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Impacts of a knowledge sharing-based e-book system on students' language learning performance and behaviors

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Abstract: E-books are becoming a popular medium for delivering learning materials in the globe. The gap between e-books and pedagogical practices has been highlighted since teachers do not generally integrate the e-book tool into their instruction in a way that facilitates student learning. In particular, new pedagogies in language teaching and learning tend to encourage students to acquire knowledge and use the language in real-life situations. Knowledge sharing with collaborative tasks in the class can be useful. Studies on knowledge sharing, specifically in language education, are limited. To this end, this study proposes a knowledge sharing-based e-book system to enhance students' learning performance in an EFL course. This study adopts a quasi-experimental design. Seventy-one freshmen were recruited from two classes of a freshman English course at a university in northern Taiwan. The implication from this study finding might help teachers to identify suitable technology based on the learning needs of students, and help consider the ability of teachers to adopt appropriate technology and to fit specific learning activities.

Keywords: Knowledge sharing, Constructive learning, e-books, learning behavior analysis

1. Introduction

English as a foreign language (EFL) learning tends to involve vocabulary memorization, grammar explanations, and practice as typical teaching and learning activities. Accordingly, EFL students are instructed in such a way that they have inadequate opportunities to acquire knowledge in their classes (Bakar, 2009; Chai, Wong, & King, 2016) even though current pedagogies in language teaching and learning tend to encourage students to acquire and use the language in real-life situations. In other words, EFL learners need to develop their knowledge and to use the target language as a way of communicating with others (Thornbury, 2016). This issue raises the importance of the social constructivist view of learning (Amineh & Asl, 2015). Constructivism is broadly treated as a way to promote learners' competence and to illustrate that competence can improve and change to higher-level thinking. That is, educators should situate learners in a learning environment that will allow them to acquire the knowledge and to practice it in-group activities (Bakar, Latiff, & Hamat, 2013).

Furthermore, technologies such as e-books have gradually affected language teaching and learning. Technology-enhanced education stresses students' intervention in meaning-making. Some technological systems are widely recognized as facilitating social interactions for collaborative learning (Kreijns, Kirschner, & Vermeulen, 2013). A technological system with collaborative learning is exclusively suitable for language learning as the primary purpose of language learning. When interacting with peers, students can learn from others as well as practice their language skills; therefore, they are more likely to acquire the content knowledge. However, there is a limited understanding of knowledge sharing in language learning.

This study proposes a knowledge sharing-based e-book learning approach to help students learn new knowledge. This study intended to identify two central values: (1) increasing learners' language learning performance, (2) supporting learners' learning by analyzing their learning behaviors from the logs. Therefore, two research questions were raised:

- RQ1. Is there a significant difference in learning performances with the knowledge sharing-based e-book learning compared to the conventional e-book learning approach?
- RQ2. Is there a significant difference in learning behaviors with the knowledge sharing-based e-book learning compared to the conventional e-book learning approach?

2. Literature Review

2.1 Using constructive learning for knowledge sharing

Knowledge should be learned actively, so the primary duty of an instructor is to facilitate and foster meaningful learning through constructivist pedagogy, and to provide the essential tasks and to guide learners as they attempt to integrate new knowledge into what they have previously learned. Constructivists claim that learners should practice higher-order thinking skills they will need to use in their life. Learners cannot deal with difficulties unless authentic learning situations are made available to them (Bada & Olusegun, 2015).

Constructive learning emphasizes cultivating students' knowledge and skills by sharing and collaboration. When learners communicate and work with their peers, they are more likely to develop new ideas and improve their learning. Interaction between peers is a way to foster students' higher-order thinking competencies (Hwang et al., 2018). Kiili et al. (2012) explored an activity on constructive learning for meaning and knowledge. When learners can make explicit the new experience in their interpretations, it shows that they have acquired it. In this study, we aimed to foster students' abilities in "differentiating" knowledge, which has been categorized by Anderson et al. (2001) as an "analyze" competence including the cognitive processes of "focusing," "selecting," "discriminating" and "distinguishing." In this study, these cognitive skills were adopted in the developed approach as a knowledge-sharing activity to enhance students' learning.

2.2 E-books for EFL learning

E-books not only present learning content in text, images and other media, but also provide various functions to facilitate learning, such as highlighting and looking-up of words (Godwin-Jones & Technology, 2011). E-books can provide more than just reading materials because they have all the trustworthy tools to support students to take notes and highlight content. Boticki, Akçapınar, and Ogata (2019) have analyzed data from e-book systems, but there have been comparatively few studies on actual e-book practices during in-class instruction. Previous studies have found that certain functions in the e-books could support learners' learning. Hwang and Lai (2017) claimed that the interactive e-book approach promoted the students' self-efficacy for learning mathematics, but also improved their learning achievement. Not only can e-books be applicable to learning math but also to language learning. Su and his colleagues (2017) found that the music function in e-books could be a possible feature to improve reading. Kiyota, Mouri, Uosaki, and Ogata (2016) claimed that their e-book system could support learners learning the connection between formal learning at school and informal learning after school. However, instructors do not generally incorporate e-books into their teaching in their classes to facilitate student learning. In this study, cognitive processes were conceptualized as involving a knowledge sharing-based e-book learning approach to support teachers' use of e-books in a class setting to build a variety of cognitive skills and to enhance language learning.

3. Research Methodology

3.1 The E-book System and Analysis Tool

An e-book system, BookRoll, was developed by Ogata et al. (2015). BookRoll offers valuable features such as annotations and page zoom. Besides, teachers can include questions in BookRoll as quizzes and exercises throughout the chapter and also at the end of the chapter to ensure that students retain the information that they are learning. As shown in Figure 1, the student's interface shows a "Memo" function to indicate sections where students can make their own annotations at the page level. Annotations in the system support learning performance and help collaborative learning (Nokelainen, Miettinen, Kurhila, Floréen, & Tirri, 2005). Five types of annotation (Chen & Chen, 2014) were adopted in the e-book, namely reasoning, discrimination, linking, summary, and explanation. Students are required to make reasoning, discrimination, question, clarification, and summary annotations in BookRoll. All course materials were uploaded to BookRoll in PDF format, and can be accessed through a standard web browser. In addition, it can support different devices such as smartphones, computers, laptops, and tablets.

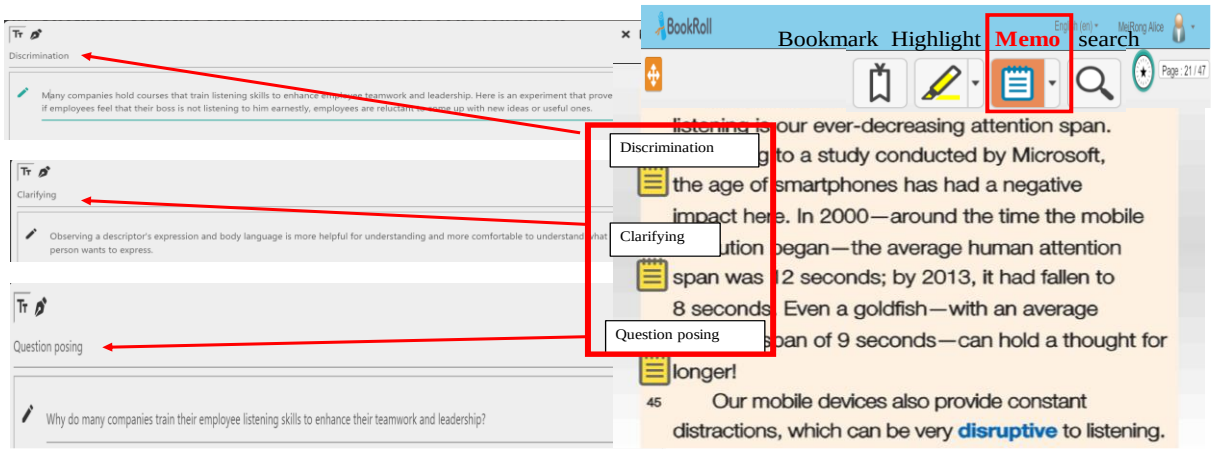

Figure 1. BookRoll system student interface.

The students' learning behavior from BookRoll is logged in a local database, Analysis Tool. After students used the memo in BookRoll, the Analysis Tool, as shown in Figure 2, generates the data of learners, content, engagement, learning traces, reading analysis, memo analysis, memo list, reading completion, and time. This information can help teachers and researchers to examine students' work and monitor their engagement (Akçapınar et al., 2019).

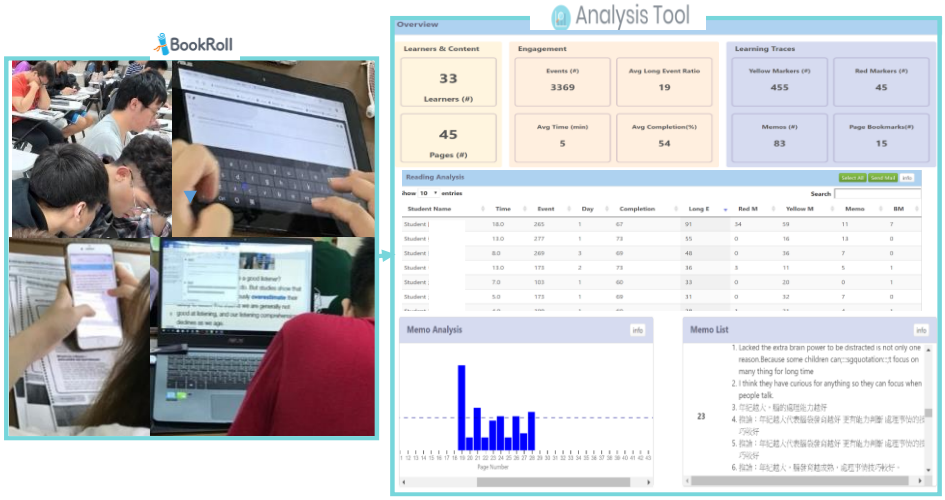

Figure 2. Students' engagement and Analysis Tool interface.

3.2 Participants

The experiment was carried out in a freshman English course at a university in the northern part of Taiwan. This course aimed to develop students' English skills, including speaking and reading skills. Two classes were recruited and randomly assigned as the experimental group and the control group. There were 38 (28 male, 10 female) students in the experimental group, while 32 (26 male, 6 female) students were in the control group. The students were 18-19 years old and had much experience reading from computer devices, such as mobile phones or tablets. Their English proficiency was at the low-intermediate level, comparable to the Common European Framework of Reference (CEFR) B1 level (Council of Europe 2001).

4. Experimental design

4.1 Experimental procedure

All participants first completed the pre-study survey, which was conducted one week prior to the beginning of the experiment. The instructor gave an introduction to the cognition skills (i.e., reasoning, discrimination, summary, question, and explanation) and some examples to both groups.

The BookRoll was introduced and showed how the students could access and make annotations through BookRoll. In order to understand students' group collaboration, the control group was required to make one of the five annotations by themselves without discussing with their peers; the experimental group was required to make five annotations on a group basis. Their annotations and performance were observed from the BookRoll system.

There are two chapters of 47 and 48 pages respectively published in BookRoll. During the 4 weeks of learning, the participants in the experimental group and the control group learned the course materials, shared and posted their memos on the course lectures and reading content as the in-class tasks.

4.2 Measuring instruments

In this study, the students' learning performances and participation of learning behaviors in BookRoll were assessed. Their pre- and post-learning performances were evaluated through five criteria, as follows:

- *Pronunciation: whether students convey their meaning accurately.*
- *Vocabulary: whether students use a large amount of vocabulary.*
- *Accuracy: whether students use the language grammar correctly.*
- *Fluency: whether students speak the language at an appropriate speed.*
- *Interaction: whether students interact with members of the group appropriately.*

The total score of both the pre- and post-learning performances was 100. Two experienced instructors rated the students' performances based on a rubric consisting of five dimensions, that is, pronunciation, vocabulary, accuracy, and interaction. The two instructors' ratings were found to have a rater reliability with Cohen's kappa= 0.505. As the kappa value exceeds 0.5, it is considered as indicating moderate interrater reliability (Cohen, 1960).

The time spent during class activities and the memos posted in the assigned tasks were collected for analysis of participation behaviors in the in-class knowledge-sharing tasks.

5. Results

To respond to RQ1, analysis of covariance (ANCOVA) was used to exclude the difference between the experimental group and the control group by using the pre-performance scores as the covariate variables and the post-performance scores as dependent variables. For the ANCOVA, this study tested the assumption of homogeneity of variance. Levene's test for determining homogeneity of variance was applied ($F = 1.42$, $p = 0.24 > 0.05$), which indicated that ANCOVA was applicable. The ANCOVA result of post-learning performance showed that significance was reached ($F = 5.56$, $p = 0.02 < 0.05$);

moreover, the mean score of the experimental group (M=79.78, SD= 0.80) was higher than that of the control group (M=77.08, SD= 0.81), as can be seen in Figure 3.

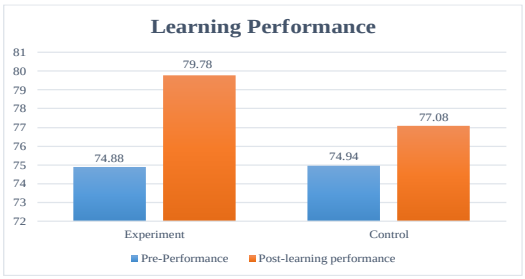

Figure 3. The results of pre- and post-learning performance.

Furthermore, the participants' learning logs, such as total time, total event, and memo length, were analyzed using the independent-samples *t*-test. As shown in Figure 4, there was a significant difference in the total time (t = 5.74, p <.001) for the experimental group (M= 58.89, SD=28.95) and the control group (M=25.41, SD =7.60). There was also a significant difference in the total event (t = 4.69, p <.001) for the experimental group (M= 185.19, SD =92.15) and the control group (M=92.15, SD =58.27). In addition, there was a significant difference in the memo length (t = 4.40, p <.001) for the experimental group (M= 615.36, SD =315.60) and the control group (M=293.79, SD =223.18).

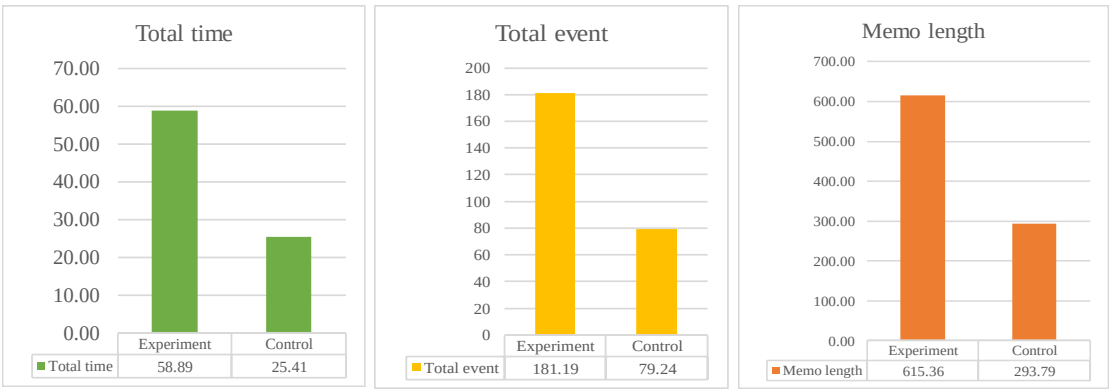

Figure 4. The results of learning behaviors.

6. Conclusions

Within the context of language learning in higher education, this study aimed to examine the effectiveness of a knowledge sharing-based e-book learning approach on students' learning performance and on facilitating class tasks involving cognitive skills. The results showed that using the knowledge sharing-based e-book system learning approach can help the participants' learning performance and enhance their learning behaviors. In the future, it would be worth exploring more research issues concerning the effects of e-books adopted in a real class setting with practical strategies for different aspects and subjects.

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References

Akçapınar, G., Hasnine, M. N., Majumdar, R., Flanagan, B., & Ogata, H. J. S. L. E. (2019). Developing an early-warning system for spotting at-risk students by using eBook interaction logs. *Smart Learning Environments*, *6*(1), https://doi.org/10.1186/s40561-019-0083-4.

Amineh, R. J., & Asl, H. D. (2015). Review of constructivism and social constructivism. *Journal of Social Sciences, Literature and Languages. 1*(1), 9-16.
Anderson, T., Rourke, L., Garrison, D. R., & Archer, W. 2001. Assessing teaching presence in a computer conferencing context. *Journal of Asynchronous Learning Networks, 5*(2), 1–17.
Aparicio, M., Bacao, F., & Oliveira, T. (2016). An e-learning theoretical framework. *Journal of Educational Technology & Society, 19*(1), 292-307.
Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education, 5*(6), 66-70.
Bakar, N. A., Latiff, H., & Hamat, A. J. (2013). Enhancing ESL learners speaking skills through the asynchronous online discussion forum. *Asian Social Science, 9*(9), 224.
Bakar, N. A., & Ismail, K. (2009). Using blogs to encourage ESL students. *Journal of Teaching and Learning in Higher Education. 1*(1), 45-57.
Boticki, I., Akçapınar, G., & Ogata, H. (2019). E-book user modelling through learning analytics: the case of learner engagement and reading styles. *Interactive Learning Environments, 27*(5-6), 754-765.
Chai, C. S., Wong, L. H., & King, R. B. (2016). Surveying and Modeling Students' Motivation and Learning Strategies for Mobile-Assisted Seamless Chinese Language Learning. *Educational Technology & Society, 19*(3), 170–180.
Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and psychological measurement, 20* (1), 37-46.
Council of Europe. (2001). Common European Framework of Reference for Languages: Learning, Teaching, Assessment. Cambridge University Press.
Godwin-Jones, R. (2011). Mobile apps for language learning. *Language Learning & Technology, 15*(2), 2-11.
Hwang, G.-J., Lai, C.-L., Liang, J.-C., Chu, H.-C., & Tsai, C.-C. (2018). A long-term experiment to investigate the relationships between high school students' perceptions of mobile learning and peer interaction and higher-order thinking tendencies. *Educational Technology Research and Development, 66*(1), 75-93.
Hwang, G. J., Sung, H. Y., Hung, C. M., Yang, L. H., & Huang, I. (2013). A knowledge engineering approach to developing educational computer games for improving students' differentiating knowledge. *British Journal of Educational Technology, 44*(2), 183-196.
Keengwe, J., & Onchwari, G. (2013). Fostering meaningful student learning through constructivist pedagogy and technology integration. *International Journal of Information and Communication Technology Education, 7*(4), 1-10
Kiili, C., Laurinen, L., Marttunen, M., & Leu, D. J. (2012). Working on understanding during collaborative online reading. *Journal of Literacy Research, 44*(4), 448–483.
Kiyota, M., Mouri, K., Uosaki, N., & Ogata, H. (2016). AETEL: Supporting seamless learning and learning log recording with e-book system. *Proceedings of the 24th International Conference on Computers in Education.*
Kreijns, K., Kirschner, P. A., & Vermeulen, M. (2013). Social aspects of CSCL environments: A Research framework. *Educational Psychologist, 48*(4), 229-242.
Mor, Y., Ferguson, R., & Wasson, B. (2015). Learning design, teacher inquiry into student learning and learning analytics: A call for action. *British Journal of Educational Technology, 46*(2), 221-229.
Nakanishi, C., Ando, K., Nakanishi, H., & Suzuki, R. (2017). Analyzing Post-Reading Questions from the Viewpoints of Cognitive Skills. *Proceedings of the International Conference on EEE*.
Nokelainen, P., Miettinen, M., Kurhila, J., Floréen, P., & Tirri, H. (2005). A shared document-based annotation tool to support learner-centered collaborative learning. *British Journal of Educational Technology, 36*(5), 757-770.
Ogata, H., Yin, C., Oi, M., Okubo, F., Shimada, A., Kojima, K., & Yamada, M. (2015). E-Book-based learning analytics in university education. Proceedings of the 23rd International Conference on Computers in Education. China: Asia-Pacific Society for Computers in Education.
Powell, K. C., & Kalina, C. J. (2009). Cognitive and Social Constructivism: Developing Tools for an Effective Classroom. *Education, 130*(2), 241.
Rau, P.-L. P., Chen, S.-H., & Chin, Y.-T. (2004). Developing web annotation tools for learners and instructors. *Interacting with Computers, 16*(2), 163-181.
Thornbury, S. (2016). Communicative language teaching in theory and practice. *The Routledge handbook of English language teaching* (pp. 242-255): Routledge.