Promoting informal Mobile Learning –
An overview on issues and interdisciplinary approaches

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ABSTRACT
Mobile learning, as a part of technology enhanced learning is a highly interdisciplinary field. In comparison with stationary e-learning it is highly dynamic, ubiquitous and context dependent. Various new issues arise from the characteristics of this field that need a special treatment by interdisciplinary approaches. This article gives an insight into specific mobile learning related problems and approaches to their solution.

Keywords: Mobile learning, informal learning, interdisciplinary approaches, issues, mobile context

1. INTRODUCTION
There is a lot of potential in mobile learning. Many people experience a lot of spare time, during commuting, while waiting for colleagues or between meetings and lectures. In the digital age information is often needed immediately on-site. We are traveling a lot and in different contexts. Mobile learning offers access to unused time slots, which could not be used by stationary e-learning before. Therefore a deeper understanding and adaption to the special characteristics of mobile learning is necessary to better support mobile learning processes and to use its full potential [1].

Mobile learning or M-Learning is often described as the process where learners have anytime and anywhere access to information via mobile technologies to perform learning activities. They have the opportunity to get information immediately at their current location in the context of their learning situation. Information can be retrieved on everything what they see and experience at the moment [2]. The typical information is short and the content should not overload the cognitive abilities the user [3].

Although mobile learning shares common features with traditional e-learning, there are some special characteristics. Especially in the area of interaction mobile devices have more possibilities and channels than desktop e-learning environments. Mobile learning also allows connecting digital information and services to the physical environment [4].

Sharples et al. (2005) defined four general characteristics of learning with mobile devices. Typical are the ease of use, the availability of content at any time, the portability and collaborative learning [1].

Regarding social aspects mobile learning is seen as an accelerator for the access to communities, finding suitable teachers or the recognition by experts – especially where internet usage is only possible through mobile devices [5].

2. MOBILE LEARNING ISSUES
As mobile learning processes, requirements and devices differ from regular technology enhanced learning, several issues arise. According to Petit and Santos (2014) the goal in mobile learning is not anymore to integrate the technology to the learning process, but to integrate the learning process to the daily use of the technology [6]. An important task of mobile learning research is therefore to develop applications that use the specific time and space opportunities in mobile learning.

To achieve this, it is crucial to recognize that mobile learning approaches are no substitute for traditional teaching and learning concepts. Instead they offer a way to enhance the learning outside of class rooms towards the conversations and interactions of the daily life [7].

Whether this approach is reasonable depends on outer conditions and the approached target group. There should always be awareness for the special limitations and advantages of mobile devices. It is not possible to simply transfer design requirements from e-learning to mobile learning [8].

The possibility to learn anywhere, anytime in all situations, even in idle times also means that users can access Information anywhere and gets updates anywhere which can be felt as a pressure to be forced to communicate or do research all the time [9] [10].

Currently the academic field of computer science provides no models with a proper theoretical foundation that describe the effect and the interdependency between IT systems and their usage context [11]. In addition even basic questions of e-learning lack research depth to be used for theory and practical experiments. More interdisciplinary work and quality check is therefore required.

Solving mobile learning issues is highly interdisciplinary. Computer scientists specify the parameters and create a suitable software architecture. Their task is further to develop new algorithms to interpret data coming from sensors, analyzing the camera snapshots, attach sensor information to context, advance text to speech systems and to create augmented reality settings.

In addition, data mining is used to find the most suiting learning
content for users. Designers are needed to make the user interface appealing and the applications easy to use which is especially important on mobile devices with limited screen space and imprecise touch input. Educators and didacts create the learning material and divide it into a mobile-friendly structure. Social scientists evaluate the mobile use and provide input for the optimization of the application and the learning process. Psychologists explore the learning process and its impact to the user and the human brain. Data security, privacy, copyright questions and the economic operation of e-learning platforms are further tasks for experts of these fields.

3. TECHNICAL ISSUES

While planning mobile learning systems several technical challenges have to be addressed. In general, the diversity of the technology appears to be a problem. There are different operating systems, learning management systems, display sizes and input methods which make content development difficult and expensive. The battery power limits the use of demanding applications.

Former problems like low CPU capabilities and connectivity problems are partly solved as a result of the technical advancement of mobile devices and infrastructure. Mobile internet access is easier to get with LTE and smartphone contracts that usually include a data traffic option. Public transports like railway companies or airlines announced the support of internet via WLAN in their vehicles. On the other side – in cases without a proper connection, e.g. being in an area without mobile connectivity, the effects worsened throughout the last years. Many mobile learning applications require a permanent internet connection as opposed to the past and fewer applications support the download of offline content. Speech interaction like Apple Siri or Google Maps location is not possible offline.

To match the technical issues applications and content should be developed directly for the mobile devices to suit their special affordances.

4. USING CONTEXT INFORMATION TO ENHANCE THE MOBILE LEARNING

A central role in mobile learning plays the context the user is in. As the environment of the mobile learning process frequently changes it is important to use the context information of mobile learners and to adapt the process accordingly.

There are two main approaches to build context aware artifacts, the technologically-driven approach and the application-driven approach [12]. The first is focused on which capabilities can be provided by the available hardware and software, which in the case of context-aware applications is a question of determining what data can be obtained through sensors and what processing can be done on that data. The second approach evaluates which features and capabilities are required by a certain learning application or user context.

Characteristics of the current situation or context dimensions [13] can be collected via sensor information and connected to time and location. Device parameters can be adjusted according to the collected environmental data. The MOBILElearn project in 2003 was the first major approach to use context-sensitivity of mobile technologies for informal, problem based learning at the workplace [12]. MOBILElearn uses a Context Awareness Subsystem (CAS) which selects content based on sensor data and user needs. Through CAS relevant content can be selected, filtered and delivered to the user.

AICHE, an abbreviation of “Ambient Information Channels”, is a model developed by Specht [4] that specifies patterns of contextual learning. It describes channels of ambient information around us, which can open anytime. The channels consist of meta-information like location, ID, content, environment and relations and activities which can be bound to physical artifacts. These artifacts, the channels and the user can utilize the sensor information.

5. MANAGING INTERRUPTIONS AND FOCUSING THE USER’S ATTENTION

During a mobile learning process users are facing various sources of interruptions that are not present in stationary learning. The simplest is an incoming call or voice chat on the mobile device that requires immediate action and a temporary suspension of the learning process.

Being mobile, a user often has only small, unplanned time spaces to use for learning purposes which makes this process fragmentary and requires a special structure and content delivery [3].

Thus it is important to understand how technologies, interactions and media have to be designed to allow a seamless flow of the learning between contexts and how to innovatively integrate them into a learning system [14].

This has been addressed by Looi et al. (2010) to describe their vision mobile assisted seamless learning [15]. To manage the step from mobile to ubiquitous seamless learning different gaps have to be bridged: formal and informal learning settings, personalized and social embedded learning, different learning times and locations, physical and digital environment and social embedded switches between different devices, between different learning tasks and activities [16] [17].

Varying environmental conditions like temperature, sunshine, rain or simply the noise of the environment lead to distraction and to different attention levels of the user during the learning process. Therefore it is important to find ways to focus the attention of the user. Attention switches between the device and the environment distract from the learning experience and can create dangerous situations.

One way to address this issue is to use audio-only presentations in certain situations. They are less intrusive, enhance the surroundings and are already successfully used in different scenarios, like in museums [14].

6. CREATING SUITABLE MOBILE CONTENT

Mobile learning content has to suit the characteristics of mobile learning. Therefore a core idea is to develop mobile content from the start instead of converting existing e-learning material. The special characteristics of mobile learning require special strategies when developing mobile learning applications. Applications developed by following instructional design guidelines can support the user through exploration and conversation and help to facilitate the collaborative work among learners to enable them to develop shared knowledge. Technology can be used to further enrich this knowledge and to make the transfer between different mobile learning contexts easier [18].

Well-designed mobile learning material can help to reduce the cognitive load of the learner. Dividing the learning material into
suitable pieces is a complex task but it helps the learner to access, keep and transfer information [19]. It is important, that these so-called learning snippets, sometimes also referred to as micro-content [3] [20], are produced by didacts. Usually they should be created by the same people that design the lecture material and who are professionals of the teaching and learning field and not as often practiced by the developers or operators of the mobile learning platform. The process of the generation and utilization of micro content, which is delivered within a sequence of micro interactions, was described by Bruck et al. [20].

Martin and Hardt suggest sorting the mobile learning units according to time consumption, complexity and interactivity to match a variety of the different learning situations experienced in a mobile context [21]. The content should consist of small portions to avoid stressing the user and to prevent an information overload. According to Looi (2010) mobile interaction has to be quick and simple [15]. Content has to be flexible to be used across contexts and the special characteristics and affordances of mobile devices that are important to make mobile applications used. Mobile learning not only delivers learning, it supports and enhances it by the use of voice communications, annotations, photography and schedules [14].

7. MANAGING SELF-CONTROLLED INFORMAL LEARNING

The portability and versatility of mobile devices lead to a paradigm shift from didactical and teacher centered learning towards participative learner centered learning [22]. Through the new connectivity and mobility the students are active participants in learning processes instead of passively consuming information. This self-controlled individual learning frequently works without an education institution and needs special didactics. It is characterized through the absence of pre-defined learning goals and dedicated control of the learner. So et al. (2008) differentiate four types of formal and informal learning while using mobile learning technologies: planned learning situations in classrooms, planned learning outside the classroom, unplanned learning outside the classroom and unplanned learning inside the classroom [22].

The learning process being informal and self-organized requires that the learner has to motivate himself to organize this process, to effectively gather information and resources and to manage his time. Learners must have an incentive to use e-learning software. Small achievement steps regarding the learning and a shared learning status with friends and colleagues help to sustain the learning process. Applications can proactively request the learning activities based on a schedule.

To address the motivation issue, elements of game based learning can be used. The presence of a challenge and immediate feedback are important to make mobile applications and games engaging, enjoyable and motivating for learners. In studies, the more students played, the more engaged they were. They established a flow that was increased over the course of the game [23].

Self-control and self-monitoring questions have to be explored interdisciplinary. Scaffolds can help the learner to gain self-monitoring competence in resource based learning. Adaptive assistance concepts that adapt to the self-monitoring competence of the learner need to be researched [24].

Self-controlled learning in an academic environment often needs a possibility of reflection and supervision by the teaching staff. This way processed mobile learning content can be asynchronous checked and enhanced by the teachers.

To enhance applications to better support self-controlled individual learning social scientists are required to measure the appeal of M-Learning applications, psychologists to investigate the learning process and computer scientists develop algorithms for log file data mining and adaptive behavior. This information is to be used as a source for application and content designers to create more appealing, easy to learn and to handle learning applications.

8. DATA COLLECTION, SECURITY AND ETHICAL ISSUES

During mobile learning data about the user and learning process has to be collected. Methods used should be unobtrusive and should not change the learners’ behavior. Therefore log files that record the user’s action just in time are suited to explore the student’s learning behavior [25]. However there are few validated instruments to capture and compare mobile learning due to its dynamic nature and the connected challenges.

Several security and ethical questions arise whenever data collection is necessary, as experienced in the mobile learning context. These issues are usually the concern of data security experts during the planning process of an M-Learning application and can also contain legal aspects. Lonsdale (2004) lists five main questions considering the ethical implications that contextual data arise [12]:

1. What information do we obtain?
2. How do we obtain it?
3. What do we use it for?
4. What risks are there in doing this?
5. What do users think about it?

There are further important aspects to consider facing user security concerns. At the installation time of an M-Learning application accessed sensors, information and general data usage should be shown and clarified by an opt-in request. This includes information about which data is saved on which location, be it on the phone or on servers, and who is allowed access the data. Ideally the data is only accessed by the learner himself. Especially assessment results are noteworthy in this context. If data is used for statistical purposes it should be saved anonymized. On request of the user the data should be deletable from the device as well as from the webserver. Only data really necessary for the learning process and for the mobile learning application should be collected. All communication should be encrypted and all collected data should be stored encrypted.

9. INTERDISCIPLINARY MODELS

To capture the nature of mobile learning and allow a structured analysis and planning of mobile learning applications and processes several models and frameworks were developed, often proposing an interdisciplinary view on the topic.

An often cited model to describe the complex nature of mobile learning is FRAME by Koole (2009) [19]. According to it, mobile learning is located at the intersection between device aspects, learner aspects and social aspects.
The degree of the usage of the aspects is measurable and can be a help to generate a more effective learning experience in certain learning situations. Based on different segments of this model Koole developed an additional checklist to plan and analyze mobile learning environments. The core of the model, the effective learning is evaluated based on the criteria of mediation, information access and information selection and knowledge navigation.

Derived from FRAME and the results of current mobile learning research Petit and Santos (2014) developed a contextual, technology oriented framework [6]. It positions learning opportunities according to experiences and interactions of the user in specific spaces at certain points of time. A different, more pedagogical perspective offers the framework of Kearney et al. (2012) which focusses on the mobile learning aspect without considering the technical peculiarities [26]. It shows the convergence of authenticity, collaboration, and personalization featured by the use of space and time. Following this framework the usage of relevant pedagogical dimensions for mobile learning processes can be planned.

10. CONCLUSION

There is a wide field of interdisciplinary issues in mobile learning. A lot of these aspects are hard to grasp and there are many research questions still to be explored. It was shown that most mobile learning issues cannot be solved by one academic field alone but have to be a joined effort of interdisciplinary research. Models covering several aspects have been developed and can be the foundation for further concepts and evaluations. Guidelines for interdisciplinary research, common definitions, methods and foundations and proof of concept projects are needed to perform these tasks. These will provide a way to further advance mobile learning and achieve a deeper understanding of the research field and its benefits.

11. REFERENCES


