

Mobile Probes in Mobile Learning

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ABSTRACT

In this paper experiences from using mobile probes in educational design of a mobile learning application is presented. The probing process stems from the cultural probe method, and was influenced by qualitative interview and inquiry approaches. In the project, the mobile phone was not only acting as an agent for acquiring empirical data (as the situation in hitherto mobile probe settings) but was also the technological medium for which data should say something about (mobile learning). Consequently, not only the content of the data but also the ways in which data was delivered and handled, provided a valuable dimension for investigating mobile use. The data was collected at the same time as design activities took place and the collective data was analysed based on user experience goals and cognitive processes from interaction design and mobile learning. The mobile probe increased the knowledge base available in the design decision process.

Author Keywords

Cultural & mobile probes, IT didactical design, educational design, mobile learning

ACM Classification Keywords

H5 Information systems and presentation (e.g. HCI),
H5.2 user centred design

INTRODUCTION - RESEARCH AREA AND FOCUS

Through ministerial funds a project partnership was formed between a broadcasting corporation and two private companies with the objective to develop a learning application for Smartphones. The vision was to combine digital information from archives with current information, and thereby support learning in multiple disciplines (as relating historical and current news shown on the phone as the user moves in the city spaces). XXXinserted-after-review was involved in this project as research-based consultants within IT didactical design. IT didactical design refers to the theories, models and practices of teaching and learning supported by IT, focusing on the process perspectives in educational design, as activities relating to both (re-)designing, planning, running, adapting and evaluating learning processes and spaces for learning.

The pre-phase began in the spring of 2010. Here, initiatives to gain knowledge of and input from users and feasible designs were established. The project's primary audience are students at 15-17y. According to the project description: More than 98% of these Danish students are using mobile phones, one third send photos, videos or similar and roughly one in five surf the web using their

mobile phones. However, very little is known about the informal strategies, the cognitive and subjective processes, as well as the reasons and motivations for mobile applications use.

Consequently, a small investigation based on the Cultural and Mobile Probe method was seen as an adequate way forward, with a specific focus on:

- 1.How can the mobile probe process be designed to explore a mobile learning domain?
- 2.How can knowledge about this age group's mobile phone use, and their informal learning strategies, support the design process of the formal learning application?

LITERATURE OVERVIEW AND CONSIDERATIONS

The Cultural Probes method was originally introduced to HCI by Gaver, Dunne and Pacenti. The method was developed using probes such as maps, postcards and other materials that were designed to provoke inspirational responses from elderly people in diverse communities [4]. The method provided empirical user generated data, whose content could not be predicted and which held valuable information about emotions, reasons as well as visual representations. This data collecting process preceded the design phase and contributed to the qualitative knowledge-base about users. [4,5].

The literature clearly reflects that cultural probes have moved to digital probing materials and in recent years in particular to focus on mobile probes using mobile phones [1]. Iversen & Nielsen applied mobile phones, as they needed to utilise a media which was suitable for children [7]. In a Finnish study by Hulkko et al, the aim was to make the probe more accessible in all contexts. Their research was rooted in a customer survey perspective, investigating the buying habits and decisions people make when buying clothes (thoughts and visual impressions). Consequently, they too digitized the cultural probes concept, handing out mobiles with attached cameras, with the intention of getting empirical data gathered in-situ [6]. The review of mobile probes studies also indicates a widespread use of the method into the consultancy domain as opposed to a more research oriented input to practice. For example, one company developed a mobile based 'probe pack'. A tool for collecting data, with the purpose of reducing development and execution time associated with the use of probes [10].

In the above studies the participants were given new tools (hard-/software), which they had to learn to use, before being able to respond on the probe tasks. If such a

strategy is applied, it may seem extensive and intrusive to the participants, because learning a new media and being able to use it actively, is a process that takes time and energy.

The “Mobile Probes in Mobile Learning” concept focuses on examining users' informal strategies on their own Smartphones, to see what the incoming data can say about user's needs and requirements when designing formal learning strategies. According to Dohn & Johnsen the advantage of using new media sources, as mobile 2.0 learning resources, is the positive effect it has on students' motivation. Interaction and collaboration with other learners, as they produce and transform material, has a motivating effect on students. Particularly when the students can and know how to control and manage the process themselves, giving them ownership of the activity [3]. As we wanted information on what motivates the students in informal learning situations, it would not make sense to give this group a new phone, with different operating systems and apps than they usually use, as it would say less about their everyday informal strategies.

Probes have often been applied by probing people randomly, with pre-designed probes and answer-channel (text, picture etc) or by allowing participants to choose time and answer-channel [4,5,6]. There are no immediate follow up on the returning data from the participants' [1]. In the context of this project, the reasons for why the participating students use their mobile applications were equally important to explore as to how they use the application. Boehner et al. argue for probes that work as an open conversation with the participants. A conversation, where the researchers' contribution is a response to what was expressed in the answers coming in from the participants', instead of making representations that delimit the design space [1]. As a result, a more dialog oriented approach seemed appropriate [2] and was chosen for this project.

From an analytical perspective, the probe method objective is not to reach a single unambiguous answer or solution, but rather they let the researcher become inspired by the participants [1]. With the aim to support the project's rigidity in the analysis phase, while keeping a user-centric focus, user experience goals and cognitive process variables were applied to the analysis. The cognitive processes were identified as: attention, perception & recognition, memory, learning and problem-solving, planning etc. The user experience goals were identified, as: satisfying, enjoyable, provocative, boring, etc. (All derived from [9]).

RESEARCH DESIGN

The research design was build on the assumption that the probe data would spread light on what are the positive and negative user experience elements, and how these components influence the students' choice and learning strategies.

At the same time as the mobile probe activity took place, other pre-phase events (as workshops, low-fi prototypes and user tests) progressed. The project thus prioritized several user activities rather than one large study and it was seen better to have in-depth contact with few probe participants in this first study with the method. In the end, four students from the same high school were chosen, in the age group 15-17, adopting a homogenous and typical sampling based strategy [2]. Access was gained through the headmaster in order to get permission to contact them during school hours. All students in this age group were presented to the project and encouraged to contact the researcher if they wished to participate. The final participants were chosen from those who replied, based on criteria's related to their access to the technology, and their experience with Smartphones.

Because of the study's focus it was natural to base the probes on generic applications, by letting the probe be simple text questions (by SMS), which the participants were already familiar with and allowing for multiple answer-channels (text, voice, pictures). Thereby, the setup reduced the intrusiveness and at the same time gained access to metadata in regards to actual technology usage. In retrospect it seems likely that this approach was a significant factor in the high return rate.

In comparison to the digital probe methods reviewed, this approach was more influenced by traditional qualitative interview-based methods [8,2]. The strength of designing the probing process to resemble a semi-structured interview is the ability to guide the users focus during the whole process. Boehner et al works with the concept of open / closed probe approach [1]. In this project, being able to follow up on a given answer or completed task, allowed some control of the probing process and thereby of the data. It is important to note, that the control is solely on a structural and perspective level, and as such the follow up typically consisted of: offering help if a user had technical difficulties, or by asking for further details in regards to a previous response/task.

An argument for using the interview-based probing method pertains to user motivation. The participants' perception of the probe tasks being made specifically for them influenced both their willingness to complete tasks and the amount of work they put into these. There can be numerous ways to facilitate these kinds of user experiences. In this project customising the probe tasks by simply adding the participant's name to the top of the text message, and using dialogue elements typically associated with face-to-face communication allowed participants and researchers to quickly establish a friendly tone and social relationship.

The probing took place over a period of seven days in which the participants received text messages with various questions about their use of Smartphones, and received tasks they should address utilising various media and generic Smartphone functions. The participants

received three text messages each day. The first question was typically sent in the morning, the second at noon, and the third around 6 o'clock in the evening. The first two questions were almost always the same for all participants, whereas the third was often used as a follow-up question to their previous responses, making it individual. Three questions per day enabled some of the positive aspects of semi-structured interviews, where you can make inquiries in to the essence of opinions [8]. Also, this afforded the chance to reach any participants who had not yet responded to questions one and two.

DATA COLLECTION, ANALYSIS & FINDINGS

During the seven days, 81 tasks were sent and 74 answers were received. The answers were primarily text messages, but also many pictures / screen shots. (table 1 and figure 1).

Number of tasks send:	81
Number of responses recieved:	74
Media used in responses*;	
SMS:	57
Audio:	4
Pictures:	19
*Some answers had both text and pictures	

Table 1. Number and type of responses



Figure 1. Example of probe response picture

The multi-modal nature of the responses presented a number of challenges during both the collection and analysis process. The primary challenge was to organise the data in a way that would give it a uniform structure and expression, in order to compare answers and reveal trends and relations. Data also had to be recorded and stored during the collection process, in a way that supported the interview-based probes approach. Consequently, the project identified two people alternating as "probe managers", sending tasks to the participants and communicating with them when necessary. To facilitate this, an online data collection site was used, where answers and thoughts on the ongoing process was shared. This site allowed simultaneous work on the data. A simple text-based table was used to store and organise both the pre-defined questions and the participants' answers; Day 1, Question A, participant 1, 2,

3, 4 - Question B, participant 1, 2, 3, 4, etc. Organising data this way enabled an ongoing preliminary exploratory analysis during the collection phase [2]. This overview helped qualify the follow-up questions, and showed if it was necessary to deviate from the original questions.

After the probing process had ended, a thematic analysis based on predetermined themes began [2]. The theme-set used was based on the reflective Cognitive Processes (CP) found in the participants Smartphone use and the Subjective User Experiences (SUE) associated with the use [9]. The answers were organised with a summary, a description of identified user experiences and cognitive processes, and they were labelled with a name based on their place in the online collection site as shown in figure 2.

3A3	
Answer category:	explain favorit app
Summary:	Facebook is favorit app most used, good design and user-friendly
SUE:	enhancing sociability emotionally fulfilling, enjoyable
CP:	Attention perception and reconition

Figure 2. Each piece of user material was first analyzed

These tables were subsequently used for a qualitative, structured, and visual management of the participants' answers. Through the physical and visual (not online) ordering of the relations in the data, it was possible to study and discuss which cognitive categories and subjective user experiences were dominant in the data, and gain insight into the correlations between these and different forms of Smartphone interaction (figure 3).



Figure 3 – All pieces were analyzed as a collective

The use of interaction design elements as scaffolding for the collection, organisation, and analysis of data meant it was possible to formulate concrete design suggestions for the project [9]. A number of design activities ran in parallel to the probe process. Just as the probe responses, the design suggestions from these activities were examined, with the intent of identifying elements that supported the cognitive processes and subjective user experiences. The data extracted during this process was stored in a similar way to the probe data, making comparisons and flow between the user-centred probe data and the design suggestions flexible.

Example: the probe data material showed that the students' primary informal use of their Smartphones was through their favourite application, "Facebook" (figure 1). This may not seem surprising but an interesting question was whether there appeared to be an informal learning through this application? This could only be answered by examining the students' use of the application. Student 4 described that he checks News Feed, "to see what his friends are doing, and that the menu on the app is good because you can get to all features from here". Several of the students also described that they often comment on their friends' comments in News Feed and create status updates. The design team thus suggested the low-fi prototype "...should integrate these (News Feed and status features) in their application, by letting the users view and comment on each other's productions and thereby strengthening the potential for developing reflective cognitive processes..."

Dohn and Johnson describe m-learning strategies and the use of the students' own Smartphones as an advantage. When the students already know the media, they are already competent and can rapidly decode relevant strategies and instead focus on the learning content. As the authors found students use small one-player games, they suggest including these in formal learning applications [3]. But what happens when one adopts the cultures and behaviours of the informal strategies into a formal learning setting? This may be valuable but can also be disadvantageous in some situations. As such this projects mobile probe data also showed use of small one-player games. The probe process, however, disclosed that they were played as a fast game "to kill time", or while waiting for something else to happen (during transport etc). If designed into learning software, the culture of "beating the game" fast, rather than learning about the domain knowledge, may be inherited.

CONCLUSION AND PERSPECTIVES

The choices of: 1. using known technology and software, 2. interview-based probe approach with an informal conversation format, and 3. follow up on those who did not respond, all ensured a high response rate. This was important to ensure the dialog-nature of the probe process and to obtain a rich data-set with only four participants. It also requires man hours, with continuously overlooking the process, which may not be possible in every project.

From an IT didactical design of mobile learning perspective, applying a pre-defined analytical frame originating in learning and interaction design, gave the project team a structured approach to the field of study, rather than a "pure" grounded and data-driven approach. This provided a way of moving from empirical data to design. However, it can be criticized for not being open enough to data that are user-generated [2, 1].

An area of particular importance in this study is the use of own Smartphones to study everyday Smartphone use. By designing the mobile probes to use the technology in

focus, meta-data pertaining to the actual informal use of Smartphones was accessed. It also reduced the risk of getting tainted data showing how the participants handled new technology and application features rather than giving insight into their strategies when using known technology and applications. This approach differentiates from both cultural probes [4,5] and existing mobile probes [6, 10]. While the technology and workflow in existing mobile probe methods might be known to the participants, it does not allow the use of their own devices. Therefore it would be hard to make qualified assumptions about their informal learning strategies that could be used to qualify the use of Smartphones in a formal learning context.

Though the specific project had consequences for design suggestions, the design was never finalised and evaluated by end-users, as the project ended prior to the final application development, due to different objectives of the funded partners. However, as researchers and practitioners within IT didactical design, the work with mobile probes already continues into new project environments, and the learning's from how this target group thinks has shown useful in other studies as well. As such the mobile probes for mobile learning may have a wider scope, and brings a knowledge base to educational design decisions about the specific target group. This needs further investigation.

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