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Real-time Analysis of Digital Textbooks: What Keywords Make Lecture Difficult?

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Abstract: This paper describes a real-time learning analytics to find learning contents or keywords that students don't understand in digital textbooks. We developed a digital textbook viewer system that can collect students' learning logs. By analyzing and visualizing the collected learning logs in real time, teachers can visually find the keywords that students don't understand during a class. This paper describes the contribution of real-time learning analytics for supporting teachers.

Keywords: learning analytics, digital textbook, real-time analysis

1. Introduction

University classes in Japan are generally conducted in a traditional lecture style. Its advantage is that teachers can convey knowledge to their students precisely. However, it is difficult for them to find keywords that students don't understand during the class unless teacher asks them. We believe that real-time collection and analysis of students' learning logs can facilitate teachers to find keywords that their students don't understand during class.

This study proposed a digital textbook viewer system called AETEL to collect the learning logs (Kiyota et al., 2015, 2016). In order to find keywords that students don't understand in the digital textbook, this study develops a real-time learning analytics system. By detecting the keywords in real time, the system immediately provides teachers with the keywords that students don't understand, and teachers are able to explain more in details based on the analysis results.

The rest of this paper is constructed as follows. Section 2 describes our developed digital textbook viewer system to collect learning logs. Section 3 describes our proposed real-time learning analytics for finding keywords that students don't understand in the digital textbook. Section 4 describes our conclusion and future works.

2. Digital Textbook Viewer System

Ministry of Education, Culture, Sports, Science and Technology (MEXT) in Japan, all the textbooks for elementary, middle, and high schools into digital textbooks (Yin et al., 2014, Ogata et al., 2015). In many countries, the polices of digital textbooks only focus on introducing the technology of digital textbooks into K12 schools (Fang et al, 2012, Shin, 2012). However, little attention has been paid to analyzing the learning logs collected by digital textbooks, although it is important to investigate how these logs can be used to improve digital textbooks and the quality of learning and education (Mouri et al., 2016). In order to find the keywords that students do not understand in the digital textbooks, this study developed a digital textbook viewer system.

Figure 1 shows the interface of our developed digital textbook viewer system. For example, in order to go to the next page, the learner will click "NEXT" button, and this action will be saved as

"NEXT". If the learner highlights some row in the digital textbook, he/she will click "Marker" button, and the action will be saved as "ADD MARKER". For example, when a learner doesn't understand a keyword in the digital textbook or a learner wants the teacher to give more explanation about it, the text information of the keyword can be collected by using the function.

By using the function, the study can collect keywords that students don't understand in the digital textbook during class. In the next section, this paper describes the real-time learning analytics for finding keywords that students do not understand in the digital textbook.

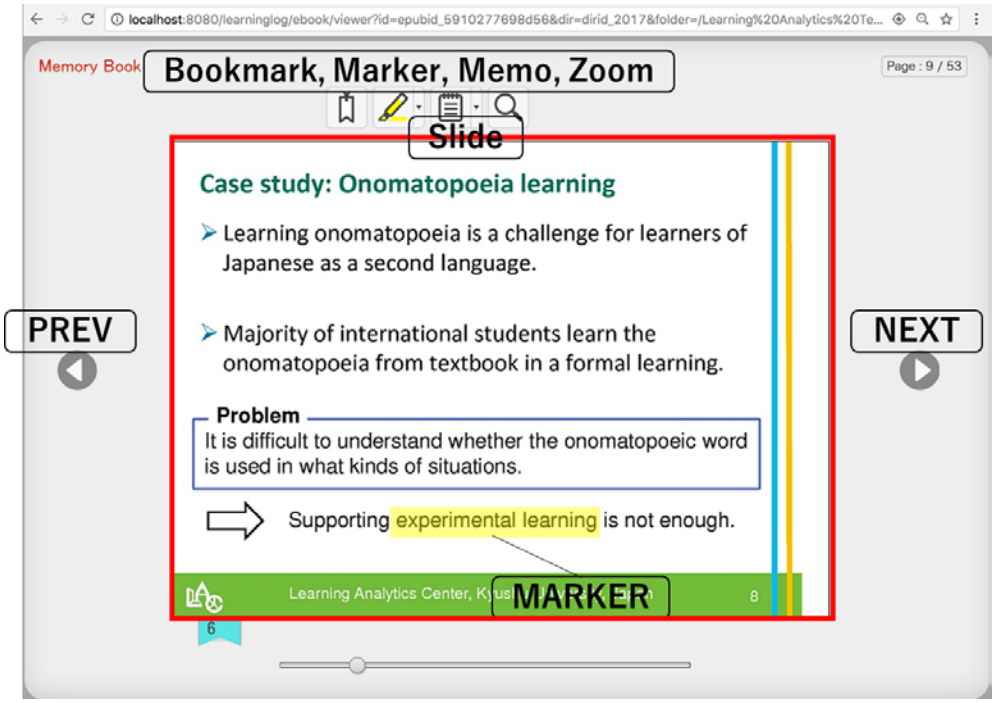

Figure 1. Digital textbook viewer system

3. Overview of our proposal

Figure 2 (Right) shows the real-time heat-map.

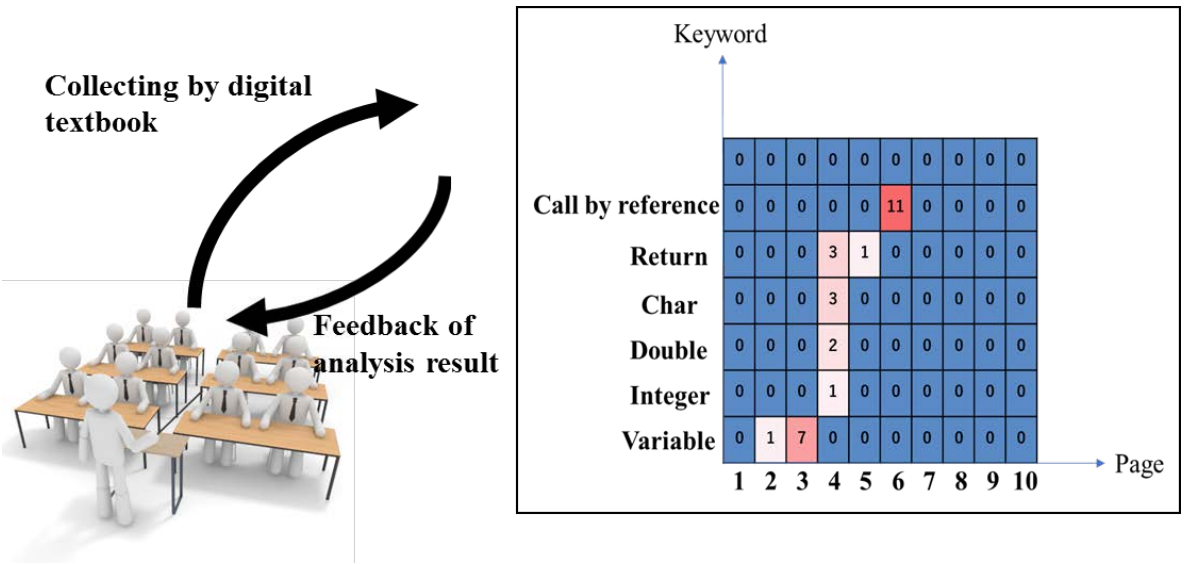

Figure 2. Overview of our proposed real-time learning analytics

The horizontal axis represents the page number and the vertical axis represents the keywords. The color of each cell represents the number of students who marked the keywords that they did not understand. In this case, teachers see that 11 students can't understand the keywords, "Call by reference" in real time during the class. As the result, teachers can explain more about it as shown in Figure 2(left).

4. Conclusion and Future Work

This paper introduced a digital textbook viewer system to collect keywords that students do not understand. By using the system, we can collect learning logs to the server, and analyze and visualize them for improving educational quality. Moreover, this paper described a real-time learning analytics for finding keywords that students do not understand in the digital textbook. However, its evaluation is yet to be conducted to examine whether our proposal is useful for teachers, e.g., "whether it hinders their lectures during the class by providing the analysis and visualization results". The real-time feedback might disturb their lectures if the information load is too much.

With these considerations in mind, we are planning to implement the real-time learning analytics approach in our universities and evaluate it. Also, we will extend our research based on our recent outcome of learning analytics (Mouri et al., 2015; Shimada et al., 2017) and other domains such as career support and language learning (Uosaki et al., 2015) in the future work. We believe that providing teachers with valuable information will lead to improve the quality of education.

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