

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

PETROVIC D.(1), KETE P.(2), JANEZIC M.(2)

(1) University of Ljubljana, LJUBLJANA, SLOVENIA ; (2) Geodetic Institute of Slovenia, LJUBLJANA, SLOVENIA

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>.

The screenshot shows the homepage of the eGradiva portal. At the top, there is a navigation bar with the logo 'eGradiva' (featuring a smiling face icon), the Ministry of Education logo ('šolstvo'), and a link 'Vstop za učitelje'. Below the navigation bar, the title 'PORTAL GIS e-GRADIV' is displayed. A 'Domov' button is located in the top right corner of the main content area. The main content area contains two hyperlinks: 'Kartografija v učni snovi osnovne šole' and 'Kartografija v učni snovi srednje šole'. Further down, there is a section titled 'Priporočamo uporabo brskalnika:' with the Firefox 3.6 logo, followed by 'Sodelujemo na:' and the 'OTROŠKI BAZAR' logo. At the bottom, there is a note about finding them in the Multimedijskem kotičku on September 9th and 10th from 11h to 12h, along with logos for the Geodetic Institute of Slovenia, Prosoft Consulting, and the Faculty of Civil Engineering.

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

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.

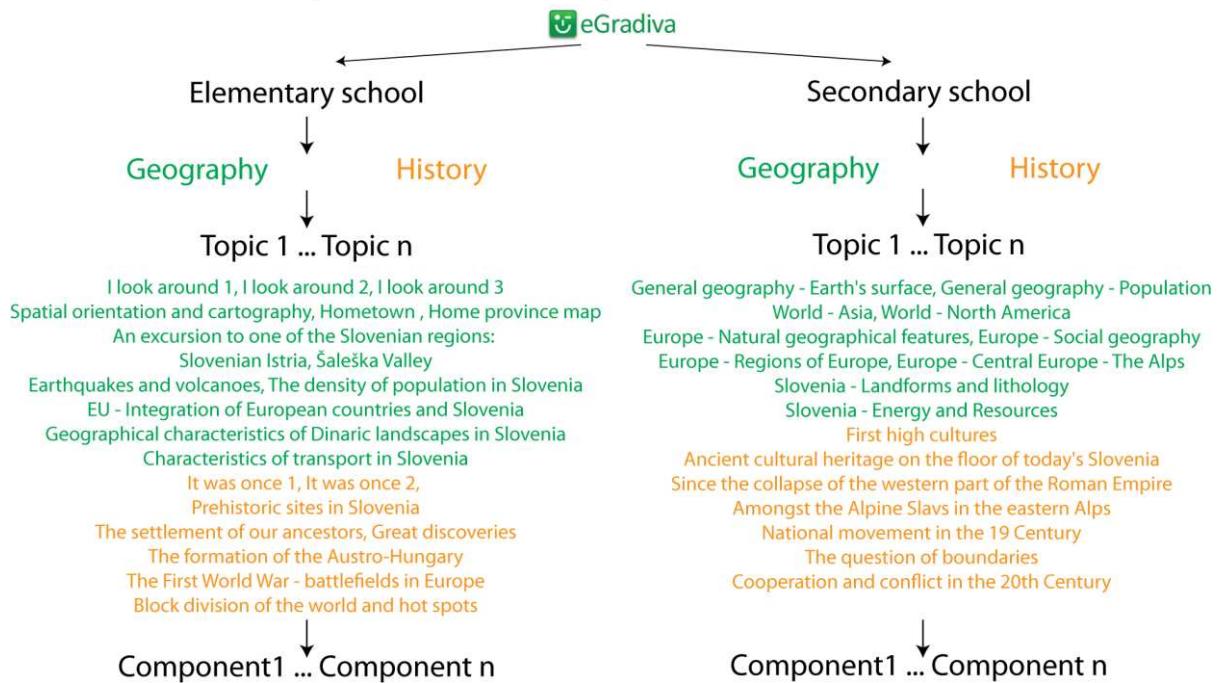


Figure 2: Structure of e-learning materials with titles of geography and history topics

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.

The screenshot displays the eGradiva platform interface. At the top, there's a header with the logo 'eGradiva', the emblem of the Republic of Slovenia, and the text 'Naloga v zelo pričakovanih'. On the right, there's a button 'Vstop za učitelje' (Teacher login). Below the header, the title 'KARTOGRAFIJA V UČNI SNOVI OSNOVNE ŠOLE' is visible, along with a link 'NAZAJ NA IZBOR TEM'.

The main content area shows a large image of a volcano with the text 'Potresi in vulkani' overlaid, and a large white 'a)' label. To the right of the image is a grid of nine smaller cards, each representing a different topic:

- NEMIRNI PLANET**: Ogled si delovanje notranjih žil Zemlje.
- ZGRADBA ZEMLJE**: Spoznaj zgodilo Zemlje.
- TEKTONIKA**: Seznan se z gibanjem tektonskih plošč. (Plošča Kokos, Plošča Nazca)
- VULKANI**: Naobičaj se vse o vulkanih.
- POTRESI**: Spoznaj značilnosti potresnega delovanja.
- NEMA KARTA**: Preveri pridobljeno znanje o vulkanih in potresih.
- POSLEDICE POTRESNEGA DELOVANJA**: Pogledj si posledice potresnega delovanja.
- POSLEDICE OGNJENIŠKEGA DELOVANJA**: Pogledj si posledice ognjeniškega delovanja. (navaj turizma, geotermalna energija, nevarnost za letalski promet)
- SESTAVLJANKA**: Sestavi zanimive slike.
- PREMETANKA**: Uredi premetane koščke v zanimivo sliko.
- Vprašalnik**: Preveri dovojeno znanje v vprašalniku. (marked with a large white 'b)' label)
- Vprašalnik**: Preveri dovojeno znanje v vprašalniku. (marked with a large white 'c)' label)

At the bottom of the page, there are logos for 'GEOGRAM INSTITUT SLOVENIJE', 'PROSES CONSULTING', and 'Univerza Ljubljana'.

Figure 3: Topic structure

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, eg. 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 production 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 constitute 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

KARTOGRAFIJA V UČNI SNOVI OSNOVNE ŠOLE

NAZAJ NA IZBOR TEM

Prva svetovna vojna - bojišča v Evropi

Blokovska razdelitev sveta in krizna žarišča



Figure 5: Slideshow

РАЗВОЈ ГОСПОДАРСТВА

Sočasno z razvojem mest se je začel tudi hitrejši napredek različnih obrti, predvsem lončarstva, tekstilštva, čevljarskega...

Razvijala se je trgovina, kakor tudi umetnost in kultura.



Detajl reliefne skulpture

Reliefna skulptura prikazuje može v čolnih, narejenih iz papirusa

Pojav imperializma

Rezultat podjarmljivanja podeželja in širjenja vpliva je bil razvoj organiziranega vojaškega aparata. Izum novega strelnega orožja in bojnega voza je omogočil razvoj velikih kraljestev in nastanek imperijev, ki so hoteli gospodovati nad vsem do tedaj poznanim svetom.



Asirski relief, Nimrud

Detajl reljefa prikazuje konje in kočijaža kraljevega bojnega voza

Figure 6: E-book

KARTOGRAFIJA V UČNI SNOVI OSNOVNE ŠOLE

NAZAJ NA IZBOR TEM

Prostorska orientacija in kartografija | Domači kraj

Vrni se na celo stran

DOPOLNI SIKO TAKO, DA Z MIŠKO IZBERES ZAHTEVANI OBJEKT IN GA POSTAVI NA ZAHTEVANO MESTO.

POSTAVI ZNAK ZA BENCINSKO ČRPALKO V POLJE H4.

GEOGRAFSKI INSTITUT SLOVENIJE PROSOP CONSULTING Univerza v Ljubljani Fakulteta za geografske in geodetske znanosti

Figure 7: Interactive Flash component for content building

Promet v Sloveniji Gostota prebivalstva Slovenije EU – povezovanje evropskih držav in Slovenija
 Geografske značilnosti dinarskih pokrajin

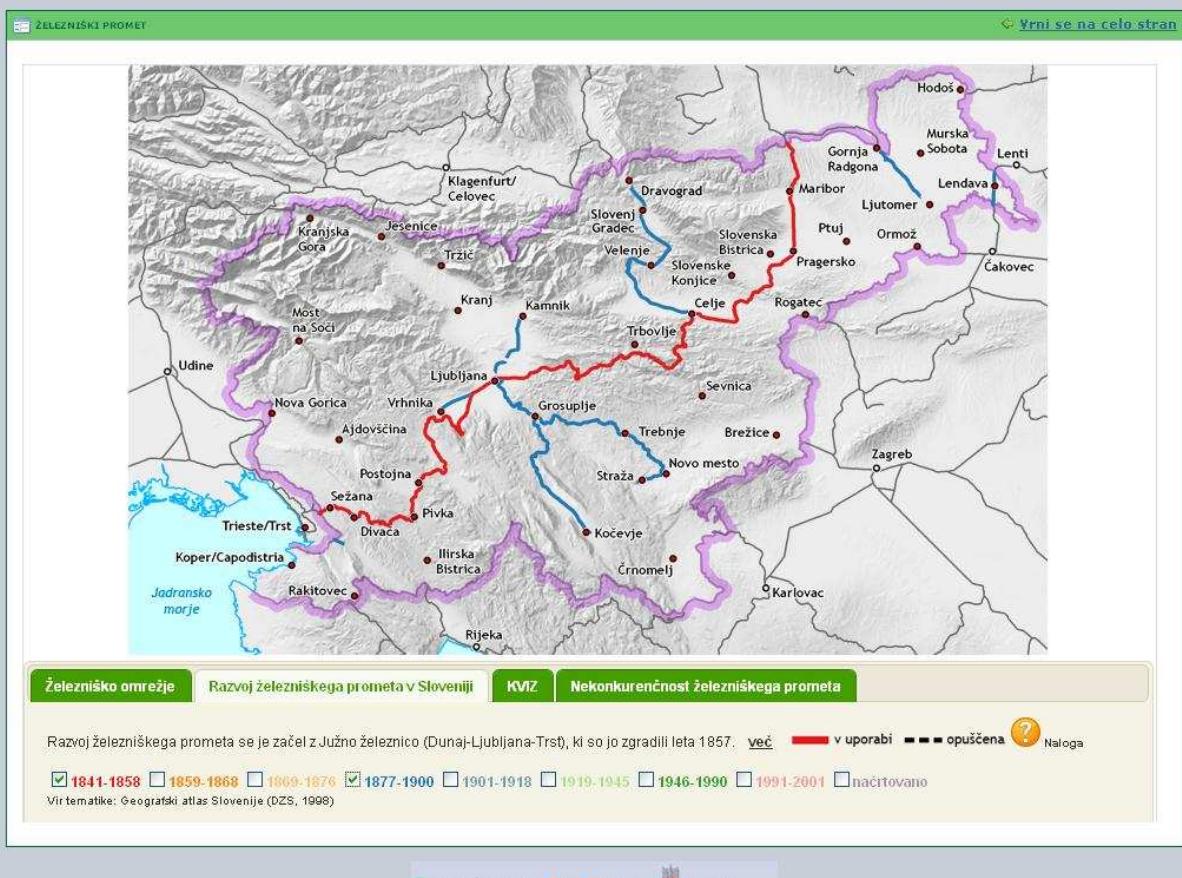


Figure 8: Interactive map

Sodelovanje in konflikti

Vprašanje meja

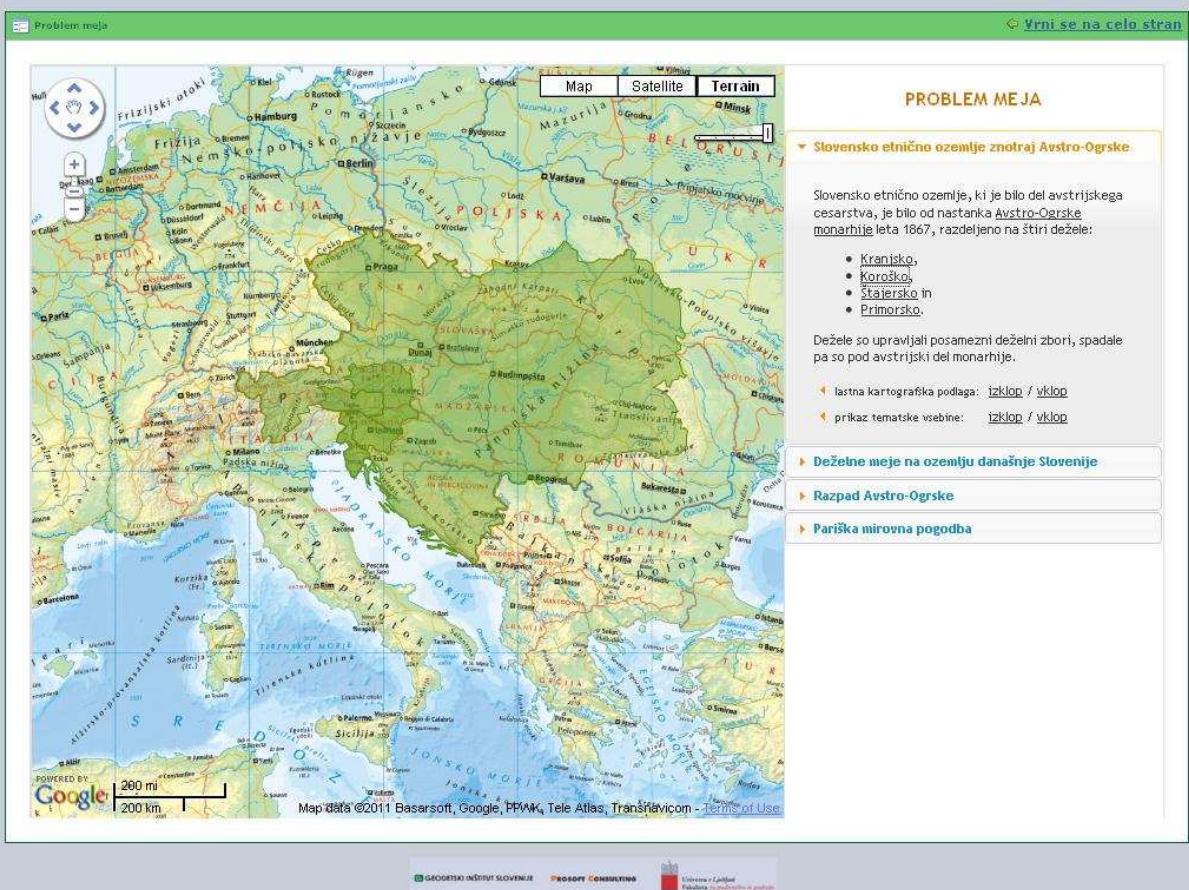


Figure 9: Interactive map on Google Maps

KARTOGRAFIJA V UČNI SNOVI OSNOVNE ŠOLE

NAZAJ NA IZBOR TEM

Promet v Sloveniji | Gostota prebivalstva Slovenije | EU – povezovanje evropskih držav in Slovenija

Geografske značilnosti dinarskih pokrajin

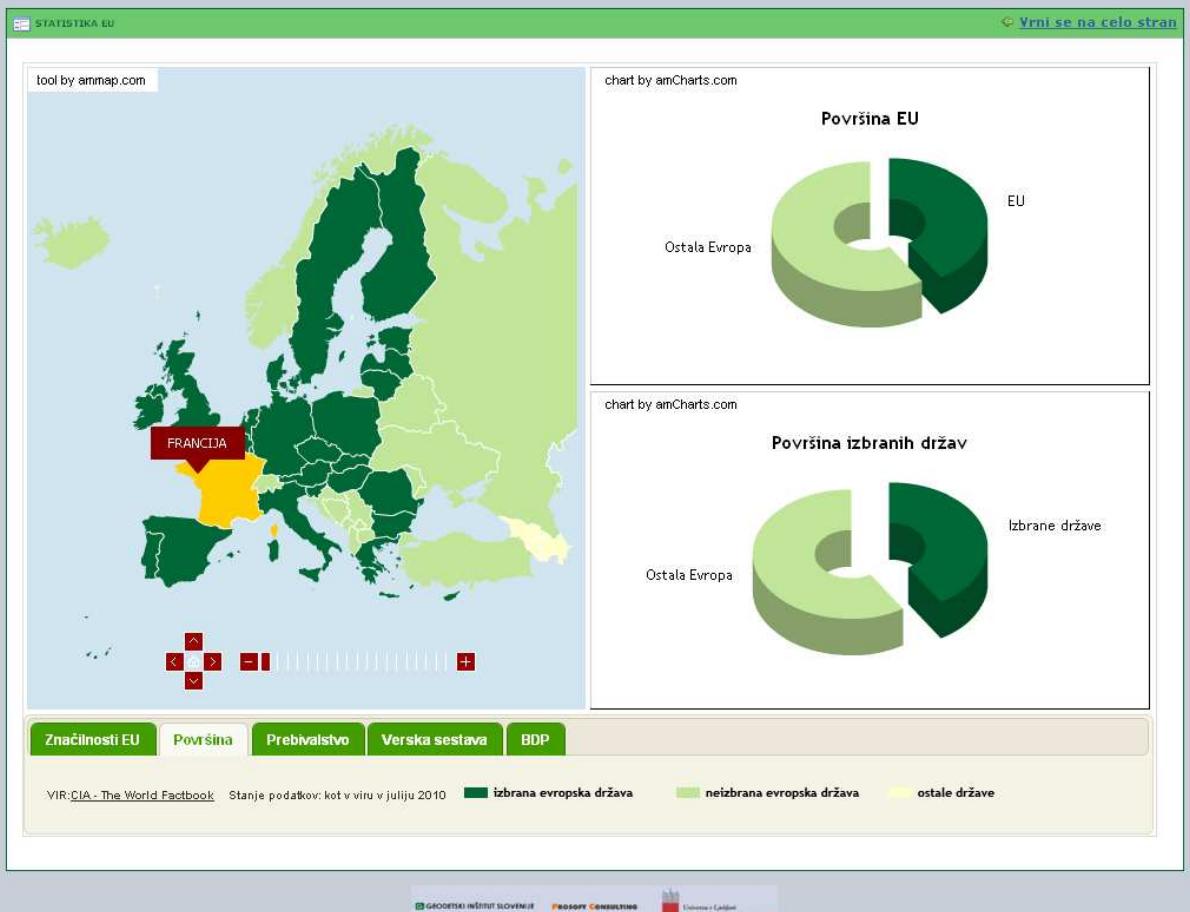


Figure 10: Interactive presentation

KARTOGRAFIJA V UČNI SNOVI OSNOVNE ŠOLE

NAZAJ NA IZBOR TEM

Velika odkritja Nastanek Avstro-Ogrske

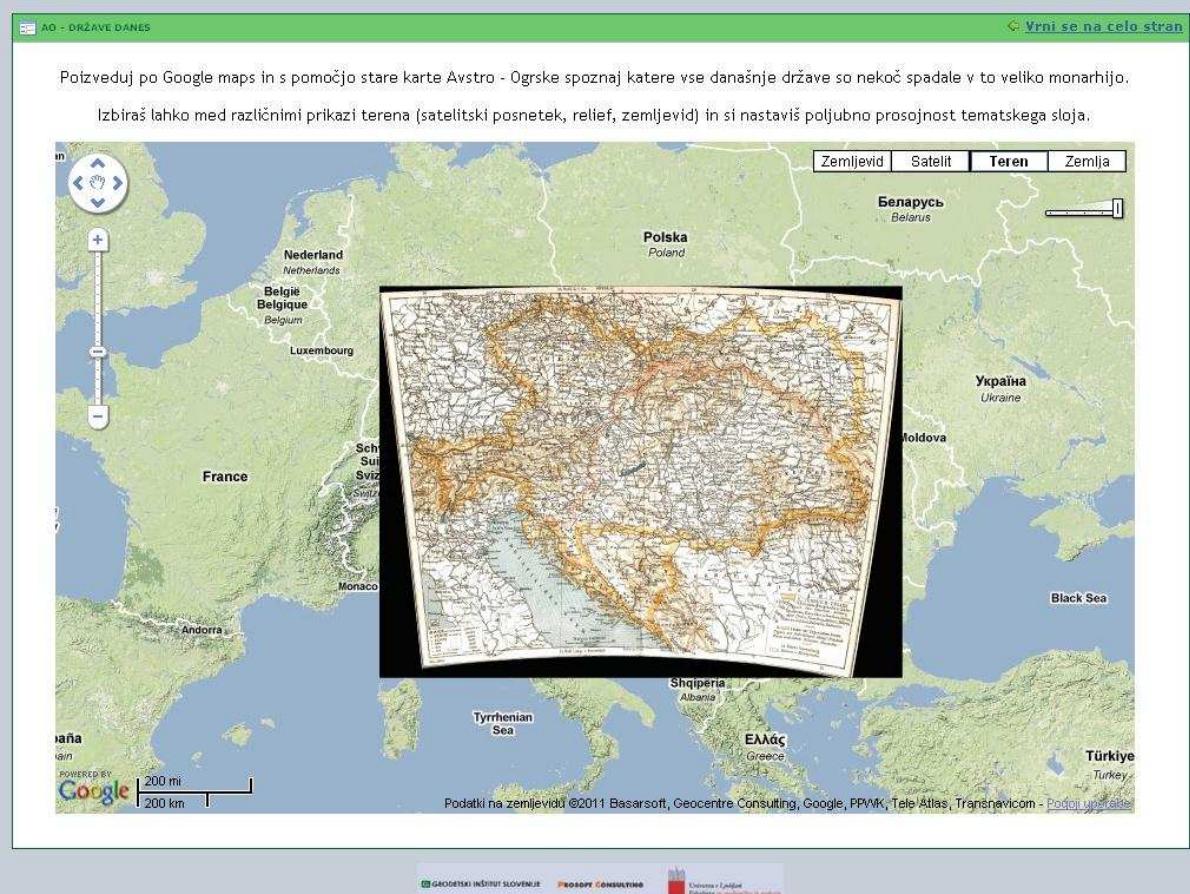


Figure 11: Interactive presentation on Google Maps



Figure 12: Timeline

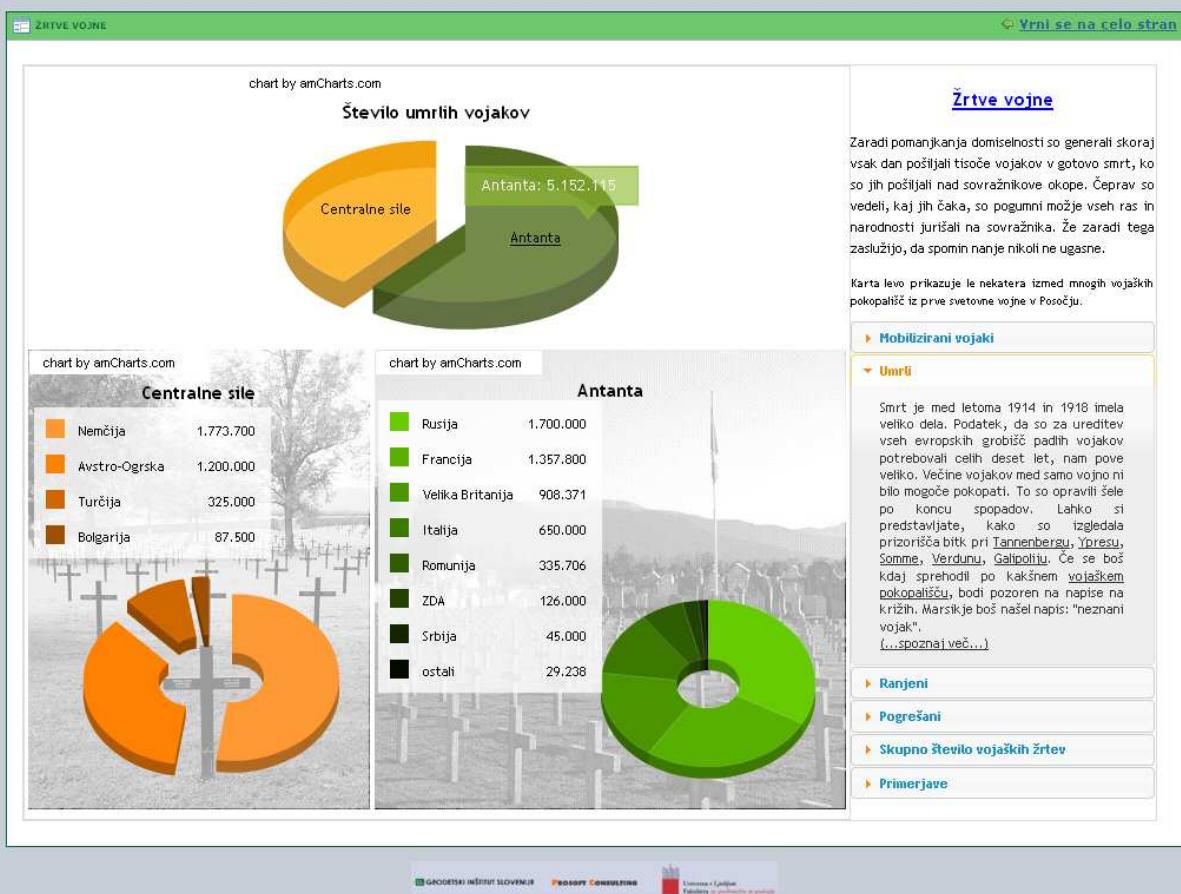


Figure 13: Interactive chart

MEJE V SLOVENSKI ISTRI

Vrni se na celo stran



ISTRA SKOZI ČAS

- ▶ Splošno
- ▶ 1584
- ▶ 1604
- ▶ 1642
- ▶ 1714
- ▶ 1753
- ▶ 1784
- ▼ 1852
- ▶ 1921
- ▶ 1938

ZEMLJOVID SLOVENSKE DEŽELE IN POKRAJIN
Avtor(ji): Knorr, Anton (graver) / Kozler, Peter (kartograf)
Leto: 1852

GEOGRAFSKI INSTITUT SLOVENIJE PROSORT CONSULTING Univerza v Ljubljani Fakulteta za geografske in geodetske znanosti

Figure 14: Zoom viewer

KARTOGRAFIJA V UČNI SNOVI OSNOVNE ŠOLE

NAZAJ NA IZBOR TEM

Promet v Sloveniji Gostota prebivalstva Slovenije EU - povezovanje evropskih držav in Slovenija

Geografske značilnosti dinarskih pokrajin

PROMET IN OKOLJE Vrnji se na celo stran

Promet vpliva na okolje s posegi v naravo zaradi gradnje omrežja ter z onesnaževanjem zraka, tal, vode in rastja. Onesnaževanje ogroža tudi zdravje ljudi in živali. Učinki prometa na okolje so največji v najgosteje poseljenih območjih in glavnih kmetijskih območjih, kjer so vodni viri in reke. Na četrtini slovenskega ozemlja, ki obsega doline, kotline ter kraška polja poteka približno 70% prometa, zato je narava tam sedemkrat bolj obremenjena kot drugod.

Na (spodnjih) primerih si oglej, kako se je zaradi izgradnje avtocest in železnice spremenila podoba pokrajine:

1 2 3 4 5 6 7 8 9 10 11 Primerjalni

Novo mesto



The satellite map shows the town of Novo mesto in Slovenia. A circular magnifying glass is centered over a large construction site, likely a highway interchange or bridge foundation, which appears as a yellowish-brown area surrounded by green vegetation. The surrounding landscape consists of agricultural fields and some built-up areas. The map is labeled "Novo mesto" at the top center.

GEOGRAFSKI INSTITUT SLOVENIJE PRIMERJALNI Univerza v Ljubljani Primerjalni

Figure 15: Magnifying glass viewer

KARTOGRAFIJA V UČNI SNOVI SREDNJE ŠOLE

Evropa - naravnogeografske značilnosti | Evropa - družbenogeografske značilnosti | Regije Evrope | Evropa - Alpe | NAZAJ NA IZBOR TEM

Slovenija - površje in kamninska zgradba | Slovenija - energetika in surovine |

Promotanke | Vrnji se na celo stran



Vodovje v Evropi

GEOGRAFSKI INSTITUT SLOVENIJE | PROSORT CONSULTING | Univerza v Ljubljani
Vabljena na predmetne in praktične

Figure 16: Move puzzle

KARTOGRAFIJA V UČNI SNOVI SREDNJE ŠOLE

NAZAJ NA IZBOR TEM

Sodelovanje in konflikti

Vprašanje meja

Besplatno

Povleči koščke iz levega stolpca na ustrezeno mesto v desni mreži!





GEOGRAFSKI INSTITUT SLOVENIJE PROSOFT CONSULTING Univerza v Ljubljani Fakulteta za geografske in geodetske

Figure 17: Puzzle

eGradiva

šolstvo
REPUBLIKA SLOVENIJA
MINISTERSTVO ZA ŠOLSTVO IN ŠPORT

Nadzor v izobrazbenem procesu

Vstop za učitelje

KARTOGRAFIJA V UČNI SNOVI OSNOVNE ŠOLE

NAZAJ NA IZBOR TEM

Promet v Sloveniji Gostota prebivalstva Slovenije EU - povezovanje evropskih držav in Slovenija

Geografske značilnosti dinarskih pokrajin

VPRASALNIK Vrni se na celo stran

VPRASALNIK

1 od 10

Prometne poti v gorski pokrajini potekajo praviloma skozi rečne doline in preko ____ (Vršič, Ljubelj, Korensko sedlo...).



GEOGRAFSKI INSTITUT SLOVENIJE Peasoft CONSULTING Univerza v Ljubljani
Fakulteta za geografske in geodetske znanosti

Figure 18: Questionnaire

Ekskurzija 2 – Šaleška dolina

Potresi in vulkani

SALEŠKA DOLINA IZ ZRAKA

Vrni se na celo stran

SALEŠKA DOLINA IZ ZRAKA

► Dolina

► Naselja

► Mesto

▼ Jezera

Pravilno

Pokaži Velenjsko jezero

Vir podlage: GoogleEarth

► TeŠ

► Pesje

Figure 19: Spatial quizz

Sodelovanje in konflikti

Vprašanje meja

Spomin – znane osebnosti

Vrni se na celo stran

S P O M I N

ŠTEVILLO PAROV V IGRI: 6

ŠTEVILLO POTEZ: 2

GEOGRAFSKI INSTITUT SLOVENIJE PROSPORT CONSULTING Univerza v Ljubljani Fakulteta za pravosodje in politiko

Figure 20: Pairing game

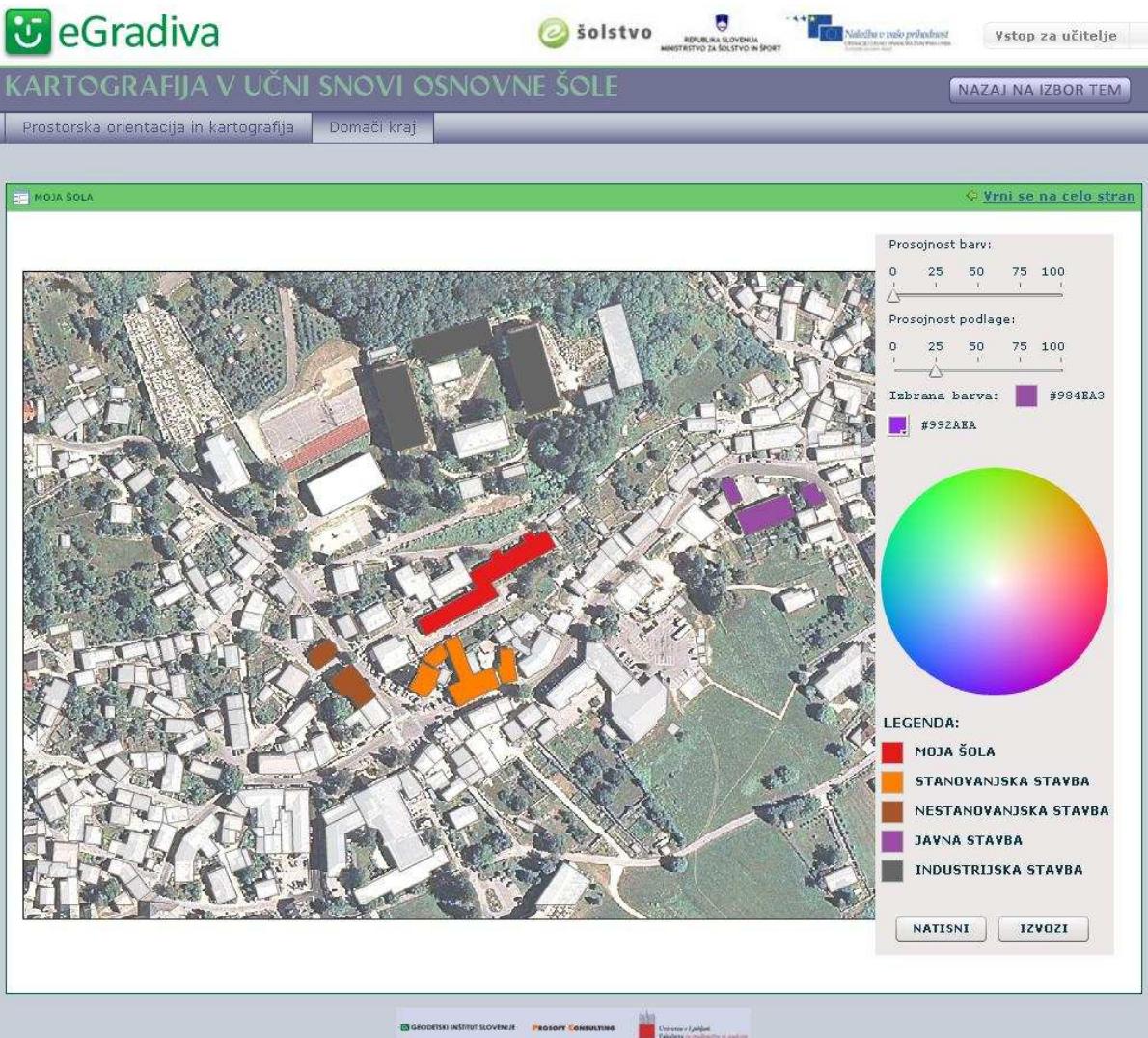


Figure 21: Flash coloring book

4 DIDACTIC VALUE

E-learning materials are a learning tool, which can not 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, 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 the 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.