

Chapter 5



GIS Project Education in Primary Schools

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Abstract

GIS Project Education took place in a primary school for a period of six months. Pupils solved easy, but also difficult assignments, which led to them gaining and fixing basic geographical knowledge. This paper informs about course and results of this work and develops a discussion on whether GIS education can be realized in practice.

Introduction

The rapid development of modern information technologies gives us more potential not only in specialist and scientific fields, but also in education, where it is possible to use innovative elements and achieve higher learning outcomes. The use of ICT is thus possible in university, but also in primary and secondary education. Many universities in the Czech Republic successfully run subjects, where students can become acquainted with geographical information systems (GIS). Students that study education and are training to be teachers are not an exception, in this case (Svatoňová, 2001). The main question is how can they use this exciting technology in education in their future pedagogical practice? Are these young teachers going to be able to use GIS (not only) in their geography lessons? What will be the reactions of pupils concerning this “innovation” in their classes? Are the pupils able to get necessary skills to work with GIS?

The GIS situation in Southern Moravia

Research of the current GIS situation preceded practical experience in primary schools. A questionnaire inquiry on primary schools in the whole Southern Moravia Region (Figure 5.1) was carried out among the total of 130 pupils and there were also many conversations with geography teachers in the region.

It was not surprising that GIS has not been introduced or developed in primary schools. Only 8% of pupils had ever heard of the term GIS, and only 2 pupils knew what GIS really was. Teachers were characterised by low theoretical awareness; they complained of the lack of education courses in this subject area, non-existent methodical material and also frequently remarked about the high financial implications on providing hardware and software equipment (Foltýnová, 2005b).

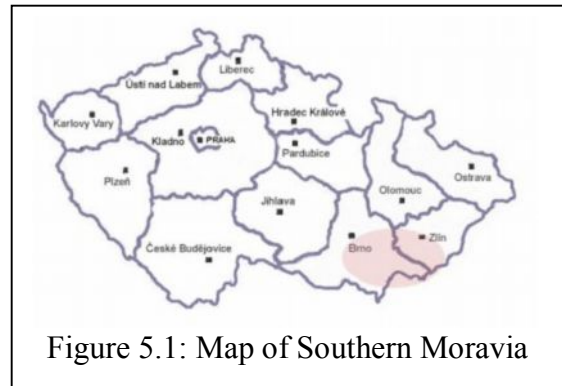


Figure 5.1: Map of Southern Moravia

All the teachers were aware that their activities need to surpass current educational procedures, which are based in the majority of schools mainly on mechanical memorising, instead of realising area connections, structures, problems, their causes and impacts on Geography as a subject. These realities have led to the second part of this chapter which is to practically demonstrate how taught subjects can be made more diversified and interesting for pupils through GIS.

GIS Project Education

A pilot GIS education project took place in 2005, which lasted for half

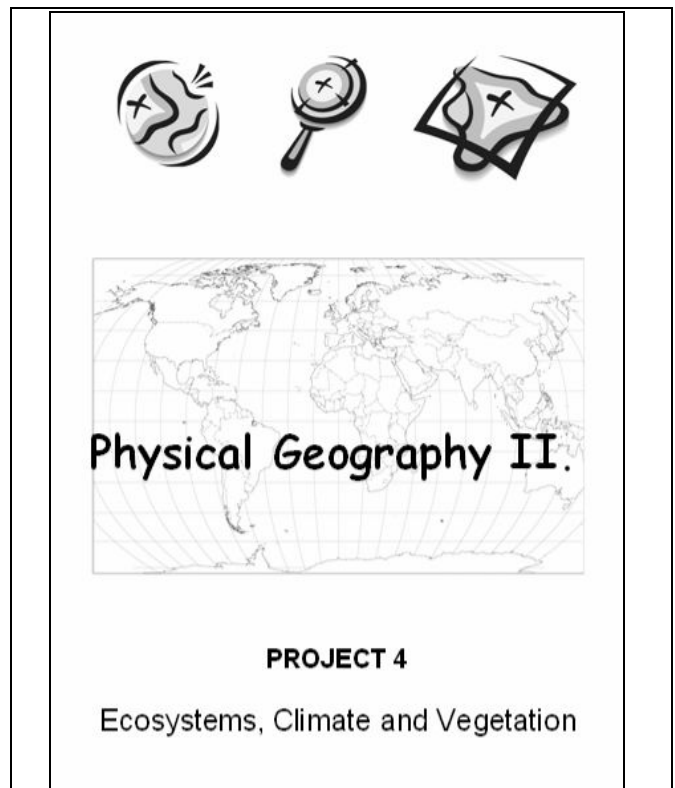


Figure 5.2: Project introductory page

a year. Altogether 15 children in each school participated every week in this optional class, where they learned to work with GIS from the very beginning. Pupils started to elaborate separate projects after initial motivation, introductory lessons (Figure 5.2) and working with GIS structures. Projects were focused on subject areas which intersected with different geographical topics from natural sphere over social to worldwide global problems (Earth's motions, climate, flora, ecosystems, population structure, cities etc.)

For working on the project, pupils used free reasonable GIS software available on the Internet. For example it is software from company ESRI called "ESRI ArcExplorer 1.1" [<http://www.arcdata.cz/>] or Czech programme "Kristyna GIS viewer version 1.2" [<http://www.christine-gis.com/>]. It is possible to easily install these programs and it does not require special computer equipment. Pupils use various buttons and tools, which were offered by the software. For example: Panning and zooming on a map, Measuring, labelling and identifying map features, Selecting features on a map interactively or by attributes, classifying spatial data, editing tables, selecting a row in a table interactively or by attributes, exporting and printing map and so on.

Every major project activity was preceded by a motivation exercise (Figure 5.3) for introducing geographical problems which will be further investigated through the project. Pupils worked most often in groups or in pairs, drew mind maps, made lists, discussed about topics, which would be necessary for their work and predicted assumed results, etc. They did not use a computer for

Name _____ Date _____

Ecosystems, Climate and Vegetation
Running Hot and Cold
Cast 1: A map investigation

Directions: In the spaces below, list the three cities on the map that you believe are the hottest in July and the three cities that you believe are the coldest in January.

Hottest in July:

Coldest in January:




Figure 5.3: Beginning the project: a motivational activity

their work in the motivation part of the project.

Pupils worked then separately according to the materials provided (Figure 5.4), they filled in worksheets (Figure 5.5) using computers and the GIS programme. Methodical instructions guided pupils step by step through the whole project. It was elaborated clearly, supplemented by a series of sample windows and icon buttons and tools, which were used by pupils during their work. A ‘question mark’ before the text informed pupils that they have to answer this question into their work sheets and an ‘exclamation mark’ warned them about some exceptions, gave advice or help for easier elaboration.

Step 6: Select all active volcanoes

 a) Make the Volcanoes theme active and click the Open Theme Table button. The Type field of the table tells you if each volcano is Active, Potentially active, or Solfatara (emits gases, but is otherwise inactive).

b) Click on the Type field heading.

 c) Click the Sort Ascending button. Scroll down and you will notice that there are many active volcanoes.

It would not be fun to highlight all of these as you did with the Earthquakes theme. This is a smart database—we can ask it to select all of the active volcanoes by using the Query Builder.

 d) Click the Query Builder button.

e) Double-click Type in the left hand Fields box. Single-click the equals sign (=). Finally, double-click "Active" in the right-hand Values box.



f) Click New Set. All of the active volcanoes are selected and highlighted yellow.

 *Hint: If you receive a syntax error, check that your equation is exactly like the one in the graphic above. If it isn't, delete the equation and try again.*

Figure 5.4: Methodical part's sample

Step 3: Observe annual world temperatures

b) Are the temperatures listed as degrees Fahrenheit or degrees Celsius? _____

c) Write three observations about the pattern of temperatures displayed on the map.

Step 4: Label the latitude zones

p) Use the Identify tool to find information on cities and complete the table below.

ZONE	TYPICAL TEMPERATURE RANGE	EXAMPLE CITY (it reflects typical Temperatures of that zone)	ANOMALIES (cities that do not fit the pattern of their zone)
Tropical			
North Temperate Zone			
South Temperate Zone			

1) Why do you think there aren't any cities in the North or South polar zones?

Figure 5.5: Sample of a part of work sheet

Pupils had every question in their worksheets marked with a number, which corresponded to a number in the response sheets and some free lines were available for answers under the question, or unfilled table or numbers for writing down a list. Reflection, control and mutual comparison and evaluation of reached results were done by the pupils at the end of each project.

The teacher had a role of a coordinator or guide during the work on the projects, leading more than directing which would inhibit pupils to think, the teacher attentively listens to pupils and helps them. The aim is to provide much more room for active learning and for pupils'

independent thinking. However the presumption was to achieve good understanding of the problems from both scientific and didactic view (Foltýnová, 2005b).

Pupils enjoyed working with GIS. Often they stayed on a long time after obligatory classes at school in order to finish their work projects. Many pupils were interested in the program and they wanted work at home as well. On the "Parents Day" they introduced the geographical course and the results of their work. They created a nice presentation poster. Pupils learned not only work with GIS software, but they demonstrated that they had developed a global comprehension of the world.

Key life skills

As a conclusion, it has been shown that it is possible to successfully develop pupils' cognitive processes through this form of 'project education', which leads to gaining key life skills. The pupils are challenged to adopt certain strategies (procedures), which they direct to solving given tasks during their project work. Among these basic strategies (skills) could be named for example (Zimmerman, 2002):

- Searching for information from several sources
- Creating structure (outline)
- Writing down notes, searching for important and interesting information
- Formulation with own words
- Using pictures, diagrams, sketches
- Recording the course, control achievement of the goal
- Working independently, but also cooperating .

Learning strategies

It is necessary to lead pupils to realise their own thinking in order to achieve efficient learning. We should not forget about reflection – which could be simplified and marked as the act of thinking about and event before it happens, during and after it takes place. We should also mention self-evaluation as this should be always routinely incorporated into education processes, if we want to achieve, that pupils would direct their learning and would take over responsibility for learning into their

own hands. About metacognitive strategies and self-regulated learning you can read in Zimmermann (2002), Flavell (1997) or Mareš (1998).

I would mention, as a conclusion, some of the questions, which were part of every project and which helped pupils to develop more efficient learning strategies in order to solve an assignment in a more systematic and strategic way. These were:

a) Planning

What was the essence of given assignment (project)?

What am I supposed to do (my goal)?

What information and strategies (procedures) do I need?

How much time and resources would I need?

b) Observing

Do I understand clearly what I have to do?

Does this assignment have any sense?

Am I reaching my goals?

Is it necessary to make any changes?

c) Evaluation

Did I reach my goal?

What did I do successfully and what was interesting?

What were my problems and how did I solve them?

What would I do next time differently?

What did I learn?

Conclusion

The challenge for geographers is to educate for present but also for future times. This means to support such learning, which provides basic foundations for building knowledge as well as for developing cognitive abilities. The key for development lies not only in professional growth of a teacher, but also in a development of new methodological procedures, where a personal computer can play an important role as a new, but also at the same time a well-integrated medium.

The GIS project activity in a Primary School was a major new experience for the author. Currently, we are living in times of modern technology and advanced information technology. I tried to constantly improve separate projects according to children's reactions during my half-year work and after every project. I received valuable information and mainly the encouragement to further continue this work and in my endeavour that GIS will become an integral part of geography lessons. I tried to show the pupils how to efficiently work with information, how GIS has become a part of their everyday life and how can they connect their knowledge even from other subject through suitable GIS projects. The main effort is to create a situation where GIS would provide highly valued help if it was integrated in geography lessons. This would make the education more realistic, exciting and funny. This was confirmed in the schools where education with the help of geographic information systems was run.

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Chapter 6



Working with computers - a study of the state of the art in Germany: Focussed on the University of Education, Karlsruhe, Germany

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Computer use by students in Germany

For many years the use of computers and Internet has belonged to the learning and working media of German students. A study undertaken by the German student union in 2000 examined the conditions affecting the integration of computers and the Internet into the everyday life of studies and teaching as well as the familiarity of the students in handling such media. The results showed that the majority of students (97%) had the possibility of using a computer. 85% of the students possessed their own computer and about 60% of the students used both, their own computer and additionally the computers in university (Middendorf, 2002). Concerning the use of Internet these values were somewhat smaller. A total of 87% of the students used the Internet and possessed their own email address. Only 55% of the students had their own Internet access at home. Additionally the survey determined that the computer equipment and the existence of an Internet account as well as the frequency of Internet use varied according to gender and the field of study. Therefore the male students usually had better equipment than their female colleagues. Regarding the different fields of study students of mathematical, technical and scientific subjects were better equipped than the students of linguistic, artistic and pedagogical disciplines (ibid; see also West *et al.*).

When concerning the competences in using computers, the survey showed big differences. Approximately one-third of the students (31%) only had good knowledge of basic applications (e-mail, word processing...), using the Internet and the basic uses of the computer in general (operating systems, file management...). The largest group of students (46%) were also familiar with spreadsheet analysis, multimedia and/or working with graphics and pictures. A further 19% additionally possessed knowledge within the range of software for statistics, Website organisation and/or computer language programming. As earlier there were also clear gender and sectoral differences.

Virtual learning activities in higher education

At the end of 2001 in Germany already more than 1600 online study courses existed and the number of opportunities has rapidly increased during recent years. They range in their approach from online courses using e-learning and blended learning to simply the availability of lecture notes (scripts) and information on the Internet (Middendorf, 2002; see also Collis and van der Wende, 2002, 39-40).

Nevertheless, concerning the development in Germany it is to be determined, that while at universities the use of information and communication technologies in research is natural for years, the new media as additional infrastructure and/or information and communication possibility in the teaching area are until now integrated in different speed into higher education (Kleimann and Berben, 2002). Therefore Kleimann and Berben postulate that the German Universities have to face up to these new tasks if they want to continue in the international competition (ibid).

The most important aim within the use of ICT is to improve the quality of education. In the same time, introducing and promoting ICT in higher education seems to increase learner motivation and also enables students to study in a time- and site-independent way. The most important part is to use e-mail, discussion forums and mailing lists. The aim here is communication, cooperation and distribution of materials and other information. In total, one can say that several forms of

instruction are integrated in the higher education sectors: “Hybrid scenarios predominate – frequently called ‘Blended Learning’ (scenarios, in which virtual elements are combined with face-to-face courses). The presentation-oriented forms of ‘traditional’ higher education predominate.” (Rinn *et. al.*, 2004, 14)

According to the results of the study of the German student union only one-third of the students in 2000 indicated that there were online course opportunities for their own subjects of study. Another third were not sure about possible offers, the rest were sure, that no such learning forms are to be offered. Only 30% of the students knew about lectures, texts, bibliographies, tasks and solutions from the Internet but only about 25% used these possibilities. Online communication in addition to learning activities takes place even more rarely and is used only by 8% of the students. Interactive teaching activities (e.g. online courses) as much as virtual seminars played only a marginal role and the proportion of students that took part in these opportunities is even smaller at fewer than 4% of the respondents. However, students consider the availability of lecture notes and information on the Internet to be very positive, especially those who have already used them (Middendorf, 2002).

In connection with the “Förderprogramm Neue Medien in der Bildung” (i.e. an initiative and funding programme for promoting new media in education) between 2000 and 2004 altogether approximately 200 millions of Euros were spend by the Bundesministerium für Bildung und Forschung (BMBF), the German Federal Ministry of Education and Research, for the integration of modern information and communication technologies in school, vocational and university education (Kleimann and Berben, 2002).

At a university level especially projects for the introduction by study elements into the normal work of the university became promoted. However the development of pure concepts or prototype solutions was not promoted in this context (*ibid.*).

Facilities for students and teacher at the University of Education, Karlsruhe

Regarding the technical and material assistance there are two special departments at the University of Education Karlsruhe, the “Centre for information technologies and media” (ZIM) and the “Audiovisual Centre” (AVZ). Both can be used by teachers as well as by students.

Technical equipment can be borrowed and for example there is a large selection of video equipment for the recording of lessons or presentations in classrooms (including several camcorders, microphones and the necessary manpower). There are also tablet-computers available for use as a class set. Students can borrow appropriate materials for their studies or for presentations. Furthermore the departments offer guidance for buying hard- and/or software as well as courses for the use of programs and technical equipments.

In addition to the technical and material assistance the university offers special computer and multimedia rooms, in which the students can work. The centre for learning languages (SLZ) offers a learning environment with a variety of special programmes, software for loan, internet access as well as a multiplicity of foreign-language (video) materials. All students have a university email account. There are beneath the specific facilities also several computer pools with Internet and network access for the students. So every student is in general enabled to work with computers, to improve their competences with computer programmes of all kinds.

The use of computers in the Department for Social and Scientific Studies in Primary Education at the University of Education, Karlsruhe

In Germany the 16 States are autonomously responsible for all matters of culture and education. According to this each state is maintaining its own school system, own conditions of study as well as examination regulations for the teacher education. For that reason for teacher education in the departments for social and scientific studies (General Studies) there is also no common curriculum.

The “Gesellschaft für Didaktik des Sachunterrichts” (GDSU) has worked out a “Perspectives Framework for General Studies in Primary Education” (Gesellschaft für Didaktik des Sachunterrichts, 2003). Among other things the competences of primary school children, which are needed to be aimed at in general studies, are formulated within this framework. Nevertheless, the decision about teaching contents is still on the single States.

In contrast to the schools there is no comparable framework on university level so that different guidelines exist for each state- and even for each university. So, for example, the teaching tasks of the department for social and scientific studies in primary education are described as followed by the study order as well as by the examination rules of the University of Education Karlsruhe:

1. Conditions of learning in social and scientific studies
 2. a) Didactics in teaching social and scientific studies
b) Fundamental aspects of teaching and learning
 3. Conception of General studies (social and scientific studies)
- (Pädagogische Hochschule Karlsruhe, 2003)

Competences for the using of computers or new media are not mentioned either in the subject examination rules or in the general examination rules. The situation is the same within the Department of Geography. The examination rules and study orders of the University of Karlsruhe determines that there must be at least one course about ICT in Geography. Nevertheless, the use of ICT in this department is very low due to a lack of personal resources for staff and students.

The department for social and scientific studies in primary education in Karlsruhe trains more then 800 students a year aiming to become a primary school teacher. It is part of the public University of Education in Karlsruhe. The university itself has about 3200 full-time-students. The final certificate of the university enables the students to apply for a job in public primary and lower secondary schools in Germany. The major tasks of the department consist in teaching, research and working within the university administration.

In connection with various research projects the department cooperates with other departments in the university and also with universities in the region, in several European countries and in the USA. The department offers in-job-training for teachers and cooperates with a number of regional schools in improving lecturing and materials. The main areas of research in the department focus on learning and teaching in science education considering mental representation, conceptual change and gender aspects. Since October 2005 the Department has been part of the project “The implementation of the Scientific Thinking process in (Pre) Primary School setting” (STIPPS) supported by the European Commission.

Within research and teaching activities computers, the Internet as well as other media is commonly used by staff as well as by students in different forms:

a) Communication by email

Communication by email certainly is the most frequent use of computers in the department. It takes place both in connection with information exchange and planning with colleagues and cooperation partners as well as in form of consultation with students. However the number of students who, according to our own data, do not possess an own email address is still very large. About 10% of the students do not even want to have or use an email account, not even the university one provided for them.

b) Presentations

Presentations using computers have become more and more self-evident. Most of the courses given by members of the department are based on the creation of Powerpoint Presentations. Some additionally include special video sequences or use the Internet during these presentations. But also for students PowerPoint based presentations play an increasingly larger role, because the implementation of computers in presentations is more and more expected by university teacher.¹ But even in this point it must be stated that in the framework

¹ The university teachers have the position that the students should be able to handle computers for presentations and therefore ask them to work with PowerPoint and other presentation programmes, even though they probably won't need to use them later on in school (because of the state of the art of the computer use at school).

of appropriate presentations many of the students are using the media (computer system with projector) and/or special programs for their presentations for the first time. Usually they have not participated in special training courses for the use (even if offered by special Institutions within the university for free)² and so much of them fall back on the good-natured assistance from friends or colleagues. According to this the students have difficulties when problems rise during their presentations.

c) Internet research and online resources

The Internet as an information medium is used in the context of the teacher education both by teachers and students. Technical and didactical aspects as well as possibilities for projects are investigated in the Web. Beyond that the Internet is also used for the literature researching through the use of online resources; national and international libraries and online magazines.

Among other resources, an online database service is offered by the library (ReDi), the university has its own e-magazine delivery service (LEA) as well as numerous publicly organisations (e.g. subito) are available online. The students can use these recourses in the university computer rooms as well as by using their private access.

d) Provision of online information and materials for students

On the Internet pages of the department (<http://www.ph-karlsruhe.de/NATUR/HUS/index.html> and <http://www.chipss.de>) students are able to find a wide variety of information relating to current courses. There are a lot of materials for preparation of taught classes, for example handouts, papers etc. Beyond that information about special tasks are provided for students, which can be worked on independently and autonomously by them and discussed later in small groups under the supervision of a teacher. Additionally the students can find materials which relate to further studies.

² The Centre of Information technologies and media regularly offer each term several introductory courses to presentation and computer use. About 20% of the students don't know that these offers exist; about 20% think they don't need them (even if they would benefit of these courses); other 15% use these offers, finally about 45% of the students say they don't need the courses because they know enough about computers and presentation techniques.

e) Providing online information about current research results and research activities

The Internet page www.chipss.de provides information about the current research projects of the department. Due to the fact that most of the results, such as research projects from students, are not published elsewhere, this would seem to be very important resource, especially within the background of the sciences. In the past, several colleagues from other countries viewed project results there and made contact with the department.

f) Online conferences with teachers and students from other countries and universities

Online conferences, in which the students mutually present prepared questions to student colleagues from other countries and discuss the results together, play only a marginal role in the department. For most students a large inhibition threshold exists, which justifies itself both in the alleged missing language knowledge and in the handling of technical media.

g) Computer programs for the preparation and analysis of collected research data

Beside the programs for text processing, which at present constitutes the greatest student use, programs for statistical analysis such as Excel and SPSS play a particularly important role in the work within the department. However, there seems to be an enormous barrier for students to consider using them. Thus, appropriate programs are usually used only by university teachers or else by students under close guidance. Programs for the analysis of interview materials, such as MaxQdata, are so far only very rarely used by students.

Conclusions

The development of computers to develop multimedia abilities and talents in both phases of the teacher training has so far played only a marginal role. Therefore information technology concepts and tools for teacher training are needed. They should focus seriously on the competencies of new teachers and intensively support them. Only a few

of the qualified teachers are able to use these new media adequately. Therefore the improvement of media competences would seem to be an urgent task for the future.

At the time of going to press, preparations for the introduction of online learning platforms such as StudIP are being undertaken at the university. Some courses had already been offered for students as part of a first testing phase in the winter semester 2005/2006. Since summer 2006 the platform is available for use in all courses. Beyond that, a number of additional fundamental questions need to be clarified if the effective application of new media in higher education is to be achieved. These need to be addressed for example at the committees of the BundLänderKommission (BLK) and the Kultusministerkonferenz (KMK). In this context for example, the mutual acceptance of qualifications delivered through the Internet needs to be clearly defined.

For the furtherance of new media in German universities, incentives for university teachers must be created for developing and using digital media. It is important also that systems and regulations for example for course preparation and subsequent payment of tutors who develop online courses have to be regulated. Additionally the German rights, such as for copyright, the rights of use and enjoyment have to be clarified.

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Useful Websites

University of Education Karlsruhe: <http://www.ph-karlsruhe.de>

Childrens Imaginations in Primary School Science: <http://www.chipss.de>

German Federal Ministry of Education and Research: <http://www.bmbf.de> and <http://www.medien-bildung.net/>

Deutscher Bildungsserver: http://www.eduserver.de/zeigen_e.html?seite=2265

Studieren im Netz: <http://www.studieren-im-netz.de/>

International Learning Technology Center:

<http://www.iltec.de/impressum/impressum.php>

Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (BLK):

<http://www.blk-bonn.de>

Chapter 7



Computer use in Geographic Education – Is Implementation worth the Time and Effort? Examples from the University of Education in Weingarten

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Introduction

In Germany the use of computers has reached a high level in all kinds of professions as well as in the private lives of citizens. Therefore, it has become a duty to prepare the coming generation of academics in the use of computers in their teaching. The national German policy and also the university-policy in Germany (described in Daniela Schmeinck's article: Working with computers - a study about the state of the art in Germany (Focus: University of Education Karlsruhe) is promoting and supporting computer use in teacher education. In particular, the universities and faculties of education (like the University of Education in Weingarten) have to prepare the next generation of teachers, to use the variety of options involving computers and e-learning.

Use of computers in teaching at the University of Education in Weingarten

The majority of students at the University in Weingarten follow the basic undergraduate courses in Education. These courses are divided into degree courses for primary/junior and secondary/high school (Grund-, Haupt- and Realschule). The University offers a wide variety of subjects for teacher training which can be studied within the

following disciplines: Humanities, Science, Fine Arts and Physical Education. In addition to that, the university also focuses on digital training and learning of all students. Therefore the University Centre for Digital Learning created a new Media Development Plan (Bendel 2005, Medienentwicklungsplan: http://www.ph-weingarten.de/homepage/zimt/ressourcen/mep_weingarten.pdf) which structures the process of computer use from 2005-2008. After years of individual ICT and computer use in the departments of the University of Education in Weingarten, since 2005 a campus-centre for ICT and computers was made available to meet all academic needs and offer support for e-learning and help in finding suitable ICT solutions (<http://www.ph-weingarten.de/homepage/zimt/INDEX.htm>). Digital facilities for offices, lecture-rooms and computer-labs for students, as well as wireless-LAN and a set of tablet-computers provide modern equipment that is useful for those who want to integrate digital media in their curriculum. A virtual learning environment (Virtual University Weingarten <http://www.ph-weingarten.de/ph2003/1412.htm>) promotes e-learning projects such as the Virtual University of Weingarten and online learning activities. The Media-Development-Plan structures the process and defines the strategic goals for the following areas:

1. ICT and digital Media to support and enhance traditional courses
2. e-learning and blended learning courses extend and improve the education
3. further training courses which should be created as both traditional courses and as e-learning/blended-learning courses
4. the use of digital media in research projects (focussing on education)
5. digital media and the administration of the university

Apart from these strategic goals the plan describes the status quo and the necessary infrastructure for the future. It includes workplaces for staff and students, technical equipment for lecture rooms and the library. In addition it regulates and informs about the financial support for new infrastructure and service-programs. To enhance these activities, one of the five centres of excellence in Weingarten is the Centre for Learning with Digital Media (<http://mediendidaktik.ph-weingarten.de/schwerpunkt-medien/index.php>). Apart from creating new projects and online environments, the Centre focuses on research

about e-learning and learning with digital media in higher education and in schools.

The use of computers in learning about and in teaching Geography

The great variety of digital tools, software products and online programs for geographic education challenge students and lecturers to integrate them in the curriculum. The general politics of the department of Geography towards computer use is an important factor. Despite the fact that special geographic education courses exist which focus on teaching and learning with digital media in schools (for descriptions see below), in regular Geography courses computers are more typically used only to present content. This involves PowerPoint presentations, use of geographic software such as Arc View, Arc GIS or others and non-GIS-based software for geographic topics such as climate animations and simulations of spatial processes (for example desertification, population growth, and volcanic eruptions).

One main ICT-oriented course developed for geography teacher-candidates is: *Teaching Geography with digital media*. This course runs for a whole semester (15 sessions, 90 minutes each) and focuses on two questions:

- 1 which digital media (software, DVD etc.) and e-learning activities are useful for teaching geography at schools (looking on the special value compared to traditional teaching-methods)?
- 2 how to integrate these tools in a lesson at schools?

Teacher candidates have to learn how to choose the right media (either digital or traditional) for school-lessons in these courses. The philosophy behind the course *Teaching with digital media* is, that it is not sufficient to inform about the theory of an e-learning didactic. Practise in teaching with digital media has to be combined with the theory at the university.

Some students are brilliant in their computer-use. They have high level database skills, knowledge about computer-file management, are able to use office-products and content management systems (CMS) etc.,

however others are still poor in these skills. For the latter group special courses and training is offered. Some of these are voluntary (evening courses on how to use PowerPoint, Excel etc.) and offered by the university once or twice each semester. Courses focusing on geographic topics, like the use of GIS (Geographic Information Systems) are included in the curriculum for geography. They are held each second semester (15 sessions, 90 minutes each) and students can continue and practice their “digital” skills while they teach in schools (students teach once a week to test their theoretical reflections and improve their teaching competence). If students are even more interested in using digital media and e-learning in geography, they can write their thesis in this field.

Another big issue for geographic education is the connection of fieldwork and digital media (Schleicher, 2003); for example, mobile learning with GPS receivers, Tablet PCs and digital cameras. Therefore, special fieldwork method courses are offered. In addition to that students have to document most of their required fieldtrips online to demonstrate their computer-skills. An example of some field trip documentation to the Czech Republic can be found on the Website of the Department of Geography: (<http://www.ph-weingarten.de/homepage/faecher/geographie/exkursionen/grossexkursion/startseite.htm>). The aim of these field trips is defined by the curriculum statement: “Use of geographic methods in the field such as running interviews and surveys, measurements etcetera”. These fieldtrips are held once a year (9 days each) – preparation courses for the technical use of field-work methods and items are run in advance of them (3-4 days).

The integration of digital media in local courses, online-courses and field work is based on the availability of the tools. The Department of Geography owns projectors, notebooks, GPS-receivers, digital cameras and further technical equipment (digital measuring instruments for wind speed, temperature, noise) and a computer-lab for students (14 computers). The facilities of the department of geography are complemented by 30 Tablet-PCs (Notebooks with special features) that

are available for all departments at the university, further digital cameras and video cameras.

A small survey completed among the geography students in Weingarten demonstrated the normal situation, that all of them own a computer, some have laptops, Internet access is available for all of them (at the university, in the students dormitories and at home at their families) and that they have at least one e-mail account (the university offers one for each student). Some of them even have digital cameras. Further digital facilities that are connected to geography (like GPS-receivers, PDAs, and Palms) are poorly spread poorly.

Online collaboration about current geographic issues in international teams

The most creative and popular ways of integrating e-learning activities in the curriculum at the Department for Geographic Education are in the development of online learning projects. One example of this is the courses created by the Online Centre for Global Geography Education (<http://www.aag.org/Education/center>). This is an international project concerning the use of Internet technology and collaboration to enhance student learning and the appreciation of Geography and global issues. One version of the project was held in the autumn of 2004. This was a 6 week course which connected the use of digital media in geographic education to the issue of population growth. Michael Solem, project manager and Educational Affairs Director of the Association of American Geographers organised the module trials that took place between September 2004 and April 2005, involving over 280 students in ten separate countries. The mission of the Online Centre for Global Geography Education is to support international teaching and learning in college and university Geography classrooms. The hypothesis was that student learning and interest in Geography can be enhanced through online interaction with peers and experts in different world regions. The Centre provides Geography academics and lecturers with a set of online Geography modules that link students in different countries for collaborative projects and international discussions about contemporary issues such as population, global economy and

nationalism. The modules support online collaboration using Blackboard™. For students, the key learning objectives included:

1. the ability to use the information methods and concepts of Geography to examine global issues,
2. knowing how to use Internet technology for effective learning and collaboration,
3. being able to formulate and carry out strategies for asking and answering geographic questions in an international team and
4. developing greater interest in the study for Geography and appreciation for its perspectives on global issues.

German students at Weingarten were connected to a group of students from the College of Geography at Beijing Normal University in China under the direction of Professor Wei Dongying. The project course on population change was organised in the following steps:

- a) a research pre-test of attitudes about Geography, digital media and online collaboration;
- b) a second pre-test of content (knowledge about world population growth),
- c) a technical support lesson about how to get in contact with the group partners in China, how to use Blackboard™, and where to find the modules and the connected exercises.
- d) each set of 3-4 German students was connected to a group with 3-4 Chinese students and they were asked to work together on four online lessons about population focused on the following topics:
 1. Where in the world is the human population changing?
 2. How is population change linked to economic development?
 3. How does the social status and education of women affect a country's population?
 4. How can countries work together to solve problems related to population and resources?
- e) each week the groups went through one module (see the topics above) individually and afterwards they started their online collaboration.
- f) at the end of the project, the same questionnaires about attitudes and knowledge of content were filled out in order to complete the research part of the project, followed by a closing ceremony with a

critical discussion about e-learning, international collaboration and the transfer to e-learning activities in schools.

The most important outcomes and the results of the evaluation showed that it was worth the time and effort to implement online-modules in traditional courses. The survey (t-test: pre- and post-test of students attitudes) showed a significant improvement in the following items:

1. I care how people in other countries are affected by important world issues (**.008).
2. I understand the causes of global problems like overpopulation (*.03).
3. I enjoy working in teams to solve problems (*.05).
4. Project collaboration with students from other countries is fun (*0.1)

Some further items showed that there was an improvement in the students attitudes towards computer use, for example for the items: the internet is a valuable tool for learning; I enjoy communication with people in other countries; Working with computers frustrates me. There was also an improvement in their interest about the geographic topic itself, some of those that showed improvement, were: learning about global problems interests me and understanding international perspectives is essential to solving world problems. Taking into consideration that English was not the mother tongue for both groups of students (Germans and Chinese) these results are even more significant.

Future objectives of the Online Centre for Global Geography Education project are to develop further modules about geographic topics that can be discussed all over the world, but with different viewpoints on each topic, such as the problems of population decline in Europe on the one hand and on the other hand the worldwide population growth.

Online modules to support faculty teaching

In the areas of Physical Geography there is a greater variety of online modules that support traditional Geography courses and content. One of these modules is ESPERE (<http://www.espere.net>) which was developed in a European Union funded project and included one

faculty member of the Department of Geography at the University of Education in Weingarten (Schleicher 2004). ESPERE stands for Environmental Science Published for Everybody Round the Earth. It is a pilot project which started in January 2003 and was finished by the end of 2004. The aim of the project was to put up-to-date and accurate scientific information about climate in a encyclopedia on the Web in a form which is understandable by all and useful in school and university lessons.

On its website, ESPERE focuses on the topics: “Our climate: Air, Ice, Water, Rocks, Soil, Life. How they are interacting. In which ways do people interfere? What scientists have understood during the past 30 years and what they are investigating today is presented step by step on these pages, which are topical, multilingual, state-of-the-art, comprehensible for everybody.”. The ESPERE climate encyclopaedia is both an online atlas as well as providing working material for web-based learning. It offers an overview of key topics on the climate system and climate change on about 250 web pages. It includes background texts which are useful for classes as well as for everybody else who are interested in the topic, and worksheets which are primarily designed for classroom use. The ESPERE website is used for teaching about climate issues in geographic education.

Further online course materials for Physical Geography are found on the WEBGEO website (<http://www.webgeo.de>). This was mainly developed to help students understand topics of Climatology, Hydrology, Geology and Geomorphology. Each module can be used in classes, before or even afterwards to repeat the content or to test understanding of the topic. In particular the learning resources such as animations, simulations and the interactive parts of online teaching materials are appreciated by the students to help them to understand complex geographic topics in these courses.

Future developments

Apart from following new innovations in the area of software, computers and geographic education, the most important issue for the future is to focus on research projects to investigate the effects of

learning with digital media in Geography classes and to bring students closer to the digital world in education so that they are prepared for new ways of teaching Geography in schools. The research results (and also the student feedback) for the Online Centre for Global Geography Education project seems to prove that it is worth the time and effort to implement computer use in the curriculum. But still, one very important question remains: Do students learn enough about the geographic topic itself, while they work on “digital projects”? (Sui and Bednarz 1999; Schleicher 2006).

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Useful Websites

Department of Geography and Geographic Education, University of Weingarten

<http://www.ph-weingarten.de/homepage/faecher/geographie/index.html>

Online Center for Global Geography Education, hosted by the AAG (Association of American Geographers) <http://www.aag.org/education/center>

Online Modules for Geographic Education–Climatology Environmental Sciences Published for Everybody round the Earth <http://www.espere.de>

Online Modules for Geographic Education–Physical Geography <http://www.webgeo.de>

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