



Supporting creativity in teaching and learning of history through small-group production of mobile, location-based games

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ABSTRACT

While much attention in research on computer games is about how they support learning processes, relatively little attention has been directed at how students themselves can create learning games for each other. The present study investigates how students are able to create mobile, location-based games for each other to facilitate learning of history. A learning scenario designed in collaboration with a history teacher, has groups of students create a game, play another group's game and create a digital media product about what they learned by playing the game. Qualitative methods, namely video, observation and interviews, were used to gather data from a field trial of the scenario. Based on initial analysis and some initial observations, which are presented in this paper, we are convinced that this is a motivating and rich way to learn and is a promising approach worthy of further study.

Author Keywords

Student-created location-based games

INTRODUCTION

Using computer games for teaching and learning has gained popularity in schools and academia, and computer games have also become increasingly studied for their educational potential (see e.g., McFarlane, Sparrowhawk & Heald, 2002; Kirriemuir & McFarlane, 2004; Shute, Rieber, & Van Eck, 2011). Most of the research focus in the scholarly literature is on various learning effects of students playing computer games. Similarly, many of the courses that deal with design and creation of computer games are courses in computer game design itself, rather than using the game design process to build games to learn other curriculum. One example that looks at both is El-Nasr and Smith's (2006) two case-studies of students in computer science learning computer skills through modifying, or *modding*, existing games by working with the game engines, where they find that game development involves many different skills other than programming, ranging from artistic to mathematical concepts. Lim (2008) raises the idea that students in school should be allowed to design their own computer games based on their own interpretations of the curriculum, as a way to create more engagement with their own learning processes. Prensky (2008) agrees that in order for educational games to be successful the students themselves should

indeed create them. In particular, he suggests that students could work with creating what he calls "*mini-games*" (Prensky, 2008, p. 1006), which are contrasted to professional, commercial game productions, and created by groups of 2-3 students doing their own curriculum-based research with an advisor, where the games usually take around one hour to complete. Prensky cites young people's experiences with different digital tools used for creating games as one of the prerequisites for this. As an example of these kinds of tools, Resnick (2007; Resnick, et al., 2009) describes Scratch, which is an online system where students can learn to program interactive, online media products such as games, stories and animations, designed to foster creative and systematic thinking.

Within the field of Mobile Learning, there has also been a research interest in whether and how games on mobile devices may be utilised for various purposes. For example, Mitchell (2004) has carried out field research regarding the motivational potential of mobile games. She found, among other things, that devices that had the potential to load games were perceived more positively than devices that could not, and that educational games on mobile devices should appear as "polished" as commercial games. Thomas, Schott and Kambouri (2004) expanded usability guidelines from design of digital games in general, to how they can apply to mobile, educational games. Göth, HässandSchwabe (2004) describe the development of their prototype of mobileGame, a collaborative and competitive game for new university students to get to know the campus, and Angarita et al. (2005) provides an account of an attempt to bring educational games into a mobile book system for continuing medical education. Miettinen and Mattila (2006) describe their work with designing a 3D virtual world game, Virtual Snellman, for the mobile phone. Fotouhi-Ghazvini, Robinson, Earnshaw and Excell (2008) report the implementation and evaluation of a mobile game, called MOBO City, designed for technical language learning in Iran.

In this paper we present a learning scenario based on location-based games and study its implementation in a field trial. The study is a continuation of a series of studies with the mobile and location-based technology called SILO, where the focus previously has been on usability (Wake & Baggetun, 2009), on how to integrate mobile, location-based games with classroom tools and activities (Baggetun & Wake, in preparation), and on game-player interactional organisation and accomplishment of location-based games (Wake, Guribye & Wasson, 2011). While the focus of these studies has been directed at various aspects of game play, *in situ*, the SILO system is also designed for the rapid creation of location-based games. Thus, we have designed a scenario, Bergen History through Mobile Games, where students at an upper secondary school in Bergen, Norway use SILO to create location-based games tied to the history of Bergen for each other to play. This paper focuses on how the students were able to accomplish game creation where both curricular materials and aspects of the city are an integral part of the game, and where the location-based gaming experience supports the creation of a media product that shows what they have learned. The concept of creativity is inherently ambiguous, and no complete definition is offered here, but by focusing on "creativity" in this scenario we want to highlight how the students created products (a game and a presentation), rather than reproducing something, using an unfamiliar digital tool.

The paper is organised as follows. First, we present the design of the Bergen History Through Mobile Games scenario that comprised three activities, including a description of SILO, the technology for creating the games. Second, we describe a field trial of the scenario, followed by the research design, including data collection and analysis methods, we used to study the field trial. We conclude with our initial observations.

THE BERGEN HISTORY THROUGH MOBILE GAMES SCENARIO

To explore the creative writing of location-based games for history learning, a scenario involving different digital tools and activities was designed in collaboration with a history teacher. The scenario, which combined activities in different contexts, that is, in the classroom and out in the city of Bergen, comprised three activities: Game creation, Game playing, and Digital Media Product development. First working in groups, the students would first work creatively to tie historical themes in Bergen's history to actual places in Bergen, before they would translate this into a location-based game for their peers to play. Second, the students would give their game to the other groups to play. Third, after playing the game, each group was to re-create their experiences with the different themes in the game into a digital media product, combining images, video and sound captured while playing the game.

Through game creation, the students were to combine features of the real world, represented by the different locations in the city, and their interpretations of the different written sources available to them, into a game narrative that would be discovered by the recipients as they played the game. The gaming aspect was very much about finding the different relevant locations in the game by following the narrative. By creating a digital media product, the students reflected over what they learned about Bergen history by playing another group's game.

Theme: WW2 in Bergen

The scenario was designed and planned in conjunction with the teacher, both in terms of the theme and how to use the available technology for creating and playing the location-based games. The participating teacher not only taught history, but was also the e-contact at the school with expanded responsibilities related to the school's ICT-systems, and helping the other teachers with digital technology. She chose Bergen history during the 2nd World War (WW2) as the theme for the game as 1) it fit with the current curriculum, which was between "older" and "newer" history, 2) the school building was occupied by the German military during WW2 and 3) the availability of physical locations related to the theme around Bergen. The teacher identified themes and events related to 16 locations in Bergen during WW2. Examples of the themes include: 'The attack on Bergen on April 9th, 1945. Where?', 'The Printed Press of Bergen during times of crisis: Illegal papers', 'The history of the Jews in Bergen', and 'Food and rationing'.

Game Creation

The class would be divided in half, each half being given 8 of the themes. Each half would further be divided into groups of 3-4 students. Each group was asked to choose 6-8 of the themes and events, which would form the basis of their game. How they were to order the locations in the game, and what they chose to write about each, was up to them. They were also free to discover and create places and events by themselves. Each location was also tied to a theme.

A set of documents was made available through their Learning Management System. These included a description of what they were to do, a list of learning goals, a description of how the activity was tied to the five basic competencies (a key aspect of the most recent reform of Norwegian education), an explanation of how they would be evaluated, a list of resources and internet-based sites with relevant background, and a user manual for SILO. A collection of texts of historical relevance to the theme, such as magazines and books were made available in the classroom. The students were also encouraged to seek out local museums, the public library of Bergen, and the school library.

Game Playing

Each team was to play the game they received, moving around Bergen and learning about the historical sites in the game. The students were encouraged to bring cameras with them, or to use the cameras on their private mobile phones, and record various aspects of the places that they visited so they could use it as source material for creating a media product after having completed the game.

Digital Media Product

The digital media product the students were to create after playing the game could take the shape of a video or film, a wiki or a blog, or a web page. It was decided that the creation of a digital media product would not interfere too much with the fun aspect of playing of the game, and would increase the learning potential of the game. As the game application paused automatically at each location they found, knowing they would have to include the location in their digital media product would increase the attention they paid to the site.

Technological resources: SILO and other digital tools

The students are provided with SILO, which is a web-based tool we have developed for rapid development of mobile, location-based games (see Wake & Baggetun (2009) for details). SILO was created in Django, originally a content management system (CMS) for publishing newspapers digitally. SILO comprises a game editor and a phone application (for phones running on Symbian S60) for playing the game. Using the SILO game editor, see figure 1, a user ties a storyline to geographical places, defined by GPS, by clicking on a map. The digital map on which it builds is openstreetmap.org.

To create a game the user first adds a name for the game, start and stop dates, and participating groups (outside of range in the screenshot in figure 1) before adding points of interest (POI) that define the geographical locations to be included in the game. The user creates a POI by clicking on a place in the map and entering a text, which usually describes the place. Additional clues/hints necessary to find the next POI can also be included. The user can also attach an icon to the POI. When a POI has been created, the user can add another, and so on, until all the desired locations have been added to the game. All the information, including the map, the route, the text, icons and hints are then assembled in a zip-file, which can then be transferred to a mobile phone.

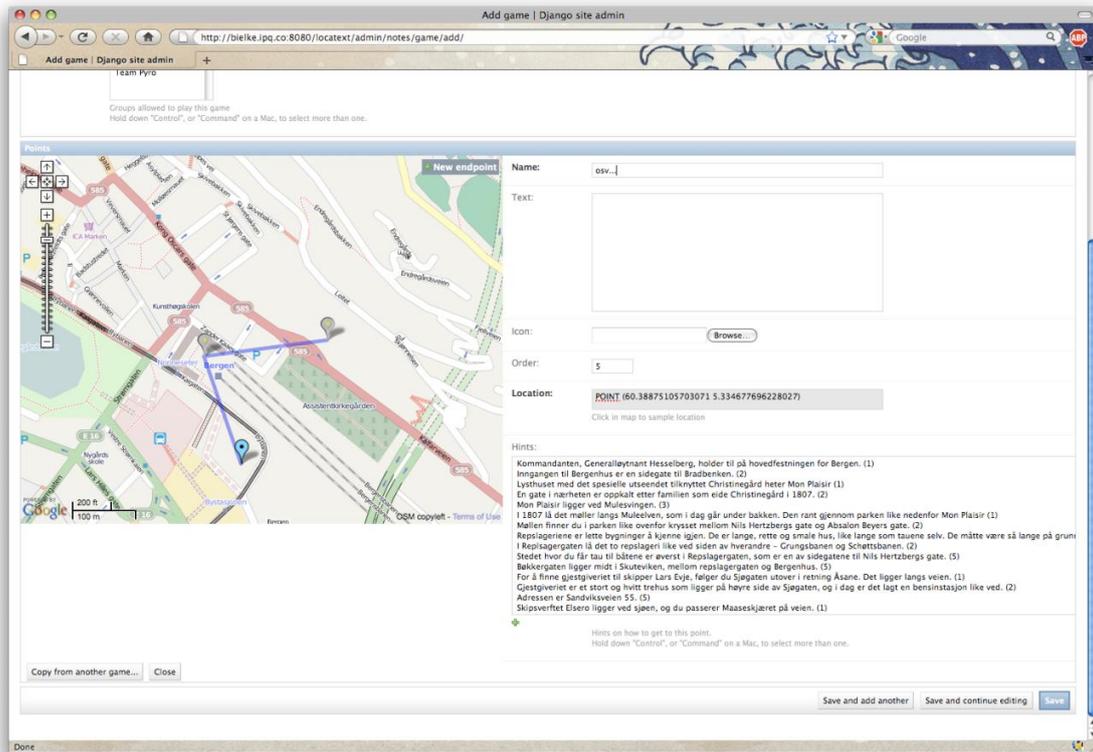


Figure 1. The SILO interface

The phone application (see Figure 2) interprets the data, and converts it into a game to be displayed on the phone. Displayed on the phone is the map, an optional marker displaying one's current position on the map, a track displaying the history of movement, and a bar (on the left side) displaying the icons of the places that the participant has visited. Additionally, there is a distance meter (shown in red numbers), displaying the remaining distance to the next location, which is updated every five meters. When the participant moves within a zone of 30 meters around the location, the numbers turn green, and they are permitted to 'pick up' the POI in the game. The zone of 30 meters around the location is a way of dealing with inaccuracies in creating zones in physical space by clicking on the map, potential obstacles in the physical space, and also the potential inaccuracies in GPS-data, which is contingent on several factors.



Figure 2. The mobile phone interface

SILO was designed for the creation of mobile location-based games, but not particularly for use in the classroom, nor for students to create games for each other. One relevant aspect of this is that the pages for creating a game are not private, and if they wanted the students would be able to see the game that was created for them, before they were played it. This contradicts the geographical discovery involved with the game playing. The students were informed of this opportunity, and asked to not look at anyone else's games but their own, as it would make their gaming experience much less interesting. From our perspective, our interest was more in the creative process of writing the game, rather than on the game playing itself, so it was not too big an issue.

In addition, the students had access to a range of digital tools, available on their wifi-connected personal laptops, provided by the Fylkeskommune (the County Government) and in daily use in their regular schoolwork. These tools included office tools such as a text editor for temporarily working with the game text, and web browsers for searching for additional sources and material.

THE FIELD TRIAL

The students were informed about the project work two weeks in advance, and provided with some of the source material so that they could prepare for it, although this was not a requirement from the teachers perspective. The field trial took place in March 2011 and spanned six days and about 13 hours distributed over two weeks, during which time they created a game, played a game and created a digital media product. We provided 4 Nokia Navigator and 4 Nokia N80's phones for the field trial.

They were informed on how they would be evaluated beforehand. They would be evaluated on the basis of the game creation process, with emphasis on critical use of sources, types of sources, the level of creating a connection between historical events and how the city is today, how creatively they used the different locations provided in advanced, and on the group collaboration process. They would also be evaluated on the basis of the Digital Media Product that they created after having played a game, with emphasis on how the information that they discovered was processed and turned into a final product, and whether it was lifted from a reproduction to a more general discussion, in addition to use of historical terminology, discussion and the ability to make the history life-like.

Before the scenario started, the students were informed that participation was voluntary, that they were able to withdraw their consent to participate at any time without risk, also after completion of the scenario, and that use of the data material would be anonymised with regard to names. One group was informed that they would be videoed. While video is inherently non-anonymous in terms of the participants' visual and audible conduct being the focus of the study, a scaled consent form was used. Derry et al. (2010) distinguishes between *use* and *capture* permissions, when relying on video data in the learning sciences. The students were offered the opportunity to choose whether or not to participate at all (*capture*), and secondly to consent to a scaled degree of public use, ranging from presentation of sequences at conferences, use of screenshots in written papers, and use of the video footage in closed data sessions with other researchers. For their participation, the students and teacher received a cinema ticket, and the students in the group that was being filmed, received a further two cinema tickets.

The Participants

The participants were a class of third-year (final year) students in an upper secondary school in the town centre of Bergen, Norway. A total of 27 students, aged 18-19, took part. The class was divided randomly in two groups, and each of the two groups was divided in four, resulting in 8 groups of 3 and 4 students,

see table 1. Groups were also paired for exchanging games. For example, Group A was to create a game for group B and vice versa, group C was to create a game for group D and vice versa, and so on.

Group	Students	Group	Students
A	1, 2, 3	B	4, 5, 6, 7
C	8, 9, 10	D	11, 12, 13, 14
E	15, 16, 17	F	18, 19, 20, 21
G	22, 23, 24	H	25, 26, 27

Table 1. Organisation of class during scenario

Designing the Game

The game design and creation was carried out over a total of five two-hour (school hour) work sessions. Eight games were created. The groups chose to divide the locations between them, writing a couple of locations each, before they sat down and created a storyline behind all the locations. A variety of tools were used for this. The students used humour and ways of talking that were internal to the class, in several of the game storylines.

Playing the Game

The games were played successfully by four of the groups; the other four groups had phones that broke down before they got started. One of the groups chose to play the game made for them on paper instead.

Creating Media Products

They created a wide variety of media products after the game. Two groups made annotated picture collections using PowerPoint. One group made a poster, two groups made films, and two groups made information booklets. The final group made a presentation of their experiences of the game, and a presentation of their own game.

RESEARCH METHODS AND DESIGN

This research focus of this initial study is on the design and field trial of the learning scenario. In this paper we are interested in how students carried out the scenario and in gleaning some initial observations from an initial analysis of the data.

Data Material

The main data source for this study was video, but interviews, observation and collecting artefacts produced by the students were also carried out. A total of six sessions were filmed. These include the teacher's introduction, sessions which consisted of reading and re-writing source material tied to places, sessions where they created the game in the SILO interface, the session where they played their games, and the session where they created the media product. This resulted in a total of 12 hours and 45 minutes of video footage. When the students were working in groups the video footage was centered on one focus group, the same group for the duration of the scenario. The researchers were present during the filming, and the recorded material was digitalised and reviewed after each session. Each student group was interviewed face-to-face two days after the scenario was completed. A semi-structured interview guide was used, containing questions about the collaboration process, the creative aspects of the scenario, and

how it contrasted to ordinary work forms in their school. The interviews with the groups, lasting from 20 to 30 minutes each, were recorded and transcribed.

The groups that were not being filmed were observed while they worked, and field notes including which tools and sources they used, how they organised themselves collaboratively, and so on, were recorded. The teacher was also interviewed in a more lengthy session, lasting about one hour, which was also recorded and transcribed.

The student products that were collected included the games that they created and the media product that they created. The games were copied from the SILO system to a file in MS Word.

Data Analysis

The analysis of the data is in the early stages. However, based on initial reviews of the video footage, observations and interviews, a number of emerging observations have been made. These are presented in the following section.

FINDINGS AND OBSERVATIONS

We begin by presenting a chronological account of how the scenario unfolded, focusing on the content of the work in the different work sessions. Then, we present some initial observations based on the video footage, observations and interviews.

Session 1: The teacher began by explaining the contents and activities of the scenario to the students. She referred to it as ‘their project’. Using a Smartboard to display a document she had prepared beforehand, she explained the topic, and that the perspective on the topic was local, that is, what happened in Bergen during WW2. She then explained the sources they could use, such as the school library, the public library, pictures video and text, in addition to the Internet and different texts that she had prepared for them. She then went through the more general goals for learning, and how they were to be evaluated and graded specifically on the work process with the game, and on the final media product. Then she explained that the scenario had to do with both historical events, and the geographical places at which they happened. Finally, she specified how the groups would be organised practically, that another group would use the historical information available in the game to create a media product after the gaming session, and that they in that way would be responsible for each other’s learning. Finally, she laid out the time schedule and content for the different work sessions, and presented the basics of how SILO works. Following the introduction, the students arranged themselves in the specified groups and started working on the games.

Game Creation, sessions 2, 3 and 4: The focus group, working on a laptop each, start off by discussing the different locations that they have been assigned, and how to search for information. Initially, this is carried out as a group discussion, with the members searching for information on their laptops individually, and then sharing the information, and discussing it with each others. In Session 2, they start off by visiting the public library of Bergen, to find more information. The focus group, and most of the other groups, relied most heavily on books as their main source of background information, citing the need for specialised information as the reason for this. For the remainder of Session 2, the groups largely work in silence. Session 3 begins with us explaining how to use SILO. This session also contains a lot of working in silence, with the occasional discussion of various aspects of the locations in the game. In the focus group, the actual entering of the storyline into the SILO system was carried out by one of the students, based on the document that they prepared in Word. This was contrary to how most of the other groups carried out this particular aspect of the game creation.

Playing the game / Telephone failure, Session 5: On the day of the game, four of the eight mobile phones broke down before the groups got started. The four phones that worked fine were Nokia Navigators, and the four that did not were Nokia N80's. They had seemingly worked fine the day before, when the games were installed. The solution for this was that two of the four groups without a working phone got printouts of the game content, and played it by reading the information that they would have gotten on the phone when they would have gotten it, to find the places they were supposed to find while playing the game. Two of the groups visited two museums, one of which they would have encountered in the game, and an additional museum with similar kinds of displays. While they experienced a highly reduced gaming experience, they were still able to visit the places that they needed to create their media items about the experience. The focus group, playing with a phone that worked, display similar ways of accomplishing game play described in Wake, Guribye and Wasson (in press). For example, navigation is socially accomplished by visibly demonstrating the act of navigation through bodily postures, and involves a lot of reading out loud feedback from the phone. Previous studies of game play have also revealed that the competitive element of the game, winning by completing it the fastest, have caused some participants to hurry through the game in order to win, and not pay so much attention to observing various aspects of the geography. The decision to plan for the groups to capture information in some form at the different locations seems to have been a success in that respect - they discuss much more of the meaning of the location than what has been seen in previous studies of SILO.

Creating the Media Product, sessions 6 and 7: The focus group decided, whilst arriving at the first location during gameplay, that they would create a poster on paper, using pictures that they took while on site. The group photographed themselves next to the different locations that they visited, and used these in the poster, along with maps and other pictures they were able to find. They first created a mock-up poster, also on paper, before they created a poster that was more visually polished.

Initial Observations

After an initial review of the data, a couple of observations have emerged. One has to do with the collaboration process, another with the choice and range of digital tools that the students used. Another has to do with emotion and engagement with working with and playing the games.

Individual & Collaborative: The students were free to organise their work as they saw fit. Thus it was interesting that all the groups organised themselves such that each student took the responsibility for two or three of the historical locations/themes. This entailed gathering relevant background material, sorting the information and writing up what they believed was relevant. After this individual work, they came back together as a group, and worked on creating a storyline threading together the locations, making it into a coherent narrative. This also allowed the students to see what the other members of the group had written about their theme/location. The interviews and observation reveal that this way of working was the same for all the groups.

Digital Tools: The students used a surprisingly wide range of digital tools in order to construct their games, many of which we did not plan for in the scenario design. For writing of historical information related to each theme most of the groups relied on Microsoft Word, although one of the groups used the web-based typewith.me. Another of the groups, a group of three where two of the members were absent during several work sessions, because of illness, used Facebook to create a password-protected page where they stored the documents that they were working on, so that all the work would be available for each of the group members. In the creation of the games, the students also used Google Streetview for matching the map in SILO (openstreetmap.org) with images of the places in question. In particular they used Google

Streetview to check for physical restrictions around each location, to avoid setting the location behind a fence or on top of a building, in addition to the map in SILO. The groups that chose to make a movie out of their game experience used Windows Moviemaker, in addition to a movie converter tool that they found on the Internet. Making the choice and finding the available digital tools for the many different purposes, other than the SILO system itself, was largely carried out on the students' own initiative.

During the playing of the game, they used a range of cameras, on their private mobile phones and specific purpose cameras that they borrowed from the school. When re-composing their gaming experience into a video, they used Microsoft Moviemaker. The class also used a Learning Management System (LMS) for communicating out of class, and keeping relevant information.

Motivation: It rather quickly became apparent that working with creating games had a high motivational effect, in particular oriented towards the competitive element, an aspect that the teacher highlighted in the interview. The teacher reported an unusual eagerness in working with the games, and used the unusual silence of the class, and their working in the breaks as examples. The video footage supports this observation; there are long stretches where only whispering can be heard. She speculated that it was the competitive elements of the gaming that sparked this engagement. One of the groups was visibly angered when returning from playing the game (the teacher had to provide them with chocolate for them to calm down), and the reason was that they believed that the group that created a game for them, made it rather difficult to play on purpose. The interviews also reveal that some of the students called each other up whilst playing, to avoid using hints available in the game, decreasing their chances of winning (the team that completes the game in the shortest time, using fewest hints, wins the game), requests that reportedly were turned down.

Variety of Media Products: Two of the groups chose to make movies out of their experiences, retelling the story content in a new format. One of these movies contained footage of the students acting and re-living the historical themes and events at the different locations. One group chose to do a poster (on paper), and two groups made PowerPoint slides with text and pictures taken whilst playing the game. One group chose to do a presentation of their own game, and their experiences on the field day. This group had a phone that did not work.

CONCLUSIONS

In this paper we have presented a learning scenario that has been designed to help students learn about local history. Students learn about selected local history events by creating a location-based mobile game to be played by another group. In addition, they learn about complementary local history events by playing the game created by another group. Finally, they reflect on what they have learned by playing the game through the creation of a digital media product.

Our field trial has shown that the students and the teacher were very enthusiastic about this approach to learning local history. The students worked both individually and collaboratively. They were creative in their use of digital technology to carry out the activities and they produced a wide variety of media products.

Our subsequent analysis will examine the data more carefully. Here, we will look at how the students are practically accomplishing the creation of a game through their interaction.

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