Approach to Education Innovation Making Use of Open Content

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"Open education" innovation, which originated in the United States, is becoming widespread all over the world. At the same time, there is a dramatic transition from educator-centric to learner-centric learning through utilization of the Web. We have been researching and developing an education method called "curation learning" in which content and services on the Web are curated and value is added for social learning through collaboration with others as well as creating a platform to support it. In curation learning, people learn through a cycle of actively "searching," "creating," and "engaging," which can not only help learners acquire information and knowledge but also cultivate "21st-century skills" including critical thinking, communication/collaboration ability, and information literacy. This paper describes case studies at universities in the United States using the curation learning method and the platform and presents a future outlook.

1. Introduction

An innovative trend in education called "open education" is now taking place in North America. This trend has its roots in the release of MIT OpenCourseWare[1] in 2001, which was followed by the launch of the Khan Academy[2] in 2006 and the rise of Massive Open Online Courses (MOOCs) such as Coursera,[3] Udacity,[4] and edX[5] in 2012. In short, a series of solutions for "Learning on the Web"[6] that leverage the Web as an open environment and massive user participation have come to be developed. These learning solutions are a clear part of an evolutionary line starting with conventional e-learning typified by "Learning on a PC."

This paper presents "curation learning," a new learning method that makes effective use of the Web and describes case studies of applying this method at North American universities.

2. From searching to learning: curation learning

Search engines such as Google have become a social infrastructure for distributing information, and searching the Web to obtain information has become a common practice. Problem solving with respect to real-world problems is often performed through a cycle of problem discovery, Web searching, information selection, and transformation of information into knowledge. Typical of such a process was the case of a high-school student in the United States who, on developing an interest in cancer diagnosis after losing a close relative to cancer, used the Web to search for information in journal papers and on various Web sites as a way of self-education and came to develop a promising test for early detection of pancreatic cancer.[7]

Web searching in this way has become an important approach to problem solving, but the key to making this process successful is determining how best to select the retrieved information and turn it into useful knowledge. One method for doing so is to share the information with others and receive feedback from them to deepen one's understanding of that information. In the United States, some students are actually using social networking sites (SNSs) specific to learning to help solve learning-related problems. One such site is OpenStudy[8] in which learners come together to learn from each other and teach each other on a user interface similar to Twitter. Such sites reflect the need for a new learning style that deepens understanding through a cycle that adds "information posting and sharing with others" to the problem-solving cycle

described above.

Fujitsu Laboratories of America, Inc. (FLA) re-defined this process as "curation learning," which promotes learning through a cycle of search, create, and engage. The word "curator" generally refers to a museum staff member, and the word "curation" means to "collect, organize, summarize, and release (share) information through manual means" (source: ALC Eijiro on the Web).[9] With these definitions in mind, we can investigate ways to apply curation to informal learning.

3. Open education platform

In North America, a number of case studies have been reported of curation learning in the classroom where existing Web services have been combined with social media in the following way.[10]
Search: Search engines like Google
Create: Curation services targeting visual media such as Pinterest and Storify
Engage: SNSs like Twitter and Facebook

There is some concern that primary and second-ary students whose media literacy is relatively low will become overly dependent on SNSs and will not be able to devote themselves to their schoolwork as a result. However, it is expected that providing students with in-structions and guidance on the proper use of SNSs will have the positive effect of developing useful skills such as cooperative problem solving.[11] There are examples in the United States of introducing curation services such as Storify in the classroom as tools for cultivat-ing critical thinking, media literacy, and other useful skills.[12]

At FLA, researchers have developed an open education platform (OEP) with the features described below to provide a one-stop service for curation learn-ing (**Figure 1**). The OEP collects and organizes open content scattered around the Web and provides an environment in which a user can use that content to create new material for study in accordance with per-sonal objectives and an environment in which users can share content and learning interests and learn from one another. Specifically, the OEP can be used to implement the functions necessary for curation learn-ing—search, create, and engage—on a single platform, thereby making it possible to maintain and examine a learner's log consisting of various types of actions (searching, accessing of Web sites and video content, interacting with others, etc.). In addition, the log data can be analyzed to clarify learning behavior that could not be understood through learning that simply combines general searches and Web services like SNSs. The results of such analysis can be used to construct a learner-centric learning environment having the follow-ing features.
1) Customization of search domain
Since a user using Google would end up search-ing across the entire Web, this OEP enables the learner to search through content tailored to the learning
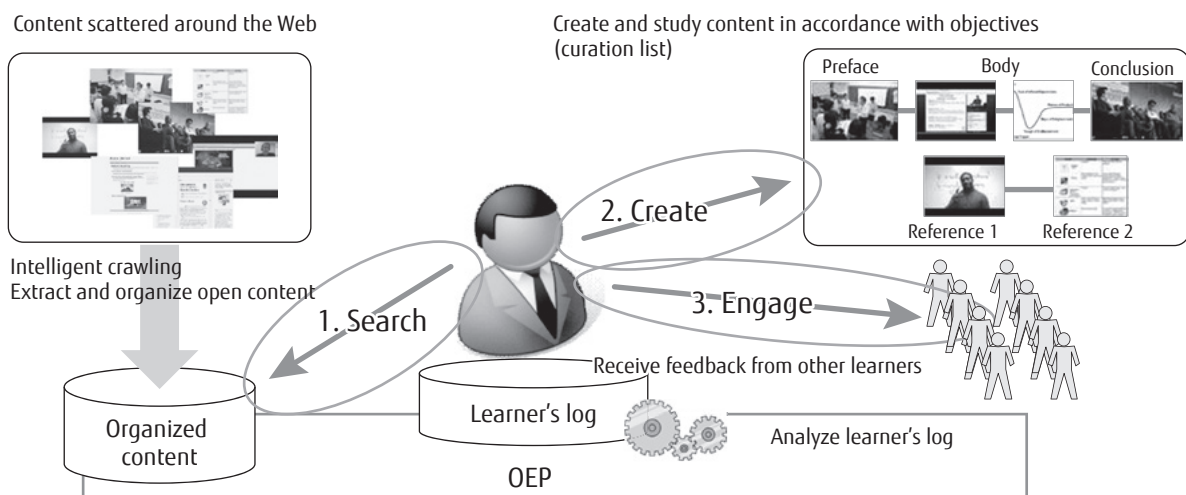

Figure 1
Overview of open education platform.

objectives.

2) Search of curation results

The content curated by individual learners can be searched and retrieved, making it easy to share the results of curation learning.

3) Visualization of acquired knowledge

The results of learner curation can be visualized at the keyword and concept level, enabling acquired knowledge to be easily understood and applied.

4) Formation of learning communities

The results of curation by learners can be analyzed so that materials can be recommended to other learners with similar interests and preferences, and communities can be formed.

5) Group-oriented collaborative work

This OEP enables multiple learners to form a group and collaborate on studying a certain subject or resolving a problem.

4. 21st-century skills and curation learning

"21st-century skills" has been defined as the knowledge, skills, work habits, and character traits needed to succeed in today's world, particularly in collegiate programs and modern workplaces and careers.[13] In Japan, the importance of a similar set of skills has been promoted within "New Educational Guidelines — Developing Life Skills in Students,"[14] established by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). Specifically, skills such as collaborative problem solving and media literacy are essential to a future society based on a knowledge economy, as described by the Assessment and Teaching of 21st Century Skills (ATC21S)[15] research project. They make up a skill set indispensable to the new generation of "digital natives." A correspondence can be established between the elements of these 21st-century skills and the three key processes of curation learning as follows.

1) Search (find, select)

Develop abilities to recognize the value and significance of data, understand concepts from multiple domains, sort and conceptualize data (uncovering themes and topics), analyze data, think critically, and engage in design thinking and problem solving.

2) Create (editorialize, arrange)

Develop the abilities described in 1) above and the abilities to understand other cultures and to learn and create.

3) Engage (share, track)

Develop abilities to solve problems through communication and collaboration and to rediscover the value and significance of data.

5. Case study of curation learning using OEP: application to tutorial program

This section introduces a case study of applying curation learning to the Tutorial Program at the Athletic Study Center (ASC) of the University of California, Berkeley (UC Berkeley), which provides learning support for the school's student athletes.

UC Berkeley is the oldest of the ten schools making up the University of California system. It is a leading university in the United States with many Nobel Prize recipients. Like many other universities in the country, it places much importance on its sports and athletic-scholarship program and actively recruits and accepts student athletes every year.

The academic ability and motivation for learning of such student athletes tend to be less than that of other students, and many universities in the United States have set up programs for supporting these students in their schoolwork. The role of ASC at UC Berkeley is to help the student athletes improve their fundamental academic abilities through the Tutorial Program, to make it easier for them to adapt to campus life, and to guide them to learn independently.

The ASC Tutorial Program consists of a program coordinator and about 60 tutors specializing in diverse subjects including literature, mathematics, science, and physics. It provides support for about 900 student athletes.

There are two main issues with the Tutorial Program. The first issue lies on the side of the coordinator and tutors who administer the program. Specifically, each tutor prepares the educational materials to be used for tutoring, but these materials are not shared within the organization, with the result that the know-how so accumulated is lost when the tutor's term of employment ends (usually at the end of a school term). The second issue concerns learning on the student's side. Simply put, how can a student with relatively low academic ability and motivation for learning be helped to acquire fundamental learning skills and improve personal motivation?

In response to these issues, we (FLA) held trials in two major phases. In Phase 1, we examined the extent to which know-how sharing among the coordinator and tutors might increase in frequency by introducing a curation-learning framework and assessed any resulting effects. To facilitate trials in this phase, we explained the concept and methodology of curation learning to the coordinator and tutors and asked those interested to create educational materials using Fujitsu's OEP and to share those materials. In Phase 2, which is still in progress at the time of this writing, we asked the students to study in accordance with the "search, create, and engage" methodology of curation learning and examined the effects if any of this methodology on learning (**Figure 2**).

The following summarizes and discusses the results of the Phase 1 trials.

1) The coordinator and tutors came to share the educational materials they created by combining open educational content, and the sharing appeared to lead to several changes. For example, it was observed that discussions among tutors were more active than before and that educational materials came to be created online in a collaborative manner.

2) Customized educational materials tailored to the detailed needs of the students could be prepared. This was accomplished by taking fundamental learning skills taught in the Tutorial Program (writing, reading, time management, etc.) and target subjects (mathematics, physics, philosophy, etc.), subdividing them into study topics, and creating educational materials tailored to
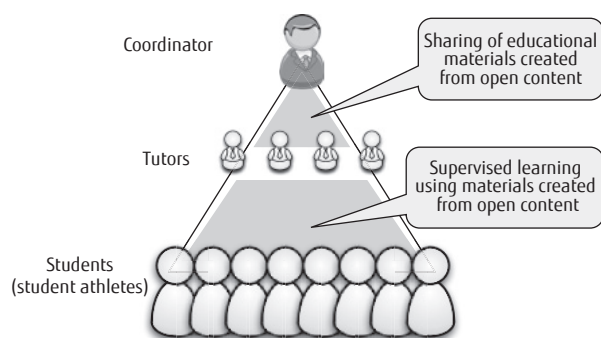
the academic ability of target students. As a result, the number of topics in the ASC Learning Management System (LMS) increased significantly, and the materials created in these trials obtained many online views compared to existing, non-subdivided materials (**Figure 3**).

At present, with Phase 1 completed, about 70 items of created materials have been placed in the ASC LMS, and their use in the Tutorial Program has begun. Next, in Phase 2, we plan to ask students to study in accordance with the methodology of curation learning while using the educational materials created by the tutors in Phase 1. We will then check for any effects of curation learning on improving academic ability and motivation for learning.

6. Case study of curation learning using OEP: application to hybrid course in anthropology

In this section, we introduce the application of curation learning to a hybrid course in cultural anthropology from January to March 2013 at a public university in the San Francisco Bay Area. This case study was conducted as an experiment in blended learning combining classroom instructions and online learning. The three activities were carried out using Moodle, an LMS, for the online learning portion and Fujitsu's OEP. The activities are described below.

1) Trip-to-Japan project (10% of points allocated to course)

In this activity, the students planned a 1-week trip to Japan consisting of visits to two cities. There were
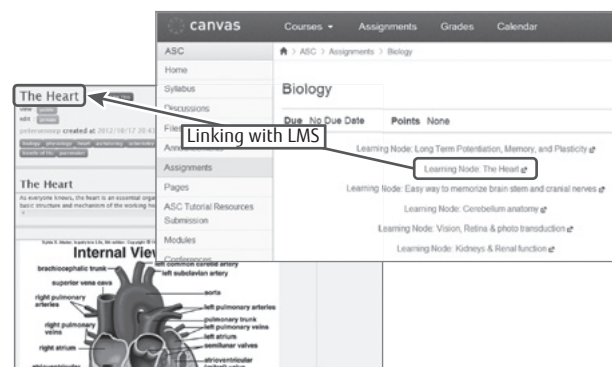

Figure 2
Athletic Study Center (ASC) Tutorial Program.

Figure 3
Provision of customized educational materials tailored to student needs.

four main learning objectives: become familiar with the geography of Japan, its sightseeing destinations, and regional specialties through Internet searches; collect information on transportation facilities, lodging, and eating in Japan to plan an itinerary; develop new viewpoints about Japan by experiencing a virtual trip to Japan; and establish a travel plan that combines diverse media to develop skills in effectively conveying information to other students (**Figure 4**). In relation to this activity, media literacy, the ability to acquire new viewpoints, and the ability to communicate have recently been attracting attention as high-order learning skills.

2) Group work and presentation (5% of points allocated to course)

In this activity, the students were divided into groups of 4 or 5. Each group took up themes or questions drawn from cultural anthropology materials dealing with young people, gender, ethnicity, and social stratification, studied points of interest prepared by group members, and gave a 15-minute presentation on the group's work. The objectives were to deepen the students' understanding of a certain theme by reading two items of materials and searching for and discussing related information in collaboration with other group members and to then curate what was learned. Curated materials from the group work were presented by making skillful use of video content. It is said that being able to switch easily from one type of resource to another on the same screen is one advantage of a presentation using curation.
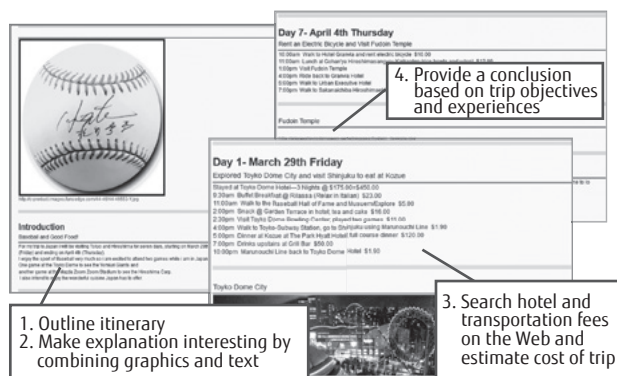
3) Learning by discovering one's own interests from themes covered in the course and curating them (15% of points allocated to course)

In this activity, the students curated three sets of materials based on personal interests or issues of concern from the themes covered in the course to deepen their understanding of the selected themes and to develop viewpoints on them while also making comments on materials created by other students (**Figure 5**). The objectives of this activity were to have the students obtain a good understanding of course materials in question, collect information on the themes selected, search and select important points from that information, develop their views on those themes, and curate that information and those perspectives while adding context in such a way that other students could understand their point of view. The students were also able to learn from the materials curated by other students. There was no firm deadline to submit their materials; they could submit them at any time during the course. This activity resulted in the curation of 59 sets of educational materials.

Applying curation learning to the above three activities resulted in the creation of an additional 76 sets of materials, which demonstrated that curation learning could be put into practice as part of a class assignment. Although students may drop a course toward the end of the term, all the students completed the assignments involving curation learning and completed the course as well. The results of a questionnaire administered on the final day of the course revealed that 12 students
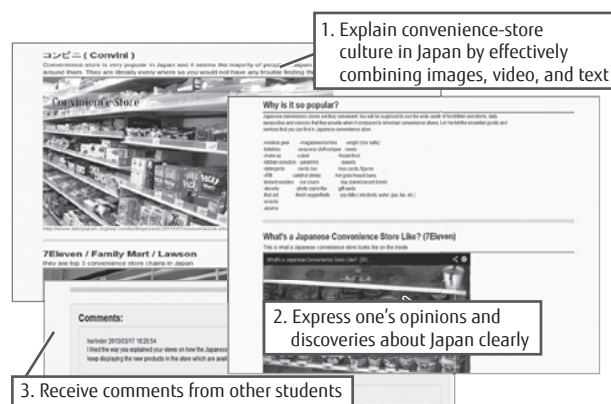

Figure 4
Curation-learning problem 1: cultural anthropology course (itinerary of Japan trip).

Figure 5
Curation-learning problem 2: cultural anthropology course (study of convenience stores in Japan).

out of 20 preferred curation learning to an essay assignment. This suggests that curation learning can be used to provide assignments that students can enjoy and learn from. However, whether curation learning is effective for learning needs to be examined in the future. To enhance the thinking skills and deepen the understanding of students, it is important to consider how each activity is incorporated into a course and how each assignment is designed. Methods for evaluating the quality of curation must also be studied.

The two case studies described above revealed that the process of curation learning—"searching" for materials based on student needs, "creating" customized materials through online collaboration, and sharing curated materials and what one has learned by "engaging" with others—has the effect of further deepening the student's understanding of curated material and stimulating communication with other students. They also revealed that the incorporation of curation learning in class assignments enabled students to "search" for information related to course materials in a stress-free, enjoyable manner, to concisely "create" material while adding their own points of view, and to deepen their understanding of those educational materials overall. These case studies also demonstrated the feasibility of acquiring new knowledge and disseminating the fruits of learning by having students convey learning achievements in a way that others understand and by sharing findings and opinions, that is, by "engaging" with other learners in the learning community.

7. Conclusion

This paper introduced case studies of using curation learning together with Fujitsu's open education platform in North American universities. In future research, we plan to make improvements based on feedback obtained from these case studies with an eye to achieving a Web learning platform and to expand trials of curation learning to universities in Japan. We also plan to research and develop the design of a learning technique that skillfully combines classes held in actual classrooms using an OEP with online classes in the manner of "flipped classrooms," where experiments in the use of MOOCs were first held.

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