Wong, L.-H. et al. (Eds.) (2013). Proceedings of the 21st International Conference on Computers in Education. Indonesia: Asia-Pacific Society for Computers in Education

Research on mobile and web 2.0 learning: A comparative review approach

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Abstract: Contemporary E-learning research tends to separately evaluate the effectiveness of mobile learning or web 2.0-based learning. Although the independent use of these technologies in the short term reveals substantial research value, in the long run, if we can integrate the various technologies according to their tool-specific features, this combination will be able to bring students greater learning benefits than their individual use. By means of reviewing and comparing both aspects of research articles published in six major SSCI journals from 2006 to 2010, this study primarily aimed to understand the individual current mobile and Web 2.0-based learning research. The results should be helpful for researchers in identifying interesting topics for further exploration. A comparative analysis of both literature tracts could then predict the potential benefits of integrated use of different technologies, suggest practical recommendations for implementation, guide the direction of educational applications, and provide effective instruments for evaluation.

Keywords: Social learning, Mobile learning, Evaluations

1. Introduction

Over the years, researchers have endeavored to use different tools to facilitate students' learning. For example, conducting learning with mobile devices (mobile learning) developed earlier and obtained many practical learning effects. Mobile learning helps to encourage children to explore outdoors and learn actively. For example, an encyclopedia of ecology for mobile devices might facilitate students to better understand animals they may encounter (Chen, Kao, & Sheu, 2003). Also, a guide agent might suggest students to visit a certain path In wetlands (Tan, Liu, & Chang, 2007). It can be said that one feature of mobile learning is to reconnect students to nature, which can be a knowledge enriching experience.

Similarly, although Web 2.0 technologies developed later than mobile learning, they are also gradually rising as a useful tool to support learning. In Web 2.0, learners can read and simultaneously write in the Web, during which learners become both the consumers and producers of learning resources. For example, blogging is now being widely used to facilitate discussions among students by publishing students' comments on an e-learning web site (Hou, Chang, & Sung, 2009). Numerous virtual professional communities have developed to stimulate knowledge sharing among experts. As a result, one of the main features of Web 2.0-based learning is to enhance communication and collaboration among participants in the Web-based learning (Huang, Yang, & Tsai, 2009).

Contemporary E-learning research tends to separately evaluate the effectiveness of mobile learning and web 2.0-based learning; however, in other areas, many examples of integration applying both tools can be found. For instance, ecologists have taken their handhelds and probes to a stream for water-quality evaluation, resulting in more efficient water management (Chaubey, Cherkauer, Crawford, & Engel, 2011). The report of aggregated datasets creates awareness of environmental issues. Sociologists share local folk customs to research peers with mobile devices for characterizing social behavior in a society (Mercer, 2009).

With an experience in the development of mobile learning and web 2.0-based learning, we have seen an emerging trend in the integration of web 2.0 technology into mobile learning. Through

the review, analysis and comparison of previous research results regarding technology-enhanced learning, which allows for a unique understanding of the characteristics of each technology and a prediction of the potential benefits of integrated use of the different technologies.

2. Methodology

In this section, we intend to investigate the research status of both mobile and Web 2.0-based learning from 2006 to 2010. Six major research journals related to technology-based learning were selected for analysis, including the British Journal of Educational Technology (BJET), Computers and Education (C&E), Educational Technology & Society (ET&S), Educational Technology Research & Development (ETR&D), Interactive Learning Environments (ILE) and Journal of Computer Assisted Learning (JCAL). These journals have been widely accessed and are recognized as having high impact factors according to the Institute for Scientific Information (ISI) Journal Citation Reports. We aim to answer three research questions as follows:

1. What interactive patterns among humans, computers, learning objects and contexts are revealed in the research?
2. How are technologies such as PDAs, mobile phones, Blogs, and Wikis used by students and teachers in these articles?
3. What data collection methods are used in the research?

2.1 Searching and selection procedures

This study surveyed both the mobile learning and Web 2.0-based learning papers published in Social Science Citation Index (SSCI) database from 2006 to 2010. Six major technology-based learning journals were reviewed, including the BJET, C&E, ETS, ETR&D, ILE and JCAL. These journals are widely accessed with high impact factors based on journal citation reports released by the ISI.

Two experienced researchers were asked to scan 93 mobile learning papers and 89 Web 2.0-based learning papers of these six journals using keyword searches including mobile learning and web 2.0 (blog, micro-blog, photo-sharing, social bookmarking, social network, wiki, youtube etc.). Only papers identified as being of the type ‘articles’ in the SSCI were considered. In addition, any publications that focused purely on examined usage profile, viability as an assessment tool, and attitudes without conducting the topic of learning outcomes were excluded. The precision of selected articles was checked by two researchers. After two iterations of selecting the papers and discussing inconsistent decisions, 31 articles concerning mobile learning and 24 articles concerning Web 2.0-based learning were identified.

2.2 Data analysis

To answer the first research question, we used Sung, Chang, Hou, and Chen’s (2010) human–computer–context interaction (HCCI) framework to guide our analysis and coding. This framework explicates four levels of interactive patterns among humans, computers, learning objects and contexts, namely as 'peer-computer-context', 'student-computer-context', 'student-computer-object', and 'student-computer'. Two new subcategories also emerged from the data, namely 'peer-computer' and 'peer-computer-object'.

As demonstrated in Figure 1 below, there are six levels of interactive patterns (Sung, et al., 2010). Level one is the student–computer interaction, in which students may access information in computers. Level two is the student–computer–object interaction, where a system can draw students’ attention equally to real objects (e.g. real exhibits) and virtual materials (e.g. web pages), rather than only the virtual material itself. Level three is the student–computer–context interaction. At this level, students not only pay attention to the physical features of the real objects, but also interact with the context of real objects (e.g. historical background or cultural context) to have a more in-depth learning experience. Level four is the peer–computer interaction, where students can communicate with peers

by using computer-medicated technology. Level five is the peer–computer–object interaction. At this level, students will discuss with peers about the learning objects. A system can facilitate the interaction between each of the visitors based on their common concerns with the real objects. Level six is the peer–computer–context interaction. The difference of interaction between levels five and six is that level six includes the feature of supporting peers to exchange everyday situations in relevant contexts. At level six, learners can provide the necessary context information; however, a system at level six needs to provide some mechanisms to integrate scattered information into a complete context.

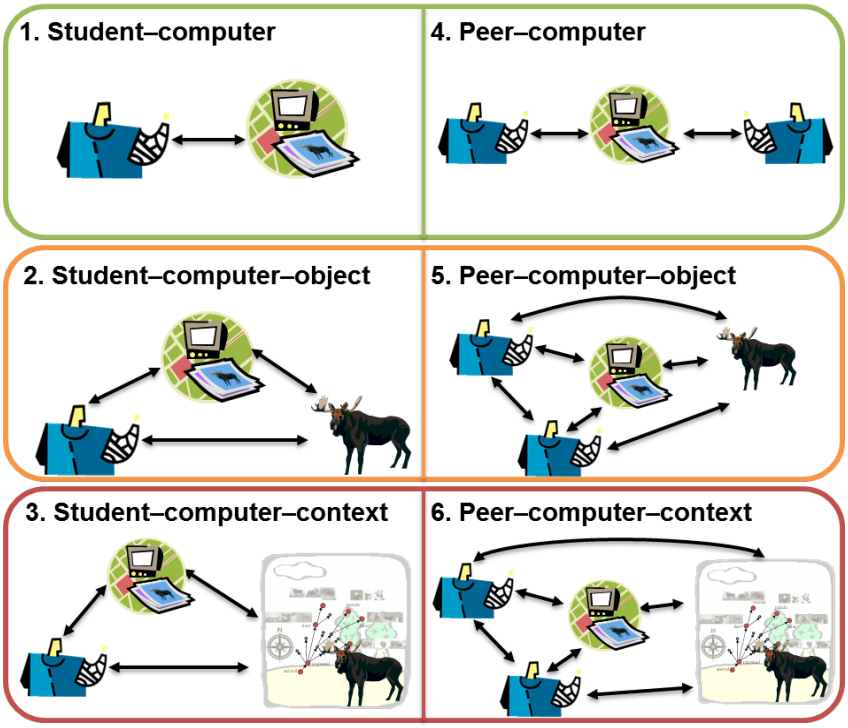

Figure 1. The types of interactive patterns

To address the second and third questions, we employed Churchill and Churchill's (2008) approach. The ways in which technologies may be used were categorized into the following subcategories, including 'multimedia access tool', 'communication tool', 'capture tool', 'representational tool', 'analytical tool', 'assessment tool', and 'task managing tool'. The data collection methods, on the other hand, were categorized into the following subcategories, including 'test or quiz', 'questionnaire', 'interview or focus group discussion', 'observation', and 'content analysis'.

3. Results and Discussion

3.1 Interactive pattern

Figure 2 shows the analysis suggested that the two most common patterns centered on student-computer interaction (32.3%) and student-computer-context interaction (25.8%) in mobile learning articles, and peer-computer interaction (45.8%) and peer-computer-object interaction (33.3%) in Web 2.0-based learning articles. Only a few studies applied peer–computer–context interaction in either mobile learning (6.5%) or Web 2.0-based learning (12.5%).

Although 8 papers applied student-computer-context interaction in their mobile learning research, which is high, the effort to design and maintain a context-aware learning content was also considerable (Hsiao, et al., 2010; Liu, et al., 2013). The researchers typically struggled with context awareness as an important enabler of more situated learning. The next frontier (peer–computer–context interaction) is not yet well populated. This indicates that there is a great potential for researchers to extend the Web 2.0 services to mobile learning, where learners provide the necessary context information.

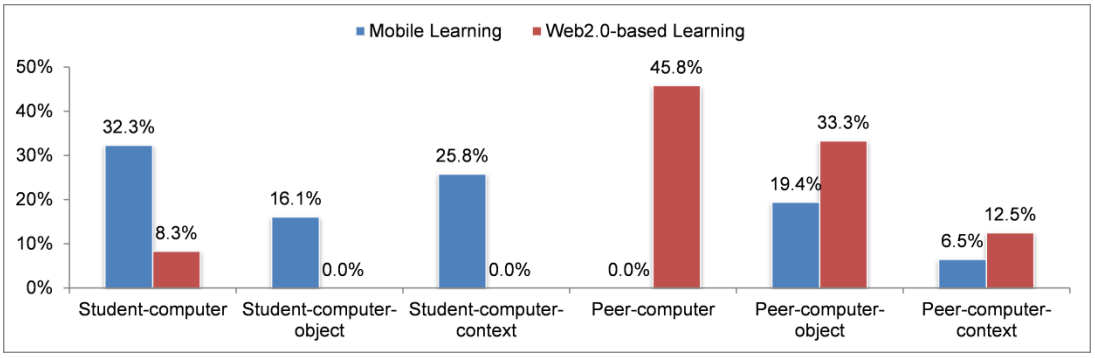

Figure 2. Interactive patterns of both mobile and Web 2.0-based learning articles selected from 2006 to 2010

3.2 Uses of technologies

Figure 3 reveals that the two most frequent uses of technologies centered on utilizing the devices for multimedia access (93.5%) and task management (71%) in mobile learning research, and communication (75%) and representation (79.2%) in Web2.0-based learning research.

Overall, this implies that mobile devices have been used as a tool to enhance information availability and accessibility, and to extend the learning environment far beyond the classroom walls and school schedules. However, pure content delivery is a rather poor way to activate learners or motivate them for deeper learning (Frohberg, Gothe, & Schwabe, 2009). Thus, some alternative tools such as capture and assessment tools can promote active learning rather than merely passive. On the other hand, use of technologies as communication and representational tools in Web 2.0-based research is natural and within expectations. However, few web2.0-based learning studies support the tools to realize higher pedagogical goals, as mobile learning research did (e.g. half of mobile learning research conduct the assessment as an instructional strategy to guide students' learning with mobile devices, such as Chu, Hwang, Tsai, and Tseng's (2010) and Hung, Lin, and Hwang's (2010) research). Thus, this implies that integrated use of different tools will provide a variety of functions to facilitate deep learning. Furthermore, it is worth paying more attention to the development of analytical tools for acquiring immediate analyzed results (e.g. use of graphing programs to plot temperature data, or use of social network analyzing tools to visualize learners' social networks (Dawson, 2010).

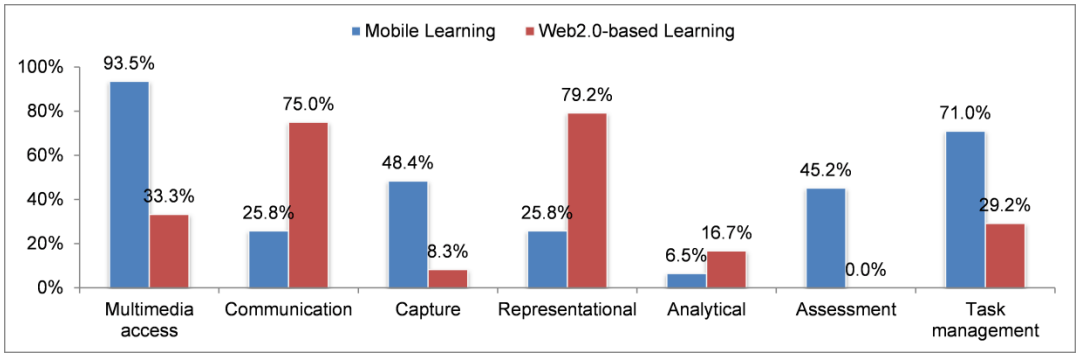

Figure 3. Uses of technologies of both mobile and Web 2.0-based learning articles selected from 2006 to 2010

3.3 Data collection methods

Figure 4 shows that the most common data collection methods for mobile learning articles and Web 2.0-based learning articles are test or quiz items (77.4%) and content analysis (70.8%), respectively. ingle line spacing throughout the document.

This implies that mobile learning research prefers to conduct the quantitative approach to evaluate their research results. On the contrary, Web 2.0-based learning research opts for qualitative analysis. Thus, we advocated using mixed methods (both quantitative and qualitative approaches) when conducting studies of integrated use of tools. In addition, because the integration technology environment could keep records of both the learners' learning processes and their social interactions, it allows researchers to explore the relationships between social behavioral patterns and learning performance in the future (Lee, McLoughlin, & Chan, 2008).

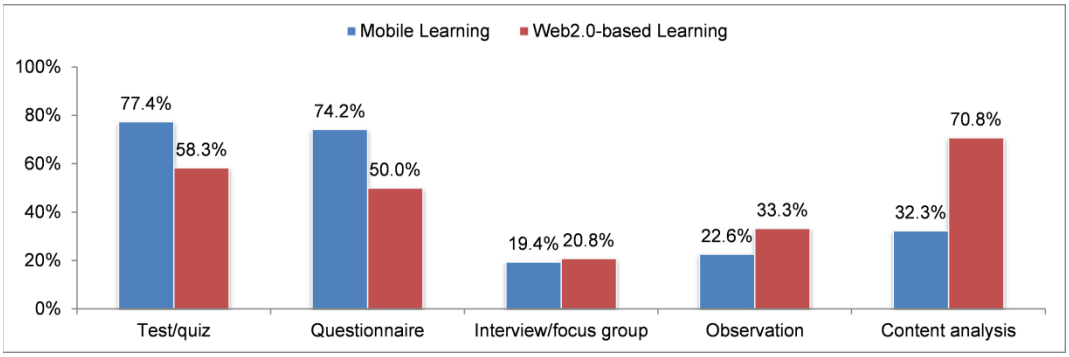

Figure 4. Data collection methods of both mobile and Web 2.0-based learning articles selected from 2006 to 2010

4. Conclusions

While considerable attention has been paid to both mobile learning and Web 2.0-based learning, their current development progressed slowly and in a limited way (Frohberg, et al., 2009). For example, Frohberg, et al. (2009) found that most mobile learning projects were in independent and formalized contexts, but hardly any in a socializing context. Similarly, Hughes (2009) noted that there was high use of Web 2.0 tools for playful activities, but low use of collaborative knowledge construction. With an experience in the development of mobile learning and web 2.0-based learning, we have seen an emerging trend in the integration of web 2.0 technology into mobile learning, so called mobile web 2.0 learning. Therefore, this study reviewed and compared both aspects of research articles published in six major SSCI journals from 2006 to 2010. The results can firstly understand the current status of mobile and Web 2.0-based learning research (in particular, the current E-learning domain lacks a

review of Web 2.0-based learning research). In addition, a comparative analysis of both literature tracts could then realize their characteristics.

Acknowledgements

This work was supported in part by the National Science Council (NSC), Taiwan, ROC, under Grant, NSC 100-2511-S-006-014-MY3, NSC 100-2511-S-006-015-MY3, NSC 101-2511-S-041-001-MY3, and NSC 101-3113-P-006-023. This study is conducted under the "Cloud computing systems and software development project(2/3)" of the Institute for Information Industry which is subsidized by the Ministry of Economy Affairs of the Republic of China .

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