Preliminary Report: Development of a Learning Management System in Middle School Science Education

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Abstract. We developed a Learning Management System (LMS) suitable for use in middle school science education. Based on an existing LMS developed for university classes, a worksheet system was added for use in middle school science classes. The combination of real-time bidirectional communication and the worksheet function is expected to lead the way for tablet utilization as active learning in middle school.

1. Introduction

The popular term "Industry 4.0" has been introduced to describe the automation industry, which is created by Artificial Intelligence (AI), Big Data (BD), and the Internet of Things (IoT). The need for Information and Communication Technology (ICT) in education is increasing to develop the human resources who can handle this industrial transition. The tablet is currently attracting attention as an ICT device in education. From April 2019, the digital textbook will be regarded as a formal textbook in Japan [1], and the provision of one tablet for every student will be necessary [2]. Beyond the digital textbook, various applications such as teaching aids utilizing the sensors provided in tablets have been developed to utilize tablets in education [3-6].

In this paper, we developed a Learning Management System (LMS) suitable for middle school education. Although LMSs have already been used in university or online classes, there are few cases of using LMSs in classroom lessons in the compulsory curriculum. LMS utilization in classroom lessons is useful, because the simultaneous exchange of a large number of opinions becomes possible; therefore, LMS can be adopted as active learning. In order to exchange opinions using tablets, text input is necessary. The next education guideline will describe the importance of tablet operation; therefore, the utilization of LMS is expected to be important [7].

In middle school science classes, teachers usually use worksheets as the class guideline. A worksheet function in the LMS will thus be necessary for the middle school students. In this study, we developed an LMS suitable for use in middle school science classes by adding a worksheet system to the existing LMS.

2. LA-II

The LMS we developed for use in middle school science classes is based on an existing LMS called Lecture Aid II (LA-II), owned by Peak corporation [8]. LA-II is capable of real-time bidirectional communication. It operates on the browser via the server; therefore, it is unnecessary to install any software and the operation does not depend on the type of OS. It has two different modes: one is the teacher mode and the other is the student mode.

In the teacher mode, the class is progressed using the "class scenario," shown in Fig. 1. Within the scenario, the learner's device can be controlled for each tool (the red outlined box in Fig. 1). The scenario has various tools, and typical tools are described below.

- Presentation tool: The slide displayed on the student's device can be controlled by the device in teacher mode. (No. 2 in Fig. 1).

- Chat tool: Opinions between students can be exchanged by chatting (No. 3 in Fig. 1).
- Description type answer tool: Descriptions of the students can be aggregated (No. 4 in Fig. 1).
- Mutual evaluation tool: Opinions can be evaluated mutually among students (No. 7 in Fig. 1).
- Exam tool: Tests can be conducted and the answers are scored automatically by the software (No. 8 in Fig. 1).

Fig. 1: Screenshot of the teacher mode. The "Points" row (3rd row) and the "Remark" row (5th row) indicate the supplements about each activity and the time required in minutes, respectively.
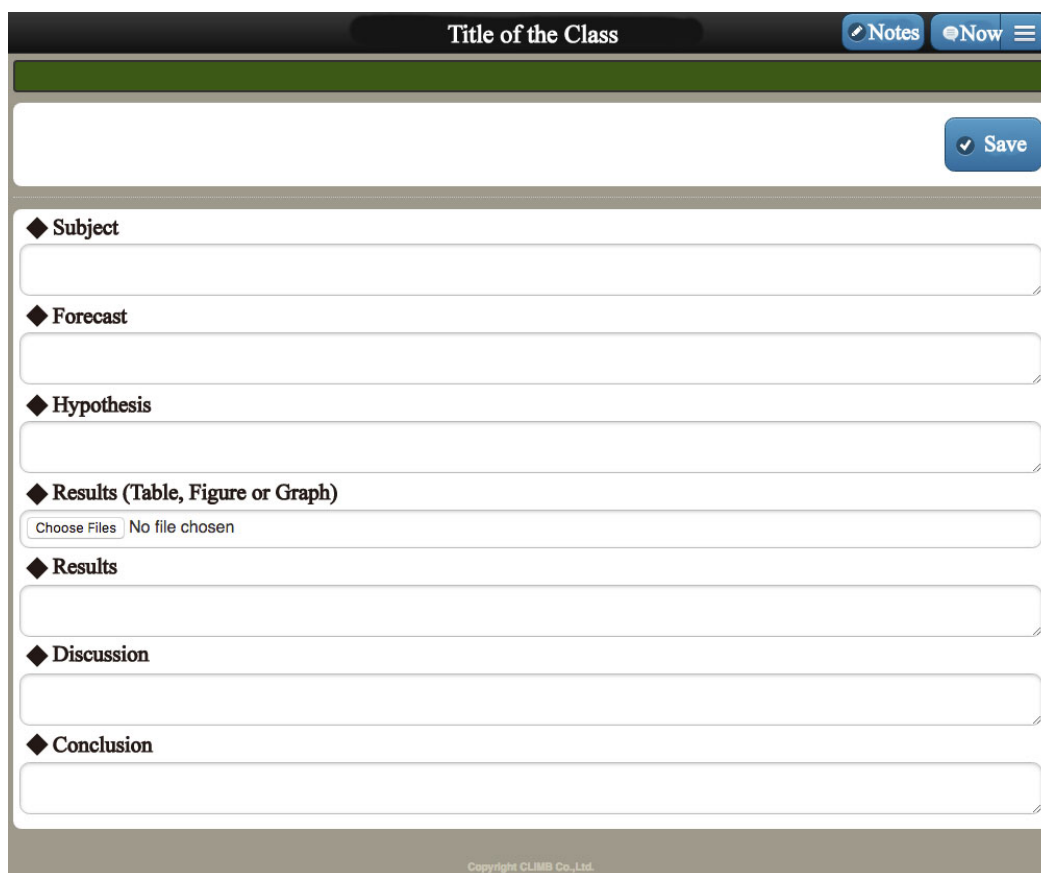
The student mode is simple. When the "Now" button (upper right in Fig. 2) is pressed, the screen is transited to a scenario item, which has been specified by the teacher.

3. Development of LA-II

LA-II has been developed for use in university classes. In this research, we improved the LMS to be used in middle school science classes. In middle school science classes, worksheets are often used. Following a worksheet, the class progresses in the order of forecast, hypothesis, experiment, results, discussion, and conclusion. To allow students to use LA-II as their worksheet, a new "Notes" button is installed and a worksheet is added, shown in Fig. 2. In each row, students can input text. The entered contents are transferred to the server and are saved when the "Save" button is pressed. These contents can be seen by the device in teacher mode. In science classes, the use of

tables, figures, and graphs are often necessary. These contents can be saved as images using the built-in camera in the tablet. The contents described in "Notes" can be shared among students from the teacher mode, and the sharing is expected to shorten the time required for consolidation of opinions.

Fig. 2: Worksheet utilization of LA-II

4. Summary & Future work

Based on the existing LA-II, we developed a preliminary LMS that is suitable for middle school science classes. Using the modified LA-II, we plan to proceed testing in middle school science classes. We will investigate how the teacher uses LA-II in the science class, and we will verify the teaching effectiveness to the students.

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