Iyer, S. et al. (Eds.) (2022). Proceedings of the 30th International Conference on Computers in Education.
Asia- Pacific Society for Computers in Education

Teaching Analytics Across Multiple Systems: A Case Study at a Junior High School in Japan

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Abstract: This study analyzed and visualized the daily behaviors of teachers on multiple systems using Experience API (xAPI). The results revealed that the learning management system was routinely used, while the learning analytics dashboard was not. Further, we examined how the teacher used the dashboard during the experimental classes with a learning analytics researcher. The results showed that the use of e-book readers and dashboards was encouraged on the day when the researcher attended class together. Additionally, the timings when the teacher checked the dashboard were getting earlier in each class. These results imply that the repeated use of a dashboard and the help of an expert foster the literacy of teachers in using educational data in their classes.

Keywords: Teaching Analytics, Data Literacy, xAPI, Multiple Systems

1. Introduction

In Japan, related ministries, and agencies, including Digital Agency and the Ministry of Education, Culture, Sports, Science, and Technology, have released a roadmap for the use of educational data, which describes how teachers can use the collected educational data in the future (Digital Agency, 2022). Additionally, learning analytics dashboards for teachers have been developed for the utilization of educational data. However, providing teacher-facing dashboards does not necessarily encourage teachers to utilize data for their daily classes. we have to first understand how teachers use education data.

Some studies have used log data from the learning management system (LMS) to understand the behavior of teachers (Su, Li, & Chen, 2021). However, the data in the LMS alone do not provide a broad picture of the behavior of teachers. Therefore, Experience API (xAPI) is attracting attention as a technology. xAPI is a technical specification for handling and analyzing multiple data sources (Kevan & Ryan, 2016). It facilitates the documentation of the learning experience. xAPI stores learning experiences in the learning record store (LRS). However, xAPI has mainly been used to visualize the behavior of learners, and few studies have applied it for teachers. This study uses xAPI to analyze and visualize the behavior of teachers from multiple data sources. The purpose of this study is to explore the factors affecting the utilization of data by teachers for their daily classes.

2. Method

2.1 Learning Evidence Analytics Framework (LEAF)

We used data collected from the LEAF system for analyses. The LEAF system is a learning analytics platform that supports teaching and learning by analyzing accumulated educational data (Ogata, Majumdar,

Akçapınar, Hasnine, & Flanagan, 2018). It consists of three major sub-systems: BookRoll, Moodle, and LOGPALETTE. BookRoll is an e-book reader, where teachers upload learning materials for students. Moodle is an LMS used to manage courses and resources. LOGPALETTE is the learning analytics dashboard that visualizes the interactions of learners.

2.2 Teacher's Literacy on Educational Data Use

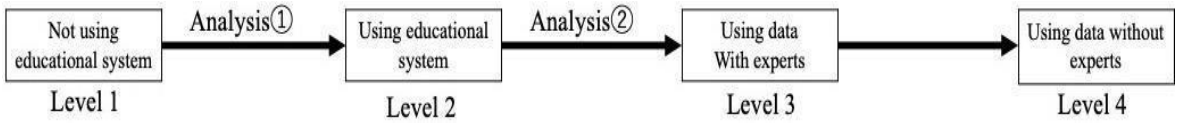

Figure 1. Level of data usage by teachers

As shown in Figure 1, we organized the literacy levels of the teachers on educational-data use. First, we assumed that teachers become familiar with the use of an educational system (Levels 1 to 2), and thereafter, they become familiar with utilizing the data with the help of learning analytics experts (Levels 2 to 3). Finally, they eventually become experts in educational-data use (Levels 3 to 4).

2.3 Data and Analyses

In this study, we extracted logs for the behavior of teachers from the LRS data recorded in the LEAF system. Typically, teachers use the LMS to manage the courses and other information of the learners. Further, LMS works as the starting point for other tools, such as e-book reader and dashboard. The analysis covered 1-month data from June 1 to June 30, 2022. To explore the factors affecting the utilization of data by teachers for their daily classes, we conducted the following two analyses. Analysis 1 analyzed four English teachers: A, B, C, and D, at a junior high school in Japan who had access to the LEAF system. Teacher A was between level 2 and level 3 in Figure 1 because Teacher A implemented an experimental class with an expert. To compare with other levels, we selected other teachers teaching the same subject, whose log data were recorded. Analysis 2 targeted teacher A who had the experimental classes with a learning analytics researcher and conducted a detailed analysis and visualization of some of the classes of the teachers. The experimental classes were conducted in three different classes in the same grade, with the same material, and the same teaching methods.

3. Results and Discussion

3.1 Analysis 1: Comparison of the behavior of each teacher on multiple systems

Table 1 shows the number of xAPI statements for teachers during the analysis period. All four teachers used educational system daily during that period. They all used LMS, two teachers used the e-book reader, and only teacher A used the dashboard. Teacher A, who is related to Analysis 2, routinely used the LMS, while not frequently the e-book reader and dashboard. Additionally, Teacher A used the e-book reader and dashboard on two days other than the experimental day.

Table1. *Log Data for Each educational system*

	Teacher A	Teacher B	Teacher C	Teacher D
LMS	1939	1418	590	916
E-book reader	81	0	0	4
Dashboard	80	0	0	0

3.2 Analysis 2: Visualization of teacher A's use of educational data

Figure 2 visualizes the log data of the function of each tool obtained by Teacher A on June 27 in the three experimental classes. Context select and Active reading were used to check the learning logs and provide feedback in class. Quiz, course, lti, and top view in the LMS were used for course management. On that day, the behavior of the teachers differed despite using the same material and teaching methods among the classes. For example, teacher A checked the dashboard 40 min after the start of the first class, 24 min after the beginning of the second class, and 21 min after the start of the third class to use the data. In other words, the timings when the teacher checked the dashboard were getting earlier in each class. This result implies that the repeated use of a dashboard fosters the literacy of teachers in using educational data in their classes.

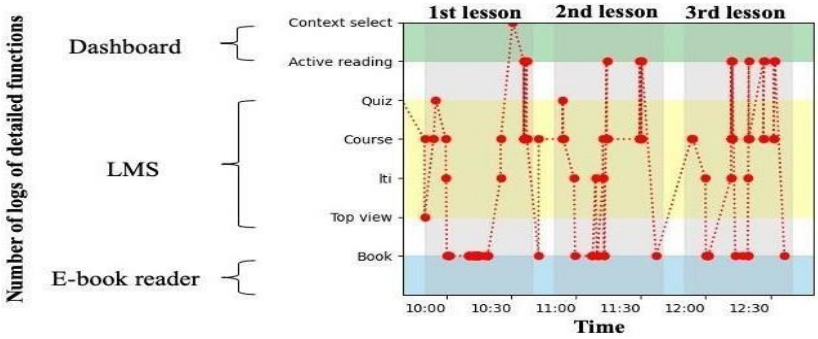

Figure 2. Visualization of teacher A's log data in the experimental classes

4. Conclusion and Future Work

This study aimed to explore the factors affecting the utilization of data by teachers for their daily classes through the analysis and visualization of the behavior of teachers using xAPI. xAPI makes it possible to visualize the behavior of teachers from multiple systems and distinguish the literacy levels of teachers on educational-data use, as shown in Figure 2. The results showed that the use of e-book reader and dashboard was encouraged on the day when the learning analytics researcher attended class with the teachers. Additionally, the timings when the teacher checked the dashboard were getting earlier in each class. These results imply that the repeated use of a dashboard and the help of an expert foster the literacy of teachers in using educational data in their classes. Although further research is required, we think that the results of this study are not limited to the subject of English. A future challenge is to develop a learning analytics dashboard tailored to the data-usage literacy of teachers in a variety of subjects.

Acknowledgments

This study is supported by NEDO JPNP18013, JPNP20006 and JSPS KAKENHI JP22K20246.

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