INTERACTIVE E-MAPS AS A SUPPORT IN EDUCATION PROCESS AT GEOGRAPHY AND HISTORY FOR ELEMENTARY AND SECONDARY SCHOOLS.

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1 INTRODUCTION

International studies have shown, that over 80% of the information circulating in the world, is related to spatial location. Usage of e-learning for demonstrations of location related information in Slovenia has been modest, with the exception of some higher education programs.

Geodetic Institute of Slovenia is spreading knowledge of new possibilities and forms of teaching aids and hosts students of different age groups for many years now. This kind of presentation and interaction with pupils and teachers have demonstrated lack of materials and great interest in modern forms of spatial data presentation. Usage of digital content facilitates comprehension of geographical knowledge, orientation in space and location of specific events or activities.

The need for materials, on the one hand, and knowledge and technical possibilities on the other, logically dictated linkage of teaching, adult education and technical skills with the aim of producing quality e-learning materials. A consortium of three organizations (Geodetic Institute of Slovenia, Faculty of Civil Engineering and Prosoft Consulting) in the year 2009 participated in the project at the Ministry of Education, funded by the European Social Fund and Ministry of Education and Sport of the Republic of Slovenia. The aim of the project was the construction of interactive e-learning materials accessible via the web portal, to support the teaching of geography and history for all levels of primary and secondary schools in Slovenia.

In project we ensured close links of primary, secondary, university and Adult Education staff from all levels of teaching history and geosciences. We carried out the connection of the school teaching staff, by academic research personnel in the field of acquisition, processing and rendering of spatial data and technical operational personnel with years of experience in the preparation of electronic thematic map materials.

The project ended in September 2010 and since then the results are available online at http://egradiva.gis.si.
2 THE DESIGN OF THE E-LEARNING PORTAL

E-learning portal addresses geography and history topics in elementary and secondary school. These four sets contain a total of 37 topics that cover selected topics in school curricula.

Figure 1: Point of entry of the e-learning portal

For the design of the portal we have set the following criteria:

- design integrity,
- interactivity,
- scalability,
- connectivity,
- up to date content.

Special attention in the design and construction of the portal has been devoted to the users. We separated basic portal users (students, random visitors) and users who produce their own content (teachers). Basic users can use the topic-specific components and gain an interactive learning experience. Users who prepare their own content, can use already constructed components within individual topics, or make completely new content in the form of new components. The advantage of the hierarchical structure of the portal is wide connectivity between the various classes and levels of study.

Each topic is presented with structured components for:

a) introductory presentation of the topic,

b) content of the topic,

c) consolidation and verification of knowledge.

Figure 2: Structure of e-learning materials with titles of geography and history topics
2.1 Technology of the portal

We are in times of great changes in technology of e-learning. New generations of pupils and students, the so-called "digital natives", widely use digital technology and web applications in everyday life. The result is a considerable gap between the solutions for daily life and e-materials, held by the school system at the moment. Existing e-learning materials are mostly created by digitizing existing static content, which are included in the uniformed packages like SCORM. Typical "digital natives" are flexible and meet the required assessment tests with minimal effort and creativity. At the same time, just for fun, they create their own content on social portals and with communication with peers develop skills and conquer new concepts. Newer generations of schools and universities seek to create conditions, under which the creative charge will come back into the learning process. It is clear, that this is essential for long-term survival of the school system as we know it.
With today's technology, "portlet" is most appropriate unit for the integration of arbitrary content on the Internet. Within portlets run Java applications and programs written in other languages, e.g. PHP. There are portlets that display any web page and other Internet content. Specialized portlets allow social networks and access to back-desk storage. Portlets communicate with each other, as well as the portlet can be mapped from one portal to another and so can access to comprehensive and complex solutions of other authors.

Each topic of e-material is defined as a collection of portlets. Each portlet can represent a single content, movie, game, web site, forum topic or any other component on the Internet. The teacher is the editor and presenter at the same time. He or she directs students through this maze and encourages and animates them. For the purpose of our project we choose Liferay, a leading open-source horizontal portal. The system works on Linux and uses the mySQL database and is therefore entirely open source.

3 DEVELOPMENT OF COMPONENTS

The development of e-learning materials was initially carried out in two more or less independent directions (preparation of content and technological development of functionality of the components), which were then merged together at the main stage of the project. First acquired conceptual solution of the technical capabilities, offered better guidance for the preparation of the contents. On the other hand, the nature of the contents struck many new ideas of how this content can be delivered to the users in the optimal, transparent and effective way. This iterative process carefully directed development and finally defined the technical proposals, which have become the basis for the integration of content.

The last step was the final processing and adaptation of content, to turn in the final functionality of individual portlets. This meant the design of definitive content and functionality scheme and the final preparation of materials (text and page breaks, selection and processing of photos, production of photo galleries, a selection of video content and production of video galleries, etc.). Such a comprehensive set of materials finally allowed software coding and integration of all visualisations in the final production of individual components.

3.1 Functionality of components

Presentation of the specific content in the form of e-learning materials has many advantages. Various functionalities, that enable exciting, dynamic and above all interactive learning of the content, provide new possibilities for learning. The portal therefore uses different sets of functionalities, which formed the basis for the preparation of components, that present the content on the portal. The following sets of functionality were used:

- Thematic maps in electronic format for the purpose of projections and physical interactions by adding graphic elements written on the projection surface.
- Interactive maps, where users can impose thematic layers, aero or satellite imagery, separate topographic content, etc.
- Multimedia spatial environment, where users relate visual material to certain spatial locations with possibility to search certain points of interest, facilities and locations with a journey through three or more dimensional models (for example Google Earth).
- Dynamic presentations (overflights, animation) of specific events, areas and phenomena (circling of the solar system and the Earth, transition of the Earth's surface in the plane etc.).
- Location Games, where a combination of the above-mentioned functionalities is used with interactive quizzes and questionnaires, or other inquiries in the form of interesting games (search for cities and countries in 2D and 3D, targeting of the given coordinates of points locating specific content, making your own maps with the assistance of e-environment, identification of certain object at different levels of cartographic visualization, ...).

For the realization of these functionalities new applications have been developed and enhanced functionality of existing web applications and commercial tools and components has been used. In this way, more than 20 independent software templates were developed. They were used individually or combined, to form the basis for the production of all components on the portal.

The seemingly simple software solutions have requested additional verification procedures of functionality and content control. At the end of the project, more than 400 portlets were produced, each of which constitutes a stand-alone web application with certain content and functionality. Portlets can be implemented with different technologies, for example, Java, PHP, Flash, etc. This concept allows personalization at a teacher level, who can establish and maintain a personal collection of programs (individual presentations, tasks, online games), which he believes will best represent a specific topic.

3.2 Forms of content presentation
Content has been presented with the following forms of presentation:

Figure 4: Animation
Figure 5: Slideshow
Razvoj gospodarstva

So učastvo v razvoju mest se je začel tudi hiter nepredviden razvoj različnih obrotov, predvsem industrije, težavštva, tečajev, cestnega območja...

Razvijala se je trgovina, kakor tudi umetnost in kultura.

Detajli reščne skulpture

Reščna skulptura prikaže može v čoknh, navejenih iz papiruža.

Pojav imperializma

Rezultat podjamevanja poddobnosti in vrnjenja vojaške je bil razvoj organiziranega vojaškega oporuba. Izraz režimskih vladnih organov in bojnih vojsk je omogočil razvoj velikega kraljestva in nastanek imperijev, ki so hčeli gospodovati nad vsem do tedaj poznanim svetom.

Animski relief, firman

Reljefski relief prikaže dogodek in odziv kraljeveg bojnega voža.
Figure 7: Interactive Flash component for content building
Figure 8: Interactive map
Figure 9: Interactive map on Google Maps
**Figure 10: Interactive presentation**
Figure 11: Interactive presentation on Google Maps
Figure 12: Timeline
Figure 13: Interactive chart
Figure 14: Zoom viewer
Figure 15: Magnifying glass viewer
Figure 16: Move puzzle
Povlecite kaščke iz levega stolpca na ustrezno mesto v desni mreži.

Figure 17: Puzzle
VPRÅŠALNIK

1. od 10

Prometne poti v gorski pokrajini potevajo pravilema skozi rečno dolino in preko ____ (Krvsič, Ljubelj, Kranjske sedlo...).

Figure 18: Questionnaire
Figure 19: Spatial quizz
Figure 20: Pairing game
4 DIDACTIC VALUE

E-learning materials are a learning tool, which cannot be compared with the textbook or as a substitute for the teachers presentation. They are meant as a support of the teachers interpretation, and individual work of students in addition to the textbook and other materials. Moreover, they do not cover the entire subject matter and they are not always made so, that pupils or students are led through the study material systematically. They complement the teaching material with additional information and illustrate the subjects vividly, graphically or even dynamically and interactively, offering exciting possibilities for repetition and consolidation of learning material.

When using e-learning materials, it is important to work actively for a teacher in the sense, that the e-material is first inspected and then decided how, where and when to apply the lesson. The teacher is the one, who values the complexity and chooses what to use, and provides guidance and recommendations to the pupils or students for independent home study. In addition, the teacher adds its own ready-made materials or web content to the e-learning materials. With the tools of the LifeRay environment, one can remove offered contents and add or even create entirely new, proprietary content.

Use of mapping e-learning materials is reasonable and recommended:

• as motivation in addressing new issues,
• for more demonstrative and variegative presentation of new teaching materials,
• for repetition and consolidation,
• for examination,
• for individual home work for students.

With e-learning materials pupils among other things, can:

• increase the ability of spatial perception and spatial thinking,
• increase the ability to create cognitive maps,
• obtain ability to map or sketch the real world,
• enhance navigation and orientation skills,
• determine how the geographic location is associated with time,
• at school used the media, which are present in their everyday life (internet, computer, GPS, GSM, Google, Google Earth, digital maps),
• be actively involved in the production and adding of new content (Wiki principle),
• actively participate in e-content (interactivity, updating of maps with their knowledge, tasks undertaking),
• learn himself how to seek knowledge via the Internet.

Pupils and students are through e-learning materials able to independently come to some conclusions. They develop the ability to independently learn and integrate content of different school subjects and current social developments. Using visualization, they deepen their knowledge. At the same time, they further develop the skills of different technologies and raise their competence in this area.

5 FUTURE WORK

It is impossible, but it is also unreasonable to draw the line at the end of such a large and complex project without many new issues, plans and ideas. A quick glance into the future quickly reveals many new possibilities. In the first place is obviously a need for further maintenance of the set of content and regular entry of time-related changes and corrections. At the very beginning, the material was designed open, for the ability to easily upgrade and further develop the components. Featured content falls far short of showing only a completed whole, but at the same time offer and open up opportunities for further development.

Primary and fastest scalability is of course linked to the areas already covered, that is mapping the geographical and historical learning content for elementary and secondary schools. An upgrade is possible within certain topics (additional functionality, different displays of the same content), but also in terms of the dissemination of topics in the field of geography and history. Furthermore, it would be wise to consider, in particular, the promotion of pre-made e-learning materials to schools and subsequently carry out tracking the impact of e-learning materials on the course of work in schools. (to achieve a better knowledge and better learning outcomes). In general, should e-materials be tested in practice as widely as possible and try to get as much feedback as possible.

We have set ourselves even more ambitious goals – to extend the knowledge and experience also to other subject areas that make up the learning process of elementary and secondary schools. It may be somewhat exaggerated claim, but theoretically set guidelines do not exclude the possibility of unification and the spread of e-learning materials to all content-related areas, as well as to slightly less related subjects. Knowledge and technology actually allows an unprecedented breadth of integration of spatial visualizations in the areas, that on the first impression, do not have much in common with space and location. And such challenges for the future, give us the impetus to work together, to pass the interdisciplinarity and informativity of e-learning materials to a wider range of users.