Can We Make an App for that? Integration of School Students within a Research-education Cooperation

Thomas SCHAUPPENLEHNER, Stefan BLAMHOFER, Matthias HORN, Andre OGRIS, Christian SCHUHMACHER, Anna HÖGLHAMMER, Andreas MUHAR, Renate EDER and Karolina TACZANOWSKA

Abstract

Co-operation between school students and scientists in joint research projects can offer great benefits for both sides. School students get an insight into the process of knowledge production and can contribute with fruitful and unconventional ideas. Nevertheless, differences in working methods and habits as well as missing co-operation interfaces between schools and universities often lead to rather limited and partial integration in research. Furthermore, research processes are often very theoretical, intransparent and hard to understandfor non-scientists.

This paper presents two case studies in a research-education cooperation project. Students from a secondary technical school (age 17-18) worked on small research topics and created geo spatial web applications (apps) as final products. By creating apps the whole research process was more transparent and ended up in a functional digital product with an additional value for the project, the students and the schools. The students contributed with their technical skills and learned how to answer specific questions by selecting suitable methods as well as collecting and analysing data. They finally structured and documented their work for a scientific publication.

1 Introduction

Research processes are mostly complex and often have project durations and working plans, which are not easily compatible with the idea of integrating students from schools. These students have a fairly tight class schedule, and the organisational structure of many schools is usually not flexible enough to react on new and singular content. Such a setting often results in minimal and partial integration of students, often limited to short workshops or interviews within research projects.

The major intention of the Austrian research programme 'Sparkling Science' is the promotion of research-education cooperations (BUNDESMINISTERIUM FÜR WISSENSCHAFT UND FORSCHUNG 2012). The idea is to integrate students as young scientists in the complete research process – starting with the problem definition and identification of research questions, continuing with the selection of tools and methods for data collection and analysis and finishing with the publication of the results. Active involvement in the research process is important to engage students' interests in the field of natural or social science and engi-

Jekel, T., Car, A., Strobl, J. & Griesebner, G. (Eds.) (2012): GI_Forum 2012: Geovizualisation, Society and Learning. © Herbert Wichmann Verlag, VDE VERLAG GMBH, Berlin/Offenbach. ISBN 978-3-87907-521-8.

neering (CAREY & SMITH 1993). In practice this poses a big challenge for both – the participating schools and research institutions.

This article describes two case studies, where students from a technical secondary school were integrated in such a co-operation. One project was a 4-week internship, where three school students worked on a small research project on spatial preferences of young people in Vienna. The second project focused on the development of a spatial web application for data collection and presentation of project relevant data within a final graduation project of a student at secondary school.

Actual web and mapping technologies like Google Maps, Bing Maps or OpenStreetMap offer a broad range of tools to collect, create and present geographic and/or thematic content. As these tools are easy to use, nearly everybody who is interested can produce maps. Combined with additional technologies, like scripting languages and social networks, comprehensive applications can be created.

2 Project Outline

The research project I AM HERE! is funded by the research programme Sparkling Science and jointly conducted by BOKU University of Natural Resources and Life Sciences Vienna, the Institute for GIScience at the Austrian Academy of Sciences, Salzburg and three secondary schools in Vienna (BRG19 Krottenbachstraße, AHS Rahlgasse and htl donaustadt). The project examines spatial activity patterns of young people in Vienna with the goal to understand the use and social meaning of public and semi-public urban spaces. These findings should assist in the development of spatial planning strategies in an open workshop environment considering special needs of adolescents.

Students from secondary schools are involved in different project stages. They act as scientists and test group at the same time by recording and describing their daily rout(in)es and favourite spaces with GPS devices, smart phones as well as digital cameras. By organising internships and the supervision of graduation projects, I AM HERE! provides opportunities for a deeper involvement in specific research topics and application development.

3 Pedagogic Concept and Involvement of the Students

Our work with school students is based on a constructivist model (VYGOTSKY 1978, VON FOERSTER & PÖRKSEN 2003, AHAMER & RAUCH 2006) of learning. The advantage of this model is that learning is seen as an active process that starts from learner's pre-conceptions and interests. As a result, students are active members of the project team, creating knowledge from their own experience, as learning is considered to emerge from a constructive process of the learning-person itself and not from the teacher (RINSCHEDE 2003). Applying a collaborative learning environment (STAHL 2002, ZUMBACH & JEKEL 2006) based on the concept of situated learning (LAVE & WENGER 1991) students are encouraged to look at the environment from their own perspective, developing research questions from their daily routines.

For recording spatial data, describing urban spaces and developing new planning strategies, individual workshops with each school were organized. For these we used the time slots of the dedicated 'school project days' at the beginning or end of the school year, which do not interfere with the standard teaching schedule. A special module structure in one participating school gave us the possibility to organize a module course over the whole term with three-hour time slots every second week. For a deeper integration of students into the research process, we organize four week internships, and elaborate specific issues within final graduation projects.

Table 1: Overview on different forms of research-education cooperation within I AM HERE!

Research-education cooperation within…	Target groups	Forms of cooperation	Level of involvment	Number of students
...regular school curriculum	school classes	project days	low	high
...thematic school modules	school classes	project days, thematic lectures	medium	medium-high
…internships	interested students	interships	high	low
…graduation projects	interested students	meetings project work	high	low

4 Case-study Description

For examining spatial activity patterns of adolescents in the urban environment of Vienna we used a set of different media and technologies. The Global Positioning System (GPS) is the core technology for recording spatial activities as tracks and waypoints. By geo-tagging, the spatial information can be combined with other media like digital images or videos for describing spatial settings. Students applied a media mix, nearly every student is equipped with and familiar in form of smart phones (NIELSON 2010) or tablet computers. As the internet is available 24/7 on these devices, borders between the real physical and digital world are blurring. Geographic positions, images, videos and other content can be shared in almost real-time and uploaded to websites or social networks. We found the integration of well-known technologies in the new context of a research topic as a good starting point for the work with the students and as an ideal basis to discuss technological boundaries and spatial privacy issues.

The next two sub-chapters describe two case studies where students create web-mapping applications as product of this research process.

4.1 Case study internship: YouthPlaces

During an internship in summer 2011, I AM HERE! invited three students from a technical secondary school to work on a small research project about preferred urban points of interest (POI) of adolescents. The students were involved in the whole research cycle: they identified research questions, developed a research concept and planned steps to achieve the target of the project. Scientists from the university acted as mentors. The idea was to survey attractive locations for young people in Vienna, describe them on the basis of different categories, and apply a rating system for different factors like perceived urbanity, suitability for young people, loudness or diversity. In the questionnaire a semantic differential was integrated to measure different dimensions of the adolescent's perceptions. For data storage and presentation they created a simple web application (see Figure 1).

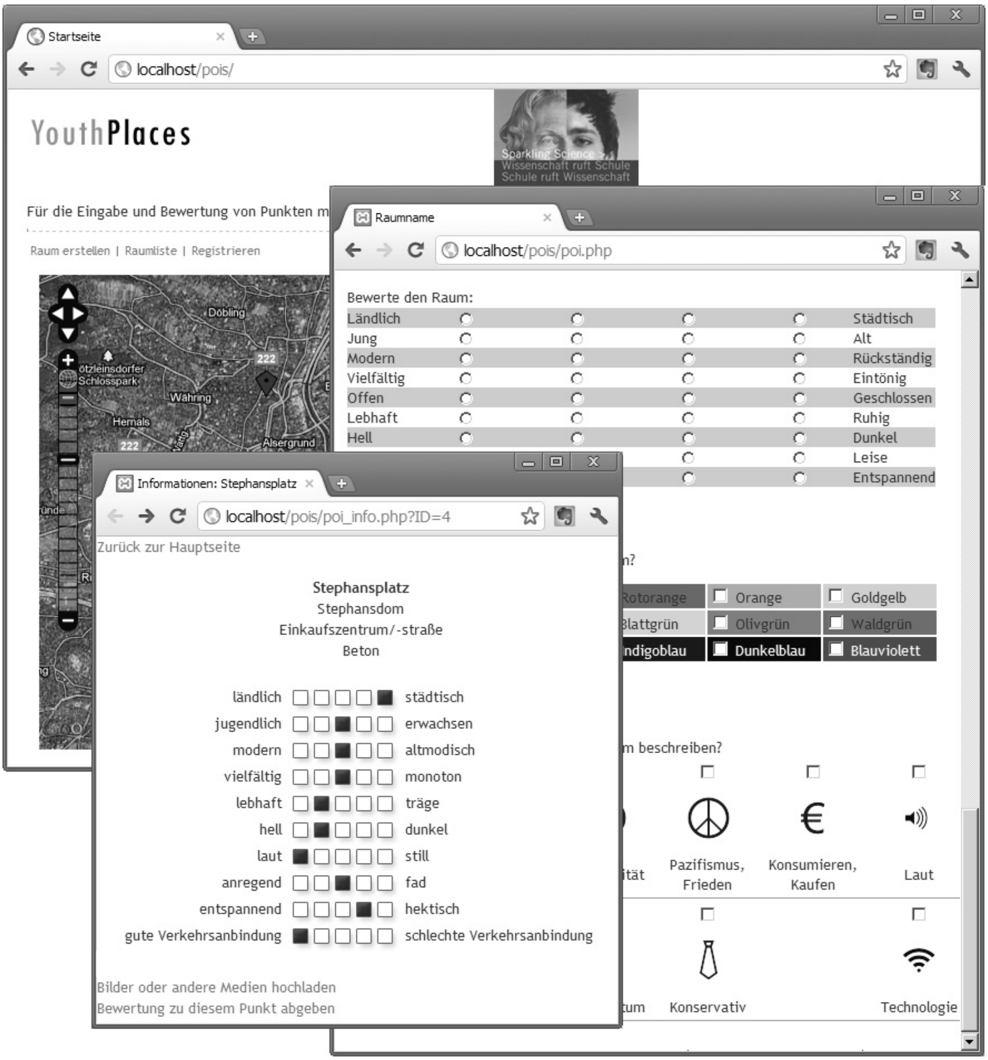

Fig. 1: Screenshots from the YouthPlaces Webinterface with web-mapping window, questionnaire interface and place rating window

In a first step, the students developed a questionnaire and conducted face-to-face interviews about points of interest among Viennese adolescents. In total the students collected 124 interviews on nine selected places in Vienna. In a second step they started to develop a web application for entering, analysing and presenting the survey data. For data storage, a relational database model was developed which was implemented using a mySQL database. Accessing, formatting and presenting the data was realised using PHP as scripting language and HTML as well as CSS. Spatial data can be entered in form of points with the help of a visual web-mapping interface using the Open Layers framework. Thematic attributes from the survey can be added using HTML-Forms.

With the production of a web application, the students had a field of activity where they already had prior knowledge and experience from their technical school background. From this "safe haven", they were confronted with methods from social sciences that were new for them like designing a questionnaire or analysing data. The whole research process was documented and prepared for a research paper that has actually passed the final review process and will be published in the journal *GW-Unterricht* in spring 2012 (SCHAUPPENLEHNER et al.). The scientific publication was a big motivation factor and additional benefit for the students as they learned how to prepare a research topic for a broader audience by structuring, describing and focusing their work – skills that are typically not part of a school syllabus.

By using a set of common and freely available technologies, the application can be easily modified for several topics and integrated into other school subjects like geography, history or biology. A download option of the documented source code is therefore planned for the end of the project.

4.2 Case study graduation project: I AM HERE!

While the YouthPlaces project was conducted by three students over a four week internship, the second case was performed by a single student just before his high school diploma within a graduation project (HORN 2012). Through intense work over more than one term, it was possible to produce a fully featured web-mapping application that solves the problem of integrating GPS data and additional spatially explicit media such as images or video and audio sequences (SCHAUPPENLEHNER et al. 2011) within an easy-to-use interface.

The application is based on a relational database realised using MySQL; the use of JavaScript as core technology allows an asynchronous application access (AJAX) without stagnant web page reloading (MOUSSAOUI & ZEPPENFELD 2008). The result is a web application with the look and feel of a desktop application, but also useable on mobile devices like smart phones or tablet computers. Outdoor recordings can be processed directly through this application. As tools like GPS, digital camera, digital video recorder and audio recorder are standard features on many mobile devices, one can directly collect and process the data in the field. With a user login, personal tracks and media can be organised and categorised. Users can also decide whether a track is personal and therefore hidden or public.

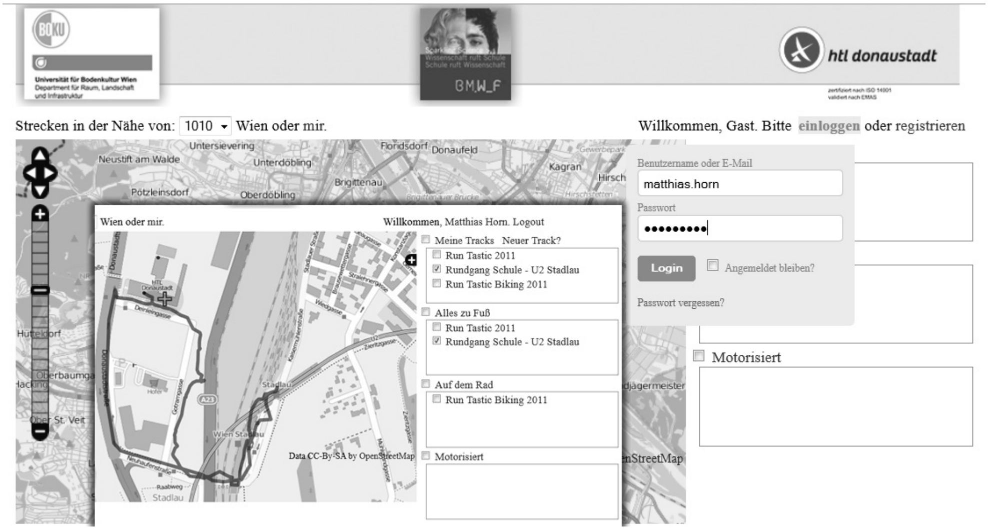

Fig. 3: Interface of the web application with several windows

For the organisation of the graduation project we organize regular meetings, where the student, his advising teacher and a researcher discuss the actual progress and clarify the next steps. Beside the practical part of programming the application, the student also has to write his graduation thesis where researchers support in the fields of text structuring, literature search and scientific writing.

5 Conclusion and Outlook

Creating an application means creating a physical (digital) product for a specific research question or research method. This requires an intensive involvement in a research process which is a huge benefit compared to concepts of partial integration of students into research projects.

But can we make an app for that? Yes indeed, and it is not as complicated as expected. Until some time ago, web-mapping and application programming meant the need to host a server with special mapping services and script engines that are hard to install and badly documented. Once this was solved, the next stumbling block was the conversion of data for the web hosted databases and mapping engines.

Today, the increasing availability of easy-to-use and interactive web technologies enables more people to understand and use these tools to create useful applications. Furthermore, the wide spread of smart phones as all-in-one media devices with GPS integration and countless spatial apps offer basic GIS functionality for everyone. Nevertheless, a technical background is definitely necessary to proceed from a basic pre-beta product or a dalliance to useful applications. In this context, the cooperation of technical secondary schools with general education schools can be very fruitful, as the ones with the “technical blinders” learn about overall concepts that are behind a useful application, and the none-engineers get a basic insight on technologies they regularly use for communication, social networking or navigation. In addition to the profit from each other's knowledge the students gain a lot of practical and theoretical knowledge as well as interpersonal skills. The collaboration within a research project allows the students to deepen their knowledge in a special field like natural or social sciences in addition to the normal school curriculum.

The project I AM HERE! and in particular the described case studies show the chances and possibilities based on the restructuring process of higher secondary education in Austria (age 14-18). Two examples should be pointed out here: (1) The modularisation of higher secondary education allows a broader and more intensive integration of school students in research processes by implementing minor research projects. (2) The implementation of obligatory scientific works ('Vorwissenschaftliche Arbeit', 'Fachbereichsarbeit', 'fachspezifische Arbeit') for each student in postsecondary education offers a lot of links between schools and research institutions and allows an intensive cooperation.

Acknowledgement

This paper was prepared within the project I AM HERE!, funded by the research programme Sparkling Science (www.sparklingscience.at) of the Austrian Federal Ministry of Science and Research (BMWF) in cooperation with students from the HTL Donaustadt (www.htl-donaustadt.at) in Vienna (Matthias Horn, Stefan Blamhofer, Andre Ogris and Christian Schuhmacher). Many thanks go also to DI Erik Sacher, teacher at the HTL Donaustadt, for maintenance and support.

References

AHAMER, G. & RAUCH, H. (2006), Von "vertikaler" zu "horizontaler" Didaktik – Globalen Wandel mittels Diskursen "verweben". Zeitschrift für Hochschulentwicklung ZFHE 1, 127-147.

BUNDESMINISTERIUM FÜR WISSENSCHAFT UND FORSCHUNG (2012), Sparkling Science [WWW Document]. http://www.sparklingscience.at/ [31.01.2012].

CAREY, S. & SMITH, C. (1993), On understanding the nature of scientific knowledge. Educational Psychologist, 28, 235-251.

VON FOERSTER, H. & PÖRKSEN, B. (2003), Wahrheit ist die Erfindung eines Lügners: Gespräche für Skeptiker. Carl-Auer-Systeme Verlag, Heidelberg.

HORN, M. (2012), I AM HERE!. Diplomarbeit htl donaustadt, Wien.

LAVE, J. & WENGER, E. (1991), Situated Learning: Legitimate Peripheral Participation. Cambridge University Press, Cambridge.

MOUSSAOUI, H. E. & ZEPPENFELD, K. (2008), AJAX: Geschichte, Technologie, Zukunft. Springer.

NIELSEN (2010), Mobile Youth Around the World. Nielsen Report. New York.

RINSCHEDE, G. (2003), Geographiedidaktik. UTB, Paderborn.

SCHAUPPENLEHNER, T., BLAMHOFER, S., OGRIS, A., SCHUHMACHER, C., HÖGLHAMMER, A. & EDER, R. (Accepted), YouthPlaces: Ein Prototyp für den Einsatz neuer Medien zur Aufnahme, Beschreibung und Bewertung öffentlicher Freiräume. GW-Unterricht.

SCHAUPPENLEHNER, T., MUHAR, A., TACZANOWSKA, K. & EDER, R. (2011), Concept for the integration of multiple media for participatory exploration of the spatial behaviour of adolescents. In: JEKEL, T., KOLLER, A., DONERT, K. & VOGLER, R. (Eds.), Learning with GI 2011. Wichmann, Berlin/Offenbach, 70-78.

STAHL, G. (Ed.) (2002), Computer Support for collaborative learning. Erlbaum, Hillsdale.

VYGOTSKY, L. (1978), Mind in Society: The development of higher psychological processes. Harvard University Press, Cambridge.

ZUMBACH, J. & JEKEL, T. (2006), Problemorientiertes Lernen mit Geoinformationen – Ansätze und Beispiele zum erfahrungsbasierten Lernen. In: JEKEL, T., KOLLER, A., STROBL, J. (Eds.), Lernen mit Geoinformation. Wichmann, Heidelberg.