An Educational Mobile Blogging System for Supporting Collaborative Learning

Yueh-Min Huang, Yu-Lin Jeng and Tien-Chi Huang

Department of Engineering Science, National Cheng Kung University, No.1, University Road, Tainan City, Taiwan, R.O.C. // Tel: +886-6-2757575 ext. 63336 // Fax: +886-6-2766549 // huang@mail.ncku.edu.tw // jeng@easylearn.org // kylin@easylearn.org

ABSTRACT

With the gradual adoption of "Web 2.0" technologies, one of key Web 2.0 technologies, blog, has become a popular and wide-accepted Web application. Although mobile device users can access the Web whenever or wherever the need arises, there is not an easy way to publish their thoughts and experiences via blog articles. In this study, we offer a solution by designing a mobile blogging system which enables mobile bloggers to publish their comments in authentic context anytime and anywhere. We show that with the help of the mobile blogging system, we can establish a collaborative learning model for students in virtual classrooms. The results revealed from the learning outcome are positive and encouraging regarding the effectiveness of the supported collaborative learning model. In the conclusions, we discuss the findings and applications of the proposed system in collaborative learning.

Keywords

Collaborative learning, W/H device, Blog, Information retrieval

Introduction

By the introduction of CSCL (Computer Supported Collaborative Learning) to e-learning, many studies have revealed CSCL to be a successful learning scheme in the field of pedagogy. Using this kind of pedagogy, learners not only can concentrate on their own assignments and projects but also can work collaboratively with other students to achieve goals, and in so doing, enhancing their own learning (Koschmann, 1996; Dillenbourg, 1999). For mutual benefit, the learners are inspired to achieve efficient learning. A positive interdependence is produced among the learners, since they are aware that other members are working together with them towards a common outcome (Kravcik *et al*., 2004). In recent years, due to the rapid development of information technology (IT), collaborative learning now takes place on the Internet as well as in traditional classrooms (Carchiolo *et al.*, 2002; Serce & Yildirim, 2006; Gogoulou *et al*., 2007).

Due to the rapid emergence of wireless communication technology and mobile devices, the use of handheld technology in education has increasingly been the object of study in recent years. From laptops to wireless phones and handheld devices (or W/H devices for short) (Motiwalla, 2005), the nature of higher education has been altered through the massive infusion of computing devices and the rapid improvement of Internet capabilities (Green, 2000). Via wireless technology, W/H devices can be synchronized with or connected to computers or wireless networks (WiFi, GPRS, 3G, etc.). Research has shown that W/H devices provide new opportunities for communication and innovative learner interaction both in and out of the learning setting (Chen *et al*., 2003; Tatar *et al*., 2003; Clough *et al*., 2007). However, there is no clear consensus on how to evaluate the benefits of applying wireless technologies to collaborative learning environments.

This paper presents an implementation of W/H devices in support of a blogging learning system on a real curriculum. The goals of the study are not only to investigate the effects of learning process through the use of W/H devices, but to explore students' learning outcomes from three aspects: (1) the learning effects of the mobile blogging system in a collaborative learning model, (2) whether being a mobile blogger can generate positive emotion, (3) whether the interactivity in blogging learning environments can also be seen in mobile blogging learning settings.

We have organized the rest of this paper in the following way: the related works are introduced in the next section and the research methodology is described in the following section, addressing both research design and learning activities. Following, we describe the system description which consists of architecture and implementation details. Afterward, the evaluation of the system with the designed learning activity is outlined; the results and discussions for the various analyses are shown following each of these descriptive sections, and finally, conclusions are presented.

Related Efforts

An Internet forum is a discussion space utilized by individuals interested in a specific topic. However, it is difficult to personalize content within a forum and a Web-based client is usually a user rather than an administrator. This deficiency can be made through the use of an emerging application, the weblog, more commonly known as a blog. A blog is an interactive website that both publishes and collects personal information, according to the purposes and plans of the blog editor (Katerina and Chronis, 2007). Blogging systems generally include the following five features: content which is separated from presentation; presentation templates which are usually provided for bloggers to easily produce blog articles; blogging application programming interfaces (APIs) also help blogging clients use other software, such as Microsoft Word, to publish content to blogs; many information management tools which are offered in blogging systems for content management; and Really Simple Syndication (RSS) a mechanism which offers a subscription to the blogging clients who are interested in specific topics (Lindahl and Blount, 2003). Blogging systems have the ability to support informal communication, shared learning, group reflection, and community building (Nardi *et al.*, 2004; Divitini *et al.*, 2005). Because of these characteristics, blogging systems have begun to be used in educational settings in recent years. An implemented blogging system has been proven to be feasible in an international distance course (Lin *et al.*, 2006). Students were able to use the system to document their learning, and to share experiences and knowledge. Meanwhile, a blogging system is able to provide useful informative auxiliary materials for assisting students' learning (Huang *et al.*, 2008). In addition, blog articles were applied to construct a learning map called blog-based dynamic learning map (Wang *et al.*, 2008). It is designed to provide informative blog articles to assist students' learning. In China, researchers applied blogs to involve new ideas of student assessment. The blog applications help them be toward new functions and goals of authentic and formative assessment previously disregarded in China (Chen & Bonk, 2008). Moreover, difficulties around the issues of direct student-student and student-tutor interactions were addressed. However, some delivery features of a blog increased anxiety among some students, resulting in some cases, in the inefficient use of learning time (Dron, 2003). Through the application of different structural and methodological techniques, these problems can be overcome. Using the learning research methods and learners' experience presented in a blog (Giarr´e and Jaccheri, 2006), researchers or learners have been able to study the relationship between the research process and results (Giarr´e and Jaccheri, 2005). With blog**s**, users can exchange information, discuss research problems, and by drawing upon the expertise of each other, collaboratively find solutions to problems and new applications for concepts without any constraints in terms of time (Mai, 2005; Nicola and Giuseppe, 2006). Nevertheless, most of blogging actions take place on PCs or laptops, which causes the temporal and spatial limitation of publishing blog entries. Under these constrains, blogging learning could not make students notice the features of problems encountered in authentic context. Hence, students could not make particular relevant actions to solve the problems encountered.

Since W/H devices can support cooperative and collaborative learning environment, it greatly enhances mobility, coordination, communication, and organization of materials, negotiation, and interactivity in ways not possible in conventional collaborative learning environments (Zurita and Nussbaum, 2004; Lai and Wu, 2006). Zurita and Nussbaum (2004) indicated the weaknesses of non-tech collaborative learning settings and described how W/H devices improved them in a mobile computer supported collaborative learning environment. Additionally, Roschelle and Pea (2002) have suggested five reasons for using W/H devices in collaborative learning environments: (1) augmenting physical space, (2) leveraging topological space, (3) aggregating coherently across all students' individual contributions, (4) facilitating evaluation of student performance, and (5) providing an easy, instant way to archive student work for future reference. The mobility and connectivity of W/H devices allows the group members to work on a task and to discuss topics with each other even while they are away from the group. Overall, W/H devices provide a more natural, mobile collaboration environment (Imielinsky and Badrinath, 1994; Danesh *et al.*, 2001; Kurti *et al.*, 2007).

Methodology

Research Design

In traditional upper level classes, the teacher would give a lecture on a platform in front of a group of students for around an hour. During the lecture, students could take notes and record key points of the presentation. Once the session ended students could discuss the points of the class amongst themselves and share their notes with each other, but they can no longer access the content of the lecture itself. Because of this, and because of a great deal of

variation in the ways in which students attend to a lecture and record their impressions, after-class discussions could just easily lead to confusion. Nowadays, with the advance of information technology (IT), the lectures could be recorded in digital form and uploaded them to a specific e-learning web site. Thus, students can review the key points of a lecture long after the class has ended up, and by making reference to the original material, correct some of the more obvious deficiencies in their notes. What is more, blogging is now being widely used to facilitate discussions amongst students and to publish students' comments on an e-learning web site. Lecturers can initially upload learning content or a lecture video in a blog system; students can then access the information and post their responses to it. However, the extent to which digital technology can contribute to learning has not yet been fully realized, and the next step in this exciting field is to find ways to free students from the limitations imposed by the need for access to desktop computer facilities. As it stands today, it is difficult if not impossible for most students to engage in meaningful digitized learning without cumbersome computer hardware, in a specific and fixed location. To address this issue, we proposed a mobile blogging learning environment to support learning activity via W/H devices, which aid in the construction of a truly modern collaborative learning environment. Then we proposed an activity design which is described as follows.

This section introduces the research design concept of the paper which applies the mobile blogging system to facilitate the learning activity in a collaborative learning environment. When we look at technology-rich learning environment, we need to look at activity from both a *'Design'* and *'Use'* perspectives (Wasson & Ludvigsen, 2003; Wasson, 2007). Figure 1 illustrates the 'Design' and 'Use' perspectives which direct a technology enhanced learning environment to deep thinking and analysis. Besides, we add two perspectives 'Mobility' and 'Blogging Application' to emphasize a mobile enhanced learning environment to make a more concrete description. The pedagogical view of collaborative learning can be regarded as the theoretical fundamental of *design* perspective and technology also supports the *design* view of the system. After students manipulate the mobile blogging system in a learning activity, the *use* from collaborative and technological perspective should be observed in the experimental process which can further influence the *design* aspect by evaluating the learning effect of students. When constructing the learning activity from *design* and *use* perspective, the concept of mobility and blogging application are embedded into the learning activity. Implementation of the *design* perspective from mobility and blogging application aspects brings collaborative learning environment a technological-enhanced issue and influence result of the activity brings a discussion room by this study. According to the *use* perspective, we designed an experiment in which students carry out the designed learning activity in a collaborative learning environment. After the experiment, the evaluation which is inferred from collaborative and technological perspective can reveal the learning outcome of students.

Design of the Learning Activity

This activity design was intended to investigate the assistance of using handhelds to support a normal learning activity in a collaborative learning environment. The experiment stresses a need to place students in a mobile collaborative learning environment in which they can engage in effortful interactions with blogging system and learning companies in order to achieve the learning goal. The designed learning activity took place over two months in a semester, and the participants included 40 college students who major in engineering science of National Cheng Kung University in Taiwan. The participants are all sophomore students in college and they all have mobile devices which support network communications. The students are all familiar with the operation of personal computer and mobile devices so that they can soon be familiar with the operation of the mobile blogging system. We developed the learning activity based on collaborative learning conception and constructed the technological environment, designed the help and assistance for the deployment. The detail collaborative learning activity is described as follows.

The testing course is called data-structure which depicts the way of storing data in a computer so that it can be used efficiently. The basic concept of data-structure contains *Arrays*, *Stacks*, *Queues*, *Linked Lists* and *Tree*, and they should be learned step by step so that students can learn the entire concept more concrete. In the beginning of the learning activity, the students were divided into five groups and each group was assigned a topic from the five types of the course. During the experimental period, each group was asked to contribute the learning resources and helpful discussion content for the assigned topic. Thus, there were five blogging topics on the mobile blogging system; each group maintained the blog content of a topic and all groups needed to read the blog content of five topics on the mobile blogging system. They can also discuss about the related topic on mobile blog as well as solve the question posted on it. The lecturer conducted the learning activity in class from the sequence of *Arrays* to *Tree*. Students can both learn the course topic from the lecture as well as the mobile blogging system. The students were all equipped

with handheld devices and they were asked to view and post the articles/questions on the blogging system. In this learning activity, the group was to:

1. Organize a collaborative group effort to contribute the related topic of the course as well as promote the understanding of the entire concept.
2. Produce a report of the assigned topic which contains the learning material, lecture note and discussion result.
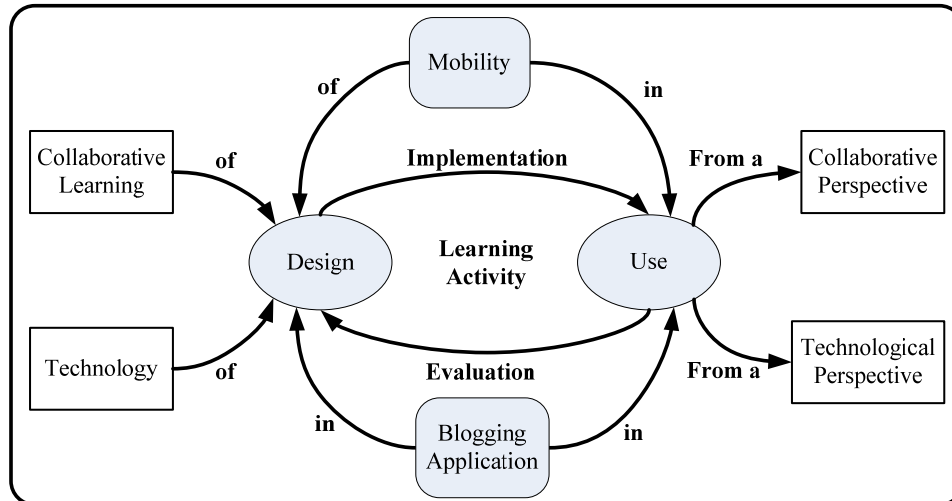

Figure 1. Design and Use of Mobile Enhanced Learning Environment

In addition to participating in the learning activity, each student needed to accomplish the questionnaire which reflects the perception of being a mobile blogger.

The technological aspects of the mobile blogging system comprise three modules, mobile blog, mobile RSS aggregator and mobile IR. Mobile blog, a blogging system deployed in the mobile setting environment, was used as the main information delivery and discussion technology. Mobile blog provides a well-integrated platform which enables group members to contribute personal knowledge, discuss posted questions, and upload learning materials (web links, files, pictures or video clips) any time and any where that construct a group collaboration work. With a various type of information presentation, mobile blog help students get more authentic context example of knowledge. Furthermore, mobile blog facilitates the personal communication with email-like function, that is, students can mail the question or comment to anyone in the system which is a personal interaction support function. From the collaborative learning perspective, mobile blog enables collaboration and supports the independent interaction between group members. Mobile RSS aggregator records the RSS feed and receives the updated information for mobile blogger. Mobile RSS aggregator assists the share of information between group members and promotes the collaborative learning activity. Mobile IR is a search engine which integrates the information retrieval (IR) technology and responds the searching request with more precise answer. Mobile IR improves the efficiency for students' searching request and help students acquire more related lecture information. The detail mobile blogging system description is illustrated in the following section.

Implementation of the Learning Activity

The designed learning activity was deployed for 2 months (8 weeks) including testing phase, training phase, main experiment and evaluation phase. The testing phase took 1 week, and students test their account and group mail address in this period. The training phase lasted for another 1 week. In this phase, the teacher assistance instructed the use of the mobile blogging system and introduced the learning activity which includes the idea of how to achieve the collaborative learning in the mobile setting. The main experimental learning activity took place in the next 5 weeks. There were 5 groups and each group was assigned a topic. The topics included *Arrays*, *Stacks*, *Queues*, *Linked Lists* and *Tree*. The students collaborated to complete the learning activity and contributed the information,

thoughts, and comments for the data-structure course. The final week was reserved for students to complete the report and the questionnaire.

System Description

Architecture

Since mobile devices are widely used in everyday life, we hoped to show that incorporating their use in a formal learning model can motivate students to take full advantage of the resources available on the mobile blogging system. Through increased frequency of discussion with others, we expected learners to not only learn assigned material more thoroughly, but also learn valuable social and communication skills, such as contributing to a group effort, exercising creativity and showing initiative. The mobile blogging learning system described in this study supports a mobile blog discussion module. We implemented a mobile blogging learning architecture utilizing the support of the RSS mechanism which is able to automatically update learning content so the waiting time for receiving learning content could be reduced and the learning efficiency could be expected to greatly raise.

Really Simple Syndication (RSS 2.0) is specified in XML format. RSS gives a blog article its information in an XML file and the file is named a *RSS feed*. Bloggers can subscribe to a blog RSS feed or RSS aggregator and automatically receive the latest postings instead of searching for them on different blog servers. An RSS feed contains the individual posted blog entries on a blog server. The content of an RSS feed contains the title and the hyperlink of a blog entry. There are also many other items that describe each blog article such as the publishing date, description, and the related file location.
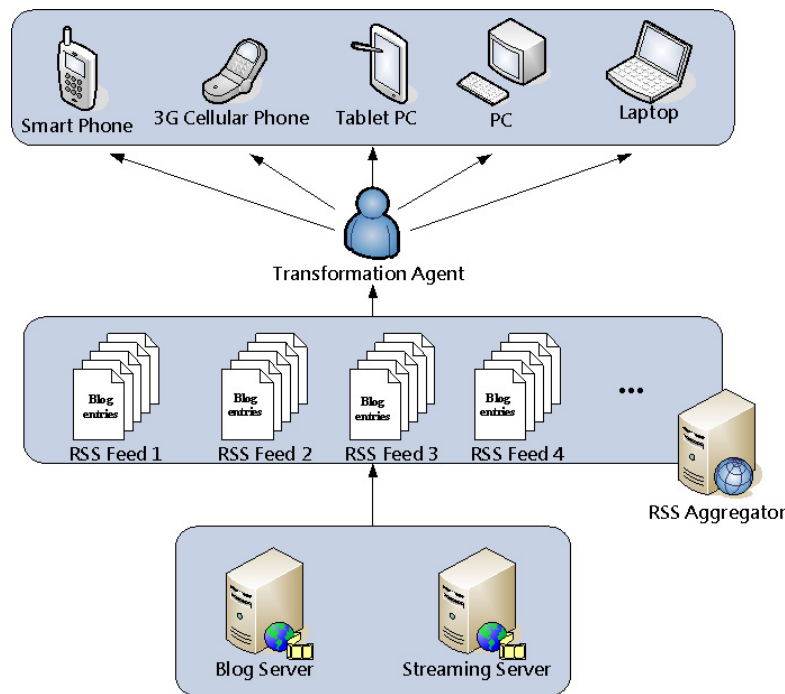

Figure 2. Mobile blogging learning architecture

The system architecture and the operation workflow of the system are shown in Figure 2. The mobile blogging system provides mobile bloggers with a flexible web environment for discussion and communication. Mobile bloggers can post blog articles using W/H devices and these articles are subsequently stored in the blog server. Additionally, through the devised transformation agent, posted blog articles can be read on different platforms such as personal computers, laptops, and other mobile devices. The agent renders different presentation of learning content by calculating different device screen sizes. If the platforms possess powerful presentation capabilities, the

agent would direct learners to a learning interface which could present considerable multimedia information. Conversely, the agent directs learners to a simple interface which renders mobile bloggers more readable learning interface. The streaming server provides video streaming which can provide rich multimedia support for posted articles. Mobile bloggers can receive other blog articles from other individuals by using the devised mobile RSS aggregator which collects all RSS feeds. The functionality of mobile RSS aggregator will be introduced in the system implementation section in more detail.

System Implementation

The mobile blogging learning system runs on a computer AMD Athlon 64 3000+ CPU at 2.0 GHz and 1G memory, using Microsoft C#.net 2005. Dopod CHT 9000 was chosen to be the testbed mobile device. This section contains the system presentation of a mobile blog, mobile RSS aggregator, and mobile information retrieval (MIR), which are presented graphically in Figure 3. RSS aggregator and MIR can be regarded as two components in the mobile blog. Moreover, in order to prove the system is able to run on real mobile devices, pictures were taken from real mobile devices instead of using screenshots of a mobile simulator.
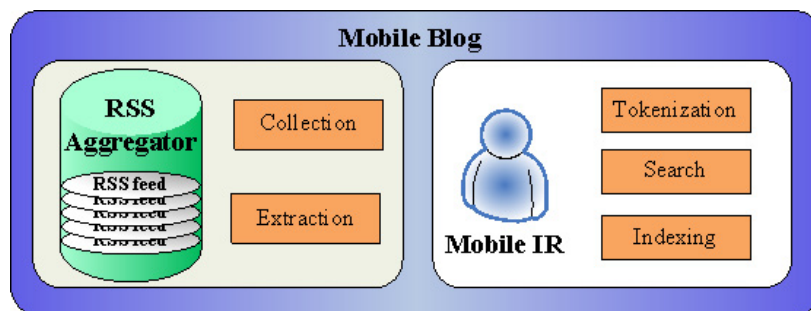

Figure 3. Three main implemented components

Mobile Blog

As Figure 4 shows, there are several links on the main page of a mobile blog, which include information retrieval (IR), RSS feeds, and the entry link of a personal blog, classification by groups and classes, and new account registration. Each posted article is listed below those links.

*Figure 4.*The system presentation of a mobile blog

A mobile blogger can directly edit blog articles on kinds of mobile devices at any place where has wireless signals. Furthermore, if the W/H devices support the Multimedia Messaging Service (MMS), mobile bloggers can also post multimedia files such as images, video, or audio files to their blogs. It should be noted that if mobile bloggers want to post blog articles with multimedia files, they must use MMS to send the edited messages to a special number that is assigned from an Internet Service Provider (ISP) and connected to an Integrated Messaging Service Platform (IMSP) server which deals with message services such as Short Message Service (SMS) and MMS. This particular server is often managed by an ISP. In order to retrieve the messages from an IMSP server, we developed an application called IMSP Decoder which is able to decode messages composed of text, images, and 3GP files, as shown in Figure 5. After pressing the button "Import IMSP", the decoder executes and then gets messages from the IMSP server continuously. The content of the messages are shown in the decoder, including the date, source, ID, original text, image, and 3gp files. Meanwhile, when our system receives a message, it is recorded in a log file so that the further analysis would be dealt with. After the IMSP Decoder decodes the messages, related information will be stockpiled in the blog server and then the blog articles will be published automatically. Figure 6 shows the process of publishing blog articles using personal mobile devices.
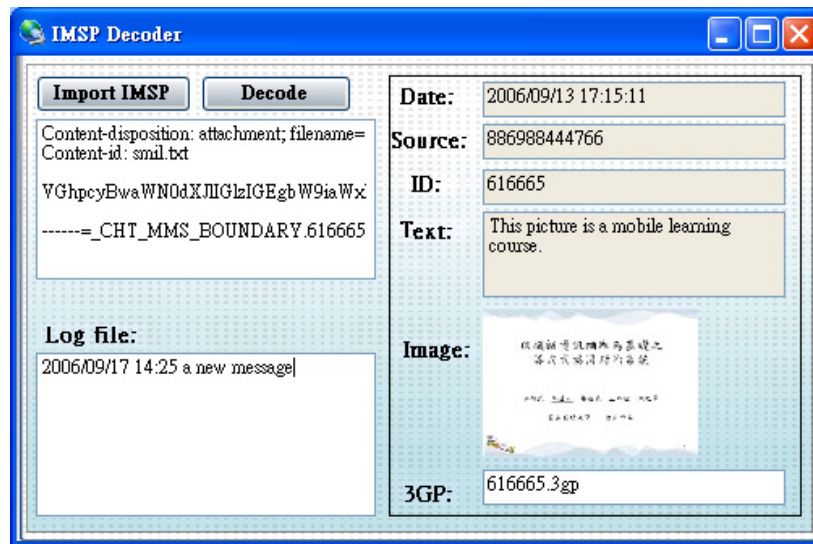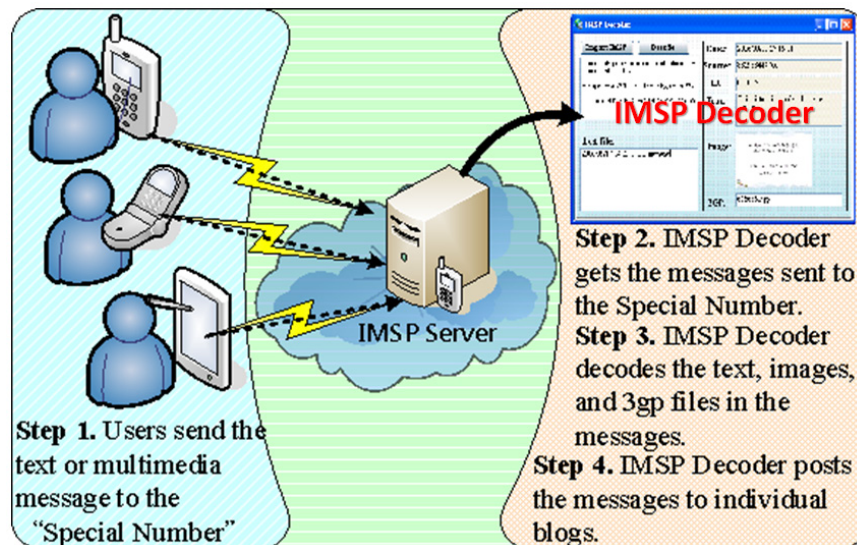

Figure 5. IMSP decoder with test data

Figure 6. The process of publishing a blog article

In order to subscribe an RSS feed into a personal blog, we developed an RSS aggregator. It extracts several key tags included in an RSS feed file, such as *channel*, *title*, *link*, *description*, etc. Figure 7 shows two RSS feed examples from five feeds: Linked Lists and Tree. The devised RSS aggregator can link to our blog server where stockpiles all managed RSS feeds and blog articles posted. Because of this, the content of blog server is constantly being updated and is always current. An example of aggregated blog RSS titles and item content are given in Figure 8 and Figure 9 respectively. Mobile bloggers could view blog articles under a specific topic. In this case, the "Linked Lists" topic is selected and five blog articles also called items are included under this topic.
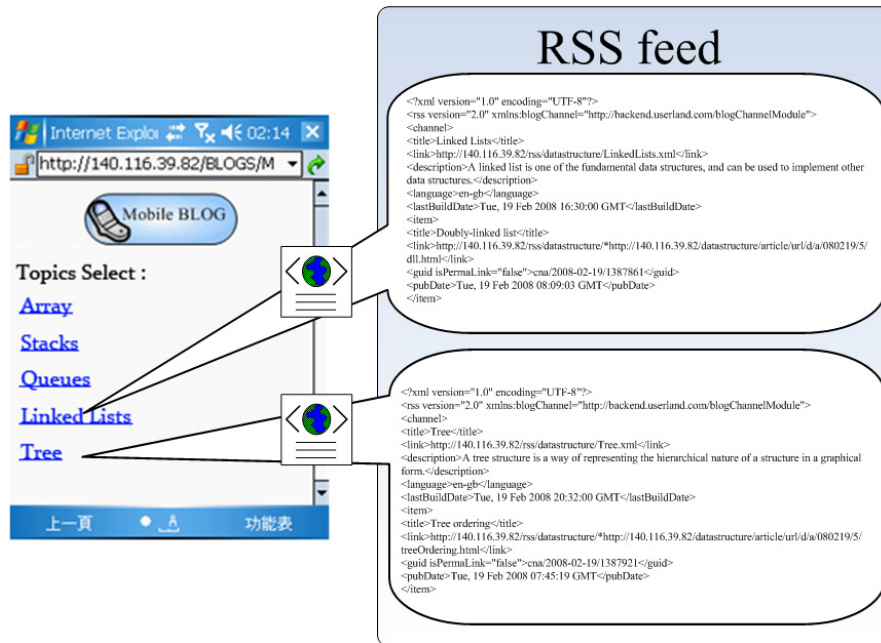

Figure 7. Two examples of an RSS feed

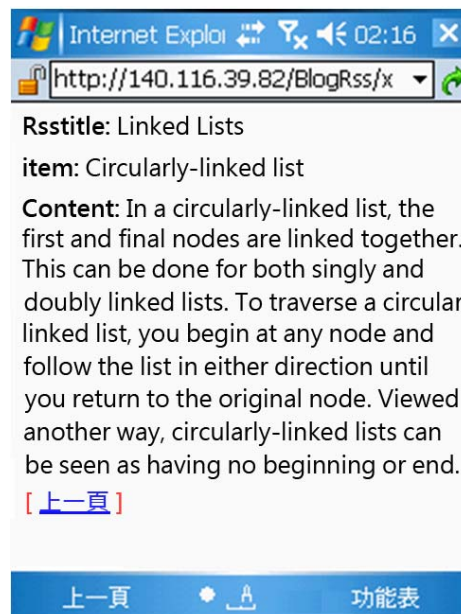| *Figure 8*. Choosing an article from the RSS Aggregator | *Figure 9*. The content of a chosen article in the RSS Aggregator |

When blog articles are stored in the blog server, IR techniques are adopted to proceed with tokenization. All blog articles are tokenized as terms that are viewed as words. Subsequently, the correlations between terms and articles are calculated, using vector models of term frequency-inverse document frequency (TFIDF) measure. Finally, we adopt the Wikipedia way to display the tokenization results, as shown in Figure 10. Each underlined word links to related articles, which makes mobile bloggers easily find interesting discussion topics and other related articles.
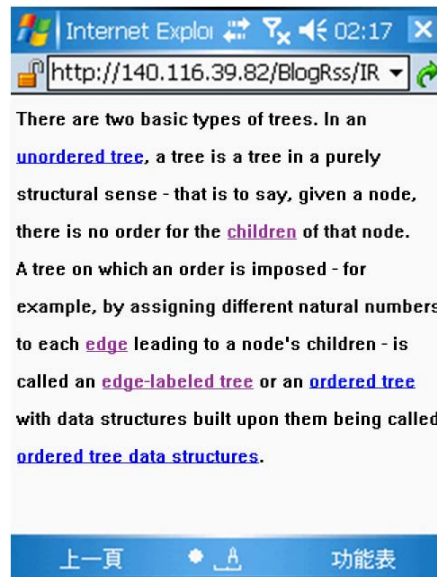

Figure 10. A search result from mobile IR

Evaluation of the use of the Mobile Blogging system

The proposed mobile blogging system was regarded as an assistant tool in a collaborating learning perspective that emphasizes the mobility and blogging application in the process of learning activity. We examined the effectiveness of the mobile blogging system on students' learning attitude using an online questionnaire. The response portion of each question in the questionnaire was designed using a 5-point Likert scale. Typically, an item in a Likert scale is given as a statement to which the user much respond using a scale from 1 to 5, in which 5 stands for "strongly agree" and 1 stands for "strongly disagree". The 5 level responses also stand for the score of each question thus we can calculate the mean value of each item. We also examined the students' attitude from open ended question which can present more realistic response. The questionnaire item includes:
1. Help me satisfy the urgency of learning need of the lecture on the mobile blogging system. (5-point likert-scale)
2. Help me acquire the related lecture information. (5-point likert-scale)
3. It is easy and convenient for me to access blog article. (5-point likert-scale)
4. The interactivity of the learning process is efficient for me. (5-point likert-scale)
5. The mobile blogging system provides the authentic context of the learning material for me. (5-point likert-scale)
6. The mobile blogging system provides the organized learning content for me. (5-point likert-scale)
7. Please comment the learning experience as a mobile blogger. (open ended question)
8. Please comment the interactivity you can do during the learning activity. (open ended question)

As we stated in the introduction part, we wanted to explore students' learning outcomes from three aspects. The above items can separately reply the three aspects. Item (1) to (6) can depict the first aspects from a statistic view, and item (7) and (8) can illustrate the second and third aspect according to the responses of students. The responses data from students were collected from online questionnaire system and it can be further analyzed and discussed. The statistical results were presented in Table 1. The 5th column describes the percentage of each item score that are greater or equal to 4. The responses to first item indicate that most students were satisfied with the mobile blogging system (Mean=4.350, 82.5%). This reflects that the mobile blogging system can be used for an urgent matter of

learning, such as posting question and searching information. The responses to second item indicate that most students can acquire the related lecture information articles on the mobile blogging system (Mean=4.425, 90%). This reflects that mobile IR in the mobile blogging system can respond the related information based on student's requests in time. The responses to 3rd item indicates that to access blog article is easy and convenient (Mean=4.375, 85%). According to the 3rd item, the educational practice can be performed conveniently and easily any time and any place. The responses to 4th item indicates that the mobile blogging system provides smooth using experience for students (Mean=4.350, 85%). This reflects that students can communicate with lecturer, peers or other materials effectively. The responses to 5th item indicates that the mobile blogging system can provide more authentic context learning material/example for students (Mean=4.350, 87.5%). Therefore, students can notice the features of problem situations that make particular replies relevant. The responses to 6th item indicates that the mobile blogging system can also provide integrated learning material with well organized (Mean=4.275, 80%). This feature facilitates complex and ill-structured learning content to be understood easily. Besides, the responses from item (7) and (8) were summarized in Table 2. According to the responses of 7th item, the mobile blogging system was regarded as a helpful, convenient tool in a collaborative learning activity. The mobile blogging system can provides the desired information for students and it can stimulate students to look for more information on the system. The responses of 8th item states that the interaction to use blogging system on a mobile device is similar to the use on a personal computer. Students wrote that the successful use of the mobile blogging system was not just tied to the convenient of use, rather, that it provides the necessary function to satisfy the collaborative learning activity.

Table 1. Questionnaire Result

Item	Mean	Stand Deviation	Variance	Score >= 4
1	4.350	0.769	0.592	82.5%
2	4.425	0.675	0.455	90%
3	4.375	0.740	0.548	85%
4	4.350	0.735	0.541	85%
5	4.350	0.699	0.489	87.5%
6	4.275	0.784	0.614	80%

Table 2. Open Ended Question Summary

Item	Summary
7	(a) …I want to share more helpful online resources with my classmates…. (b) …Mobile blogging system is convenient for me to post article, upload pictures any time and any where, even when I was in bathroom… (c) …I can find the article I want through the searching engine…
8	(a) …I can discuss the question with my group members privately before I post the question on the mobile blog … (b) …I can write the article, post my comment and upload the figure which is similar to the interactivity in my additional blog on the web … (c) …I can subscribe the RSS feed on mobile blog which is convenient for me to gain latest article … (d) …when I see an event which is related to the learning concept, I can take a picture by the mobile device and upload it using mobile blog immediately…

The mobile blogging system is useful and it furnishes students with well learning effect in collaborative learning environment which is working with peers in the classroom and in the field as well as with students from other schools or countries towards a common outcome. In a mobile blogging environment, students need not to meet each other but can make the collaboration effort to accomplish the learning goal of the lecture. Additionally, according to the result of questionnaire, student as a mobile blogger can generate positive emotion (see Table 2, response of Item 7(a) and 8(b)) during the collaborative learning activity. The mobile blogging system not only provides the blogging application for students but also the convenience with no limitation in time and position. In our observation from the experiment, students gradually learned the coordination of activity between group members to solve an identified problem. Particularly, the coordination process took place in the distributed situation where students need not to get together. In this interactivity, the mobile blogging system encourages students' cognitive activity and self-regulation in the collaborative learning activity, engaged students to learn and discuss during the activity. Furthermore, a mobile blogging system in collaborative learning activity can train students to provide constructive comment because that everyone can post, ask and comment a question before the posted information is useful. Neutral comments are

perceived to be less useful than constructive or supportive comments (e.g., suggesting what the next step or encouraging comments). The mobile blogging system provides more convenient to free the tie from sitting together and meeting face to face so that students have more courage and time to consider posting an article/comment. Consequently, students learn to contribute constructive comment in the mobile blogging system.

Our general findings in the experiment include:
- In collaborative learning setting, the mobility and blogging applications play an important part.
- The mobile blogging system offers more authentic context learning example for students. For example, students took the picture of people stand in a line as an instance of *Queues* and shared it to group members.
- Coordination issue is a challenge for collaboration with distributed students, and the mobile blogging system provides a possible solution for it.
- Blogging applications provide potential possibility to facilitate different kind of learning activity. However, the mobile blogging system owns the advantage in mobility of learning setting.

From the above findings, we can summarize to reflect the response of the three perspectives mentioned in the Introduction section as follows. (1) With the benefit of mobility and blogging applications implemented in the collaborative learning setting, students' learning attitude is enthusiastic and their responses are appreciative of the blogging system. Students can find useful articles in the blogging system and enjoy as a mobile blogger. Additionally, this interactivity in collaborative learning setting brings learning effect a positive impact. (2) In the responses of questionnaire item 7, students thought the mobile blogging system is a helpful and convenient tool to acquire more authentic context learning examples. They are willing to discover knowledge in the system and share their own learning materials with other peers. In the process of discovering and sharing, their learning emotion is positive. (3) According to responses of questionnaire item 8, students can interact with the mobile blogging system similarly as they do in a general blogging system. Moreover, the mobile blogging system brings coordination issue a solution by its advantage in mobility.

Conclusions

This study aimed to investigate the learning effects of the mobile blogging system in a collaborative learning model as well as to explore the learning behavior of mobile blogger. We highlight the importance of mobility and blogging applications in a collaborative learning environment. Thus, an educational mobile blogging system is implemented for this purpose. The designed learning activity focuses on exploring students' learning outcomes from the proposed three aspects in the Introduction section. The results of the conducted learning activity were evaluated by the questionnaire, which reveal our observations and findings. We found that the mobile blogging system can provide more authentic context learning example and help to solve the coordination issue in a collaborative learning environment. In addition, the developed mobile blogging system established a mobile blog-based learning environment which brings students a similar manipulation of web-based blogging system in daily life and ties no position and time limitations.

Technology that supports the development of pedagogic activity should be deployed according to the concerned issue of pedagogic activity. In this study, the experimental activity joints intellectual effort by the participants from different position and time which is the characteristics of collaborative learning activity. By the reflection of students' learning outcomes, mobility and blogging applications bring them an unlimited discussion space so that they can learn in a more free and easy manner.

Learning with related and appropriate example helps students in reasoning and deliberation of learning concept. A good learning example should be easily realized and make students feel familiar with daily life. The result of the study implies that the mobile blogging system can be used for providing authentic context of learning example. For instance, student can share a picture of a train which can be an example of *Linked Lists* concept and upload it to mobile blog. After students read the blog article, they can discuss and comment it. One student can illustrate the concept of the figure, and the others can look for different example more appropriate. By the manner, students learn to coordinate their efforts toward consist and correct outcomes and elaborate the learning material in a collaborative learning setting.

With novel technological support, more tools that emphasize aspects of mobile supported learning environment could be made available for lecturers or students to facilitate their learning process. However, it is important to put right technology into right pedagogic application. This study implemented a mobile blogging system, and took the characteristics of it to improve the learning effect in a collaborative learning environment. Additionally, we believe design a technological supported learning environment should consider along with an appropriate pedagogic theory. In this manner, technology supported learning system not only helps to amplify the feature of the pedagogic theory, but also stimulates students' learning emotion to learn enthusiastically.

Acknowledgements

References

Carchiolo, V., Longheu, A., & Malgeri, M. (2002). Adaptive formative paths in a Web-based learning environment. *Educational Technology & Society, 5* (4), 64-75.

Chen, Y. S., Kao, T. C., & Sheu, J. P. (2003). A mobile learning system for scaffolding bird watching learning. *Journal of Computer Assisted Learning, 19* (3), 347-359.

Chen, W., & Bonk, C. (2008). The use of Weblogs in learning and assessment in chinese higher education: Possibilities and potential problems. *International Journal on E-Learning, 7* (1), 41-65.

Clough, G., Jones, A. C., McAndrew, P., & Scanlon, E. (2007). Informal learning with PDAs and smartphones. *Journal of Computer Assisted Learning, 24* (5), 359-371.

Danesh, A., Inkpen, K.M., Lau, F., Shu, K., Booth, K.S., & Geney, T.M. (2001). Designing a collaborative activity for the palm handheld computer. *Paper presented at the Conference on Human Factors in Computing Systems,* March 31 - April 5, Seattle, Washington, USA.

Dillenbourg, P. (1999). *Collaborative learning: Cognitive and computational approaches*, Oxford, UK: Elsevier Science.

Divitini, M., Haugaløkken, O., & Morken, E.M. (2005). Blog to support learning in the field: lessons learned from a fiasco. *Paper presented at the 5th IEEE International Conference on Advanced Learning Technologies*, July 5-8, Kaohsiung, Taiwan.

Dron, J. (2003). The Blog and the Borg: A collective approach to E-Learning. *Paper presented at the World Conference on E-Learning in Corporation, Government, Healthcare, & Higher Education,* October 15-19, Montreal, Canada.

Giarr´e, L., & Jaccheri, L. (2006). *ResearcherBlog*, retrieved March 9, 2009 from http://researcherblog.blogspot.com.

Giarr´e, L., & Jaccheri, L. (2005). Learning research methods and processes via sharing experience in a BLOG. *Paper presented at the 44th IEEE Conference on Decision and Control- European Control Conference*, December 12-15, Seville, Spain.

Gogoulou, A., Gouli, E., Grigoriadou, M., Samarakou, M., & Chinou, D. (2007). A Web-based educational setting supporting individualized learning, collaborative learning and assessment. *Educational Technology & Society, 10* (4), 242-256.

Green, K. C. (2000). *Technology and instruction: compelling, competing, and complementary visions for the instructional role of technology in higher education,* retrieved March 9, 2009 from http://www.campuscomputing.net/archive/papers/tech_and_instruction.pdf.

Huang, T.C., Huang, Y.M., & Cheng, S.C. (2008). Automatic and interactive e-Learning auxiliary material generation utilizing particle swarm optimization. *Expert Systems with Applications, 35* (4), 2113-2122.

Imielinsky, T., & Badrinath, B. (1994). Mobile wireless computing: Challenges in data management. *Communications of the ACM, 37* (10), 18-28.

Katerina, M., & Chronis, K. (2007). The role of Blogs in studying the discourse and social practices of mathematics teachers. *Educational Technology & Society, 10* (1), 73-84.

Koschmann, T. (1996). Paradigm shift and instructional technology. In Koshmann, T. (Ed.), *CSCL: Theory and Practice of an emerging paradigm*, New Jersey, USA: Lawrence Erlbaum, 1-23.

Kravcik, M., Kaibel, A., Specht, M., & Terrenghi, L. (2004). Mobile collector for field trips. *Educational Technology & Society, 7* (2), 25-33.

Kurti, A., Milrad, M., & Spikol, D. (2007). Designing innovative learning activities using ubiquitous computing advanced learning technologies. *Paper presented at the 7th IEEE International Conference on Advanced Learning Technologies*, July 18-20, Niigata, Japan.

Lai, C. Y., & Wu, C. C. (2006). Using handhelds in a Jigsaw cooperative learning environment. *Journal of Computer Assisted Learning, 22* (4), 284-297.

Lin, W. J., Yueh, H. P., Liu, Y. L., Murakami, M., Kakusho, K., & Minoh, M. (2006). Blog as a tool to develop e-learning experience in an international distance course. *Paper presented at the 6th International Conference Advanced Learning Technologies*, July 5-7, Kerkrade, Netherlands.

Lindahl, C., & Blount, E. (2003). Weblogs: Simplifying web publishing. *Computer, 36* (11), 114–116.

Mai, N. (2005). Engaging students in group-based co-operative learning: A malaysian perspective. *Educational Technology & Society, 8* (4), 220-232.

Motiwalla, L. F. (2005). Speech-enabled mobile learning application. *Paper presented at the Wireless Telecommunications Symposium*, April 28-30, Pomona, USA.

Nardi, B. A., Schiano, D. J., & Gumbrecht, M. (2004). Blogging as social activity, or, would you let 900 million people read your diary? *Paper presented at the ACM2004 Conference on Computer Supported Cooperative Work*, November 6-10, Chicago, Illinois, USA.

Nicola, P., & Giuseppe, S. (2006). Cooperative project-based learning in a Web-based software engineering course. *Educational Technology & Society, 9* (4), 54-62.

Roschelle, J., & Pea, R. (2002). A walk on the WILD side: How wireless handhelds may change CSCL. *Paper presented at the International Conference on Computer-Supported Cooperative Learning*, January 7-12, 2002, Boulder, Colorado.

Serce, F. C., & Yildirim, S. (2006). A Web-Based synchronous collaborative review tool: A case study of an on-line graduate course. *Educational Technology & Society, 9* (2), 166-177.

Tatar, D., Roschelle, J., Vahey, P., & Penuel, W. R. (2003). Handhelds go to school: Lessons learned. *IEEE Computer, 36* (9), 30-37.

Van'T Hooft, M., Diaz, S., & Swan, K. (2004). Examining the potential of handheld computers: Finding from the Ohio PEP project. *Journal of Educational Computing Research, 30* (4), 295-311.

Van'T Hooft, M., & Swan, K. (2004). Special issue on ubiquitous computing: Introduction. *Journal of Educational Computing Research, 30* (4), 275-279.

Zurita, G., & Nussbaum, M. (2004). Computer supported collaborative learning using wirelessly interconnected handhelds computers. *Computers and Education, 42* (3), 289-314.

Wang, K.T., Huang, Y.M., Jeng, Y.L., & Wang, T.I. (2008). A blog-based dynamic learning map. *Computers & Education, 51* (1), 262-278.

Wasson, B., & Ludvigsen, S. (2003). *Designing for knowledge building*, Oslo: Unipub forlag.

Wasson, B. (2007). Design and use of collaborative network learning scenarios: The DoCTA experience. *Educational Technology & Society, 10* (4), 3-16.