

The Possibility of Moodle-based e-portfolio with Database Module for Medical Education – from the Viewpoint of the Usage for Learning Analytics and Institutional Research

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Abstract

In medical education, e-portfolios are needed both for supporting students' self-learning and for quality assurance of education based on the global standards. Although there are some e-portfolio systems, it is sometimes complicated to use both learning management systems and e-portfolios. In this study, a Moodle-based e-portfolio with database module are proposed for the minimal portfolio use in medical education. Although it has a limited feature compared to the e-portfolios as commonly used, the advantages of the system are that it is unified and easy to use, and that data can be exported easily.

Keywords: E-portfolio, Learning Logs, Medical Education, Moodle

1 Introduction

1.1 Global Standards for Basic Medical Education

Accreditation of medical education based on the global standard is widely conducted. In Japan, Japan Accreditation Council for Medical Education (JACME) has been conducting the accreditation based on the Japanese version of the World Federation for Medical Education (WFME) global standards for Basic Medical Education (BME) [1].

There are 9 areas in the WFME BME standards, such as "Mission and outcomes" and "Educational programme", shown in Table 1. Each areas have two standards: Basic Standards and Standards for Quality Improvement.

Area 6 is about "Educational Resources", which includes the use of information technology such as Learning Management Systems (LMS). In fact, sub-area 6.3 is about "information technology" and its annotations address about the usage of the learning management system. Recently, due to the COVID-19 pandemic, more and more institutions implemented online learning, both synchronous and asynchronous style. Thus, this sub-area might be a natural one after the pandemic.

Even though the specified area about ICT is sub-area 6.3, some other areas and sub-areas needs ICT implicitly. For example, in area 3, the standards require the appropriate assessment methods, including portfolios and log-books. For fulfilling this requirement, it is not enough for students to keep their own learning records; institutions have to gather, organize and analyze the student

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learning records for evaluating and improving of education. Of course, the traditional, paper-based portfolios or log-books can use, especially for using self-reflection tools for students. However, for the purpose of the assessment, online-based system would be better for sharing results between faculties and students.

Another specific area is area 6.2, about clinical training resources. In the basic standards of this sub-area, it is stated as follows:

"the medical school must ensure necessary resources for giving the students adequate clinical experience, including sufficient - number and categories of patients. (B 6.2.1) - clinical training facilities. (B 6.2.2) - supervision of their clinical practice. (B 6.2.3)" [1]

ICT tools would be also useful for gathering these kinds of data.

Table 1: The areas in the WFME BME standards

Number	Area
1	Mission and Outcomes
2	Educational Programme
3	Assessment of Students
4	Students
5	Academic Staff/Faculty
6	Educational Resources
7	Programme Evaluation
8	Governance and Administration
9	Continuous Renewal

1.2 Global Standards for Distance and Distributed Learning

Although the official accreditation by JACME is based on the WFME BME, there are some other standards published by WFME. The newest standard is "WFME Standards for Distributed and Distance Learning in Medical Education (DDL)", which is published in 2021 [2]. This standard is published after the COVID-19 pandemic.

On the WFME site, the reason for the creation of this standard is written as follows: "The immediate stimulus for the creation of these standards was the Covid-19 pandemic that made medical educators think about appropriate ways of teaching students in a situation when face-to-face education was not always possible. "

The definition of the DDL is: "a varied and planned course of study, designed and developed to address the curriculum for students who are in different locations away from the central teaching institution".

Although the DDL is not used for accreditation by JACME now, the standards are important for thinking about BME, especially about technology-enhanced teaching and learning. In fact, DDL has 8 areas that are similar to the areas of BME, shown in Table 2.

In areas 2.7 (ensuring clinical exposure), it is noted about developing appropriate tools such as portfolios, logbooks, and case records for gathering data and for reviewing clinical learning events.

Table 2: The areas in the DDL standards

Number	Area
1	Distributed and Distance Learning: Scope and Accountability
2	Course Design
3	Course Production
4	Assessment
5	Student Support
6	Academic and Clinical Teachers
7	Course Management and Records
8	Quality Assurance

1.3 Objectives of the Study

Based on the two standards, the system for storing student learning logs is considered necessary. The system not only for storing but for analyzing and reviewing logs is needed. For gathering learning logs such as clinical experiences and other learning logs, an e-portfolio system is usually considered implemented. There are several e-portfolio systems such as Mahara [3]. E-portfolio is useful for students to organize the learning evidence such as the text and media, and to submit and share their learning outcomes. It also will be appropriate for analyzing and assessing it for teachers. However, sometimes implementing an e-portfolio would be challenging for faculties and students since it will need time commitment and some training for appropriate use. On the other hand, many institutions have already implemented LMS due to the pandemic.

In this study, the simple learning logging system based on Moodle is considered.

2 Methods

2.1 Choosing the Learning Environment

In this study, the author used Moodle as LMS. Moodle is an open-source, widely used LMS in the world [4]. Since the server of Moodle is usually managed per institution, it is possible to get the learning log from Moodle, even as the row data.

Moodle has several features, such as quizzes and discussion forums for online learning, especially for asynchronous education. Moodle also can install more than 1000 plugins for additional features. Although there are some plugins for e-portfolio, such as Exabis E-Portfolio [5], the author did not use the plugin for making an e-portfolio. This is because of the continuity of the education. If some specific, additional plugin is used for the fundamental and must-require features, the institution has to upgrade both LMS itself and the plugin. In addition, sometimes the development of the plugin will be ceased. In this case, institutions must improve the plugin by themselves, or change to the alternative features or plugins.

Although there is no "e-portfolio" features in Moodle, the standard "database" activity module (DB) would be able to use. DB is defined as follows;

“The Database activity allows the teacher and/or students to build, display and search a bank of record entries about any conceivable topic. The format and structure of these entries can be almost unlimited, including images, files, URLs, numbers and text amongst other things.”

In addition to setting up several fields such as text and images, the displaying style can be designed with CSS and JavaScript. Moreover, it is possible to make comments or review each other. Thus, DB has minimal features for e-portfolio as a learning log.

There are some situations in which the portfolio would be an effective learning tool. From here, the types of e-portfolio and the example will be introduced.

2.2 Examples of e-Portfolios Needed in the Medical Education

2.2.1 The learning diary with a free form text

The first one is e-portfolio as a learning diary. In this case, student will post about their learning log such as the learning from lecture or an experience from clinical clerkship. It may be also needed some multiple choice or checkboxes to save some status such as a self-assessment of the learning. In this case, faculties should check the learners' logs and provide appropriate feedbacks. It is also useful for supporting students, as it is required in DDL area 5.

2.2.2 The record of clinical clerkships learning

The second one might be similar as a first one. Here, the difference from the first one is the items which is needed. As it noted in 1.1, the global standards require to record the data of clinical clerkships, such as the number and the categories of patients. To gathering these kinds of data, selectable items such as checkboxes are better for analyzing the data.

2.2.3 The formative assessment tool for learning based on educational outcomes

The third one is for the assessment based on the educational outcomes, such as diploma policies. In the BME standards, sub-area 1.3 requires the definition of the educational outcomes when students graduate. Based on this, sub-area 2.7 requires the program management based on the educational outcomes, and sub-area 3.2 requires assessment based on the outcomes. In addition to this, sub-area 7.1 requires the monitoring of educational processes and outcomes, which for the evaluation of the curriculum. To fulfill these requirements, formative assessment based on the outcome is needed. The recording of education is also required in DDL area 7.

Note that the difference from the first one and the second one is the person who record the data. The first two portfolios are recorded by students themselves; faculties check and make feedbacks sometimes, but it is the dependent, not a primary element of the portfolios. However, the third one, the assessment based on the outcome will be done both by students themselves and faculties. Of course, both students and faculties can post, make comments, and assess the DB of Moodle. However, each record of DB is connected the person who posted the original one. This means, if the faculties make records of assessments, it is connected to faculties, not to the students. To solve this issue, the administrator of Moodle prepared the data connected to each student in advance, and then faculties assessed the student.

Figure 1 shows the image of three patterns of e-portfolio usages.

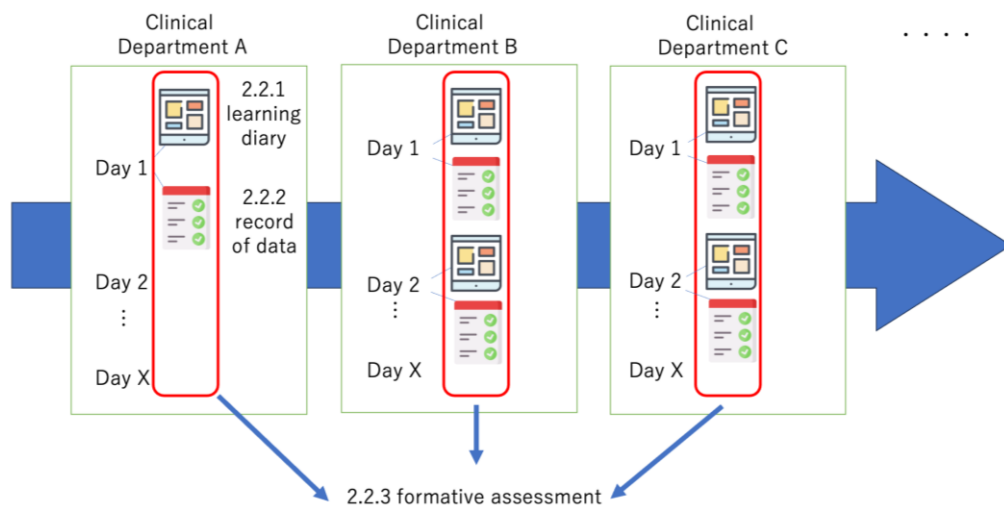


Figure 1: The three patterns of e-portfolio usages

2.3 Exporting Results from Database Activity Modules

Although there is a feature to export records from DB, it has some limitations. For example, since there are no bulk exporting features in Moodle, it is mandatory to export individually. In addition, there are no feature to export comments to each record. So, if administrators or IRers try to analyze the feedback comments, they have to access each DB one by one to get these data.

In fact, the features for exporting logs are not so sophisticated compared to importing or storing data [6]. Thus, the author used Moodle plugin to run SQL queries for getting appropriate data for analytics as the previous research [6][7].

3 Results

3.1 The Design and Development for the Learning Diary and for Recording Clinical Clerkship

The first type of e-portfolio as a learning diary needs at least a "textarea", which is for the free-form text input. If additional elements such as the length of study hours or self-assessment of

their each learning, it is possible to add some "menu field" or "radio button" for single choice and "checkbox" for multiple choices.

The second type of e-portfolio for recording clinical clerkship is similar as the first one from the viewpoint of designing and development, except for the number of fields.

Although both single choice and multiple choices are possible to use, the usability of the students and the format of the exported data are different. If student use the Moodle mobile apps, "checkbox" is a little complicated to answer than usual checkbox. When the "checkbox" field is set, students have to do following steps; (1) choose the title of checkbox field and the popup menu of items are appeared (2) choose the items they want to select, and tap "OK" to finish.

The ideal interface would have only checkboxes on the screen, so the current situation adds one extra step. Moreover, when the "checkbox" data is exported, it become a one data with the separator "###", such as "ItemA###ItemC###ItemD". Although it is able to divide into each item, it is a little complex task for data ranging, since there are more than 30 symptoms and more than 60 medical procedures to be checked.

Considering the usability of it, multiple checkbox fields which have only one item "done" is created for the e-portfolio usage. This means, if there are three items to choose, three individual checkbox fields are created and students choose "done" for each when they completed. Even though it is a little complicated, the pop-up screen can be used as a confirmation screen, which can be used to avoid incorrect input. The difference of checkbox style is shown in Figure 2.

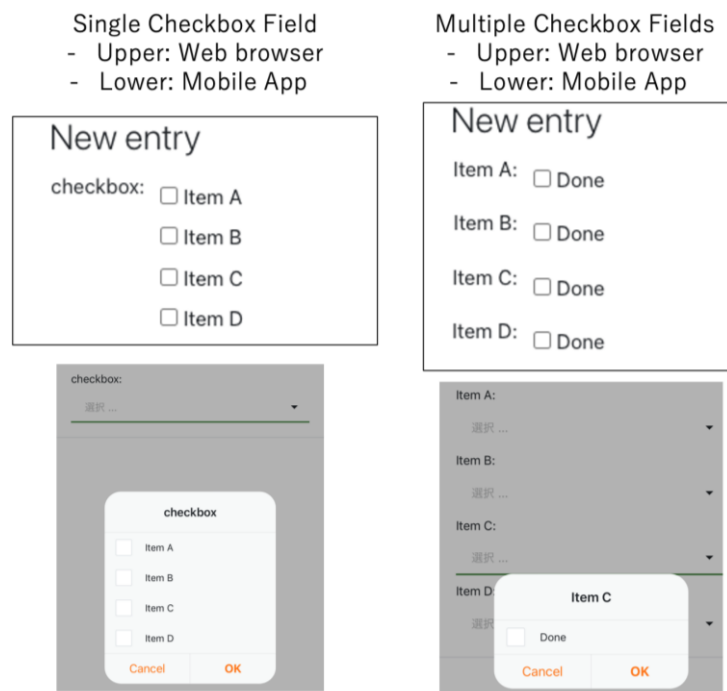


Figure 2: The difference of checkbox input from web browser and mobile apps

3.2 Examples of e-Portfolios Needed in the Medical Education

As it noted in 2.2.3, the important thing is the setting that who will be the connected to the data. If students assess themselves, there are no issues since the data will be connected to each student. The careful consideration must be given when faculties assess students. If faculties make new record to DB, these records will be created as the data of faculties, not of students. To avoid this situation, all records connected to the students should be created before faculties assess students.

Moodle DB has a feature to import data from CSV, with the user name information to define the user who created the data. So the first step is to make the default data CSV with student name to import DB.

The next step is to assess students by editing the recorded data as the teacher's permission of Moodle. It is easy for teacher's role in Moodle to edit the data which is created by student's role. Another problem is how to show each data and the name of students who are connected to. DB has "view" screen and "edit" screen. Since "view" screen can be shown to other students and faculties, there is a feature to display the user's name who created it. However, there are no feature to show the user information in "edit" screen since the user who accesses to the screen is almost the same as user who created it. In this study, the author added the student's name field to importing CSV to show these data to faculties. Of course, faculties may accidentally overwrite the name of students in this case. Thus, the author wrote simple JavaScript to lock the input fields of user's name. Figure 3 is the sample of JavaScript.

```

window.addEventListener("load", function(e) {
  var baseFieldInput = document.getElementsByClassName("basefieldinput")
  if(baseFieldInput.length){
    for (var i = 0; i < baseFieldInput.length; i++) {
      document.getElementsByClassName("basefieldinput")[i].disabled = true;
    }
  }
})

```

ID number	Name	Group
999999	Sample User	group 01

I-1:	I-2:	I-3:	I-4:	I-5:	I-6:
Choose... ▾	Choose... ▾	Choose... ▾	Choose... ▾	Choose... ▾	Choose... ▾
4					
3					
2	II-2:	II-3:	II-4:	II-5:	II-6:
1	Choose... ▾	Choose... ▾	Choose... ▾	Choose... ▾	Choose... ▾
NA					

Figure 3: Sample of JavaScript to lock the fields: gray colored fields are not editable

3.3 SQL for Data Exporting from the Database Module

Moodle has several database tables. For example, Moodle 3.9 has 429 tables. From the database schema of Moodle 3.9 [8], the connection between database module tables and comments are shown as Figure 4. The SQL queries were created based on the Figure 4. Figure 5 is the sample

SQL to export the whole contents from DBs in a current course.

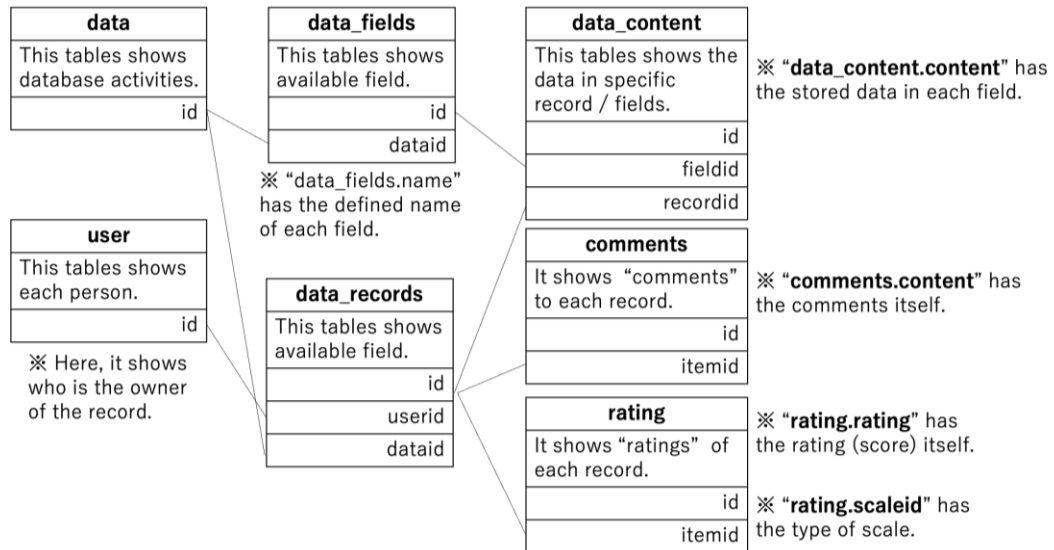


Figure 4: Relationships between tables: it shows only fields which are used for joining tables

```

SELECT d.name as databaseName
, df.name as dataFieldNama
, dc.content as Content
, u.username

FROM prefix_course AS c
JOIN prefix_course_modules AS cm ON c.id = cm.course
JOIN prefix_data AS d on c.id = d.course AND d.id = cm.instance
JOIN prefix_data_records AS dr ON dr.dataid = d.id
JOIN prefix_user AS u ON dr.userid = u.id
JOIN prefix_data_fields AS df ON df.dataid = d.id
JOIN prefix_data_content AS dc ON dc.fieldid = df.id AND dc.recordid = dr.id

WHERE c.id = %%COURSEID%%

```

Figure 5: Sample SQL to export the whole contents from DBs in a current course

4 Discussions

The basic design and development of Moodle DB based e-portfolio were shown. The next step to use the DB based e-portfolio is to copy the DB to other courses, or another Moodle. It is able to copy in the same Moodle as the feature of importing. It is also possible to copy another Moodle by using course backup, or "presets" exporting feature. Exporting presets make an XML file of the presets of DB, including other files such as CSS and JavaScript. It is possible to edit these

files before uploading to another Moodle. For example, if more checkbox fields are needed in another course, the XML file should be edited to add fields in advance to meet the requirements.

The SQL shown in Figure 5 provides a result as a “long” format, where the data is organized so that each row represents a single observation, and each variable is stored in a separate column. Although it may be difficult to read by humans, it is easier to analyze with tools such as business intelligence tools or statistical tools. Thus, the exported data with SQL is easier to use for learning analytics or institutional research. Moreover, it is possible to convert from “long” to “wide” format, where each variable is stored in a separate column, and each observation is stored in a separate row.

There are some limitations. As it noted on 2.1, DB is able to use as a minimal e-portfolio. However, it is not for a “full” e-portfolio. For example, there is no feature to make a “collection” page from students own learning logs and evidence. Nonetheless, DB is useful for the e-portfolio as a learning diary or a logbook for the medical education, especially for the clinical clerkships.

The sample of JavaScript will show a limited behavior. The script lock all the one-line text input areas. If it is needed to lock only the student’s name fields, the JavaScript should be improved. Another limited point about the script is that JavaScript is worked only users who access from the normal web browser, not from the Moodle apps. Since most faculties uses web browser even if they use mobile devices, it will not be the huge problem now. However, it should be improved for better usability for both students and faculties.

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