Field Trip and GOLM based on Database Applications

3.3 Didactical approach

The developed tools belong to the “Blended Learning Model“. One should be wart that the personal and financial efforts for realisation of the subjects and instruction into the virtual environments and the programming of animations and interactions are often seriously underestimated. A multiple use and integration of the tools in widespread types of lectures, seminars or other courses is essential. One can than reduce extensive text pages on the screen and low animated figures.

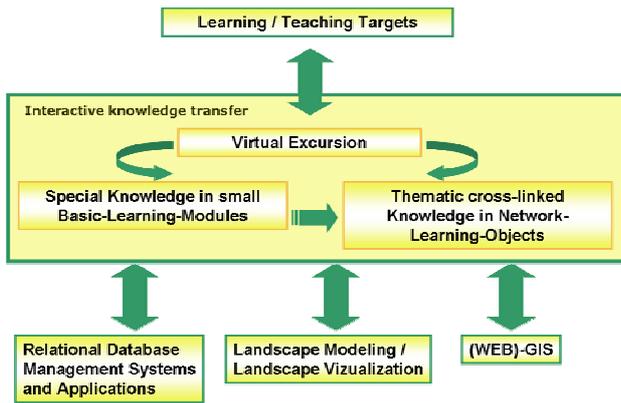


Figure 5: Basic Concept of Interactive Knowledge Transfer

All contents of education are summarized to modules, we call geovlex-online-learning module (GOLM). Each GOLM contains basic knowledges, welcome pages, content pages, exercises and final pages (Fig. 6).

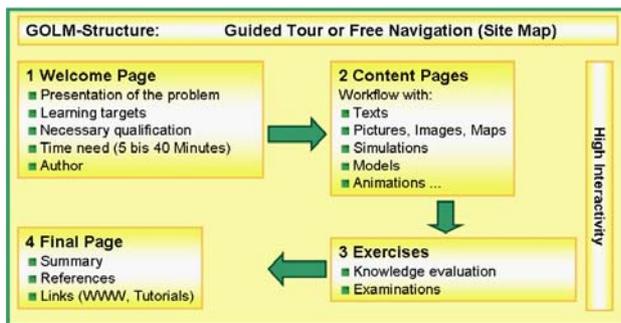


Figure 6: Structure and Content of the Geovlex-Online-Learning-Module (GOLM)

A prerequisite for successful use of the system is an intensive study of literature for the basic theoretical background. Each GOLM contains the condition for use and references. In addition a glossary explains essential terms. A large variety of self-evaluation tools and tests, like drag and drop, multiple choice, fill in given text using the interactivity and animation, enable the self-pacing of learners as well as the supervision by teacher (Braun et al., 2003).



Figure 7: Interactive Map for Tourism and Tourism Concepts in the Goitzsche Area (URL 7, Kratsch 2005)

The modules can be used for enhancement of theoretical knowledge based on facts for teachers and learners in Earth

sciences education. They are applicable in face-to-face-learning as well as for distant online learning:

- ✓ Integration in lectures, seminars or other courses by teachers;
- ✓ Multiple use in preparation and wrap-up of field trips and lectures;
- ✓ High flexibility and individuality depending on pre-existing user knowledge;
- ✓ Improved individual navigation and selection of GOLMs by use of modular structure,

All modules are characterized by high interactivity and integration of numerous animations and the implementation from a large variety of interactive and interdisciplinary exercises and tests (Fig. 5, 8).

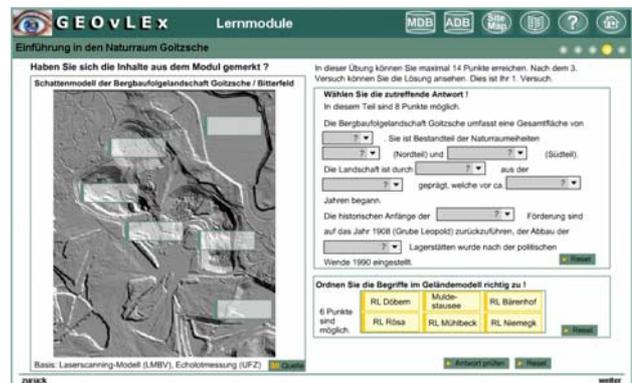


Figure 8: Interactive Test in the Landscape Environment (URL 8)

4. CONCLUSIONS

Virtual landscapes are innovative tools for geoscientific education and interdisciplinary knowledge transfer from theoretical topics to a real landscape. Design of virtual landscapes requires complex knowledge of geoscientific processes and data processing techniques, applied informatics, digital cartography, geographic information system, image processing, and science of cognition.

The realization of the virtual excursion is an effective way for interdisciplinary knowledge transfer from geoscientific topics of a real landscape to contextualize with basics of remote sensing, cartography and GIS and enables trans-sectoral teaching and learning. More over promotes the use of IT systems and GIS systems. The high degree of interactivity using real geo data in a virtual environment and the 4D real-time application improve the students' understanding of historical and future processes. The modular structured tools are developed as "Blended-Learning-Scenarios" for various lectures, not only in geography. A multiple use of modules, applications and objects can be included in other courses of study like multimedia, landscape planning, and geobotany. Moreover the integration of the tools in education in higher classes in schools, for long term study for teachers themselves and environmental communication and education, is both possible and necessary. The virtual excursion "Darß" is now implemented in the environmental education center "Darßer Arche" (www.darsser.arche.de), plans for the region "Goitzsche" will be similarly implemented

There exists a large variety of new solutions in e-learning and e-teaching; we are at the beginning of this development, which requires intensive and multidisciplinary research for technical realisation, and new didactical concepts (Lindau, 2004). Often

underestimated is the personal expense for the permanent evaluation of modules, supervision of students and actualisation of the data used. The rapid technical development of multimedia software products requires a continuing updating of existing tools. If we are not able to manage this process, we will convert the positive effect of modern e-learning and e-teaching tools into negative experiences. To set the technical and personal requirements for this development is an unsolved problem in many universities. The long term learning is a challenge for the future and for which we have to develop excellent concepts.

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