

Perspectives of remote sensing in higher education: a training for the “Spatial Behaviour Competence”

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ABSTRACT: Satellite images and aerial photographs can be found increasingly in atlases, books, on TV and in the Internet. Nevertheless, the use of remote sensing has hardly become integrated into lessons and curricula in many countries, like in Germany. But the introduction of modern geographical methods at school, which include the use of satellite images and aerial photographs, is indispensable to ensure a sustainable development of problem solving and the ability to act. In geo and environmental sciences this is expressed through a “Spatial Behaviour Competence”.

Against this background the different concepts of teachers and pupils about the extent and kind of satellite images and aerial photographs that are used in geographical lessons are being examined in an international study.

The information which will be gained out of this study about structural conditions, methodological-didactic concepts and questions in terms of content which favour or hinder the operative use of satellite images and aerial photographs in lessons should lead directly to the outline of an own overall concept of remote sensing-didactics for younger pupils. On this basis a new interactive and multimedia remote sensing didactics for higher education should be developed and implemented within the context of the EU-founded project “Science Education through Earth Observation for High Schools” (SEOS).

The multimedia-based remote sensing learning environment will be evaluated in different European countries and should lead to better assessment of global environmental change by students.

1 INTRODUCTION

At least since the start of Google Earth satellite images play an increasing part in the everyday life of pupils, as it is now possible for everyone to have access to satellite images of the whole world. Teenagers are therefore used to see the world from a different perspective and “play” with satellite images as they are growing up with new media. So on the one hand it is necessary to pick this up in school and to react to the new geospatial technologies and on the other hand it is a good base to enhance the necessary methodology of remote sensing in school.

Especially the imparting and use of modern geographical methods at school, which include the use of satellite images and aerial photographs, is of an increasing importance against the background of the progressing globalization as well as the growing environmental problems and an increased ecological consciousness of problems (Siegmund 2005). The introduction and application of more specified subject-orientated instruments should support the methodology, the professionalism and personal competence with the goal to reach a problem solving- and action-competence for a lasting development. In the geosciences and environmental sciences it expresses itself in a “Spatial Behaviour Competence” (Köck 1993, Verband Deutscher Schulgeographen 2003). This is defined in Spatial Thinking as knowledge, skills and habits of mind to use concepts of space, tools of representations, and process of reasoning to structure problems, find answers and express solutions to these problems (Committee of Spatial Thinking 2006). This competence of Spatial Thinking and the ability to build up Spatial Behaviour is supported by the use of geospatial technologies. While remote sensing is used by researchers since a long time and the use of satellite images and aerial photographs booms, in school it still plays no major role in most countries. In Germany, for instance, the use of the method of remote sensing has hardly been integrated into lessons as well as the curriculum even though since the last couple of years, free satellite images and aerial photographs can be obtained increasingly through the internet (Wolf & Siegmund 2007). Moreover, not even special educational programs for kids in the internet, produced for example by NASA and ESA, could raise the amount of use of satellite images in schools significantly.

2 AN INTERNATIONAL REMOTE SENSING EDUCATION STUDY

So far there is no international survey about the effort, the success or the failure of using satellite images and aerial photographs in school. Therefore the different concepts of teachers and pupils about the extent and kind of remote sensing data that are used for different subjects in schools, such as geography, should be examined in an international education study, based on an online questionnaire.

2.1 *Setup of the online questionnaire*

The choice of the participating countries that are explicitly asked to take part in the online questionnaire has been made based on the results of the 2003 PISA study in natural science competences. Five countries above the OECD average (Finland, Korea, Australia, Switzerland, France), three among the average (Sweden, Germany, Poland) and five below (USA, Austria, Spain, Portugal, Mexico) have been chosen. The questionnaires for the teachers and pupils are available in the respective languages. It is also possible for other interested countries to take part in the survey.

The project “satellite images in school” is internationally available on the webpage www.ph-heidelberg.de/satbild. The online questionnaire was programmed in PHP and is based on a SQL databank. The participating teachers and pupils receive a code index that



Figure 1. Introduction and starting page of the online questionnaire.

makes it possible to reassign the results of the questionnaire – saved in the SQL databank – to the participating school.

On the start-up page the participants can choose their language (Figure 1). Besides the online questionnaire the participants can find background information for teachers and pupils, as well as information about the project and the project managers (Figure 2).

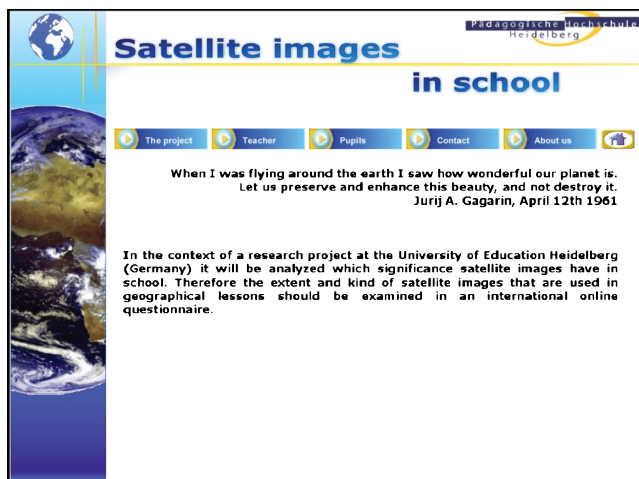


Figure 2. Information page about the project.

Besides general information about the teacher and the school, the teacher questionnaire focuses on the embedding of satellite images in the curriculum, the topics to which the teachers use satellite images and the reasons why they use or do not use satellite images in lessons. The data will be analysed in order to identify correlations between the media equipment of the school, the curriculum and the use of satellite images. Furthermore, the analysis aims at finding out whether there are certain topics that are especially suitable for the use of satellite images.

Apart from the personal and school surrounding also the technical expertise and previous knowledge of the pupils in handling satellite images are examined. Through this it is possible to find out whether pupils own certain knowledge, abilities and skills to use satellite images, even if they have not dealt in the lessons with it yet. Additionally, it is possible to compare the technical competence across different countries. Moreover, analysis can indicate correlations between the media competence of the pupils, awareness of satellite images and the interpretation of meanings of satellite images.

At the moment the schools are contacted, final results will be expected in summer 2007.

2.2 *Results of the pre-study on the use of remote sensing in schools*

The pre-study conducted in Germany with 138 pupils of all age-groups was done to evaluate the validity and reliability of the study-design. It was also important to find out if pupils are able to understand the language, the technical phrasing and the questions that are asked.

First results of the questionnaire can be given. Out of the 58 percent of the pupils that have already worked with satellite images in school, more than 50 percent found it really interesting but only about 30 percent found it motivating to work with satellite images (Figure 3).

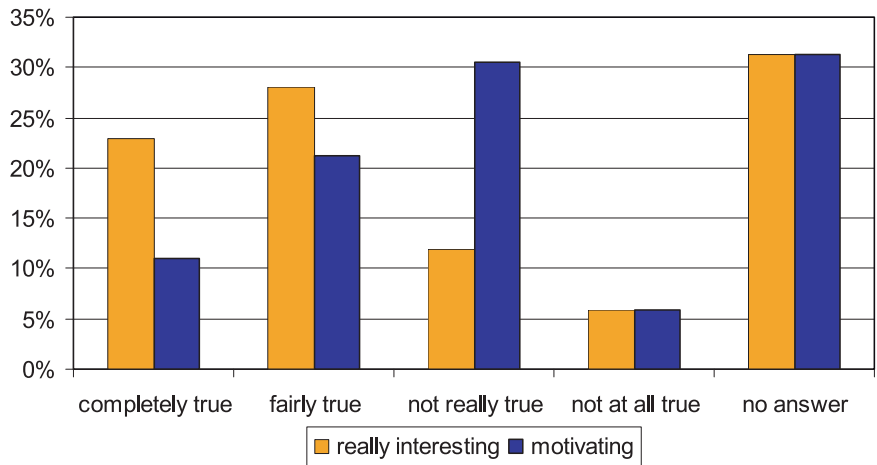


Figure 3. Meaning of pupils to their interest and motivation by using satellite images in school.

So satellite images do have a great potential in school, although a motivating way of the use of satellite images has still to be found.

Pupils are therefore used to see the world from a different perspective and also to work with new technologies. Modern didactical concepts should build on these abilities and react with an adequate methodology. The goal is to reach a problem solving- and action competence for sustainable development expressed in the “Spatial Behaviour Competence”.

3 DEVELOPMENT OF AN INTERACTIVE AND MULTIMEDIA PLATFORM AS A MODULE OF A MODERN REMOTE SENSING DIDACTICAL CONCEPT

The results won from the international comparative remote sensing education study lead directly into an overall didactical concept of remote sensing methodology. Its different parts include explanatory notes for teachers, materials and tasks as well as presentation elements. The centre is the development of an interactive and multimedia educational platform which should promote the use of remote sensing at school.

The multimedia platform for younger pupils has already been developed with examples of satellite images from Germany. Right now the second version is under development, with changes in design and satellite image examples. The new version includes examples on global, local and regional level as intended in UN environment-conference in Rio: thinking globally, acting locally.

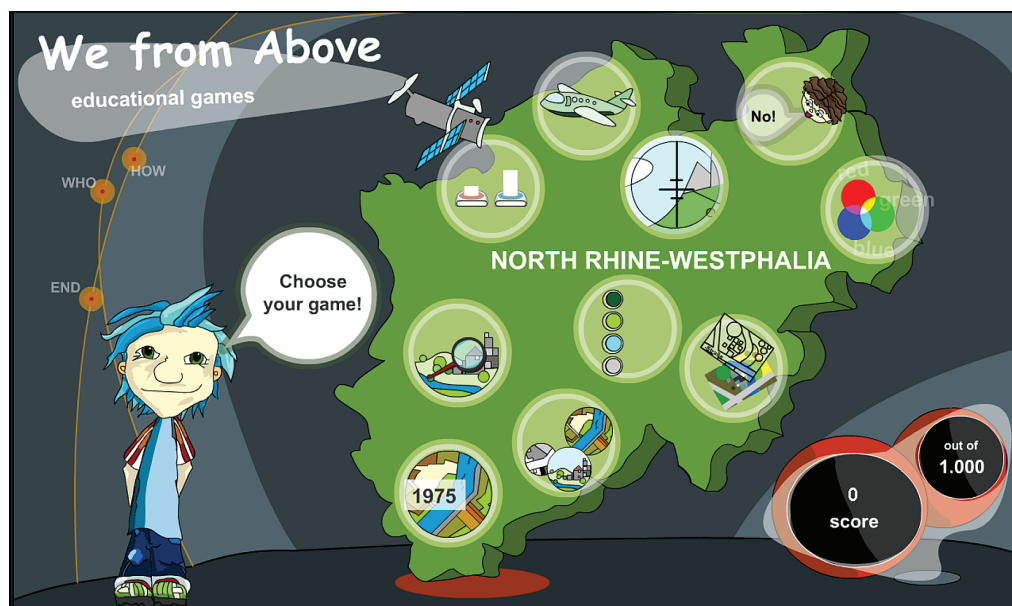


Figure 4. Starting page of the multimedia learning platform on remote sensing.

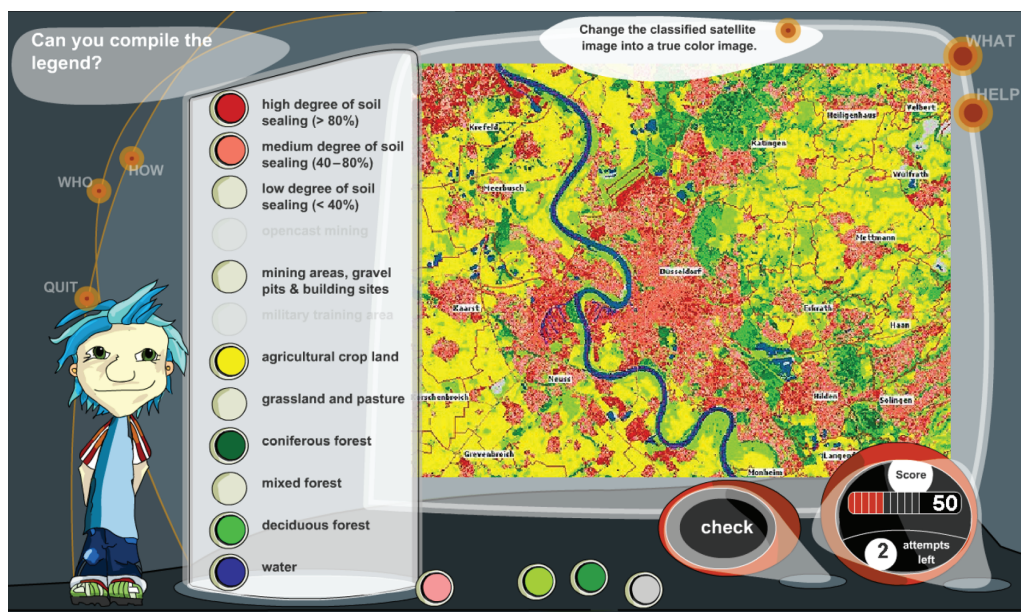


Figure 5. Module to create a legend in the context of the interactive learning platform on remote sensing.

The learning platform offers two different degrees of difficulty. Seen from the didactical background this increases motivation. The goal, that is to achieve as many points as possible in the ten modules, also encourages motivation (Figure 4).

The goals of the different modules are manifold. They range from map reading, change of perspectives, the interpretation of classified satellite images, to understanding the different tasks of satellite images and much more. For example, module 5 called “Can you compile the legend?” has the purpose to create the legend for the classified satellite image through ‘drag and drop’ (Figure 5). The users can change as often as necessary between the true colour and the classified satellite image so that they are able to interpret the colours independently.

Altogether the research project in progress will lead to a sustainable didactical introduction and support of the use of satellite images and aerial photographs in school for younger pupils based on the international remote sensing education study. It is thereby important that satellite images and aerial photographs are not the centre of the lesson but the media that transports and conveys best the contents of the lesson.

4 AN ONLINE-SUPPORTED REMOTE SENSING LEARNING ENVIRONMENT – THE PROJECT SEOS

The presented study and the outline of an integrated environmental didactical concept is continued and extended into an online-supported remote sensing learning environment.

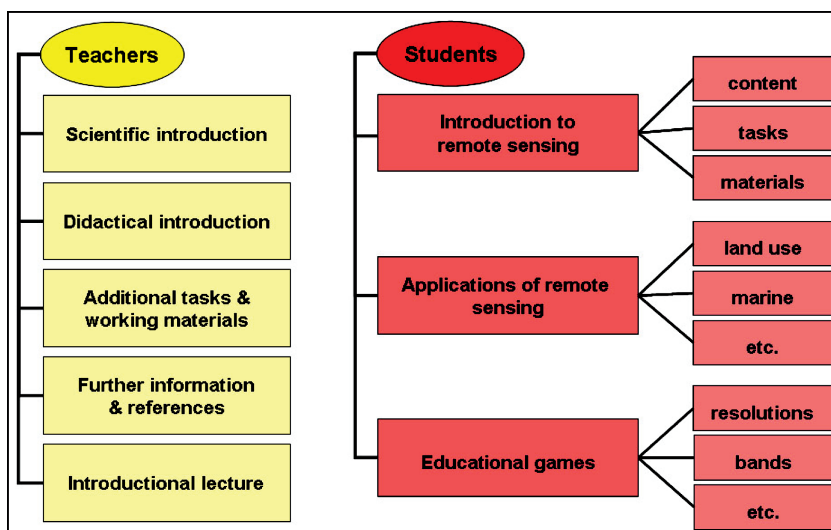


Figure 6. Draft of the possible structure of the interactive remote sensing learning environment.

This could be implemented within the EU-funded project “Science Education through Earth Observation for High Schools” (SEOS), commencing in summer 2007.

A first draft of a possible structure of the multimedia-based remote sensing learning environment is shown below (Figure 6). It can be divided into a teacher and a student environment. The teacher environment contains technical/scientific recommendations and didactical background information about remote sensing. Furthermore it includes not only the student interactive learning modules and educational games but also additional tasks and working materials like transparencies, graphs and satellite images or aerial photographs for the direct use in school lessons. Teachers can receive more information through an annotated link list and a list of references. As a presentation element an introductory lecture could be included into the teacher environment. The lecture can be used directly in school or as an overview for the teacher in preparing remote sensing lessons.

The learning environment for students is divided into learning modules, like introduction and applications of remote sensing, and educational games. The learning modules could contain didactical sound information about the physical basis of earth observation, satellite systems, resolutions etc. The content is supported by tasks and materials for active learning, the students can answer questions or solve given problems. In the learning modules of remote sensing applications like land use/land cover some case study examples can be developed for the methodological use of satellite images in school lessons. The most interactive element of this learning platform is the educational game selection. Various educational games are under development for the problem-oriented pragmatic use of satellite images and aerial photos in application examples which are complemented by animations, film sequences, etc.

The complete multimedia-based remote sensing learning environment will be evaluated in the European context within the SEOS project and should lead to the improvement of the “Spatial Behaviour Competence” and better assessment of global environmental change by students.

5 CONCLUSION

The multimedia-based remote sensing learning environment will be one step to emphasis new methods of remote sensing into school curricula through offering a integral didactical concept. Scientific institutes like ESA, NASA and others are also working on new and improved educational programs and furthermore Google Earth starts some activities on scientific education. The field of remote sensing in education is increasing and will hopefully contribute to a new geography curriculum which includes a methodological concept of remote sensing. Remote sensing can contribute to fostering “Spatial Behaviour competence” through the development of a didactical concept like the multimedia-based remote sensing learning environment.

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