

# Efficiency or Engagement: Two Book Recommendation Approaches in English Extensive Reading

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**Abstract:** Reading is one of the essential skills in mastering English as a foreign language (EFL). Extensive reading (ER), which is oriented to readers' pleasure, has been proved to improve various skills of language learning, such as reading, writing, vocabulary, learners' attitudes etc. Besides, many recommender systems for students have been developed, including systems which recommend English lessons the learner should take next. These systems could foster their positive attitudes to learning, but few studies have dealt with a problem, i.e., which is the better approach to improve learners' English skills, efficiency-oriented or engagement-oriented. In this paper, we focus mainly on EFL learners' vocabulary and reading speed, and introduce two English book recommendation methods for Japanese junior-high school students, one of which utilizes knowledge map (KM) and is oriented toward efficiency of learning, and the other employs content-based filtering and aims to promote learners' engagement. We also propose experimental methods of verifying whether each approach has a positive effect and of comparing which can improve learners' skills better.

**Keywords:** Extensive Reading, Knowledge Map, Recommendation, Learning Efficiency, Learning Engagement

## 1. Introduction

Reading, an ability required for acquiring written knowledge, is one of the essential skills in mastering English as a foreign language (EFL). By many previous studies, extensive reading (ER) as a method of learning foreign language and its effectiveness are well understood. Day and Bamford (2002) offered 10 principles for an extensive reading approach: The reading material is easy; a variety of reading material on a wide range of topics must be available; learners choose what they want to read; learners read as much as possible; the purpose of reading is usually related to pleasure, information and general understanding; reading is its own reward; reading speed is usually faster rather than slower; reading is individual and silent; teachers orient and guide their students; and the teacher is a role model of a reader. ER is also proved to have positive effects on learners' reading comprehension (Mason & Krashen, 1997), writing skills (Mason & Krashen, 1997; Mermelstein, 2015), vocabulary (Pitts et al., 1989) and attitudes (Mason & Krashen, 1997).

And now, turning to recommender systems, a great number of systems have been developed. For example, Hsu (2008) developed an English lesson recommender system for ESL (English as a second language) students which took into account readers' interest and aimed to increase their motivation to learn, but it didn't consider its learning effect and efficiency. Nishioka & Ogata (2018) proposed a research paper recommender system on the e-book system. It recommended research papers related to lecture materials the students looked at, although failed to make personal recommendations.

However, in extensive reading, it is not considered effective to emphasis efficiency too much and ignore individual's reading experience. As mentioned above, "the purpose of reading is usually related to pleasure" and "reading is its own reward"; thus, extensive reading must be fun and bring joy to readers. Therefore, when developing computer assisted language learning (CALL) system, we should

also make much account of learners' pleasure of reading. In our knowledge, nevertheless, few studies have dealt with a problem, which is the better approach to improve learners' English skills, efficiency-oriented or engagement-oriented.

In this paper, the term “efficiency” is defined as less materials or learning times to gain more learning effect, and the term “engagement” as students' involvement in learning activity caused by their interest. Besides, we introduce two English book recommender systems, both of which will be implemented on an existing e-book reader system, BookRoll (Flanagan et al., 2018), for junior-high school EFL students in Japan. One of these systems is based on knowledge map (KM) (Flanagan et al., 2019) and is oriented toward efficiency of learning, mostly of learning vocabulary. The other is based on learners' preference of books and aims to promote learners' engagement. We also propose an experimental method for answering following 3 research questions:

**RQ1.** Whether and to what extent does the KM-based book recommender system improve learners' vocabulary and reading skills in EFL?

**RQ2.** Whether and to what extent does the preference-based book recommender system improve vocabulary and reading skills in EFL?

**RQ3.** Which can improve learners' vocabulary and reading skills in EFL better, the KM- or preference-based book recommender system?

## 2. System Overview

### 2.1 Existing Platforms

#### 2.1.1 BookRoll

The book recommender systems we propose are added to existing e-book reader system: BookRoll (Flanagan et al., 2018). BookRoll, linked to an e-learning platform, Moodle (<https://moodle.org>), provides not only e-book page display and back and forth navigation, but text highlighting, notes taking, text search, bookmark, and material recommendation function. Figure 1a shows the interface of the system. The green button on the top left of the screen allows users to show material recommendations (thereafter we call this button “recommendation button”).

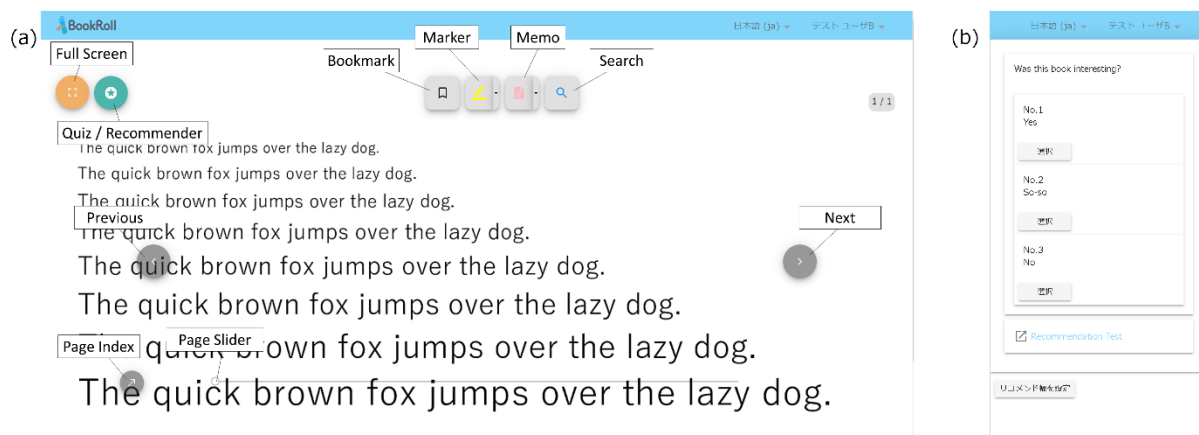


Figure 1. The Interface of E-book Reader BookRoll

When users push the recommendation button, a recommendation and quiz panel is displayed on the right side of the screen (see Figure 1b). In this panel, users can answer quizzes and jump to the recommended website. With specification as of May 2020, all the quizzes and recommendations are provided from providers of materials.

When users raise events on BookRoll, such as moving pages, clicking recommendation button, answering quizzes, etc., these events and the date they occurred are stored as reading logs to Learning

Record Store (LRS). The logs stored to LRS include event logs retrieved from Moodle (Details will be explained on 2.2). From these features, we think the quiz and recommendation functions are suitable to implement book recommender systems because we could get feedbacks about users' preference of book and display recommended books with the quiz and recommendation functions, respectively.

### 2.1.2 Knowledge Map

Flanagan et al. (2019) proposed vocabulary study map, which can be automatically generated from learning materials and the semantics of words they include. Figure 2 shows an overview of an example of vocabulary study map.

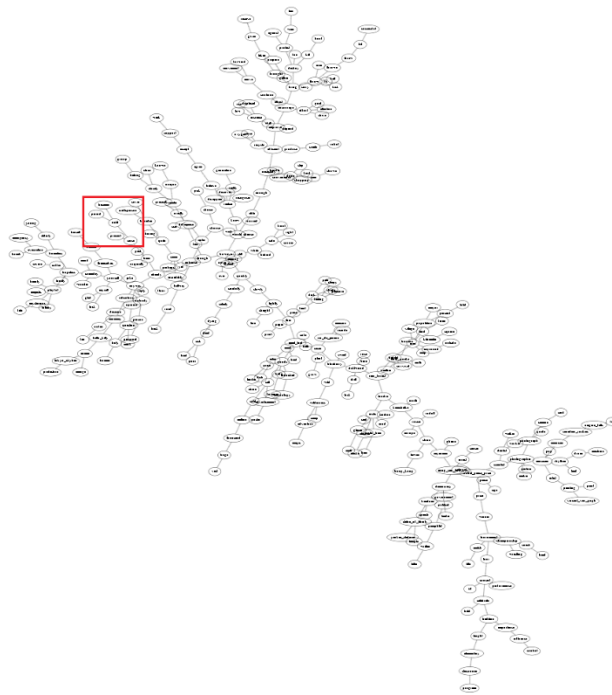


Figure 2. An Overview of an Example of Vocabulary Study Map

In the map they introduced, each node represented a word in English materials, and the words which have similar meanings were connected by edges. Figure 3, which is the detailed view of the red highlighted branch in Fig 2, shows an example of the edges of vocabulary study map. This suggests that the words “until” and “present” should be learned after “since”, and “period” after “until”. Besides, the information of words already learned could also be registered in the map. By this feature, learners can get in contact with more words in less learning time or with less learning materials and memorize them with comparative ease. Therefore, this map could be utilized to help learners learn vocabulary efficiently by introducing new words connected with words already learned.

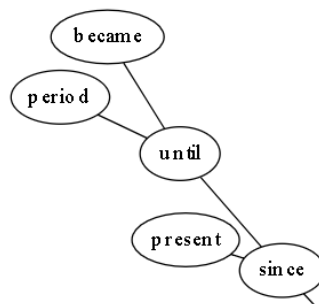


Figure 3. An Example of the Edges of Vocabulary Study Map

## 2.2 System Architecture

Figure 4 shows an overview of the architectures of the proposed book recommender systems.

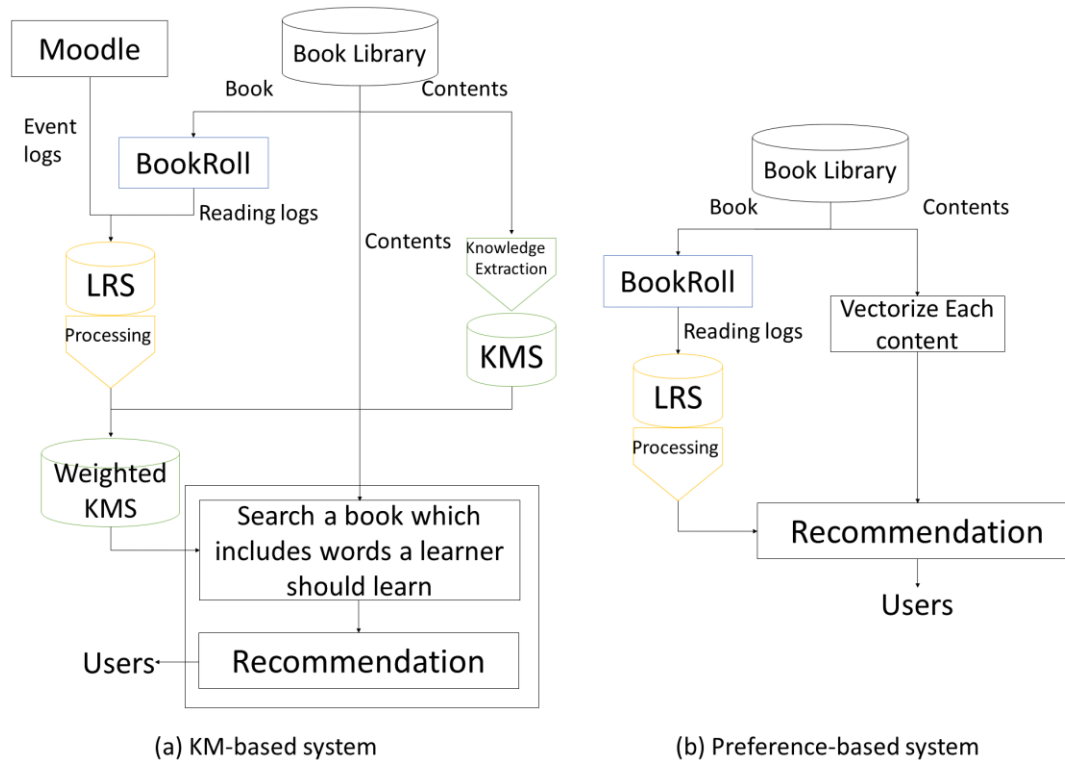


Figure 4. An Overview of Proposed System Architecture

### 2.2.1 KM-based System

Figure 4a corresponds to the architecture of the KM-based recommender system, adopting efficiency-oriented approach. First, all the words which appear in books in a book library, are extracted, and a vocabulary study map is generated in the way Flanagan et al. (2019) introduced. The generated map is stored in knowledge map store (KMS). In parallel, reading logs of books and event logs are stored in learning record store (LRS) through BookRoll and Moodle, respectively. Event logs from Moodle include logs about results of word quizzes provided at Moodle. Through the processing of these logs, information of words which each learner has already learned or not is extracted, and this information is saved on the vocabulary study map by weighting each node of the map. The weighted map can be tailored to each learner and stored in weighted KMS. By using the weighted map and the contents of books, the system searches books which includes as many words as possible a learner should learn to maximize efficiency of learning English and recommends them to the learner.

### 2.2.2 Preference-based System

Figure 4b corresponds to the architecture of the preference-based recommender system, adopting engagement-oriented approach. In this research, we adopt content-based recommender systems, in which the descriptive attributes of items combined with the rating behavior of users are used to recommendations (Aggarwal, 2016). First, the system makes a vector from each content of a book library. We will decide to use either of TF-IDF, word2vec (Mikolov et al., 2013), or BERT (Devlin et al., 2018) according to some demonstration experiment. In parallel, the logs of users' behavior on BookRoll are stored in LRS. These logs contain not only learners' reading time, but also whether they

have taken to the book they read. Using these logs, the system calculates cosine similarity of vectors which represent the contents of the books. In that way, the system recommends books whose contents seem to be similar to those of the ones a learner likes.

### 3. Method Overview

#### 3.1 Participants and Experimental Period

This study will take place at a secondary school in Japan. This school is a combined junior and senior high school and is equipped with an online learning environment with Moodle. As all the students in this school are provided with their own tablet or PC and internet access at their home, we can trace and analyze their learning logs in real-time. We will target the 3rd grade of junior high school students at this school as research subjects.

The students to participate in the study will be divided into 3 groups, and each group has around 40 students. The first group uses the KM-based book recommender system, the second uses the preference-based system, and the third is a control group to which no recommender system is applied. To answer the three research questions mentioned above, we will evaluate the improvement of English skills of the students in each group.

The experiment will last for 2 months. As detail will be mentioned on 3.3, we will conduct some tests for students to evaluate their English skills.

#### 3.2 Materials

476 English picture-books are stored at a book library and the students can select and read them as they like. These picture-books are classified into several categories by their difficulty, and students can select and read freely which book they want to read among these books. To maximize the effect of ER and evaluate how the proposed systems affect the attitudes of the students, reading the books should not be mandatory for the students, even though it is highly recommended. This reading is supposed to be done at home, not as formal learning at school.

Table 1. *The Numbers of Books Classified by CEFR Levels*

CEFR level	Number of books
pre-A1	42
A1	201
A1/A2	10
A2	79
A2/B1	92
B1	17
B1/B2	10
B2	10
B2/C1	10
N/A	5
Total	476

Table 1 shows the numbers of books which has each CEFR (Common European Framework of Reference for Languages) levels. Most of the books have A1 level (201 books), and the second most have A2/B1 (92 books). Some books have a level of A1+, A2+, etc., but these are counted as books which have level of A1, A2, etc., respectively. The 5 N/A level books did not have information about the level.

### 3.3 Evaluation of English Skills

The students' English skills will be evaluated mainly from the viewpoint of reading speed and vocabulary level. First, we will conduct a pre-test for evaluating each student's reading speed and vocabulary level. The reading speed will be calculated by the reading logs obtained from BookRoll, and the vocabulary level will be evaluated by a standardized vocabulary test which can estimate test-takers' vocabulary. Similar tests will be conducted during the experimental period several times, and finally, we will conduct a post-test after the period. In this way, we can obtain the data about the change of students' reading speed and vocabulary level before and after the experiment.

## 4. Conclusions and Future Work

In this paper, we raised a question, which language learning approach is more effective to learners, efficiency-oriented and engagement-oriented, and proposed an experimental method for answering it. We introduced two English book recommender systems, one of which was designed to maximize the efficiency of learning, and the other was designed to promote learners' interest in learning English. Both systems can be integrated into existing platforms so that we can trace the change of the students' behavior and skills.

In future, we will put this experiment into practice in an actual environment through the simulation. Besides, we will build student models according to the students' English level, which shows typical behaviors of students in each level. This model will be utilized to decide proper intervention in the students to stimulate them to study harder and improve their scores.

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## References

- Aggarwal, C. C. (2016). *Recommender Systems: The Textbook*. Springer.
- Devlin, J., Chang, M. W., Lee, K., & Toutanova, K. (2018). Bert: Pre-training of deep bidirectional transformers for language understanding. arXiv preprint arXiv:1810.04805.
- Day, R., & Bamford, J. (2002). Top ten principles for teaching extensive reading. *Reading in a Foreign Language*, 14, 136-141.
- Flanagan, B., & Ogata, H. (2018). Learning analytics platform in higher education in Japan. *Knowledge Management & E-Learning: An International Journal*, 10(4), 469-484.
- Flanagan, B., Chen, M. A., Lecailliez, L., Majumdar, R., Akçapinar, G., Ocheja, P., & Ogata, H. (2019). Automatic vocabulary study map generation by semantic context and learning material analysis. *Proceedings of the 27th International Conference on Computers in Education (ICCE2019)* (pp. 698-702).
- Hsu, M. H. (2008). A personalized English learning recommender system for ESL students. *Expert Systems with Applications*, 34(1), 683-688.
- Mason, B., & Krashen, S. D. (1997). Extensive reading in English as a foreign language. *System*, 25, 91-102.
- Mermelstein, A. D. (2015). Improving EFL Learners' Writing through Enhanced Extensive Reading. *Reading in a Foreign Language*, 27(2), 182-198.
- Mikolov, T., Sutskever, I., Chen, K., Corrado, G. S., & Dean, J. (2013). Distributed representations of words and phrases and their compositionality. In *Advances in neural information processing systems* (pp. 3111-3119).
- Moodle.org. (n.d.). *Moodle – open-source learning platform*. Retrieved May 30, 2020, from <https://moodle.org/>

- Nishioka, C., & Ogata, H. (2018, May). Research Paper Recommender System for University Students on the E-Book System. In *Proceedings of the 18th ACM/IEEE on Joint Conference on Digital Libraries* (pp. 369-370).
- Pitts, M., White, H., & Krashen, S. (1989). Acquiring second language vocabulary through reading: A replication of the clockwork orange study using second language acquirers. *Reading in a Foreign Language*, 5, 271-275.