Geogames in geography education - A design-based research study

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Abstract

This paper reports on first results from a design-based research (DBR) project in the field of geography education on location-based mobile learning using Geogames, with regard to the development of a design framework.
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1 Introduction

Mobile electronic devices (MED) offer versatile possible uses, especially for curricular knowledge transfer outside the classroom (e.g. on field trips) [1]. Many innovative approaches are embedded in a game-based learning context, or include playful components (gamification) [2]. Location-based mobile learning (LBML), combined with the motivation potential of game-based learning, holds great potential to foster sustainable learning experiences in real space. Game-based mobile learning has become increasingly popular during recent years and has resulted in a growing number of "best practice" applications [2]. However, there are many obstacles such as the lack of technical equipment, teachers´ concerns and there is also a lack of thoroughly designed and tested games for geography education. Another problem is that the game content of location-based mobile games (LBMG) cannot be easily transferred to other locations [3]. Therefore many teachers are put off by the time and labour it takes to develop new game contents for their school site.

From the viewpoint of LBML didactics, there is a need for action in order to make use of the great potential of LBMG and to integrate these innovative approaches into teaching concepts. Or, as Schito et al. (2015) describe it: "Bridging the gap between location-based games and teaching" [4]. On that account, the aim of my research project is to develop a design framework for the use of Geogames in geography classes.

2 Research framework

2.1 Design-based research

To that end, I apply the research methodology design-based research (DBR). "Design-Based Research blends empirical educational research with the theory-driven design of learning environments." [5]. Research projects using DBR have the common goal to develop educational interventions (such as teaching-learning materials for school books or teaching concepts applying new methods) in real world settings. They are developed on the basis of both theoretical and empirical research findings. Through multiple iterations, these interventions are assessed in practice and then modified according to the findings of the accompanying research. The re-designed interventions are then tested again in practice. The purpose of this iterative approach is to contribute both to the development of didactic theory and to improve educational practice. Furthermore, it intends to reinforce the collaboration between science and practice through close cooperation between scientists and practitioners, who work together in all phases of the design cycle [6]. "It is important to note that design research follows a holistic approach, and does not emphasize isolated variables" [7]. Therefore, the aim of DBR is the development of design principles. These are derived from the theory, and during the research process they are adapted, discarded or confirmed. Design principles are meant to support and guide others who want to make use of the intervention, but they are not irrevocable and have to be adjusted according to the particular framework conditions.

2.2 Geogame Neocartographer

For the implementation the Geogame Neocartographer is being used. This game is (among others) being developed at the Chair of Computing in the Cultural Sciences (Prof. Dr. Christoph Schlieder) at the University of Bamberg. In the course of the game, two teams consisting of several students compete against each other at the same time. Based on a (digital) map, on which the game board is displayed, the students go to geographic locations (also marked on the map). There they have to fulfil (geographic) tasks (Fig. 1a). These tasks can be knowledge-based, e.g. to find certain information or facts on site; they can have the function to collect data, e.g. to map an area; or they can be more open, e.g. to evaluate what makes a place worth seeing. The purpose of these tasks within the conceptual framework of Geogames is originally to solve the "synchronization problem" [8] and balance the game temporarily at each location (for more information see Schlieder [3] or Schlieder et al. [8]).

Once the students have finished the task they have virtually occupied the region on the game board (Fig. 1b). The locomotion of the players and the strategic navigation decisions they have to make fosters their orientation in real

space and their spatial cognition. The game offers students a playful exploration of a certain area.

2.3 Research questions and first results

My educational intervention consists of a short introduction of the game and organizational measures, the implementation outdoors and a debriefing teaching sequence back in the classroom.

The focus of the teaching concept is to develop tasks that encourage students to involve themselves with their surrounding environment and thereby create a sustainable learning experience. To develop such tasks I refer to findings from different research fields, e.g. outdoor education. I then adapt tasks that have shown to be successful in encouraging students to intensively explore their surrounding environment (e.g. by disrupting their daily routines and by drawing their attention to specific aspects).

For instance, tasks that lead to a change in perspective have shown promising results to raise awareness that the perception of places is a subjective and selective process. To give some practical examples from Neocartographer: students have to re-enact how different groups of persons might use the same public space and take a picture of that; they have to describe a certain location to a person that is blind; or they have to discuss in the group which modifications they would make in order to improve the town square. To carry out the task usually nothing more than a paper, pen and the MED are needed. The results are then advanced further in the following lesson(s) in class, when the students create a personalized, subjective map. Therefore they use the data that they collected, by taking pictures or making notes, and place them on a map of the game board (Fig. 1c). The results of the different groups are then presented and discussed in class.

Thereby, the intervention accounts for the "ability to reflect upon spatial perceptions and constructions" and the "social constructedness of space" [9] which are learning objective in the "Educational Standards in Geography for the Intermediate School Certificate" in Germany.

I also examine what factors provide a promising setting in which students gain a high degree of intrinsic motivation (based on the Self-determination Theory by Ryan and Deci 2000) [10], and what factors help or hinder intrinsic motivations in this educational setting, as this is an indicator for the intensity of the experience and the success of the learning process.

In the qualitative accompanying research I carry out "problem-focused interviews" [11] with the students. Based on standardized scales using the questionnaires IMI (Intrinsic Motivation Inventory) and PENS (Player Experience of Need Satisfaction), a quantitative examination of the motivation takes place. In addition, protocols from participative observations are written during the implementations and later analyzed.

Several (explorative) implementations, including all phases of the design-cycle (for more information see Feulner et al. [6]), helped us gather a lot of useful information, which in return led to modified re-designs of the intervention.

First results with reference to perception show that the game leads students to previously unknown paths and places (Fig. 1d). Even in places they already knew, the students discover new aspects or manage to see them from a different perspective, as their attention is drawn to features they would not have explored were it not for tasks of the game. The subjective maps help reflect upon the fact that perception is a subjective and selective process.

However, it seems that not all types of tasks succeed to involve the students in intensive exploration. Some students describe that they "felt pressure of time" and therefore did the tasks very quickly ("We just rushed there, took a picture and went on."), while other tasks lead to a much longer duration of stay because the group intensely discussed how to "solve" the task. This supports my assumption that one of the great potentials of Neocartographer is not to impart factual knowledge but to intensify the spatial experience by assigning action and experience-oriented open tasks (within the meaning of constructivism). An additional benefit is that these types of tasks can also be transferred and applied to other locations more easily (e.g. to all kinds of public spaces). As a result we are going to re-design some of the tasks and we are also going to exceed the phase of the reflection of the subjective maps. This will take place with the assistance of my cooperation partner, a teacher for secondary education.

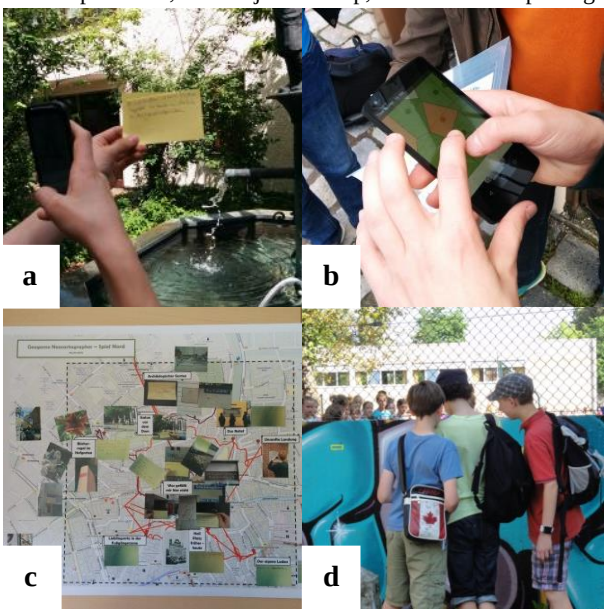
First preliminary results with reference to motivation indicate that the experienced competence arises mostly from the various spatial choices that are possible during the game. As shown in Kremer et al. [12], the students' experience of competence contributes most to the enjoyment of the game, unlike traditional excursions where enjoyment arose only from the absence of stress. Furthermore, it is indicated that the individual's experience of relatedness has a strong influence on their engagement in the activities. Groups that work together well are more likely to spend additional time in the game locations and get involved in negotiation processes. However, it is necessary to get a deeper insight into the conditions supporting motivation, such as team dynamics.

3 Conclusion and outlook

The experience gained so far and the first empirical results imply that the use of Geogames holds great potential for geography education. Students voluntarily engage with their surrounding environment and don´t seem to mind the interruption of the game flow to perform tasks. To foster these positive effects, I had the impression that creating opportunities for perspective change and increasing the intrinsic motivation of the learners were the primary objectives to make use of these potentials. There might be other possibilities and surely there is a lot that we don´t know yet about the effects of learning with Geogames. Another challenge ahead is to transfer these findings both into didactic theory and help to improve educational practice.

Therefore, the next steps within my work will be to fully analyze the data, re-design the intervention and then test it again in practice to examine the challenges and opportunities of Neocartographer more closely. To facilitate the transfer of research results into teaching practice, I am going to formulate design principles as a guideline for teachers who want to implement their own Geogame.

Figure 1a: Game board on MED, 1b: Students documenting their impressions, 1c: Subjective map, 1d: Students exploring



Source: Photos by author.

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