

モバイル学習の効果—実証研究文献の概説—

The Effectiveness of Mobile Learning: A Critical Review of Empirical Literature

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ABSTRACT

ワイヤレスモバイル技術は多様な教育状況の中に取り入れられてきた。モバイル学習の長所は学習者がいつでもどこでも学習を可能にすることであり、多くの研究者は学習の新しい変革の可能性を信じている。しかし、いくつかの研究は学習者が学習にモバイルデバイスを使うことを好まないことに加え、技術の限界について批判している。モバイル学習への疑問があったとしてもモバイル学習をそれぞれのフィールドで実践してきた多様な研究は肯定的な結果を報告している。本論文は、これらのモバイル学習の効果を評価してきた実証研究を概説する。その結果、モバイル学習は相互作用を促進し、学習成果を高め、クラスの管理を支援し、非公式学習に積極的に使われることが示された。この結果に基づき、モバイル学習の可能性と将来の挑戦について議論した。

Wireless mobile technology has been adopted in a various education contexts. The advantage of mobile learning is that it allows learners to study at anytime and anywhere. Researchers believe that it heralds a new revolution on learning. However, some studies criticize this facility from the point of view of technical limitation, as well as learners' unwillingness to use mobile devices in their learning. Even though there have been doubts about mobile learning, researches on the application of activity which apply mobile learning in various fields have reported positive results. This paper reviews the empirical studies which have evaluated mobile learning's effectiveness. Results indicate that mobile learning facilitates interaction, improves learning performance, supports class management and is actively employed for the purpose of informal learning. Based on these results, the potential of mobile learning and future challenges are discussed.

1. Introduction

The growth of wireless mobile technology is promising a new revolution on learning. Sharples (2000) proposed the potential that the personal mobile technologies could enhance lifelong learning and continuing adult educational opportunities. Abernathy (2001) insists that mobile learning doesn't seek to replace the PC, but instead it will help supplement corporate learning objectives. This mobile learning has been applied in a variety of educational, governmental and industrial setting (Mcconatha & Praul, 2008). Commonly mentioned the advantage of mobile learning is that it allows learners to study at anytime and anywhere.

On the other hands, some studies emphasize the technical limitation as well as learners' unwillingness to use mobile devices for their learning (Shudong & Higgins, 2006). The portable devices' small screen, low resolutions and input limitations are weakness of mobile learning (Bryan, 2004; Houser & Thornton, 2004). And it is found that the students rarely use their mobile-phones for learning purpose (Thornton & Houser, 2005). In addition, there is worry that the surrounding situations would often interrupt the learning in mobile learning context. Also, it is still high-cost technology to access ordinary Internet web pages from mobile devices. Lastly, some studies say that Short Message Service could be harmful to a student's grammatical development because text message tend to be compact and time riddle with incorrect spelling mistakes (Attewell, 2003).

Despite doubts on mobile learning, a piece of research which applies mobile learning on their fields has been reporting positive results. This paper reviews the empirical studies which have evaluated mobile learning's effectiveness. It is found that facilitating interaction, improving learning performance, supporting to manage the class and supporting informal learning are outstanding the recent

effectiveness of mobile learning. These results are described in detail in the following sections. Finally, this paper discusses the future challenges and potentials of mobile learning.

2. A definition of Mobile Learning

Generally speaking, mobile learning is learning accomplished with the mobile devices. These mobile devices include cell phones, PDAs, and any kinds of portable media players such as MP3 players and electronic book. The initial research was to integrate learning materials into the portable devices (Peters, 2007), but recently Web 2.0 technologies or social network services such as Facebook and Twitter, have made mobile learning more interactive and dynamic (Park, 2011).

The researchers of mobile learning agree that mobile learning is not just about the mobility of the technology but also the mobility of the learner. Learning across contexts is getting recognized as a critical characteristic of mobile learning (Walker, 2006). Accordingly, Sharples, Sánchez, Milrad and Vavoula (2007) suggested that "the mobility of learners augmented by personal and public technology can contribute to the process of gaining new knowledge, skills, and experience (p.3)".

3. Effectiveness of Mobile Learning

This paper analyzed the results of empirical studies on mobile learning which have been published between 2006 and 2010 year. To access the initial body of literature, the keyword search that utilized the following words and word combination: (a) mobile learning, (b) m-learning, (c) ubiquitous learning, was conducted within the academic journals of Education. Altogether, we collected 89 articles and 57 were discarded because they are not empirical research, but theoretical or opinion papers. According to analyzing the empirical

effectiveness of mobile learning, it is concluded that the mobile learning is effective for improving interaction, improving learning performance, supporting to manage a class and supporting informal learning.

3.1 Improving interaction

People usually bring their mobile device all the time, and check the message which is from mobile phone immediately. Therefore, this characteristic can improve interaction between students and students as well as a teacher.

Huang, Jeng and Huang (2009) introduced the mobile blogging system. The experiment took place two months with 40 college students who major in engineering science in Taiwan. The participants were divided into five groups. Each group was assigned the different topic and was asked to contribute the learning sources and discussion. Therefore, there were five topics on the mobile blogging system. The lectures were generally conducted in a class. Students could learn the course topic both from lecture as well as the mobile blogging system. After using the mobile blogging system for two months, effectiveness of the system on collaborative learning was examined by online survey. The results showed that the students perceived this mobile system as a helpful, convenient tool in a collaborative learning activity. Also, it found that the mobile blogging system could provide more authentic context learning examples and help to solve the coordination issues in a collaborative learning environment.

Jarvela, Naykki, Laru and Luokkanen (2007) investigated the way to facilitate individual and collaborative learning with smart-phones. The researchers used Mobile Lecture Interaction (MLI) tool to facilitate higher education students' self-regulated learning in university lectures. This tool allows the students to ask questions, answer polls, and vote on presented questions. And surveys and interviews were conducted to explore students' re-

flecting on the use of the tools. The students reported that they were more active in thinking of questions while using the tools. Also, the students said that the use of the tool supported their engagement in the content and lecture as well as their feeling of belonging to a group.

The mobile technology enables the learners to communicate instantly. This characteristic plays a critical role for successful online learning activity. Response time is found to be a critical factor of the learners' high satisfaction on cooperative learning through the internet. If the message sender did not receive the comment within the expected time frame, he or she might feel frustrated and perceive less social presence, which in turn resulting in less engagement in learning. This problem can be solved by mobile communication devices. It is already conducting that the learning management system or personal email server can send Short Message Service (SMS) to notify the learner on the receiving of specific email. This service enables prompt interaction among learning and building their positive social presence.

3.2 Improving learning performance

There are a growing number of the mobile applications to support learning. These applications enable students to conduct learning or to access learning materials whenever or wherever they want.

At the Near East University, the research team developed Mobile Learning Tool or MOLT, and investigated its potential in teaching the technical English language word (Cavus & Ibrahim, 2009). The MOLT was the computer software to send the SMS to a mobile phone. The experiment was carried out with 45 first year volunteer students majoring Computer Information System. MOLT operates between the hours of 9am to 5pm, and every half hour sends the SMS to all participating students. The messages contained the new technical English words. The 16 messages were sent daily, and total 48 messages

over three days. The result showed that the students got higher success in the test after MOLT was used than the previous test. And the students said that they could easily remember the words that were received on their own mobile phones.

Rau, Gao and Wu (2008) compared the effectiveness of using different technologies for learning. The researcher conducted a three-week experiment with 176 juniors in a vocational senior high school in Taiwan. In the experiment, the researchers divided students into the four groups and provided the learning material and the instructor's encouragement via four different types: Short Message Service through a mobile phone, email, online forum and all information in the class without using digital media. The researchers measured the students' learning performance, pressure and motivation. Learning performance was measured with the quiz score at the end of each week. A five-point scale consisting of six items measured motivation and pressure. The results indicated that the SMS group significantly increased students' perceived performance and motivation. The control group using traditional Email and Online tools showed no significant difference.

Another study was conducted using a mobile tool designed to improve students' knowledge by means of self-assessment in junior school, high school and college (De-Marcos, Hilera, Barchino, Jimenez, Martinez, Gutierrez, Gutierrez, & Oton, 2010). The researchers developed the web-based system to support mobile self-assessment in traditional a class-based learning context. Their research purpose was to examine the effectiveness of mobile self-assessment activities on students' learning achievement at different ages. There were three experimental groups. The first group was 50 14-15 year-old students, and another group was 48 17-18 year-old students, and the other group was 28 20-21 year-old university students. The teachers developed the self-assessment test with ten questions for each

learning objectives. All participants installed the program, which contained self-assessment tests on his or her mobile phone. The teachers and technicians assisted the participants to use the program. The students were asked to complete every test. The results showed that all three experimental groups achieved a higher score than the control group on the exam.

Thornton and Houser (2005) reported on their study of data and opinions regarding mobile learning and its use in a Japanese University. The researcher evaluated outcomes when distributing the classroom material using mobile phones, both via e-mail and using Wireless Application Protocol (WAP) technology for web enabled phones. It was mentioned that in Japan, rates for cell phone plans are far less expensive than in the United States, which allowed more students to take part in mobile learning study and research. The researchers observed improvements in test scores ranging from between 35% and 75%, using pre-post test measures over paper materials alone. The students' reactions to this new learning opportunity were positive. The researchers noted that since the cell-phone is so well established in Japan, distributing educational material through them is a relatively effortless process. Also, they stressed that interactivity in content seemed a superior teaching method when compared to using static web pages alone for distributing material.

3.3 Supporting to manage a class

SMS is useful for administrative work such as announcement, reminding dates, advertising school events, and so on. The reason is that people rarely miss the messages of their mobile phone.

At Kingston University, an experiment was undertaken to research the effectiveness of a two-way SMS campaign in the university environment (Stone, Briggs, & Smith, 2002). They developed a system that sends SMS to students. The messages

were about their schedule, changes in it, examination dates and places and student's marks. After registering, the students were automatically separated in 5 different groups. One group was receiving announcements via e-mail, other 3 groups via SMS and the last via web. They compared the effectiveness of email, SMS, and the web as a method of announcement and communication. The results showed that the number of responses of the SMS groups was much more than the other groups. In addition, the students' response time of SMS group is faster than Web. Also, the study found that the students felt the SMS's information is more personal and they most preferred SMS to get the announcements.

Shen, Wang and Pan (2008) developed a system to manage a large-size blended classroom where has a traditional lecture and real-time interaction through mobile phone. The system enables the instructor to monitor all online students' mobile phone screens, to facilitate instructor supervision of students' learning activities and to provide guidance when necessary. The system also provides several teaching-assisting functions such as a real-time poll and text-messaging exchanges, to enable the instructor and the students to freely and timely communicate about their learning status and about students' suggestions for better learning. According to the instructor's reflection, this new way of teaching was very helpful. The two-way interaction and the active student participation motivated the instructor in the teaching process as well.

3.4 Supporting informal learning

The informal learning settings, mainly museums, are largely adopting mobile devices to make their exhibition more attractive and more informative.

Hsi (2002) introduced the electronic guidebook in which mobile web content was created for Exploratorium Museum in San Francisco. The electronic guidebook provided additional information of the

exhibition which is the nearest to the visitor. The researcher conducted the survey of the teachers who had used this guidebook. According to the results, the teachers think that the mobile guidebook would make museum visits more of a learning activity.

Sung, Chang, Lee and Yu (2008) explored the effect of a mobile electronic guidebook on visiting behavior in a museum. They compared two visiting modes, one through visiting with the electronic guidebook and another through visiting without it. 42 college students were invited to visit the National Museum of History in Taiwan. The researchers analyzed the students' behavior. According to the results, the students who looked around the museum using the electronic guidebook showed more inquisitive behaviors and their behavior patterns became more directional.

4. Conclusion

This paper has seen the empirical research to examine the effectiveness of mobile learning. Mobile learning improves interaction and learning performance, and supports to manage a class and informal learning. This paper further encourages to those engaged in mobile learning development and serves as a primer to those planning to embark on it.

Nowadays, mobile learning has been applied in various areas, but it still faces several challenges for its future development. In addition to the technology issues, such as the convergence of wireless infrastructure with handheld devices, the smoother delivery of learning content and the innovations in content creation, this study will discuss three main challenges of mobile learning.

The first challenge arises from the concept of adaptive learning. Since the wireless network enable the learners to be engaged into the learning anytime anywhere, the learner may pursue learning at various location and atmosphere and with various

motivation. Under such circumstance, these learners' conditions should be taken into consideration, and the instructional strategies and learning content should be designed to adapt to learner's profile and personal needs.

The limited text display is also challenging in support the learning. However, the mobile technologies can support the learners to be often involved in learning process instead provide rich information. Therefore, the mobile learning could play a supportive role in providing continuous learning activity during the learning courses. For example, reviewing keywords and simple quiz on the learning subject over time is a powerful method of enhancing learning performance. Mobile learning can extend such opportunity from the instructor's lecture to the learner's daily life.

How mobile learning can be integrated with formal education is another challenging issue. Learners can extend their classroom learning to homework, field trips, and museum visits by mobile learning. On the other hand, these mobile devices could also disrupt the carefully managed environment of the classroom. Wang, Shen, Novak and Pan (2009) suggest to provide an orientation to help students understand the scope of mobile learning activities and a reward system for students to get engaged, and suggest to make an activity simple and interactive. Also, Librero, Ramos, Ranga, Triñonab and Lambertd (2007) emphasize that mobile learning activity should have fun so that students are willing to spend their time and money when they have freedom of deciding on whether study or not.

As explained the above, in order to maximize the learning effect of technology while handling its limitations, the researchers and educators need to take more consideration on how the mobile learning environment is designed. The mobile learning design should be based on sound theoretical grounds and the informed previous research results

rather than derived from intuition.

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