ESZTER SIMONNÉ DOMBÓVÁRI

Development of interactive web applications in teaching cartographical skills (for 4th, 6th and 8th grades of high schools)

Summary of doctoral (Ph.D.) thesis

DOCTORATE SCHOOL OF EARTH SCIENCES
HEAD: Dr. GYULA GÁBRIS D.Sc., University Professor

DOCTORATE PROGRAM OF CARTOGRAPHY
HEAD: Dr. ISTVÁN KLINGHAMMER MHAS, University Professor

SUPERVISOR
Dr. JOSÉ JESÚS REYES NUÑEZ Ph.D., Associate Professor

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I. INTRODUCTION AND AIMS

During my studies, those publications and applications aroused my interest that allow learning and teaching cartography in a new and entertaining way. I chose interactive map applications, exiting map games – that mean entertainment and education at the same time – for the topic of my MSc degree thesis. I collected and classified map games and a mute map game based on my own ideas was prepared (The Blind Mouse – Mute Map Game, http://vakeger.elte.hu/). It can be recommended to anyone who likes playing to test his/her knowledge of maps and geography. Over the past years, it was followed by additional applications (3D Blind Mouse – Mute Map Game, http://vakeger.elte.hu/, Geolearn – educational tool and collection of mute maps for topographical knowledge, http://geolearn.fw.hu/).

I had the opportunity to present this topic and the completed applications in several national and international scientific, educational and professional events. Positive feedback from these events confirmed that there is need to continue my research in this area. The use of the Internet and interactive applications in education is increasing and there is need for further similar developments. During my study abroad, I learned more about further technical solutions of web mapping as well as about the educational system and cartographic education of a neighbouring country, Austria. Therefore, I decided to go on with my research in the field of educational practice of European Union member states: especially in the field of teaching cartography of Hungary and Austria.

In my research I focus on how international experiences and new applications can support teaching and learning of cartographical knowledge to enable students to learn spatial information and orientation with maps easier. My aim is to create interactive applications on the Internet, which prepare the cartographical skills and topographical knowledge of the curriculum. With these programs students can deepen and practice what they have learnt previously, namely, the curriculum itself, in an amusing way in school or at home. Before preparing my proposal I had to analyse education in different countries. My questions were which kind of national and international web applications can be found in this topic and which web technology solutions are available. My aim is to collect the international interactive web applications in this topic and to present my completed programs in a unified website.
II. METHODS USED IN THE RESEARCH

For the presentation of teaching cartographical skills it is important to analyse the development of educational politics, the structure of educational systems in the European Union, as well as to study the education of geographical and cartographical skills in some member states, namely Hungary and – because of my study in Vienna – Austria. I studied international and national technical literature, collected the educational tools and methods connected to geography, and within this, to cartography and drew up a chart about them.

Nowadays, with the quick development of Internet and web cartography there is a great number of resources and tools to create a web map. Therefore, I reviewed the available web technology solutions. I collected and analysed the websites dealing with cartographical skills. Based on these results I worked out recommendations for interactive digital applications and programs in amusing teaching and learning of cartographical skills.

In my research I prepared a web site for entertainment and education. It consists of programs which can draw the attention of the users and teach cartographical and geographical knowledge in an amusing way. They are quick and simple, and some of its parts are available in several languages (Hungarian, English, German and Turkish) on the Internet. Various programs and technologies helped in making the recommendations.

Two sources are used for this map game: the graphic and the text background of the program. The maps come from the free web mapping services (Google Maps and Google Earth) via application programming interfaces (API) or they are prepared in the graphic program CorelDRAW. These are geographic maps for education. The map areas are the same as in atlases and in school books. The other part of used sources was the list of topographic requirements. The levels of the programs correspond to the Hungarian National Core Curriculum. The purpose behind this was that the developed game should be used at all levels.

The programs were prepared with the same server- and client-side software. They were planned to be portable, so all codes were written in scripting languages (PHP and JavaScript). The server-side PHP scripts implement the user management (user registration, logging, score storage, top list generation), the theme and category selection, the random object selection for every new game, and the forum page of the game. The client-side JavaScript realizes the interactivity of the game. All the data (the object information, the scores and the user information) are stored in MySQL tables with uniform structure. This allows an easy migration as PHP and MySQL are usable at most hosting providers.
III. RESULTS AND CONCLUSIONS

1. The international review of public education and teaching geography and cartography in the European Union member states, especially in Austria and in Hungary

In my thesis I have summarized the development, major policies and decisions of the educational politics in the European Union. I presented the curricula, structures and types of education systems of each member state. I presented the situation of geography education, and within this, teaching cartographical skills. I studied the educational system, especially in Hungary and Austria (development, structure, curriculum, geographic and cartographic skills education). I have collected and summarized the traditional and digital teaching tools (school maps, atlases, textbooks, workbooks, and interactive multimedia learning materials) and educational methods in these two countries.

The European Union is actively coordinating the educational policies of the member states. The aims are the competitive and knowledge-based society, unified compulsory education, "lifelong learning" as well as competency-based education (appropriate for student’s skills). But I found that the education systems of the member states have been developed differently because of historical, political and economic influences. As a result, the school systems of the European Union countries can be classified into three different types (three cycles, two cycles with longer elementary and shorter secondary levels and two cycles with shorter elementary and longer secondary levels). Therefore, it varies in which grades and how they teach geography and cartographical skills. I illustrated this by the examples of some member states.

The education in Hungary and Austria has similarities because of their common history. Their curriculum systems are the same. Their main characteristics are central guidance, ideological freedom, skeleton curriculum and tutorly freedom. Teaching cartographical skills and choice of educational tools are similar. But the role of topographical knowledge is different in the approach of the two countries’ education.

2. Summary of the development and current stage of web cartography

I presented the definition, the development of web cartography, the types of web maps, the technologies to research which technologies are suitable to teach and practise cartographical skills.

We can add another type to the four generations of web mapping technologies (statistic web maps, interactive web maps, Web Mapping Services, Virtual Globes): the online maps for mobile
phones. The important element of the web maps are interactivity and multimedia. We can
differentiate groups in respect to the data type (vector or raster), presentation of the maps and
interactivity (static or dynamic, interactive or non-interactive). Nowadays, it is also necessary to
update the previous types and characterise them. The web technologies are based on the server
client communication. We can distinguish between server- and client-side technologies (e.g.
client-side scripts like JavaScript, Java Applets, AJAX; or CGI, server-side scripts like PHP or
ASP, WMS, relational database management systems like MySQL, PostgreSQL, Oracle) which
we can use for further web applications.

3. Summary and analysis of web sites in some European Union member states in the
field of teaching cartographical skills and topographical knowledge

I summarized web sites for teaching cartographical skills and topographical knowledge in some
European Union member states to present the international experiments. I presented and
analysed this web sites for every topic. The result is a database on the web with search function. I
summarized the characteristics and used tools (presentation matters and practical tasks) of the
analysed web sites as part of my theoretical research. The results can be seen in summarizing
tables.

I found web applications for learning and practicing cartographical skills from several EU
member states. I think they are less popular than educational applications. We can find a
collection of educational tools and web sites with whole presentation of cartographical skills too.

Analysis of these web sites shows four groups of web applications of each topic. There are
either more or less examples for them. Some topics have either no tools to practice or there are
more practical tools than tools to present it. The most used topics are e.g. points of the compass,
scale, types of maps, symbols, coordinate systems and positioning. Some topics are less used for
such web applications, e.g. generalisation, names, thematic map methods or the national
topographical systems. The practical tools do not consist of generalisation, map elements,
decision of position or height. There are more practical tasks as theoretical presentation e.g. for
map making, map types, colour of maps, symbols, points of the compass and orientation.
4. Summarized recommendations and implemented practical examples for further possibilities of teaching cartographical skills

Based on the analysed web sites I summarized recommendations for further possibilities of working out of some topics on the web and the useable technical tools. The part of my practical research is a web site (http://geolearn-fw.hu/map/). It contains the database of web application for education of cartographical skills and topographical knowledge in EU on one side. On the other side it is a collection of my web applications which were prepared in the last time for geographical, cartographical and topographical skills with mute maps, tests and other tools.

I presented ideas based on the analysed international and national applications which can be used by pupils at home or in school. They focus not only on cartographical skills but other related skills on the web as well. On one hand it is important to present these skills in Hungarian even if they exist in other languages. On the other hand it is important to work with such topics which are not easy for the pupils. But with interactive web applications they can be accessed easily and they can suit the interests of pupils. On the other hand the technologies of web cartography (databases, script languages, webGIS or online web mapping services) give further possibilities for teaching and learning these topics.

In the last time I analysed the usefulness and applicability of web application with the help of pupils and teachers. I have presented the applications during personal visits, web forums and professional events. Using web statistics, it turned out that these web sites are regularly visited from different parts of Hungary and abroad. Based on the received feedback, there seems to be a demand for such easily and quickly accessible web-based education materials.
IV. REFERENCES


V. PUBLICATIONS

Journal articles


Book chapter


Conference papers and posters

→ Papers presented at conferences


→ Posters presented at conferences


