
GIS in Primary Schools – Teaching Local History and Cultural Landscape

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Abstract

Since the 1990ies Geographic Information Systems (GIS) have been introduced to secondary level education. There are numerous examples of best practice for teaching secondary level geography using GIS technology. There are fewer examples of using GIS at primary level or bridging local history and geography teaching. This essay emphasises the didactic possibilities of teaching local history and cultural landscape with GIS through a pilot project and the suitability of the method to be applied to primary level education.

1 Introduction

In the german language community many best practice examples exist for teaching geography at secondary level supported by Geographic Information Systems (GIS) (see BORSCH 2002, FRAEDRICH et al. 2004, JUENGST et al. 2002, JUST et al. 2004). There are also recent examples in publications addressing GIS and historical scholarship (GREGORY & ELL 2007, KELLY KNOWLES 2008). But what are the possibilities of using this technology in primary school level? And what didactic opportunities offers GIS to bridge teaching geography and history in schools?

The following report is based on a school pilot project that was carried out in summer 2011 in a 4th grade primary school class in Hamburg (BRAUCKMANN 2011). The objective of the pilot project was to demonstrate that even young pupils (around ten years) can effectively use GIS technology to get educated in local history and the cultural landscape.

In Germany, education planning is the responsibility of the "Bundesländer", the federal states (see VAN ACKEREN & KLEMM 2011). As one of the 16 states, Hamburg has its own curriculum. Following school reforms, individual schools and teachers are generally autonomous in planning and organising their own teaching syllabus. The education authority is, however, responsible for defining the competencies that pupils have to acquire as well as defining compulsory teaching topics. These aims are set out in the curriculum that exists for each teaching level and subject. In primary schools history and geography are categorised as social sciences, within the overarching subject of "Sachkunde" (general studies). Teacher training is also administrated by each state. At university, prospective teachers for general studies and geography attend courses together with geography students, including GIS courses. But new teachers have limited examples of [GIS] lesson design, so they do not use their GIS-skills in practice. Thus the main aim of the pilot project was to combine GIS skills of teachers learned at university level with teaching practice in primary school education.

2 Educational Content

Based on the Hamburg curriculum for social sciences in primary schools (FHH 2010) “Hamburg” was selected as a compulsory topic, with the subdivision in the topics “urban planning and structures”, “Hamburg in the Middle Ages”, “analysing past and present” and “spatial orientation in Hamburg and the periphery: The HVV¹-project”. Only these titles were compulsory, while the content could be individually defined.

Only 90 minutes (two lesson periods) were allocated to the pilot project, with the main focus on urban development. The pupils were tasked with enquiries about their neighbourhood, their surroundings and social space, including the different historical periods, or the “evolution” of historical time and space. The historical specificity of current spatial configurations should therefore be summarized. For instance, the prevailing spatial configuration of Hamburgs’ cityscape is primarily influenced by the 19th and 20th Century², which is considered more significant than the Middle Ages and the Early Modern Age. Historical traces of these earlier periods have survived only in some fields like street names as well as in the historical characteristics of the streets.

To enhance the pupil’s learning experience and bring it in line with learning targets, lessons should focus mainly on the historical development of the area surrounding the school building. If a school is located in a “Gründerstilviertel” close to the city centre, the social and economic problems in the 19th Century may feature strongly, while in a suburb the focus will be on the analysis of suburbanisation and remnants of rural life. The school where the pilot project took place is located in a typical residential district close to the city centre. There are many urban villas, multi-storey houses and municipal buildings in “Gründerstil”, as well as buildings built in the period of the Weimarian Republic³ and the period of reconstruction.

The following topics were selected:

- Rural situation before the 1880s
- House building before and after the Cholera outbreak of 1892
- Social house building in the Weimarian Republic and associated reasons
- War destruction and reconstruction due to World War II

3 Didactic Objectives

The GIS supported teaching methods of the “Kulturlandschaftsforschung”⁴ (cultural landscape studies) are didactically located at the interface of key topics: “spatial orientation” and “time-based orientation”. Adhering to an action-orientated approach,

¹ HVV = Hamburg Transport Association.

² For the History of Hamburg it is: Great Fire (1842), Customs Union (1881), Cholera Epidemic (1892), First World War, Weimar Republic, Nazi-Time, Great-Hamburg-Law (1937), Second World War with Allied Operation Gomorrha (1943), Reconstruction and Suburbanisation, Reurbanisation (since 1990).

³ In Hamburg the typical „Rotklinkergebäude“ – Social housing in red brick buildings.

⁴ Cultural Landscape should be synonymous for Historical Geography, Industrial Archaeology etc.

pupils should be motivated to formulate their own questions, devise their own perceptions on urban history, and engage in discussion with classmates. The school building and its surrounding neighbourhood acted as a general conversational topic, while historical events and transformations are identified by the pupils themselves. The next step involved checking whether observations can be considered unique or universal and in doing so, we can use current perspective to analyse the past. With the effect of enabling pupils to realise that although the past is irrevocably over, its effects continue to inform the present as well as the future (see SCHREIBER & GRUBER 2009; BERGMANN 2008). Conventional educational materials attempt to explain the present the other way around.

Extensive engagement with the local area and with individually created maps can promote spatially-joined-up thinking. By undertaking field work knowledge is not only imparted on how to create a map, but visual and descriptive competencies are also strengthened. Technical equipment and computer applications were used as “tools” to advance specialised knowledge, therefore formulating practical education closer to real life working requirements. The teamwork element of this programme strengthened social competencies such as interaction, conflict management and work-load organisation.

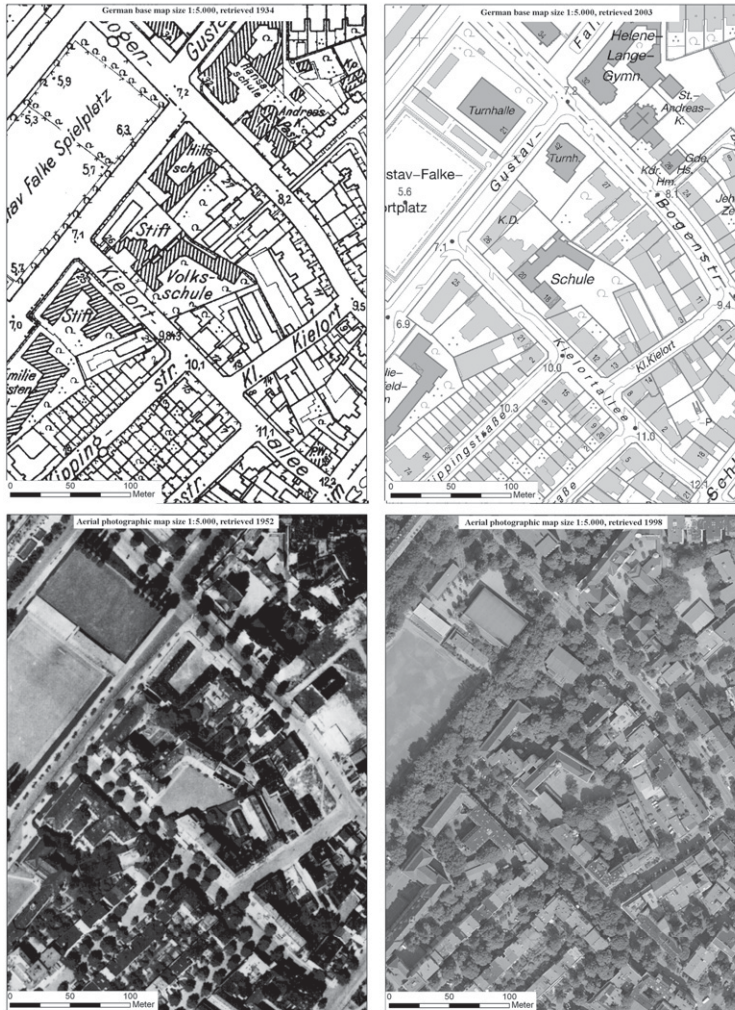
Table 1: Teaching units and targets

	Teaching Unit	Methods	Competencies ⁵
Class	Introduction (Presentation of different maps and definition of the study area)	Cartography	Analytical Skills Spatial Orientation Time Orientation
	Social Competences (e.g. Interaction)		
Teamwork	Field Work	Mapping/Questionnaire	Visual and descriptive Competence Spatial Orientation Time Orientation
	Supported Analysis ⁶	GIS	Analytical Skills Media Relations / Using different Media
	Presentation	Presentation/Discussion	Communication Dealing with conflicts
			Social Competences (e.g. Teamwork, Interaction)
Class	Conclusion and final Discussion	Discussion	Presentation of Results Linkage between individual results and learning targets
	Social Competencies (e.g. Interaction)		

⁵ Compare FHH 2010.

⁶ At primary and early secondary school level the teacher should help with interpretation.

The interests of the pupils are key to the programme, which is why the teacher should be capable of responding spontaneously and flexibly to the needs of the pupils, even in introductory phases. Therefore the teaching material should encourage pupil's questions about the development of particular sites and places. Based on the Hamburg curriculum the following table shows how the teaching unit corresponds to the methods of cultural landscape studies, and sets out the competencies covered.



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Assembled by Stefan Brauckmann, University of Hamburg, 2011

Fig. 1: Handout made with GIS. The school building is in the middle of each map sheet

4 Teaching Material

The pilot project was split into two parts; the first part a computer focussed introduction in the classroom, and the second part comprising field work in small groups.

Kartierschlüssel für eine Nahraumerkundung

- Name:** Pupils names _____
- Straße, Hausnummer:** Kielortallee Nr. 12 Address of the building
- Gauß-Krüger-Koordinaten (laut GPS-Gerät):** 3564631 5938215
Coordinates
- Baualtersklasse** Age of the building
Eingezeichnet in Karte von 1896 1938 1959 1971 2000
- Gebäudefarbe** Colour of the building
 rot weiß grau gelb blau grün braun andere Farbe
- Anzeichen für Laden im Erdgeschoss?** Signs of a former shop in first floor?
 Ja Nein Unsicher
- Nutzung (Bitte für jedes Stockwerk ankreuzen)** Current usage for each floor

	EG	1. OG	2. OG	3. OG	4. OG	5. OG	Dach
Wohnen	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Handel & Dienstleistung & Verwaltung (Büros, Geschäfte, Bäcker, Blumenläden, Friseure)							
Industrie & Gewerbe							
Öffentliche Einrichtungen (z. B. Schulen, Altenheime, Theater, Kirchen)							
Konsum & Freizeit (z.B. Kinos, Gaststätten, Sportclubs, Vereine)							
Sonstiges:							

- Eigene Beschreibung** Individual discription
Hat pro Stock 6 Fenster. Pro Stockwerk
gibt es 2 Wohnungen. 75 Quadratkilometer
pro Wohnung

Fig. 2: Mapping guidelines (BRAUCKMANN 2011)

During introduction, a computer with ArcGis-Software from ESRI⁷ as well as a projector was used. For the GIS application the following maps were made available:

- City-map of Hamburg (original scale 1:60,000)
- Thematic map of the River Alster 1100 AC
- Topographic map from 1895 (original scale 1:10,000)

⁷ The Federal Government of Hamburg has a general license agreement with the company ESRI, one of the market-leaders for GIS-Software.

- German base-maps from 1934, 1951, 1971 and 2002 (original scale 1:5,000)
- Aerial photos from 1952 and 2002 (original scale 1:5,000)

Based on these maps, teaching materials were compiled with various maps in different versions but in the same orientation and size dimensions (see fig. 1).

As preparation for the field work, simplified mapping guidelines were created (see Fig. 2), with similarities to the optimised models in cultural landscape studies used by NAGEL et al. (2001).

The mapping guidelines enabled the following perceptions:

- A building can be identified by an address (point 2) or a coordinate (point 3).
- Comparing different maps supported by GIS, changes in spatial formations are shown enabling the pupils to guess the age of a building (point 4). Pupils are encouraged to discuss variations in how the map differs to the original urban formation.
- The colour of a building and, of course, its building materials (point 5) can also help to verify the building's age.
- Traces of a former usage as a shop can be found on multi-storey Gründerzeit-buildings (point 6). The pupils learn that shops before the 1960's were smaller than those today, but closer to residential areas.
- The function of a building or its individual parts (point 7) depends on the period of urban planning. The mapping of mono-functional residential areas compared to (historically) mixed areas helps the pupils to better understand the historical context.
- Space for individual observations (point 8), while not directly useful for a schematic analysis, teaches observational and presentational skills.

In conjunction with the mapping guidelines, GPS and digital photo cameras were used. The GPS were not only for positioning, but also to save the track and waypoints. The digital photo cameras helped to collect visual impressions. In the analysis the pictures were integrated into the map and used to give a visual impression of the area in the presentation.

5 Lesson Progress

The first section of the pilot lesson was designed as a computer focussed introduction and begun with a current aerial map. Pupils started to discuss the images on the screen and to identify the school building, surrounding houses and other details without the help of the teacher. It was discovered that most pupils were familiar with reading aerial maps through access to web-based services such as Bing-maps, Google maps, etc. This prior knowledge was used to compare the difference between an aerial map and a graphical map. For this an overhead railway line close to the school was chosen as an example. In the aerial map the railway line was completely obscured by trees. Once the pupils grasped the differences, they were given the opportunity to identify points of individual interest in both maps.

At this point the perspective of time was introduced. On the aerial map published in 1952 pupils were initially unable to locate the school building, as they were disoriented without knowing the exact location of the school. Only after the outline of the school building was drawn from a current map, pupils realised that the historic map displayed the same detail as the previous maps. This allowed the pupils to analyse the changes in the landscape.

Working unsupervised they looked for traces of war destruction and reconstruction, supported by graphical maps published in 1934 and 1958 (Fig. 1). In a later step a topographical map published in 1895 was analysed. This time the pupils pinpointed the school location immediately, even though it wasn't constructed till then. The pupils recognised the end of the founder style period of urban development (a spontaneously comment of a pupil: "The city ends here") as well as the difference between the site density in the south (multi-storey buildings for workers and factories) and the north (predominantly agriculture). This discovery was used to discuss the social and hygiene situation in the 19th century. At this point difficulties in distinguishing the Middle-Ages (which had previously been taught in earlier lessons) from industrial era came up.

To underline important differences, the old city wall and the building restrictions on the city outskirts were discussed. Using field and street names (ending with -gate and -wall) the pupils reconstructed the former fortification lines which once existed in Hamburg. Additionally they highlighted the distance between the school and the historic city centre on the map. Analysing field and street names was subsequently used to analyse the local area. The pupils named places, which they assumed were historic sites, with individual pupils asking questions to investigate the physical changes. Close to the school for example, a street is called "Hohe Weide" ("High Pasture"). Pupils presented the hypothesis that this name means "a place which is higher than the surroundings so that animals were protected from flood". With the help of a "GIS-Layer" with the information of the hydrological situation in 1100 AC this hypothesis was verified. The final stages of urban development shown in the 1895 map clearly equated the location of the historic city centre.

In conclusion of the desk-based section the pupils' perspectives of the area were altered. Focussing on the time from the beginning of the urbanisation in the Middle-Age to the present time, spatial changes were analysed with examples. The final part of the pilot lesson was devoted to field work. The pupils' explored changes in the landscape in small groups. Each group was equipped with a camera, a GPS device and copies of the mapping guidelines (Fig. 2), as well as some maps (Fig. 1). The pupils responded with enthusiasm and except for asking questions, worked unsupervised in their groups. To map out a single building took them approximately ten minutes. It also opened up opportunities for the pupils to get in contact with the neighbours and passers-by to build knowledge. Due to the tight time frame in the pilot project, the mapping exercise was limited to thirty minutes, and the evaluation of the outdoor fieldwork had to be cancelled.

6 Conclusion

The cooperating teachers involved in the pilot project gave positive feedback to the selected methods for teaching pupils about city development in the surrounding area. During the lesson pupils were very focussed and concentrated on their residential area and the school building itself. The use of GIS enabled them to analyse the changes in scale and time easily. Examples can be adapted for specific classes and to individual interests, thus it was easy to motivate the pupils and to keep them concentrated as they were able to explore their own interests.

The analysis of the school neighbourhood supported by GIS-tools optimises the "orientation in space" and the "orientation in time". It also meets many of the competencies

outlined in the Hamburg curriculum. Including “methodology competency” (data preparation and presentation), “social competency” (team work) and “competency of diverse media” (source criticism). Furthermore new ways of learning related to practice were tested for primary school education. For example, to teach “knowledge” (the progression of individual research), “structured knowledge” (assessing and analysing secondary data), and “problem-solving knowledge” (critical thinking using appropriate data, tools and forms of presentation).

The higher level of preparation and supervision of the pupils that is required in comparison to conventional methods might be a drawback. Furthermore many schools do not possess fitting hard- and software equipment or training budget. In addition, teaching materials and resources, especially for primary schools, are not available and neither are there empirical studies to support these learning methods. GIS as a tool for secondary school education is a relatively new tool. In recent years many simplifications have been made to the technology so we can hope that GIS will soon be usable for primary level education. In sum, the experiences made by the students and pupils in the Hamburg pilot project demonstrates that a GIS-supported analysis of the surrounding cultural landscape can strengthen the awareness of time/-space perspectives and assist in linking geography and history classes.

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