Yonago Acta Medica 2021;64(4):324–329 doi: 10.33160/yam.2021.11.001 *Review Article*

Creating an LMS ePortfolio Building System That Enhances the Quality of College Life from One That Supports Self-Regulated Learning

Masayuki Miyoshi,* Masaru Ueki,* Kenichi Ohno† and Motoyuki Ohmori‡

**Division of Medical Education, Department of Medical Education, School of Medicine, Faculty of Medicine, Tottori University, Yonago 683-8503, Japan, †Administrative Assistant Office of the President, Tottori University, Tottori 680-8550, Japan and ‡Organization for Information and Communication Technology, Tottori University, Yonago 683-8503, Japan*

ABSTRACT

During the recent coronavirus disease 2019 (COVID-19) pandemic, the ability to be a self-regulated learner has become more important with the introduction of online classes. These changes mean that students are now required to review their learning strategies and self-manage their learning time. We have developed a new "ePortfolio system" with the aim of building a system that fosters self-regulated learners and can visualize students' learning outcomes. This paper introduces the concepts of our ePortfolio system as a Learning Management System ePortfolio building system that will provide enhanced functions and become a university-wide initiative.

Key words ePortfolio; formal learning and informal learning; Learning Management System; self-regulated learning; visualization of learning outcomes

In recent years, educational programs based on Outcome-Based Education have been recommended to guarantee the quality of medical education and to facilitate evaluation.[1] At Tottori University (hereinafter referred to as "our university"), students are required to self-evaluate their achievement of the Diploma Policy (DP) prior to graduation in the sixth year of medical school. The DP is linked to competencies and courses, and the degree of achievement of the DP is measured by analyzing grade point averages. We previously reported the results of our efforts to show the level of DP achievement to students upon graduation and to establish an award system.[2] This initiative is significant in that it constitutes a summative evaluation of academic learning provided to students in the sixth year, and as a future issue, the formative evaluation of academic learning that should be promoted through continuous visualization of DP-based academic achievements from the first to the sixth year.

In the past year, due to limitations in face-to-face classes during the coronavirus disease 2019 (COVID-19) pandemic, many online classes have been introduced, and the use of digital technology for this purpose has become more common. Use of the Learning Management System (LMS) contracted by the university has increased opportunities for students and faculty to come into contact with digital technology, and digitization in a number of areas has accelerated, including class materials and classes themselves. Changes in academic methods have made it necessary for students to bear responsibility for reviewing their learning strategies and managing their study time[3]; in other words, the COVID-19 pandemic has placed a particular emphasis on the need for each student to develop their ability to be a self-regulated learner.[4, 5] The main goal of higher education is to develop lifelong learners, defined as intentional and autonomous self-regulated learners who can acquire, retain, and search for new knowledge on their own.[4, 5] At our university, it was considered important to create a system to train students to become self-regulated learners. In response to growing expectations for the construction of a system that visualizes students' academic achievements and incorporates a mechanism for fostering self-regulated learners, we have developed a new "ePortfolio system" at the School of Medicine that seamlessly links the LMS, which provides information on the academic process and results, with the ePortfolio system, which shows the results of DP mastery. In addition, it was decided that the functions of this system would be expanded for use in other faculties as a university-wide system. This paper presents an overview of the ePortfolio system and the concept of building an LMS-ePortfolio system as a university-wide initiative.

Corresponding author: Masayuki Miyoshi, PhD
m.miyoshi@tottori-u.ac.jp
Received 2021 July 19
Accepted 2021 August 27
Online published 2021 September 18
Abbreviations: AI, artificial intelligence; COVID-19, coronavirus disease 2019; DP, Diploma Policy; DX, Digital Transformation; LMS, Learning Management System

APPLICATIONS

Construction of the ePortfolio system at the Faculty of Medicine

The purpose of establishing the ePortfolio system at the School of Medicine was to conduct an evaluative

analysis of students' learning and to thereby enable them to visualize their continuous learning outcomes and to develop their abilities as self-regulated learners. It is recommended that students conclude their ePortfolio activities with an evaluative analysis of the portfolio as a whole in order to integrate all the learning from their various course assignments, which should help them practice many self-regulated learning skills and develop metacognitive abilities.[6] Therefore, Jenson and Treuer have published five essential skills for the effective use of the ePortfolio system for learning: Collecting, Reflecting, Self-regulating, Integrating, and Collaborating.[7] These skills are listed below, in addition to the functions required of an ePortfolio system that is based on such skills, and also corresponding system functions and student activities. Collecting: Establishing a database containing the results of learning activities conducted using the LMS, data related to grades, and data unique to the medical school. Reflecting (evaluative analysis and reflection) and Self-regulating: Using the ePortfolio system to display the degree of mastery of each DP ability, as calculated from the database using the analysis system. Integrating: Creating a self-promotional showcase to highlight a student's strengths by integrating their past academic activities and their results. Collaborating: Sharing the self-promotional showcase with a student's tutors and other instructors and using it for feedback. The showcase will also be presented to off-campus training sites and for job-hunting activities, and will thereby enable efficient sharing of each student's learning status.

RESULTS

System development

We built a system based on Moodle, an LMS platform. The outline of the system and its functions are shown in Fig. 1. The system incorporates the five aforementioned skills that are essential for effective learning, and the degree of mastery of each DP ability is displayed in ePortfolio using data from the LMS database. Figure 2 shows an example of continuous visualization of the degree of mastery by DP ability. For each DP ability, the current level of mastery is displayed on a radar chart. In addition, the total score of each DP ability over time is displayed in a bar graph. This ePortfolio system makes it possible to visualize the degree of mastery of each DP ability from the past to the present, which has been an issue for our university, and facilitates the formative evaluation of learning. In addition, the system can serve as a foundation to support activities that foster the development of self-regulated learners.

Operational methods

The activities corresponding to the five essential skills are scheduled to be implemented at the end of each semester. In the Collecting section, the LMS collects the activity history, reports, quizzes, practical assignments, and other learning products related to each half-year class. In the Reflecting (evaluative analysis and reflection) and Self-regulating sections, the total score for each DP ability is displayed in ePortfolio, and students can use these scores to determine the required level of DP achievement, the current status, and their own position throughout the entire academic year. Based on an analysis of their current situation, students write down their new goals and learning strategies in their ePortfolio. In the Integration section of ePortfolio, students create a self-promotional showcase that includes a list of their strong points, as well as URLs and explanations that can be accessed in the LMS for practical assignments and other activities that support these points. In the Collaborating section, each student shares their self-promotional showcase with their tutors for feedback and other purposes.

By using this system, which incorporates the five essential skills for effective use of ePortfolio for learning, students will be able to analyze their learning results, reflect on their goals, review their learning strategies, record new learning goals and strategies in their ePortfolio, and expand their self-promotional showcases. This ePortfolio activity process will cultivate both metacognitive ability and self-regulated learning ability.

Enrollment management and institutional research

The system was designed and built with the objective of visualizing learning outcomes and creating a system for fostering self-regulated learners. By building a system that incorporates the five essential skills for effectively using ePortfolio for academic learning, universities can quantitatively evaluate the growth process of students from the time they enter the university, for instance using questionnaires, and qualitatively evaluate changes in their self-promotional showcase and other areas. The system can be used to manage enrollment in job hunting activities and graduate follow-up surveys, and for analyzing academic achievements in institutional research. In particular, the collection and accumulation of learning-related data enables not only the quantitative understanding and centralized management of students' learning outcomes, but also visualization of the status of teachers' support for learning and the degree of their contribution to educational activities on an organizational level. In the case of visualizing the degree of mastery of each DP ability in ePortfolio, continuous efforts as an organization make it possible to accumulate data over the years and to provide optimal individual support

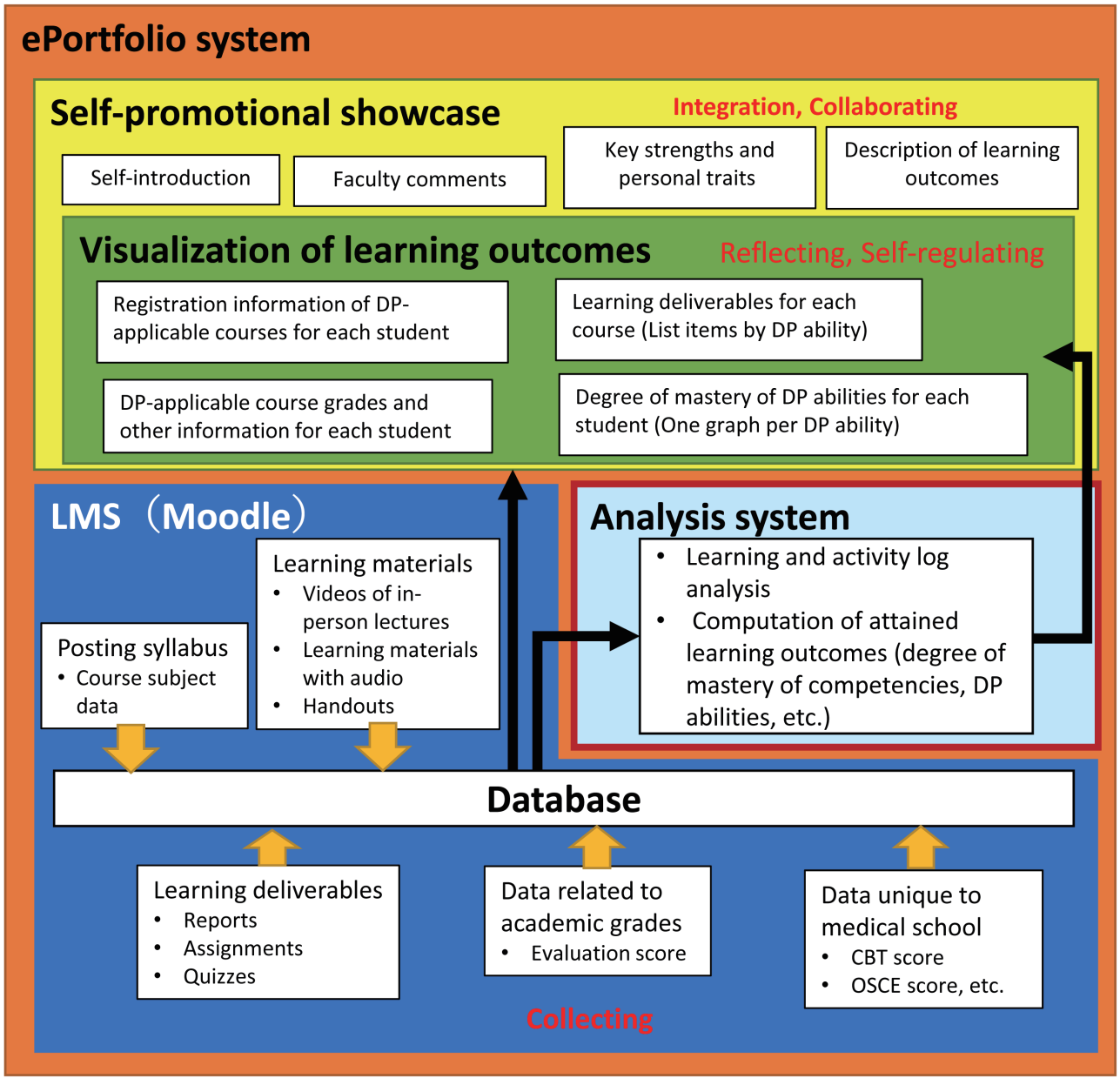

Fig. 1. An outline of the system and its functions. CBT, Computer Based Testing; OSCE, Objective Structured Clinical Examination.

by comparing each student's self-adjusted learning patterns with those of past students.

Reflections on practice and future prospects

Use of ePortfolio systems at other university medical schools

A survey of medical schools across Japan in 2014 showed that only 38 of the 70 responding universities had implemented an ePortfolio system. The most common purpose of using an ePortfolio system in medical schools was to facilitate clinical practice (13 universities), followed by education for collaboration with other professions (4 universities), early experience training (3 universities), introduction to clinical practice (3 universities), and professionalism education (2 universities).[8] In addition, an annual report of each university's medical education field showed that in 2019, many universities were considering the use of ePortfolio, and the majority of medical schools that had already adopted it were using it to record students' experiences with patient cases and clinical procedures.[9] Recently, more and more companies are creating systems that combine LMS and ePortfolio. Nonetheless, systems suitable for the development of self-regulated learners have not been sufficiently developed, and to date, there have been no reports of studies in medical schools in

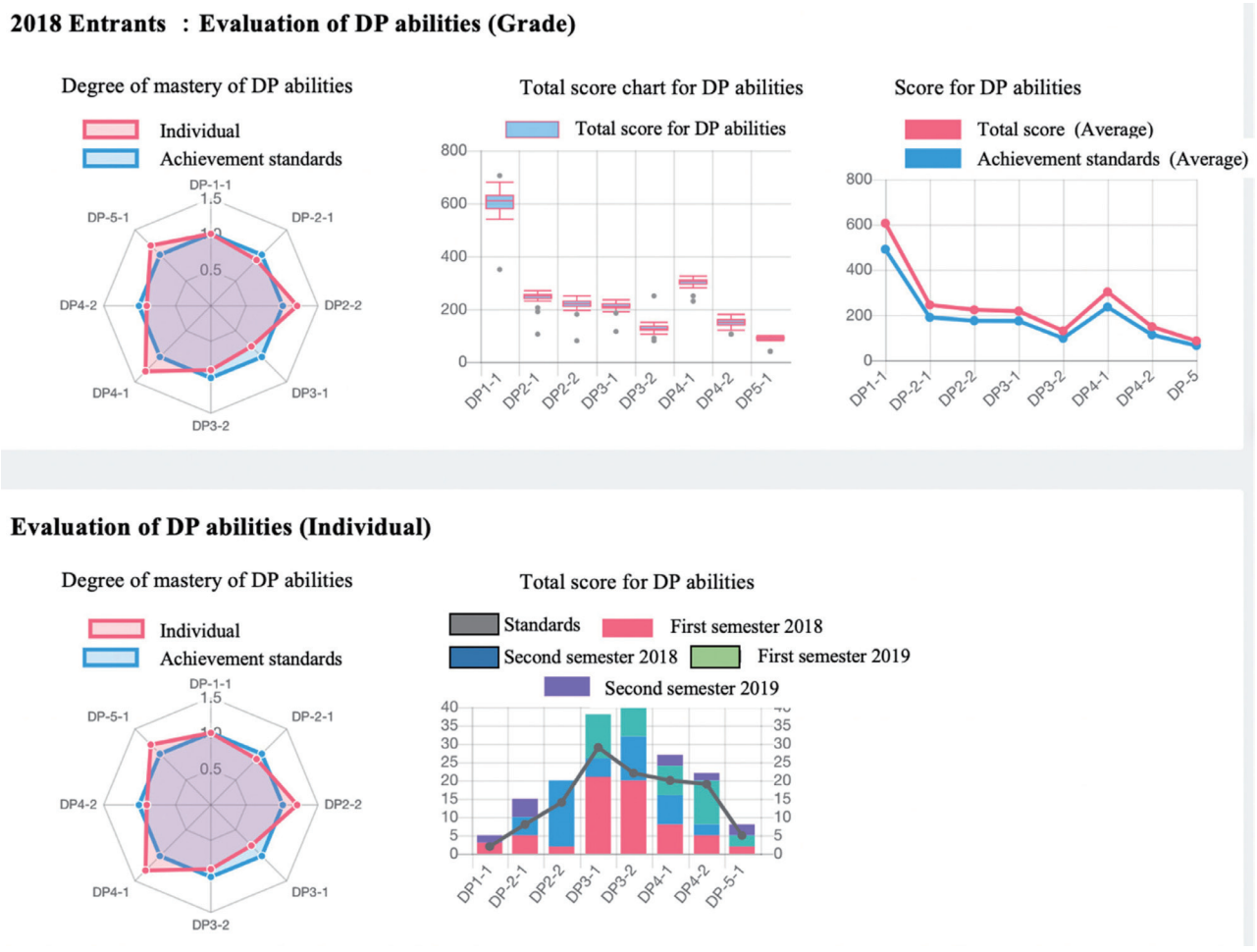

Fig. 2. Example of visualization of the degree of mastery of DP abilities.

which ePortfolio has been established for the purpose of fostering self-regulated learners. We expect that the initiative described here will not only lead to the utilization of ePortfolio in each practicum and class, but will also create new value that will help foster self-regulated learners.

In the case of the competency-based portfolio, we recommended that students use two sample templates, one containing "substantial examples" and the other consisting of "minimal examples." A previous study using a competency-based portfolio demonstrated that all students were able to complete the templates.[10] Using these results as a reference, we will prepare sample templates with multiple sample descriptions and implement scaffolding strategies to lower the hurdle for formulating such descriptions, aiming to improve the utilization rate.

Toward an LMS ePortfolio system for university-wide initiatives

We previously built a system that focused on formal learning within the context of school education. Research has shown that 70% of learning opportunities for working adults occur in the setting of informal learning, defined as learning from communication with friends and from one's living environment.[11] As a result of the COVID-19 pandemic, students are increasingly unable to attend university, and opportunities for informal learning have decreased. During the pandemic, formal learning using syllabi is possible through online classes. However, universities are lagging behind in the development of informal learning environments, a task that is important with a view to the future and to the post-COVID-19 era. Therefore, we viewed this pandemic as an opportunity and thus clarified the Digital Transformation (DX) concept of education, expanded the functions of the ePortfolio system we built earlier, and developed a comprehensive student support system that can be used by all faculties and that introduces functions to support both formal and informal individualized learning activities. We have decided on the concept of "building an LMS-ePortfolio system to enhance the quality of college life" (Fig. 3). Specifically,

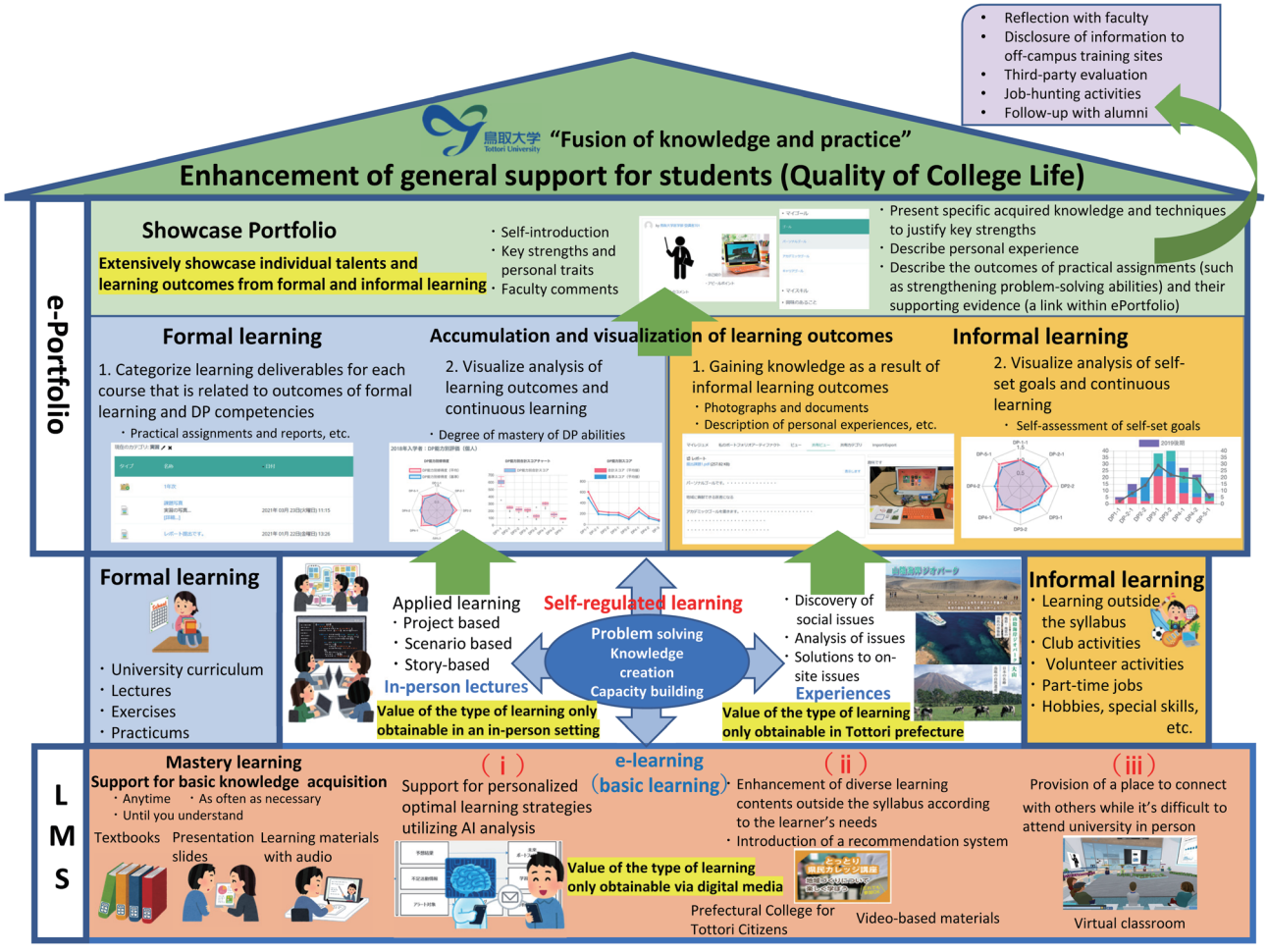

Fig. 3. Building an LMS-ePortfolio system to enhance the quality of college life.

this system will integrate the following: i) an artificial intelligence (AI) analysis system that supports optimal individualized learning strategies, ii) the enrichment of a variety of learning content outside the syllabus that meets the needs of students and makes it possible to introduce a recommendation system for learning activities, and iii) the introduction of a virtual classroom that cultivates the ability to build digital social skills. These areas are described in detail below.

i) Introduction of an AI analysis system to support individualized learning strategies

We will introduce an AI analysis system into the LMS to provide optimal individualized academic support to each student. The specific functions of the system are to analyze the learning data of the LMS platform in real time and to provide information on each student such as learning progress and learning outcomes, to students and faculty. The system predicts future learning outcomes, such as the degree of DP mastery, in response to current LMS-based activities, and for each student it displays a report in the LMS with suggestions for improving learning activities. The system can also provide necessary support to prevent dropouts. To facilitate students' growth as self-regulated learners, the support provided by the AI will gradually be removed, and it is hoped that students will eventually acquire the ability to determine their own learning goals and strategies.

ii) Enrichment of a variety of learning content outside the syllabus and introduction of a recommendation system to meet the needs of learners

Since there are few liberal arts departments at our university, such as the Faculty of Literature and the Faculty of Law, the provision of liberal arts education is insufficient. Therefore, to enrich both formal and informal learning, we will develop materials, for instance videos, in a variety of fields. The materials will include content from the Tottori Prefectural College as well as content integrated with nature, culture, industry, and other learning fields that can only be experienced in Tottori Prefecture, and will support experiences in nature, sports, volunteerism, and culture. In addition, a

related content recommendation system will be introduced to enable students to efficiently search for content that meets their needs, thereby supporting easy access to learning.

iii) Introduction of virtual classrooms to cultivate the ability to build social skills in the digital world

During the current COVID-19 pandemic, students are unable to attend the university and there is a concern that their isolation will lead to decreased motivation to learn and a reduced number of informal learning opportunities. In this study, we propose creating a virtual classroom that fosters the ability to build social skills in the digital world by using avatars to communicate in a virtual space while taking online classes and engaging in campus activities. The goals of this project are to deepen the learning process by moving back and forth between the real campus and the digital campus, and to promote communication and learning on a shared digital campus that can be accessed at any time, transcending the physical distance between international students and domestic and international exchange students.

The new LMS-ePortfolio system will add the above three functions to the existing system. We aim to build a system that fosters problem-solving skills and intellectual imagination by promoting self-directed learning and growth to support both formal and informal learning in a comprehensive manner.

CONCLUSION

University education includes components that are not primarily knowledge-based. For instance, it is expected that students will develop generic skills, as indicated by Human Potential (Cabinet Office), Basic Skills for Working People (Ministry of Economy, Trade and Industry), and Basic Skills for Employment (Ministry of Health, Labour and Welfare), as well as various skills for international activities. A previous study reported that these skills cannot be evaluated by conventional evaluation methods or in a short period of time, but should be assessed by examining the process of task execution and the content of activities.[12] In order to achieve this, it would be beneficial to use ePortfolio to produce a record of learning that spans several time points: when a student begins school, when they take their employment examination, and when they become a working member of society. This ePortfolio system would implement a pass/fail grading policy and a formative evaluation of learning. We will build an LMS-ePortfolio system and operate it as a system that will serve as a foundation for learning, and strongly promote the "fusion of knowledge and practice" that is the basic philosophy of the university, along with the DX concept of education. The planned system will be constructed with a 2020 subsidy from the Ministry of Education, Culture, Sports, Science, and Technology for the promotion of university reform (project for the advancement of digitally enhanced education).

Acknowledgments: The construction of the ePortfolio system described in this paper was funded by a subsidy from Shimane Prefecture to support the development of doctors working in the region, and was contracted out to Resonant Solutions Co., Ltd.

We would like to express our gratitude to the faculty and staff of Tottori University, the administrative office, and all other related parties who have contributed to this project.

The authors declare no conflict of interest.

REFERENCES

1 Tanabe M. Three Policies in The Baccalaureate Degree Program and Outcome-Based Education. Igaku Kyoiku. 2017;48:237-42. DOI: 10.11307/mededjapan.48.4_237 Japanese with English abstract.
2 Nakamura H, Nakano T, Kaidoh T, Takahashi Y, Miyoshi M. Visualizing the Achievement Level of Diploma Policy by Analyzing Grade Point of Subjects Associated with Competency. Igaku Kyoiku. 2019;50:329-36. DOI: 10.11307/mededjapan.50.4_329 Japanese with English abstract.
3 Reigeluth CM, Beatty BJ, Myers RD. Instructional Design Theories and Models Volume IV. New York: Routledge; 2017.
4 Association of American Colleges and Universities. Greater expectations: A new vision for learning as a nation goes to college. Washington DC: Association of American Colleges and Universities; 2002.
5 Association of American Colleges and Universities. College learning for the new global century. Washington DC: Association of American Colleges and Universities; 2007.
6 Zubizarreta J. The learning portfolio: Reflective practice for improving student learning. 2nd ed. San Francisco: Jossey-Bass; 2009.
7 Jenson JD, Treuer P. Difining the E-Portfolio: What It Is and Why It Matters. The Magazine of higher learning. 2014;46:50-7.
8 Monkawa T, Breugelmans R, Asada Y, Hirakata M. Survey of e-Portfolio Practice at Medical Schools in Japan. Igaku Kyoiku. 2015;46:443-6. DOI: 10.11307/mededjapan.46.5_443 Japanese with English abstract.
9 JACME Browser [Internet]. Igaku Kyoiku Bunyabetsu Hyouka no Kekka. Tokyo: Japan Accreditation Council for Medical Education; 2021 [cited 2021 June 28]. Available from: https://www.jacme.or.jp/pdf/jacme_web_licensebanner_link.pdf. Japanese.
10 Nemoto J, Takahashi A, Takeoka A, Nakano H, Suzuki K. Designing and Evaluating "Portfolio Practice I," a Course for Online Graduate Students. IJEMT. 2017;11:25-33.
11 Kim K, Collins M, Williamson J, Chapman C. Participation in Adult Education and Lifelong Learning: 2000–01. Washington DC: U.S. Government Printing Office; 2004.
12 Matsuba R, Komura M. Gakuseiryoku wo Takameru ePortfolio. Tokyo: Tokyo Denki Daigaku Shuppankyoku; 2018. p. 121-31. Japanese.