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AETEL: Supporting Seamless Learning and Learning Log Recording with e-Book System

Mahiro KIYOTA[a*], Kousuke MOURI[a], Noriko UOSAKI[b], & Hiroaki OGATA[a*]
[a] *Faculty of Arts and Science and the Graduate School of Information Science and Electrical Engineering, University of Kyushu, Japan*
[b] *Center for International Education and Exchange, Osaka University, Japan*
*{mkiyota.kyushuuniv, hiroaki.ogata}@gmail.com

Abstract: Seamless learning is an approach in which learners can build a relationship between their formal learning and informal learning. One of the issues of seamless learning is the way to connect formal learning with informal learning. To tackle this issue, we propose an e-Book based system in this paper. Our proposal learning system has two functions. One is an e-Book viewing function which can log what learners learned from e-Books as learning logs. The other is a seamless learning function which enables users to connect formal learning with informal learning. In this paper, we introduce our system and its evaluation.

Keywords: mobile learning, ubiquitous learning, seamless learning, e-Book

1. Introduction

With the advances of the mobile and wireless technologies, a learning approach called "seamless learning" has been gaining many researchers' attention. Seamless learning is defined as a learning environment where learners can learn whenever they want to in a variety of scenarios and that they can switch from one scenario to another easily and quickly using one device or more per student ("one-to-one") as a mediator (Chan et al. 2006). Meanwhile, Wong et al. (2011) identified ten salient features of seamless learning; (1) Encompassing formal and informal learning, (2) Encompassing personalized and social learning, (3) Across time, (4) Across locations, (5) Ubiquitous knowledge access, (6) Encompassing physical and digital worlds, (7) Combined use of multiple device types, (8) Seamless switching between multiple learning tasks, (9) Knowledge synthesis, and (10) Encompassing multiple pedagogical or learning activity models.

Since seamless learning proposed, many researchers approached their seamless learning based projects. For example, Milrad et al. (2013) introduced five different seamless learning projects researched in Taiwan, United Kingdom, Sweden, Singapore, and Japan.

When we consider connecting formal learning with informal learning as one of the seamless learning styles, one of the issues is the way to connect formal learning with informal learning. To tackle the issue, some seamless learning systems have been explored by researchers. For example, Uosaki et al. (2010) proposed a seamless learning system called SMALL System (Seamless Mobile-Assisted Language Learning Support System). Meanwhile, Wong et al. (2014) proposed a system called MyCloud (My Chinese Language ubiquitOUs learning Days).

Thus, some seamless learning systems have been approached. However, they do not consider connecting learning from learning materials with the other learning. Generally, textbooks provided by schools are used during class. Especially, when we consider providing learning materials as e-Books (electronic-books), by connecting inside-class e-Book based learning with outside-of-class self-learning, it is expected that learners can connect formal learning with informal learning. Meanwhile, e-Books have been introduced to schools in many countries; especially, in Japan, Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT, 2011) planned to introduce e-Books in schools by 2020. Therefore, it is highly expected that there will be a growing demand of e-Book based learning in the near future.

In our research, we tried to connect formal learning with informal learning by using e-Books to tackle the issue mentioned above. This paper describes an e-Book based seamless learning system called AETEL (Actions and learning on E-TExtbook Logging) System and its evaluation.

2. Related works

2.1 Visualizer for improvement of e-Book

Reflective Designer Analytics Platform (RDAP) is a platform that can help e-Book (learning material) authors (Karkalas et al. 2016). They developed a dashboard and a visualizer that can support e-Books authors redesigning their e-Books reflecting on the actual use of their e-Books. As for the visualizer, three kinds of visualizations – (1) users per page, (2) actions per page, and (3) widget usage - are available. Especially, (1) and (2) are based on the information of users' actual use (ex. Pie chart of actions per page is based on the number of users' actions on each page). The information can support e-Book authors by providing information that which page gained attention and which page did not.

Thus, the system uses the information of users' actual use for supporting e-Book author. Our proposal system aims to use learners' learning records for supporting learners' seamless learning.

2.2 M2B

M2B (Mitsuba) is a learning system used in Kyushu University, Japan (Ogata et al. (2015)). It can collect and analyze educational big data. M2B consists of three systems - (1) Moodle (Learning Management System), (2) Mahara (e-portfolio system), and (3) Booklooper (e-Book system). Especially, in the three functions, Booklooper is strongly related with AETEL. Booklooper is an e-Book reader system that can log learners' actions as logs. The one of the functions of AETEL - capturing learners' actions - is the same as that of Booklooper because AETEL is developed as an alternative function of Booklooper. Actually, Booklooper will be replaced with AETEL in the future.

The idea of the Booklooper project is to use learners' learning record for (1) improving learning materials, (2) analyzing learning patterns, (3) detecting students' comprehensive levels, (4) predicting final grades, and (5) recommending e-Books. However, our research in this paper aims to use learners' learning records for supporting seamless learning. Actually, it is difficult for learners to record what is learned from e-Book using Booklooper, while it is much easier for them to do it using AETEL.

3. AETEL

3.1 Architecture

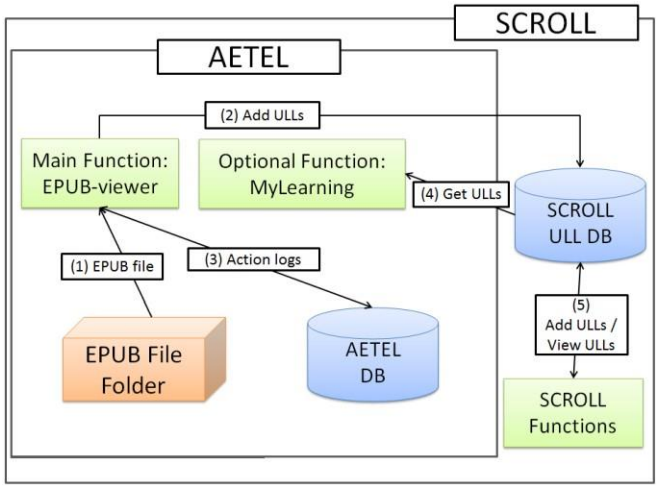

Figure 1. Architecture

Figure 1 shows the architecture of AETEL System. AETEL works as a part of a ubiquitous learning system called SCROLL (System for Capturing and Reusing Of Learning Log) which implemented by Ogata et al. (2014). SCROLL enables learners to record their learning experience as a log called ULL (Ubiquitous Learning Log). Currently, we have more than 30,000 ULLs on the server.

As shown in Figure 1, AETEL consists of database, EPUB (Electronic PUBlication; one of the e-Book formats) File Folder, and two functions – (1) EPUB-viewer and (2) MyLearning - . AETEL EPUB-viewer fetches them their selected EPUB file from EPUB File Folder and shows it to the learner (Figure 1 (1)). Learners can add ULLs on EPUB-viewer to SCROLL ULL Database (Figure 1 (2)).

While learners are reading EPUB on EPUB-viewer, their actions on EPUB-viewer are recorded to AETEL Database (Figure 1 (3)). MyLearning shows information to the learner according to the recorded ULLs (Figure 1 (4)). AETEL users can use SCROLL functions such as add ULL, view ULL, and so on, and they can view and relog ULLs in SCROLL ULL Database as well (Figure 1 (5)).

3.2 AETEL EPUB-viewer

AETEL EPUB-viewer is one of the functions of AETEL. This function can show EPUB to learners, record learners' actions as action logs, and record learners' learning from e-Books as ULLs.

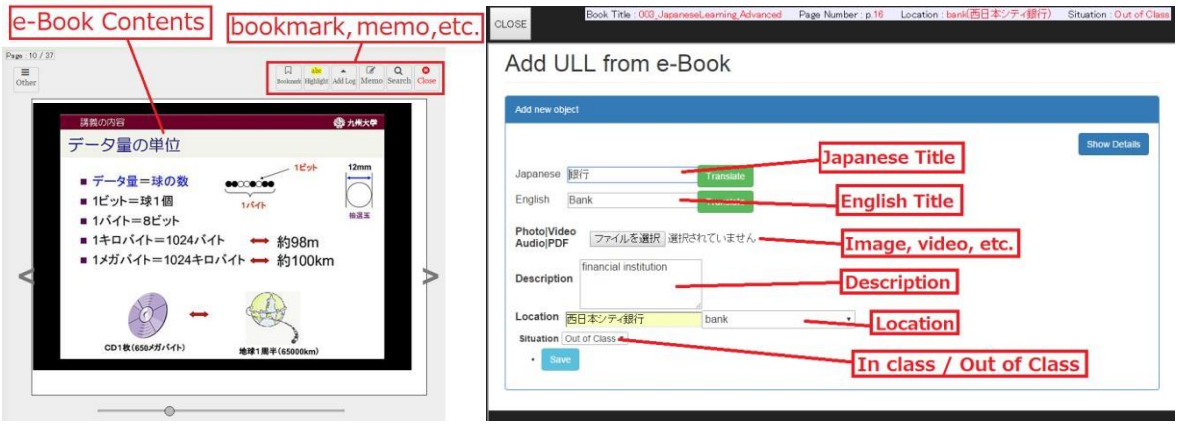

Figure 2. AETEL EPUB-viewer: Viewer window (left) and Add ULL window (right)

Figure 2 shows sample windows of EPUB-viewer. Learners can read EPUB and register ULLs from it. When the learner clicks Add ULL button on the viewer (Figure 2 (left)), the Add ULL window (Figure 2 (right)) opens. On Add ULL window, learners can input titles, files (image, video, etc.), description, location, and situation (formal / informal). The other information such as time is recorded automatically. The displayed e-Books are EPUB files. As shown in Figure 2 (left), not only usual EPUB files but also PowerPoint slides can be shown if it is converted into EPUB format.

3.3 AETEL MyLearning

AETEL MyLearning is one of the functions of AETEL. MyLearning was developed to support seamless language learning with AETEL. MyLearning provides learners with information such as whether the words were learned under formal or informal setting.

We consider it is important to provide the learned words information such as "location the word can be learned", "the other meanings of the word", and "information on where the word appears in the book". MyLearning is a system which can provide such information to the learners. In MyLearning, words the learner learned are shown in three different colors - black, blue, and red -. Words in black are the well learned words. Words in red and blue cards are not enough learned words so that the learners are encouraged to change red and blue words into black ones for seamless learning. (Words in red: The word that was learned only in formal situation. Words in blue: The word that was learned only in informal situation. Words in black: The word that was learned in both formal and informal situation.)

Figure 3 shows sample windows of MyLearning. As shown in Figure 3 (left), MyLearning consists of 4 small windows – [A] formal learning, [B] informal learning, [C] my logs information, and [D] other learners' logs information. Window [A] shows a word list that the learner learned in formal situation. Learners can add new words here by adding ULLs from EPUB-viewer. Window [B] shows a word list the learner learned in informal situation. Learners can add new words here by adding ULLs from SCROLL or EPUB-viewer. Window [C] shows your logs related to the specific word. Window [D] shows logs related to the specific word recorded by the other learners. Originally, window [A] and window [B] are shown while window [C] and window [D] are empty as shown in Figure 3 (left). If the learner requires further information about a specific word on window [A] or [B], then the learner can get further information from window [C] and window [D] by clicking the specific word on window [A] or window [B]. For example, on Figure 3 (left), there is a card about a word "Go – 行く" in window [B].

When a learner wants to get further information about a word "Go – 行く", the learner can click the word card on [B] (Figure 3 (1)). Then, the information about "Go" – such as the location the word can be learned, the other meaning of the word, and the e-Book information on where the word appears - will be shown in window [C] and window [D] (Figure 3 (2)). Thus, MyLearning can provide information to learners. We are expecting this system can be a bridge between formal and informal learning.

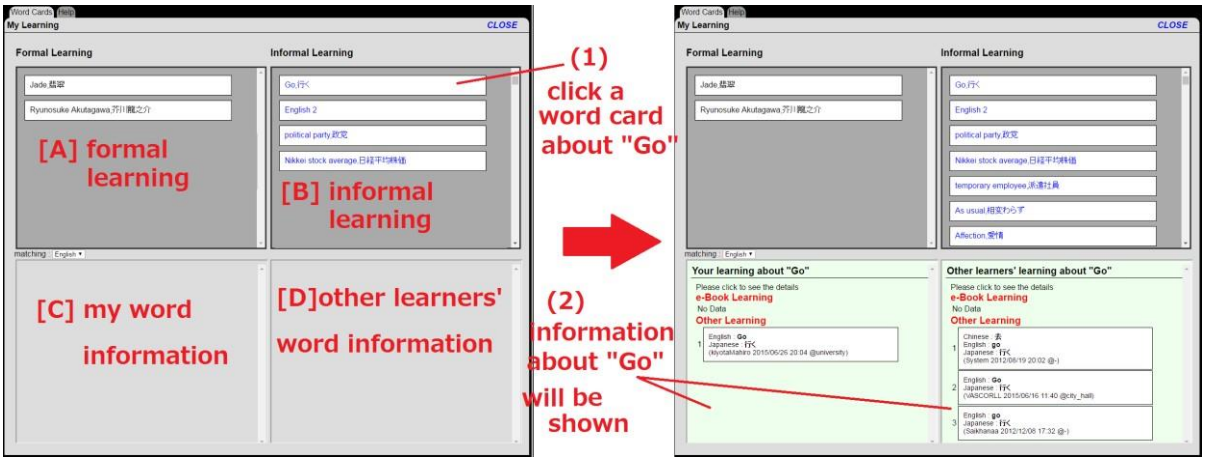

Figure 3. AETEL MyLearning: before word clicked (left), after word clicked (right)

4. Evaluation

4.1 Method

The study group consists of 16 foreign students of CALL (Computer Assisted Language Learning) class at university in Japan. All of the participants were learning Japanese as L2 (Second Language). At first, they took three Japanese examinations as pre-tests (each examination consists of 20 questions). There are two kinds of examination and learning materials: beginner level and intermediate level. All of the participants took "Japanese Proficiency Level Check" created by Center for International Education and Exchange, Osaka University in advance. According to the results of the level check, the participants were divided into two levels: beginner and intermediate level. Each learner uses learning materials and examinations which match to the learners' level (beginner, intermediate).

This evaluation consists of 3 phases, 6 weeks (2 weeks for each phase). Learners attended to the 90 minutes class (as formal learning) once per week. After the class, they do informal learning for 1 week. At the first phase, all of the students used EPUB-viewer, MyLearning, and SCROLL. At the second phase, students used EPUB-viewer and SCROLL. At the third phase, students used SCROLL and paper book. At the end of the each phase, students took a post-test. The contents of the post-tests are the same as those of the pre-test. Finally, at the end of the evaluation experiment, students answered the two questionnaires. The questionnaire 1 (for AETEL) consisted of 5 questions (5-point scale); (1) AETEL supports your ULL recording more effectively than paper-textbook, (2) AETEL helped you understand the e-Book contents you learned during class and improve your language skill more than paper-textbook, (3) By using AETEL, you used annotation (bookmark, highlight, memo etc..) more often than paper-textbook, (4) AETEL supports your learning and increased your learning efficiency more than paper-textbook, and (5) With many functions such as check meaning, highlight, and bookmark, AETEL is more convenient than paper-textbook. The questionnaire 2 (for MyLearning) consists of 6 questions (5-point scale); (1) By using MyLearning, you could understand which words were learned inside-class and which words were learned outside-of-class, (2) During outside-of-class learning, by using My Learning, you could remember what you had learned inside-class (and vice versa), (3) MyLearning helped you understand other meanings of the words that you learned, and where and how they were used in other contexts, (4) MyLearning helped you grasp which words were learned both inside-class and outside-of-class / only inside-class / only outside-of-class, (5) My Learning helped you increase the number of your ULLs, and (6) My Learning helped you understand the e-Book contents you learned during class and improve your language skill.

4.2 Results

Results of evaluation experiment of AETEL are shown in Figure 4 and Table 1. As shown in Figure 4 (left), more logs were recorded with AETEL in total. It's notable that the number of recorded formal logs with AETEL is twice as many as that of "without AETEL". According to the results of ANOVA (significance level = 0.05), there was the significant difference between "with AETEL" and "without AETEL" on formal log recording. On the other hand, there was no significant difference between "with AETEL" and "without AETEL" on informal log recording and total recorded logs.

According to Figure 4 (right), Pre- and Post-test score difference of "with AETEL" is larger than that of "without AETEL", while there was no significant difference between "with AETEL" and "without AETEL".

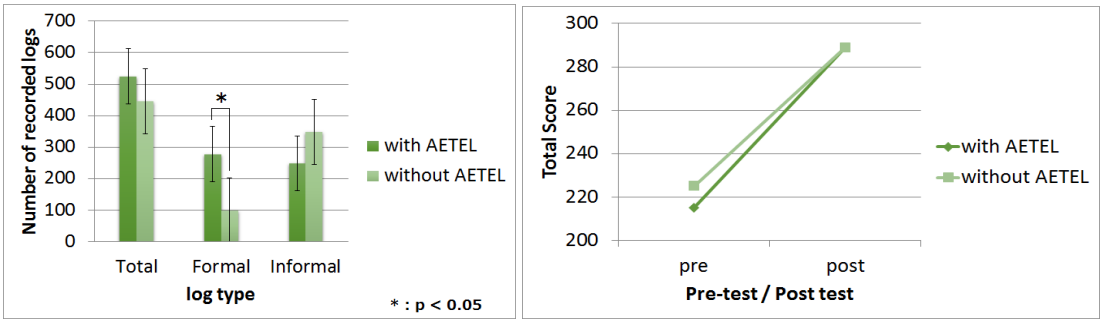

Figure 4. Evaluation of AETEL: Number of recorded logs (left), examination score (right)

As shown in Table 1, all of the questions scored around 3. It means reaction of the learners' was not good. According to their comments, most of the learners felt the learning materials are difficult for them. It is assumed that the difficulty of the learning materials affected the result of questionnaire.

Table 1. Result of Questionnaire about AETEL (5-point scale, N=16)

	Q1	Q2	Q3	Q4	Q5
Average	2.93	2.86	2.46	2.75	3.36
SD	1.22	1.16	1.38	1.02	1.20

Results of evaluation of MyLearning are shown in Figure 5 and Table 2. As shown in Figure 5, MyLearning could not boost up both the number of recorded logs and the examination scores.

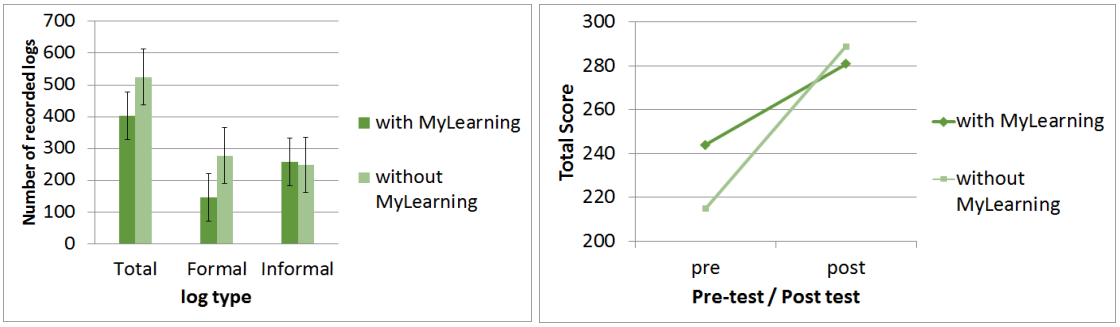

Figure 5. Evaluation of MyLearning: Number of recorded logs (left), examination score (right)

Table 2. Result of Questionnaire about MyLearning (5-point scale, N=16)

	Q1	Q2	Q3	Q4	Q5	Q6
Average	3.23	3.00	2.69	3.00	2.69	3.00
SD	1.42	1.36	1.38	1.30	1.32	1.30

Table 2 shows the result of questionnaire about MyLearning. All of the questions scored around 3. According to the learners' comments, most of the learners felt MyLearning was difficult to use and it did not work well. They did not feel it was effective for their language learning. Therefore, we conclude that MyLearning is not effective as a means of seamless language learning support.

5. Conclusions and future work

This paper proposes an e-Book system called AETEL. This system currently has two functions - EPUB-viewer and MyLearning. EPUB-viewer can show EPUB and log learners' actions and learning on EPUB. Furthermore, it supports learners' ULL recording as well. According to the results of the evaluations, it has a positive educational impact on the learners.

MyLearning is an additional function of AETEL which was expected to support seamless language learning. This system can show words information and we expected it could support learners' seamless language learning. However, according to the results of the evaluation experiment, we could not recognize the effectiveness of the MyLearning.

In this paper, the effectiveness of AETEL was successfully demonstrated, while MyLearning did not work effectively as expected. Therefore, as our future work, we will remove MyLearning from AETEL and add a new function - adaptation function which uses ULLs and action logs – to AETEL instead of MyLearning. Also, we will consider analyzing various methods such as social network analysis and visualization of graph theory (Mouri et al., 2014, 2015).

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