

# A Flipped Model of Active Reading Using a Learning Analytics-enhanced E-book Platform

Yuko TOYOKAWA<sup>a\*</sup>, Rwitajit MAJUMDAR<sup>b</sup>, Louis LECAILLIEZ<sup>a</sup> & Hiroaki OGATA<sup>b</sup>

<sup>a</sup>*Graduate School of Informatics, Kyoto University, Japan*

<sup>b</sup>*Academic Center for Computing and Media Studies, Kyoto University, Japan*

\*yflamenca18@gmail.com

**Abstract:** Flipped learning is an effective learning method embraced by many teachers. However, it is difficult to observe how students are actually engaging in their learning outside of classrooms. By using an e-book reader with an analysis tool called BookRoll (BR), learning attempts can be visualized. This is an ongoing experiment in an active reading (AR) class to measure the effect of Survey, Question, Read, Record, Recite and Review (SQ4R), a common AR strategy in a university in Japan. Sixteen freshmen do their AR assignments through BR, and the classroom activities are organized based on the analysis of their outcomes. The following two research questions are stated: 1) what is the engagement of the students in different phase of the learning activity? and 2) is there any relation between the students' test scores and their flipped active reading performance? The results show that there are relations between students' test scores and their flipped reading performance. Limitations and future implications for data informed teaching are discussed.

**Keywords:** SQ4R active reading, flipped learning, learning analytics, log data

## 1. Introduction

Reading is a complicated individual task, which is performed in an individual's mind. Because of that, it is always challenging for teachers to design classroom activities for reading. In a reading class, the first objective might be to improve students' reading comprehension skills. But at the same time, it is important to lead students' individual autonomy so that they can work on reading by themselves outside their class. Flipped learning is one of the popular approaches, which has been called attention to by many educational stakeholders. Through flipped learning, students study concepts of the topic at home in advance so that they can engage in classroom activities actively and cooperatively with other students. However, it has been difficult to gauge how and how many students are working on their assignment outside of their class. This study examines how university freshmen in an AR basic class learn through a common active reading strategy, SQ4R (Survey, Question, Read, Record, Recite and Review) (Wong, 2009; Khusniyah & Lustyantje, 2017). They are asked to conduct a reading assignment as flipped learning by using a learning analytics enhanced e-book reader, BookRoll (BR) (Ogata et al., 2015). The classroom activities are designed based on their assignment outcomes. Two research questions are as follows: 1) what is the engagement of the students in different phase of the learning activity? and 2) is there any relation between the students' test scores and their flipped active reading performance?

## 2. Literature Review

### 2.1 SQ4R AR Strategy

Introducing appropriate reading strategies would help students to acquire reading skills and, hopefully, would eventually lead to their motivation and autonomy toward reading. Learning a reading strategy might be essential, especially for learners with lower reading competency. Novice readers may benefit from learning how to read actively and critically.

SQ3R (Survey, Question, Read, Recite and Review) was originally developed by Robinson for acquiring fundamental reading skills and its technique has been favorably applied in many reading classrooms (Robinson, 1946). SQ4R (Survey, Question, Read, Record, Recite and Review) is an extended version of SQ3R (Wong, 2009; Khusniyah & Lustyantje, 2017). Its effectiveness has been examined in many previous studies and the results were preferable (Basar & Gürbüz, 2017; Khusniyah & Lustyantje, 2017). Consequently, implementation of the technique in English classrooms has been suggested. Each phase of SQ4R is listed as follows:

- Survey: Skim and scan the overview of the upcoming reading to visualize the contents before reading.
- Question: Ask questions to oneself from what one has grasped from the Survey phase, and/or associate new information with one's previous knowledge to pay more attention to the reading.
- Read: Engage in reading by keeping questions in mind.
- Record: Take notes or annotations, and use markers for later reflection.
- Recite: Recite the contents in one's own words and write summaries for further retention.
- Review: Reinforce what has been read by reading again, answering questions, and/or going through other exercises.

A study was conducted to observe students' reading comprehension and teachers' perception toward SQ4R strategy in an English reading comprehension class by using the Zoom application (Khusniyah, 2020). It indicates that students improved reading comprehension skills and the teachers showed positive perceptions toward SQ4R, but they also indicated that SQ4R was too systematic and required complicated class-activity preparation. Overall, it was concluded that the application of SQ4R in online learning was recommended to use with media according to the needs of the objectives.

## 2.2 *Flipped Learning*

Flipped learning is one of the emergent learning methods in which learners go over the concepts of the topic before participating in the class activities through watching video lectures or studying online in advance (Bergmann & Sams, 2012). Learners come to class with their previous knowledge so that they can actively engage in classroom activities. The previous studies about the effect of flipped learning (Acarol, 2019) highlights that it has positive effects for student achievement, classroom participation and motivation, and students' attitudes.

## 2.3 *Learning Analytics of E-book Based Activities*

Learning analytics (LA) is a relatively new emergent study field which focuses on how technologically obtained data can be used to improve teaching and learning with minimum time delay between the capture and the use of data (Elias, 2011). An experiment was conducted to explore the relationship between learning engagement, behavior and achievement of senior high school students by using BR (Chen, 2020). The results from Chen's experiment indicated that the LA e-learning approach could assist not only highly engaged learners, but also improve the achievements of learners with low- and medium-level engagement.

## 3. **Orchestrating a Flipped Model of AR Using BR**

BR is a learning analytics enhanced e-book browsing tool, which allows students to browse digital learning materials anytime and anywhere (Ogata et al., 2015). Learning materials can be uploaded in the form of a PDF, and users' logs are recorded and visualized using the analysis tool. BR was used as a main learning platform for flipped reading assignments and some class activities in an online class. It provides features such as a recommender system, a yellow and a red marker, a memo board, and a dictionary function named DicoDico (Lecailliez et al., 2020). Learners can look up unknown words by using DicoDico, and these words can be visualized in the analysis tool. A yellow and a red marker can be used to highlight unknown words, as well as main or important ideas. The memo can be used to leave annotations. A pre- and a post-quiz created by the recommender system can be used to examine the learning gain of the students.

### 3.1 Students' Workflow with BR Affordances

A set of the first 4 phases of SQ4R (Survey, Question, Read and Record) is conducted as a flipped reading assignment over BR. The online synchronous class then follows all the SQ4R steps. The basic flow of the AR activities in both the flipped and online mode is illustrated in Figure 1.

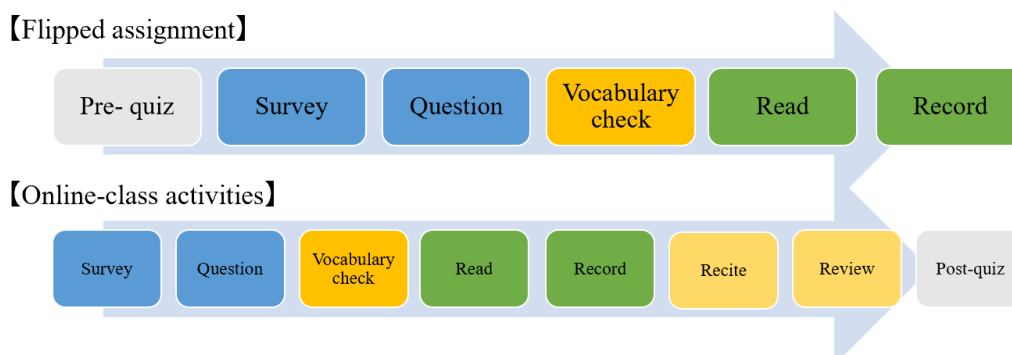


Figure 1. SQ4R Flipped Assignment and Online-Class Activities.

The online-class activities are based on what is left in the logs from students' flipped assignment attempts and some requirements indicated by school. As an introduction phase, students' predictions from the Survey and questions are shared, followed by a vocabulary check. Vocabularies highlighted by the students are shared and checked together in class. After confirming the vocabulary and overview of the reading material, students are asked to read the text on BR by themselves. The timer is set on the screen; students can check their reading time on the screen to keep record. After that, students are asked to use markers, DicoDico and the memo board to read the passages carefully during the Record phase. While using Zoom, they can be divided into Zoom breakout rooms and go through the text on BR as a group and confirm the vocabulary and contents together (Read and Recite phases). Using the analysis tool dashboard is recommended to confirm and compare their work with other students' work. After discussing the meaning of the contents, each group answers comprehension questions from the textbook on BR to reinforce their understanding further (Recite phase). Predictions and questions from students' flipped assignment are used as discussion topics for group activities or presentations for further retention of the information. As a part of the Recite and Review phases, they are asked to write a summary of the reading, using the memo board, in Japanese or English, as well as to check their reading speed, review, and take a post-quiz.

### 3.2 Teacher's Workflow Over Flipped Active Reading with LA Model

The teacher's role for the flipped assignments is to upload quizzes and learning materials on BR, provide feedback to students, and assemble online-class activities based on their assignment outcomes. For the online classes, the teacher's role is to assist students as a facilitator: encouraging students to participate in activities, facilitating and monitoring breakout-room activities (if conducted on Zoom) by visiting each room and checking students' engagement with the analysis tool available in near real-time, and dealing with questions from students. A report was distributed as feedback to students and the school based on the data from logs and the results of the first test. Feedback was exchanged between teachers and the school. After reflection, some modifications on flipped assignments and classroom activities were made. The flow of the LA cycle of flipped active reading is illustrated in Figure 2.

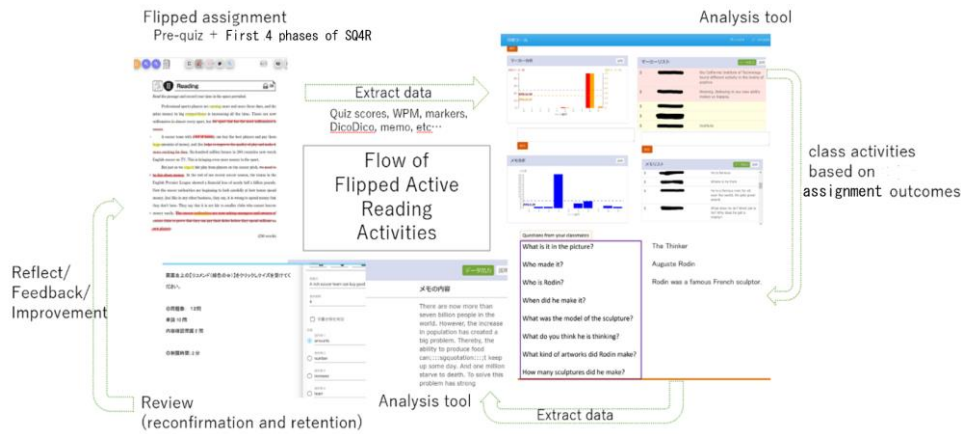


Figure 2. LA Cycle of Flipped Active Reading.

## 4. Pilot Study

### 4.1 Study Context and Methods

Participants are 16 university freshmen who are enrolled in an AR basic course. There are three basic classes for the course. Those were divided based on the university enrollment placement test scores. The participants' level is the lowest among the three. The course objectives stipulated by the university are that students will be able to 1) understand simple passages which is about 200 to 250 words, and 2) summarize the reading contents in their own words, and discuss opinions and ideas about the topic. The experimental class is collaboratively implemented by two teachers: one is done by online and the other one is done face-to-face. The AR course lasts one semester, which is a total of 30 classes held twice a week. A class lasts for 90 minutes. For this study, students' engagement during the first 5 flipped assignments and online-class activities were examined.

### 4.2 Data Analysis and Result

Collected data was analyzed with data collected during three different phases: pre- and post-quiz, flipped assignment outputs, and online class activities. One chapter is covered in one class, and a pre- and a post-quiz are assigned for each chapter. The pre-quiz had 15 multiple-choice vocabulary questions, and the post-quiz had 10 vocabularies and 2 comprehension questions to observe students' lexical and reading comprehension achievement. Normalized gain was measured to evaluate the differences between the pre- and post-quizzes in terms of students' performances. 10 out of 16 students attempted to take both quizzes. The average normalized gain score for the experimental group was 21% which was in the low range as shown in Table 1.

Table 1. *Normalized Gain* (as per Hake, 1999)

Normalized gain score(N=10)	Criteria	Value
Average gain		21%
.07<(g)<1.00	High	1 student
0.30<(g)<0.70	Average	4 students
0.00<(g)<0.30	Low	2 students
(g)=0.00	Stable	0 student
minus1.00<(g)<0.00	Decrease	3 students

Extracted data are accumulated into logs in an analysis dashboard. Log data from BR contains students' reading interactions and engagements during the flipped assignments. Memo lists containing predictions and questions were examined for students' comprehension. Students' learning engagements, such as time spent on flipped assignments and the number of operations, were extracted from the feedback panel and real-time graph (see Figure 3).



Students' predictions and questions left in the memo were examined. Each student wrote a single prediction per each chapter. 7 students wrote all 5 predictions for 5 chapters, while 1 student did not write any prediction as assignment. Regarding questions, a total of 56 questions in English and 24 questions in Japanese were left in the memo.

The operation time as seen in the feedback panel indicated that students were actually using tools such as the markers and the memo while they were studying. It shows that they were not just opening BR, but browsing the pages and actually spending time on studying. The maximum length of the time spent on browsing BR was 75 minutes per day and the average was 20.56 minutes. From the panel, it was understood that 12 out of 16 students did all their flipped assignments for each chapter while 4 students sometimes did not do their assignment. Further, students are required to take four monthly tests and a final exam to fulfill the course grade requirement. Their test results are available from school. For this study, the first monthly test was taken into account. The test assessed students' lexical, grammatical and reading comprehension achievements. The first monthly test scores were ordered from the highest to the lowest (Papi & Abdollahzadeh, 2012). 6 students belong to the high group (score over 91); 7 students are in the middle group (scores from 73 to 90); and 2 students belong to the lowest group (score below 73); 1 student was absent. Furthermore, the transition patterns between the pre-quiz score and students' time engagement in flipped assignments, and the first monthly test scores were illustrated by interactive Stratified Attribute Tracking (iSAT) methods in Figure 4 (Majumdar & Iyer, 2016) in order to answer the second research question for the relation between the students' learning achievement and their flipped active reading performance.

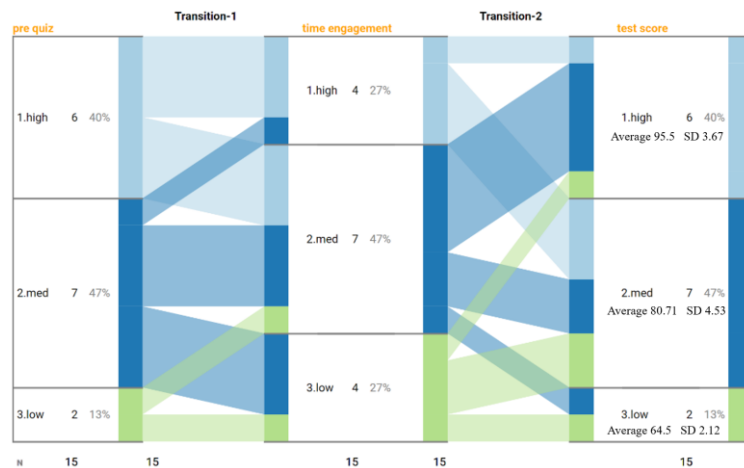


Figure 4. Cohort Transitions between Pre Quiz, Engagement in Flipped Assignments and Term Performance.

It was observed that the test score is related to the quiz score and flipped assignment performance: students who got lower scores on pre-quizzes and spent less time on their homework got lower scores, except one who got a higher score.

## 5. Discussion and Conclusion

From the implementation of flipped active reading with a learning analytics enhanced e-book reader, students' engagement in each activity phase was examined, and it was observed that there are relations between freshman English learners' learning achievement and their flipped active reading performance. The dashboard also provided the information to the teacher to decide, conduct and monitor the activities during the synchronous online phase.

However, we acknowledge some limitations at this current stage. Overall, the number of participants were less to conduct any inferential statistics related to students' learning performance with SQ4R AR strategy through flipped learning and their achievement. We shall continue with a two-group study design with the current participants as experimental group and other class conducted with traditional activity learning strategy as control groups in order to determine the effectiveness of SQ4R active reading strategy in the flipped learning context.

It took about 4 weeks for most of the students to get used to the learning procedure over digital devices. Flipped learning procedure has to be simple enough so that students are able to attempt learning by themselves. Moreover, giving constant feedback and assistance, and encouraging students to work on their assignments would be the key to conduct flipped active reading effectively.

As for teachers' workload, it takes an extra effort to prepare flipped learning materials and construct class activities based on the students' assignment submission. In addition, technical problems, such as system downtime and bugs, need to be considered and alternatives set aside. The teacher's role as a facilitator and the degree of class preparation has a strong influence on the engagement of the students in the learning activities. Progress of this research aims to further investigate these matters and refine the workflow and technical affordances of the system to support flipped active reading activities.

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