

Digital Learning Platform "Fisdom"

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Recently, services that offer university-level lectures free of charge or for a small fee via the Internet have been attracting attention. In 2012, massive open online courses (MOOCs) started in the U.S., and over 500 schools mainly from the West are now offering courses, which over 30 million people are now taking. In Japan, with the aim of making MOOCs popular, courses certified with the Japan Massive Open Online Education Promotion Council (JMOOC) began in April 2014, and the courses are offered by 45 universities and taken by over 500,000 people. Fujitsu has established "Fisdom," a digital learning platform that provides MOOCs and small private online courses (SPOCs) to diversify and sophisticate education using flipped learning. Fisdom is equipped with functions including discussion boards, where students ask and answer each other's questions to solve problems, and peer evaluations of reports, in which reports submitted by students are evaluated by other students. These functions lead to retention of learning by providing students with opportunities for mutual teaching and learning and helping students give each other advice. In addition, students' lifelong learning can be recorded, which raises expectations for the utilization of their learned knowledge in numerous life events. This paper describes the features and application examples of Fisdom.

1. Introduction

Massive open online courses (MOOCs) are university-level courses that can be taken free of charge by anyone over the Internet. Originally developed in Europe and the United States, Japanese-language MOOCs have come to be provided in Japan through the Japan Massive Open Online Education Promotion Council (JMOOC)¹⁾ founded in November 2013. These MOOCs are also being targeted for use in higher education.

JMOOC is a multiplatform consisting of the following four MOOC delivery platforms: "gacco," which means "school" in Japanese, from NTT DOCOMO, INC., "OpenLearning, Japan" from NetLearning, Inc., "OUJ MOOC" from The Open University of Japan, and "Fisdom,"²⁾ a digital learning platform that Fujitsu started in March 2016.

In addition to delivering JMOOC-certified MOOCs, Fisdom can deliver small private online courses (SPOCs) that are limited to students in universities and educational institutions. Fisdom enables students to record

what they have learned over time, so knowledge gained in this way can be used by a student in numerous life events such as college entrance exams, job-hunting, and career planning upon leaving a job.

In this paper, we introduce Fisdom features and application examples and touch upon future issues.

2. Digital learning platform

Conventional educational systems were designed in an era in which digital technologies such as cloud computing, AI, IoT, security, and big data did not exist. As a result, attempts at using digital technologies in education have only gone as far as replacing analog systems with their digital counterparts.

Specifically, on-site education has become more efficient by using electronic blackboards, tablets, and other devices to present lectures, perform blackboard writing, automatically score tests, etc., and have promoted standardization by making lectures more homogeneous and the level of difficulty in tests more uniform. However, these changes have not

fundamentally transformed the existing education model. There is therefore a need to design an education model from scratch based on digital technologies to achieve true educational reform.

A digital learning platform refers to a shared-use system targeting universities and educational institutions for the purpose of designing an education model with digital technologies as a precondition. Fujitsu is achieving educational reform by providing such a digital learning platform. Instead of one-way teaching from instructors to students, collaboration among fellow users engaged in mutual teaching and learning plays a central role in educational reform. Such collaboration provides a foundation for knowledge integration, so a digital learning platform can also be called a platform that achieves knowledge integration in education.

3. Fisdom features

This section describes the technical features of Fisdom.

3.1 Identity verification by e-mail authentication

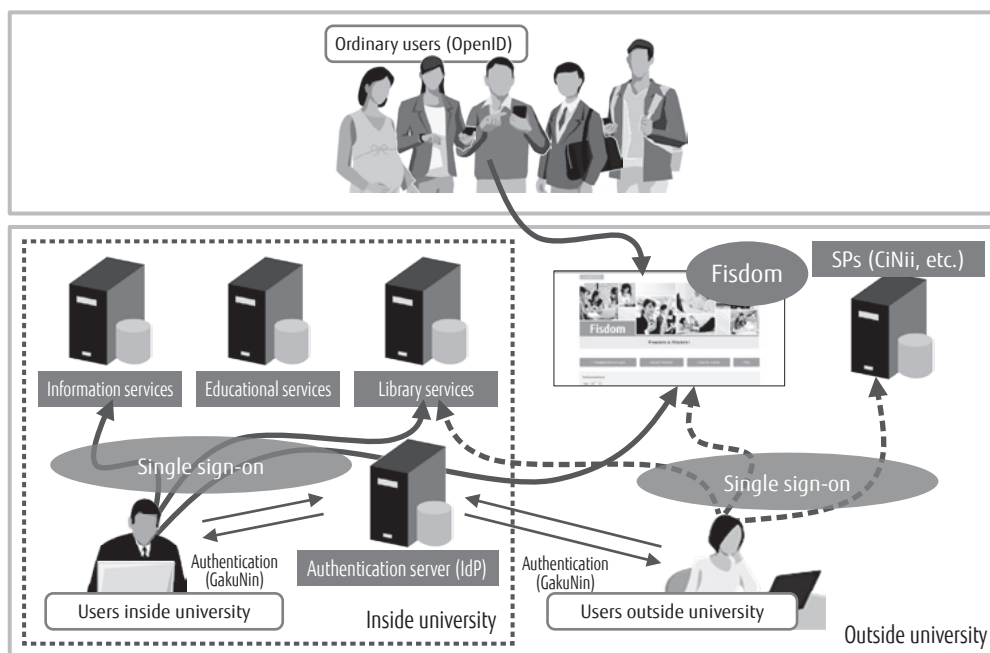
A Fisdom student's login account can be registered through e-mail authentication. This is a mechanism

for performing identity verification on the basis of an e-mail address. Specifically, the student inputs an e-mail address on the Fisdom input screen and receives by e-mail a temporary URL for registering an account. Then, on an account registration screen pointed to by that URL, the student enters a password and profile to register a student login account. On completion of registration, the student can then enter his/her e-mail address and password on a course screen to log in as a Fisdom student.

3.2 Single sign-on by OpenID and GakuNin

Single sign-on is a mechanism that enables a user to access all systems in a certain group through one-time user authentication. OpenID is one type of protocol for achieving single sign-on. This protocol can also specify the ID itself that can be used. Fisdom enables single sign-on by OpenID to simplify the login process for users having OpenID. As of July 2017, Fisdom supports Facebook and Google+ OpenID.

Single sign-on by OpenID and the Academic Access Management Federation in Japan (hereafter, GakuNin) is outlined in **Figure 1**. GakuNin is a federation managed by the National Institute of Informatics (NII) with the purpose of linking institutions and



CiNii: Citation information by NII

Figure 1
Single sign-on by OpenID and GakuNin.

publishers that provide academic e-resources such as educational content and e-journals and universities that use such e-resources. If a certain service desired by a user belonging to a university or educational institution corresponds to a GakuNin service provider (SP), the user can use that service with their ID and password registered in the GakuNin identity provider (IdP) of that university or educational institution. Fisdom supports GakuNin SPs, so it enables Single sign-on from a university or educational institution having a GakuNin IdP.

3.3 High reliability by FUJITSU Cloud Service K5

As a platform running on FUJITSU Cloud Service K5, Fisdom achieves high reliability by supporting high-transaction processing (increased number of processes) through elastic load balancing (ELB).

Fisdom consists of three application layers: view layer, logic layer, and database management system (DBMS) layer. The view layer that controls the look and behavior of the screen and the logic layer that controls business rules are placed on the same virtual machine (VM), which is called an application server.

ELB is a mechanism for deploying an additional

application server on detecting that the number of transactions has increased and exceeded a certain threshold. Conversely, if the number of transactions should decrease, the number of application servers can be decreased by ELB.

3.4 Flexible course configuration

MOOCs and SPOCs that can be delivered by Fisdom both have a structured but flexible course configuration. A course consists of a course overview of essential elements, a playlist, promotional videos of optional elements, a discussion board, a course badge, and a certificate of completion (Figure 2).

1) Playlist

A playlist is a unit of student learning. It corresponds to about 60–90 minutes of lectures in the case of a university course. Multiple playlists can be set up that support a variety of instructional designs. A playlist consists of content (essential elements) and a playlist badge.

Content:

This is the minimum unit of student learning. There are seven types of content as listed below. Multiple items of content may be set.

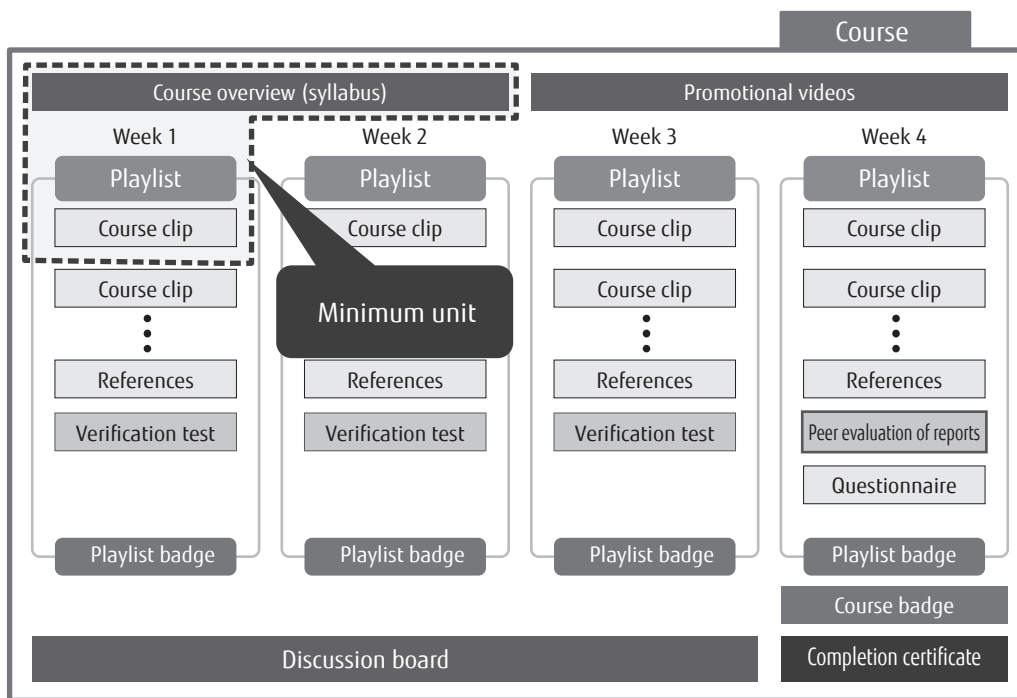


Figure 2 Flexible course configuration.

- Course clip (5–10 minutes of lecture video)
- Quiz
- Reference literature
- Verification test (automatically graded)
- Short essay (instructor graded or automatically graded)
- Report (peer evaluated by fellow students)
- Questionnaire

The number of content items making up a playlist and the order of their placement can be flexibly set in accordance with class design.

Playlist badge:

A playlist badge proves that the student has completed the playlist. These badges, which are displayed in the student's badge list, can be a motivating factor.

2) Course badge

A course badge proves that the student has completed the course. This badge, which is also displayed in the student's badge list, can be effective in enhancing the student's sense of accomplishment.

3) Certificate of completion

The certificate of completion includes the student's full name. It is issued as a PDF file ready for printing.

4. Fisdom main functions

The following introduces the discussion board and

peer evaluation of reports driven by students as part of learning in Fisdom. These functions provide a "mutual teaching and learning" space in which students can give advice to each other, which can contribute to learning retention. In this sense, they are an effective means of facilitating learning in SPOCs as well.

4.1 Discussion board

In a face-to-face course, a student will ask a question and the instructor will reply in a one-to-one Q&A style. Other students in the classroom can also learn from such an exchange.

Given that anyone can take part in MOOCs at no charge over the Internet, it is not unusual for 1,000 to 10,000 people to be participating in one course. Fisdom includes useful functions for such a large number of students by taking advantage of Internet features. One of these functions is a discussion board that enables fellow students to ask each other questions with the aim of solving problems (Figure 3). In Fisdom, a discussion board can be set up for each course as in the case of a face-to-face course to facilitate Q&A and discussions on course content. Multiple categories can also be set up within a discussion board in accordance with class design. For example, a discussion board may be divided into units of playlists, students' native languages, and course start times.

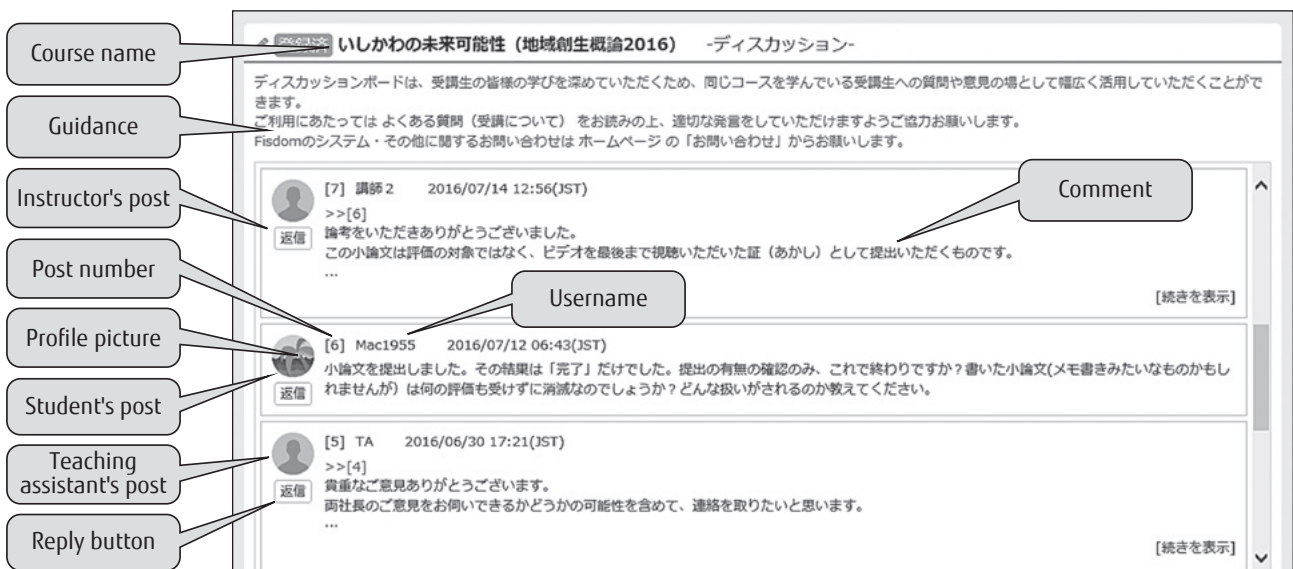


Figure 3 Discussion board in Fisdom.

A discussion board is a space where students taking the same course can ask each other questions and exchange opinions. However, in the event that a particular problem cannot be solved or the discussion begins to move in an undesirable direction due to topic digression, mutual disparagement, etc., the instructor or teaching assistant (TA) can step in and facilitate the discussion. In this regard, an issue for future study is the application of AI technology, which could be used to detect signs of intractable problems, digression, or disparagement and activate a bot to automatically facilitate the discussion. Such use of AI would significantly ease the burden on instructors.

4.2 Peer evaluation of reports

Since MOOCs are provided on a large scale, it is also necessary to consider methods of evaluating reports submitted by students. We therefore studied a mechanism for evaluating a student's report by other students (peer evaluation) and made this a function in Fisdom. This function promotes reflection since the student can re-evaluate their own report on the basis of its peer evaluation results. In this process, the instructor presents students with grading criteria and grading rules.

Peer evaluation in Fisdom supports both Japanese and English reports, so a student preparing a report selects the language to be used. Once the report submission deadline for the course has been reached, Fisdom allocates a peer evaluation group consisting of six students for each student who has submitted and self-evaluated their report. At this time, students writing in Japanese and those writing in English will not be placed into the same group.

The conditions for completing peer evaluations are as follows:

- Report submission
- Self-evaluation of report
- Peer evaluation of five reports submitted by other students
- Own report's peer evaluation by other students by three other students. The median grade from these three students is taken to be the passing criterion.

Although a student will evaluate the reports of five other students, there may be times when three other students do not evaluate the student's own

report. In such a case, the instructor and/or TA will take on the role of an evaluator.

5. Fisdom application examples

This section presents several Fisdom application examples.

5.1 Development of human resources for regional revitalization

The development of human resources that can play a central role in regional revitalization requires researching a particular region's geography, history, industries, personalities, etc. as basic knowledge. Converting such research into MOOCs through government and university collaboration can present the attractiveness of regional areas to the whole country and increase the number of students with the potential of becoming human resources for regional revitalization.

For example, such MOOCs could be used as remedial education for a student after being accepted to a university and before starting school or as compulsory subjects in the student's first year. This approach could facilitate ideathons and co-creation on the theme of regional revitalization within and between universities. In addition, the joint use of MOOCs in multiple universities could be used not only for regional revitalization studies but also for general-education courses, which could help solve the instructor-shortage problem while enabling instructors to devote their time to specialized subjects.

Fisdom issues a certificate of completion in PDF format to a student on completing a course. Fujitsu expects the use of Fisdom for receiving credit for formal university courses to be approved.

5.2 Faculty development

The development of instructors' abilities as in the area of research ethics must be carried out periodically in many universities and research institutions. A method for this purpose that can be jointly used by multiple universities can be achieved by turning such studies into MOOCs. However, there is some content here that cannot be publicly released, so it would be necessary to deliver such content as SPOCs to specific students (faculty of multiple universities). Since Fisdom is a platform that integrates both MOOCs and

SPOCs, it can deliver courses for both general release and restricted release. In addition to promoting a learning effect, which is the primary purpose of MOOCs, there is a need for studying the social contributions of MOOCs and class design on the basis of branding.

5.3 Brush-up program for students and professionals

The science and engineering basic-subject series delivered by Fisdom consists of courses developed to support the brush-up program for professionals advocated by JMOOC. As of July 2017, 12 courses that can be taken by anyone have been developed. These are electrical circuits, control engineering, electronic circuits, electromagnetism, mechanical dynamics, fluid dynamics, mechanisms, industrial mechanics, quality control, metallic materials, introduction to statistics, and differential and integral calculus. For employees of JMOOC member companies taking these courses, Fisdom provides a portal for use by the education coordinators of those companies to assess employee course status (learning history). This portal facilitates the use of these courses for pre-learning or brush-up as a part of employee training.

Employees to be displayed on this portal are identified by whether the domain section of the e-mail address corresponding to the student's login account agrees with that designated by that company. However, in observance of the principle that learning history belongs to the student, Fisdom provides an on-screen mechanism for obtaining the student's consent for each course.

By having employees of multiple companies take the same course, Fisdom holds the potential of providing mutual solutions among those companies or becoming a space for various types of co-creation.

6. Future issues

One issue of concern is interconnectivity between Fisdom and other systems and services. In this regard, Fisdom provides a Web application programming interface (API) that other systems and services can call to achieve seamless data and screen linking. Likewise, Fisdom can call the Web APIs of existing platforms to provide enhanced services. Single sign-on by OpenID and GakuNin is one example of such interconnectivity, but further studies on inter-system linking and

coordination are needed.

7. Conclusion

This paper described the features of Fujitsu's digital learning platform Fisdom and presented application examples and future issues.

"Fisdom" is short for "Freedom is Wisdom." It includes the meaning of "freedom in learning" and "wisdom to secure a free future." By enabling students to record what they have learned over a lifetime, we expect Fisdom to be used in all sorts of life events ranging from college entrance exams and job-hunting to career planning upon changing jobs.

References

- 1) Japan Massive Open Online Education Promotion Council (JMOOC).
<https://www.jmooc.jp/en/>
- 2) Fisdom.
<https://www.fisdom.org/english/>



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Fujitsu Ltd.

Mr. Matsunaga is currently engaged in development and operation of the "Fisdom" digital learning platform and in planning and globalization of new businesses in the field of education.