Development of Learning Analytics Platform for OUJ Online Courses

Masako Furukawa, Kazutsuna Yamaji
National Institute of Informatics
NII
Tokyo, Japan

Yoshitomo Yaginuma, Tsuneo Yamada
The Open University of Japan
OUJ
Chiba, Japan

***Abstract*—The Open University of Japan (OUJ) and National Institute of Informatics (NII) have started collaborative study for learning analytics. OUJ is the largest distance education institution in Japan. In the academic year of 2015, OUJ launched interactive online courses. One of the essential features of online courses is the possibility to collect and analyze educational big data. To utilize such educational data, OUJ and NII have developed learning analytics platform for OUJ online courses. In this paper, the features of the system are overviewed.**

Keywords—Online Courses; Learning Analytics; xAPI;

I. Introduction

Learning analytics is the technology to collect and analyze educational data. Learning analytics is useful to evaluate and improve the courses, and enables adaptive support for learners [1]. For example, Bouchet et al. employed a sequence mining technique to identify activity patterns of students [2]. Peckham et al. showed that k-means clustering combined with Bloom's Taxonomy is useful to determine cognitive skill sets [3]. However, in order to have such benefit of LA, educational institutions need a platform for LA.

The Open University of Japan (OUJ) and National Institute of Informatics (NII) have launched collaborative study for learning analytics, and developed a platform for LA. OUJ is the largest distance education institution in Japan. OUJ provides about 300 of TV and radio lectures for lifelong learning. NII is the academic research institution for informatics. NII provides advanced academic information infrastructure, academic content, and services for universities. The Science Information Network (SINET) provided by NII connects universities and research institutes nationwide, and the online course platform of OUJ is developed on the NII servers.

In the academic year of 2015, OUJ launched interactive online courses. In the academic year of 2017, about 20 online courses, such as "Introduction to Java Programming", are available. The number of participants in several courses is over 1000. It is planned that the line-up of online courses will be expanded in a short time. One of the essential features of online courses is to collect and analyze educational big data. The results of analysis are useful for the customization and optimization of the courses. To utilize such educational data, OUJ and NII have developed the learning analytics platform for OUJ online courses. In this paper, the features of the system are overviewed.

II. Learning Analytics Platform

A. System Overview

The architecture of the learning analytics platform is shown in Figure 1. OUJ adopted Moodle as the learning management system. The database software of the system is PostgreSQL. To deliver lecture videos, Flash video is used for PCs, and MP4 video is used for iOS and mobile devices. To prevent students from downloading videos, URLs of the videos are hidden behind the reverse proxy. Using integrated authentication system, when a user enters the user name and password, the user can access multiple online systems seamlessly.

Every time a student uses a module of the courseware, a new entry of learning records is added to the learning management system. The learning records include the grades of online assignments, reading time, the total number of login times, the total number of online discussions and so on. The learning records are transferred to the Log Store server developed by NII, and are used for the analysis. Dashboard interface for teachers and learning analytics is also developed.

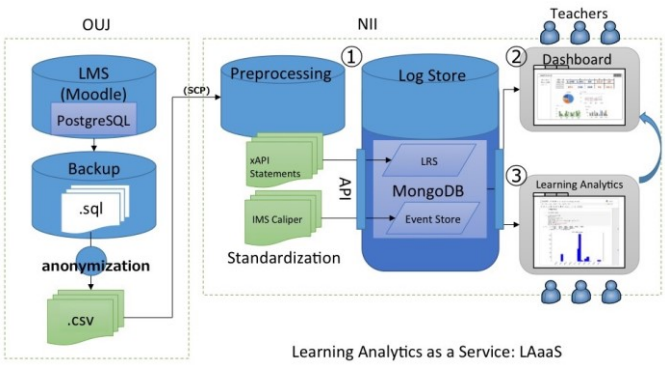

Fig. 1. System overview.

B. OUJ System

To realize detailed analysis of learning records, the following 3 modules are developed for the OUJ system.

(1) User agent record module

The user agent information, which describes IP address, screen size and other browser information, is used for the server to select suitable content. In the OUJ system, based on

the user agent, the OS running on the devices are detected, and suitable video format (Flash or MP4) is chosen. By using the user agent record module, we can record user agent strings in the Moodle standard log format. We can obtain user agent strings associated with user IDs.

(2) Video player module

Video player module is a module that records video player interactions (play, pause, stop, skip) in the Moodle standard log format. Figure 2 shows the interface of the video player module. The area for video controls and caption is located below the video. At OUJ, the rate of captioning for the TV lectures is above 50%, and the rate of captioning for the online lectures is 100%. To reduce the time and effort for the captioning, we are trying to use speech recognition technology experimentally [2]. The video player logs show which parts of the videos are watched and skipped by the user. Using these kinds of data, we would be able to examine, for example, the relation between video player logs and quiz-answering activity.

Fig. 2. Video player module.

(3) Anonymizing module

In order to protect personal information, it is easy to delete personal identifiable information such as user name, user ID, IP address. However, in this case, it becomes difficult to trace each student's learning records. In the OUJ system, SHA-2 hash is used to anonymize such information. The student information, such as age, gender and occupation, is stored in another system named WAKABA. If the user ID is hashed in the same way, we can combine learning records and such student information.

C. NII System

The learning logs are stored in the Log Store developed by NII, and used for the analysis.

(1) Standardization module of user log

Experience API (xAPI) is one of the standards related to learning log analysis [3]. The xAPI describes learning log data in JSON format, and enables applications to share such data. In our system, the learning log data extracted from the Moodle are converted to the xAPI format. 90 types of events, such as "logged in" and "viewed", are converted to the xAPI format.

(2) Log store

Although the data source is currently one Moodle, the learning records from multiple servers will be gathered to one log store server. The base of the server is Learning Locker, which is an open source log store server. The mongoDB is used as a database system, and stores the log data that are converted to xAPI format.

(3) Dashboard interface

The results of basic analysis, such as simple statistical values, are shown on the dashboard interface as shown in Fig.3. Currently, the targets of this system are the teachers. This system will be a guide for teachers to improve their lectures. The detailed analysis of learning records is also available on the Web browsers. The analysis can be carried out using R, which is an open source software for statistical analysis. The advantage of our system is that we can share the analysis program on the dashboard, and can use the dashboard as a basis of research and improvement of the courses.

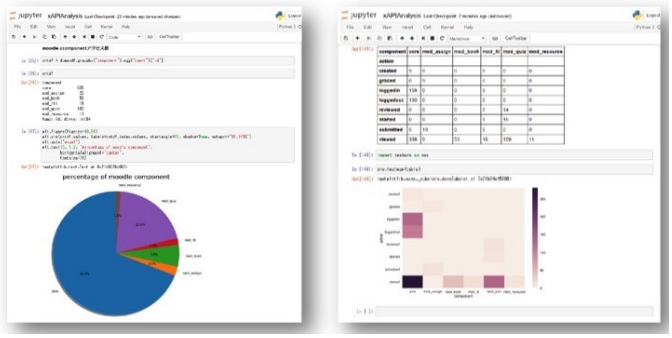

Fig. 3. Dashboard Interface.

III. Conclusions

In this paper, the development of the learning analytics platform for OUJ online courses was overviewed. To realize detailed analysis of learning records, 3 modules on the OUJ system are developed. The learning logs are stored in the Log Store developed by NII, and used for the analysis. We will carry out detailed analysis using the data provided by the learning analytics platform.

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