THE CURRICULUM DEVELOPMENT TO ACCOMMODATE DIVERSE STUDENT IMAGES BY INCORPORATING CDIO IDEAS

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ABSTRACT

Department of information media of Hokkaido Information University (hereafter HIU) has made four major curriculum revisions and three minor updates since it started in 2001. The concepts of the curriculum revisions are as follows; 1) enhancement of the first-year educational program focusing on active learning abilities including critical thinking and interpersonal skills, 2) executing practical project based learning (hereafter PBL) courses based on requests from industry, 3) conducting efficient disciplinary courses through blended learning using iPad and/or PC and cooperation among courses. This paper reviews the history of the department and the curriculum revisions which the department has been working on over the past 15 years. The curriculums were planned based on the characteristics of the enrolled students of this department and the type of human resources to be trained. Therefore, the working group (hereafter WG) composed of professors from each field examined the overall picture of the integrated curriculum in the first stage. The department actively worked on PBL with the same awareness of the context of CDIO standard 1. Concerning learning outcomes (standard 2) including personal skills and interpersonal skills, the department has also considered the opinions of industry advisors and graduates. The authors also considered an integrated curriculum (standard 3) that aims to improve personal skills, interpersonal skills, motivation for studying, etc. through cooperation among disciplinary courses. Moreover, the department considered a course placement in which disciplinary courses and the liberal arts courses interacted. In the curriculum, various required courses provided individual and group tasks to learn personal skills and interpersonal skills (standard 4). In addition to PBL, there are many courses using various methods of active learning, e.g. utilization of ICT. Considering the above mentioned, it can be said that the curriculum development and operation, and the administration of courses in this department are very close to the idea and efforts of CDIO.

KEYWORDS

Curriculum development, PBL, ICT, personal and interpersonal skills, CDIO standard: 2, 3, 4, 5, 7, 8

INTRODUCTION

The department of information media of Hokkaido Information University in Japan has made four major curriculum revisions and three minor updates in the past 14 years. In the background of these changes, there was requests from the industry, the desire of applicants for enrollment and the changes in the quality of the students. Programs to cultivate human resources that can participate actively in the industry were considered.

HIU was awarded the funds Support Program for Contemporary Educational Needs (2005-2008) and Program for Promoting High-Quality University Education (2008-2011) from the Ministry of Education, Culture, Sports, Science and Technology (hereafter MEXT) of Japan. Using the above funds, HIU developed a learner adaptive e-learning system and the system for Faculty development (Fuji et al., 2007.) In addition, the authors were also awarded the funds from the MEXT, and from the Ministry of Economy, Trade and Industry (hereafter METI) of Japan, and have been promoting educational programs, developing teaching materials, and opening new workspace for media design called Media Creative Center (MCC). This paper presents an overview of the curriculum development for the Department of Information Media and how it is connected with CDIO standards.

CHANGES IN CURRICULUM TO ADAPT TO NEW NEEDS

The Department of Information Media was established in April 2001 with the aim of nurturing multimedia engineers and designers to have professional knowledge of information expression in the multimedia era and technology for building web systems. The authors are not involved in the composition of the first curriculum. This curriculum corresponded to a wide range of information media technologies and many special courses were arranged, but there was no cooperation among courses. Only elective courses were provided, and systematic learning models did not exist. For that reason, since spring of 2003 the authors verified the problems of the curriculum and started planning the second curriculum.

Curriculum development by the department required active faculty development. The curriculums were planned based on the awareness of characteristics of the enrolled students and the type of human resources to be educated. Therefore, the WG composed of professors from each field of study examined the overall picture of the integrated curriculum in the first stage (standard 3). On that basis, WG addressed the skeleton of each course and designed the framework, then assigned the professors in charge. Although details of each course were left to the discretion of the professor in charge, it should not deviate from the framework of integrated curriculum, i.e. cooperation among subjects. To increase efficiency and decrease load of work of the students, some professors in charge of the required courses cooperated with each other, and some classwork assignments operated simultaneously between the courses.

In the second curriculum which came into effect in 2005, the purpose was to train human resources to play a role as a liaison generalist connecting designers and engineers. To make it easier for design and IT engineering students, most of the basic education courses for freshman and sophomore were set as required courses. Furthermore, the connections among the core subjects were examined.

From this curriculum, a course called "Presentation Practice" was placed for second-year students. It was an individual project and the aim of this course was to develop presentation techniques and problem-solving abilities. Another goal of this course was to increase the number of completed works to be included in the portfolio at the time of future job hunting and to further bring out motivated students.

From this curriculum, some liberal arts courses were rearranged from first and second year to third and fourth year. This is due to the consideration that students will be able to notice the importance of liberal arts courses for their disciplinary studies; and from the idea that students want to acquire disciplinary knowledge from early stages of education.
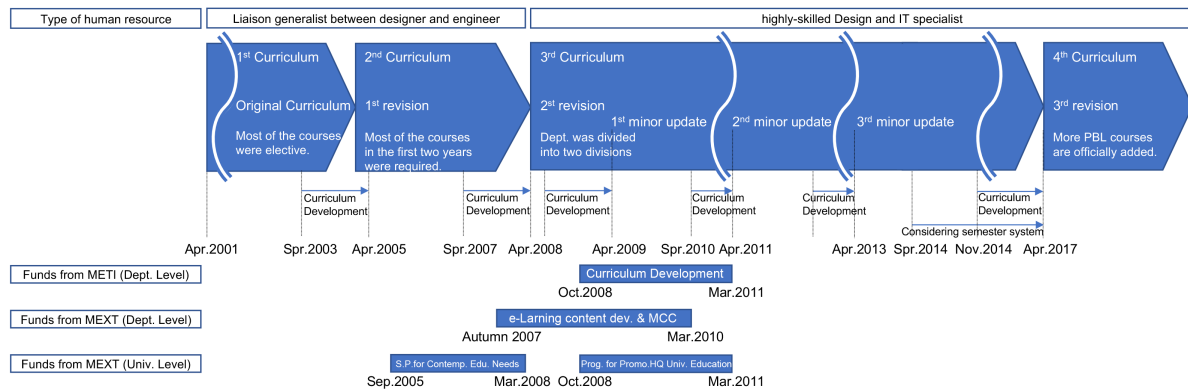
Figure 1. History of the curriculum development of Department of Information Media

At the same time, HIU began to develop a learner-adaptive e-learning system that was selected by MEXT's Support Program for Contemporary Educational Needs. The system supports autonomous learning and is suitable for the education of diverse students. The system now has functions such as discussion, watching class videos, class assignments including video contents for flipped classroom, and virtual workplace tour of graduates. Many courses are using this system currently. Regarding the digital learning in CDIO framework, it has been proposed that "Digital learning standard" should be added as an optional CDIO standard (Malmqvist, Edström & Hugo, 2017).

The third curriculum was an amendment resulting from a change in the method of recruiting new students. HIU decided to divide the department of information media into division of media design and division of media technology, so that the types of human resource to be educated could be changed from the generalist to specialized personnel of media design or media technology. Since the second curriculum was designed sufficiently with respect to the core courses, based on this curriculum the third curriculum was examined focusing on the higher-level courses so that more specialty can be enhanced. In addition, some courses were updated to more practical contents.

The 2008 curriculum was updated soon in 2009, as it was decided to clearly state the contents of various programs such as web design, graphic design, game programing, internet security and so on. In this update, more advanced courses for the above programs were added. These disciplinary courses also include PBL. In addition, as a basic skill to promote PBL, "Practicum in Idea Generation" for learning critical thinking and the methods of information arrangement and idea generation, e.g. mind mapping, was also added as a required course for first-year students. This course also has a role as the first course to develop interpersonal skills.

Since the reviewing WG of the curriculum development also included industry advisors as stakeholders, the courses that compose each program of this curriculum have been strengthened to meet the needs of industry as shown in CDIO standard 2. As shown in Figure1, this improvement was implemented by funds of the METI (2008-2010.) Also, at the same time, budget was obtained from the MEXT, and e-learning contents of practical training to acquire design skills were prepared. Media Creative Center (MCC) was founded by using the MEXT funds.

In the minor update of 2011, some programs were revised, but no major course change was made. In the minor update of 2013, as media art / technology art began to attract attention, courses related to those technologies were added, and a program of media programming was

newly placed. Courses related to mobile application development were also newly placed from the prediction of the spread of smartphone popularity. However, it was decided that major changes in the curriculum were necessary.

The course has been changed and the curriculum improved from time to time in response to changes in social situation, requests from industry and trends of applicants for HIU. Meanwhile, the students' background, level of education, motivation, economic situation and so on are diverse. For that reason, providing good education has become a difficult process. In particular, the decrease in communication abilities and stress tolerance have become remarkable. For that reason, the curriculum so far has gradually become ineffective to the students. Therefore, since 2014 HIU has considered switching to quarter system. At the same time, the department of information media has decided to reform the curriculum. This is the fourth curriculum of the department.

A curriculum that can steadily strengthen not only high-level students but also diverse students with low communication skills and motivation was sought. The authors decided to arrange a number of special basic courses that will give awareness of university education with reference to the first year's education initiative at Kanazawa Institute of Technology (Kanazawa Inst. of Tech., 2017).

Until now, many PBL projects have been positioned as extracurricular activities and have not been credited. In recent years, the number of students who cannot do time management well has increased. Also, it is hard to say that the operation of these projects is a sustainable mechanism since it was covered by volunteer teachers. Therefore, project courses have been newly placed so that these projects will be certified as regular courses. By doing this, students with grades in the upper middle level will be able to approach graduation while acquiring interpersonal and professional skills through the project courses.

On the other hand, for students whose project activities are difficult due to lack of fundamental academic ability or developmental disability, the traditional education is also available. However, in this curriculum, first-year experience courses that improve interpersonal skills are arranged by elementary PBL and all students are advised to take these courses. For those students that have taken first-year experience courses to improve their interpersonal skills and are still unable to pass the courses, other choices are available.

At the same time, for the students who are less motivated to study or believe they are not good at certain basic subjects, it is important to show how the basic academic knowledge is useful for advanced studies they want to pursue. Also, their motivation can be raised by using ideas from Kumon's learning method, in which courses are settled at a level students can accomplish easily. When they gain confidence after the training, it is time to try PBL. Contents for upper-level students were also provided. Since both the lectures of "Introduction to Information Media" for first-year students and "Project Trial II" for third-year students are assigned same time slot in the first quarter, first-year students are able to see the final presentations of "Project Trial II." The lectures of "Beginning Information Media II" for freshman will also be held at the same time slot of "Project Trial I" is placed in the fourth quarter. So, the first-year students have a chance to see the proposal presentations of "Project Trial I." Making these opportunities for students to visualize how their academic lives will be in two years is important to keep or increase motivation in fierst-year students. In the fourth curriculum, there are many courses to increase students' motivation as shown in Figure2.

Senior
- 4th Quarter
- 3rd Quarter
- 2nd Quarter
- 1st Quarter

Junior
- 4th Quarter
- 3rd Quarter
- 2nd Quarter
- 1st Quarter

sophomore
- 4th Quarter
- 3rd Quarter
- 2nd Quarter
- 1st Quarter

Freshman
- 4th Quarter
- 3rd Quarter
- 2nd Quarter
- 1st Quarter

Graduation Research IV

Graduation Research III

Step-up Project III

Graduation Research II

Graduation Research I

Step-up Project II

Regional Contribution Project

Step-up Project I

Project Trial II

Project Trial I

Special Lectures on Media Design

Specialist Lectures for Information System

To the various disciplinary courses

Mathematics on Information Media I

Some interaction

Beginning Information Media II

Passport to Information Media

Beginning Information Media I

Some interaction
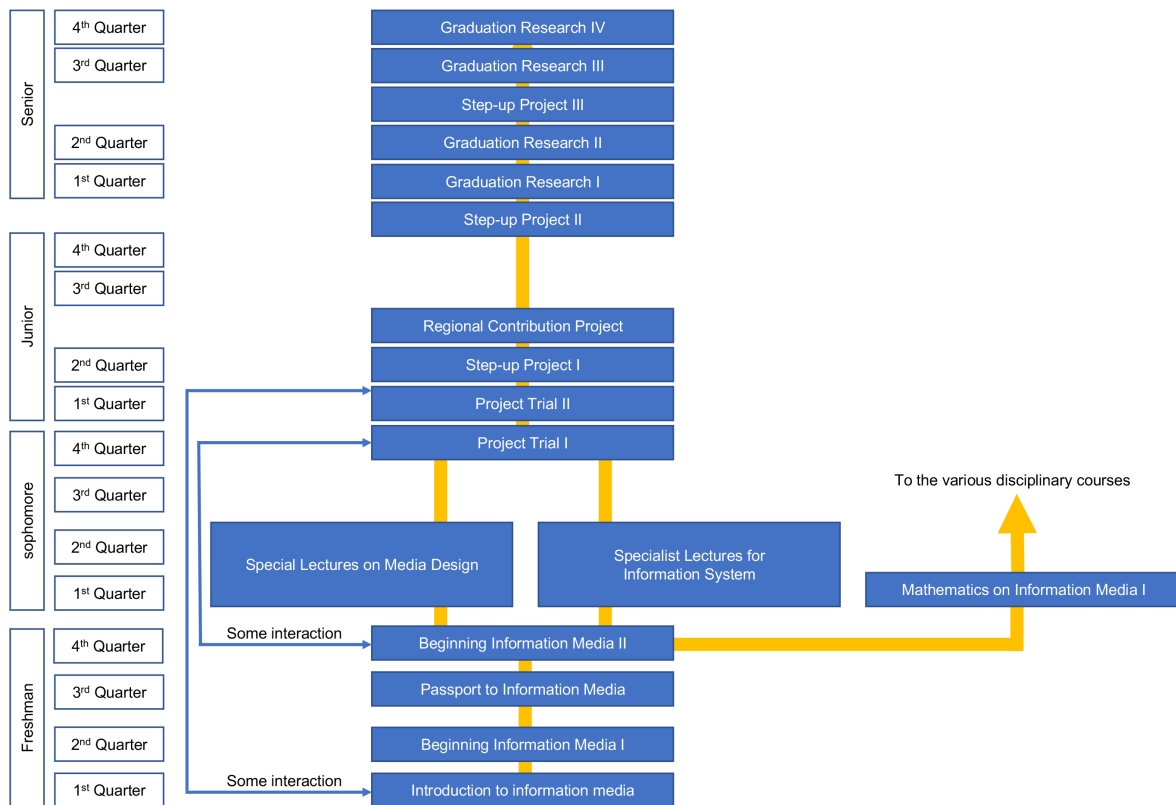
Introduction to information media

Figure 2. Integrated Curriculum for student motivation and curiosity cultivation

In the introductory course of PBL for freshman, by gradually completing simple critical thinking tasks and simple idea generation exercises, students can reach the final assignment. In addition, simple project tasks were prepared in various practicums to acquire professional skills. In the latest curriculum, students can take a total of six comprehensive project courses and a few courses from seven project courses that are set as the highest-level courses in each program. From the fourth curriculum, students are able to choose projects courses instead of graduation thesis.

FOSTERING THINKING SKILLS

Before "Practicum in Idea Generation" was placed, third-year students of the author's laboratory could not expand their ideas in a project. So, by teaching mind mapping, both the quality and quantity of output dramatically improved. This is the reason why "Practicum in Idea Generation" was assigned as a required course for first-year students. After that, "Design Management" and "Design Thinking" were placed as higher-level courses. These courses together with project courses aim to improve educational effort. "Practicum in Idea Generation" was initially designed for learning idea tools such as mind mapping and KJ method, and for group project works of constraint tasks for proposal preparation. However, lack of critical thinking skill became clear, and the course was modified to work on this problem, too. Two years after the course started, because the characteristic of first-year students changed and many students could not complete some assignments, fundamental study methods had to be included in the course (Hayata, 2013). As a result, in the fourth curriculum, besides "Practicum in Idea Generation," a course to learn positive attitudes toward learning and methods for

learning autonomously was placed. In principle, both of these courses are to be taken by all first-year students.

PRESENTATION TO PBL

Japanese are believed to be poor at presentation. The reason is largely dependent not only on Japanese culture and mind but also on the educational content. As shown above, in the 2005 second curriculum, "Presentation Practice" which combined individual projects and presentations as placed. In the 2008 third curriculum, this course was updated as "Project Trial" which focused on interpersonal skills rather than personal skills. In 2009, since "Project Trial II" course was positioned as a project for developing games for Tokyo Game Show, the name of the "Project Trial" was changed to "Project Trial I." This is a PBL course that takes eight months to complete from team planning to production and final presentation. The name "Project Trial II" will be changed to "Game Creation Project" in 2019.

The students of the department of information media have diverse subjects of interests. In particular, first and second year students are eager to start production projects as soon as possible. Second-year students challenge team project activities in "Project Trial I." Students are able to decide their project theme freely in this course. Through the projects, by studying skills autonomously, some students started to use higher-level of skills that will be taught at third and fourth year or much higher than the skills taught in the whole curriculum (Standard 7 & 8).

On the other hand, in recent years, the quality of their outcomes began to decline. Many teams dropped out due to lack of communication skills, time management skill and/or sense of commitment. In fact, many students were frustrated for not having personal skills and/or interpersonal skills. For that reason, improvement of the course was necessary.

In the fourth curriculum, the course "Project Trial I" was divided into "Project Trial I" and "Project
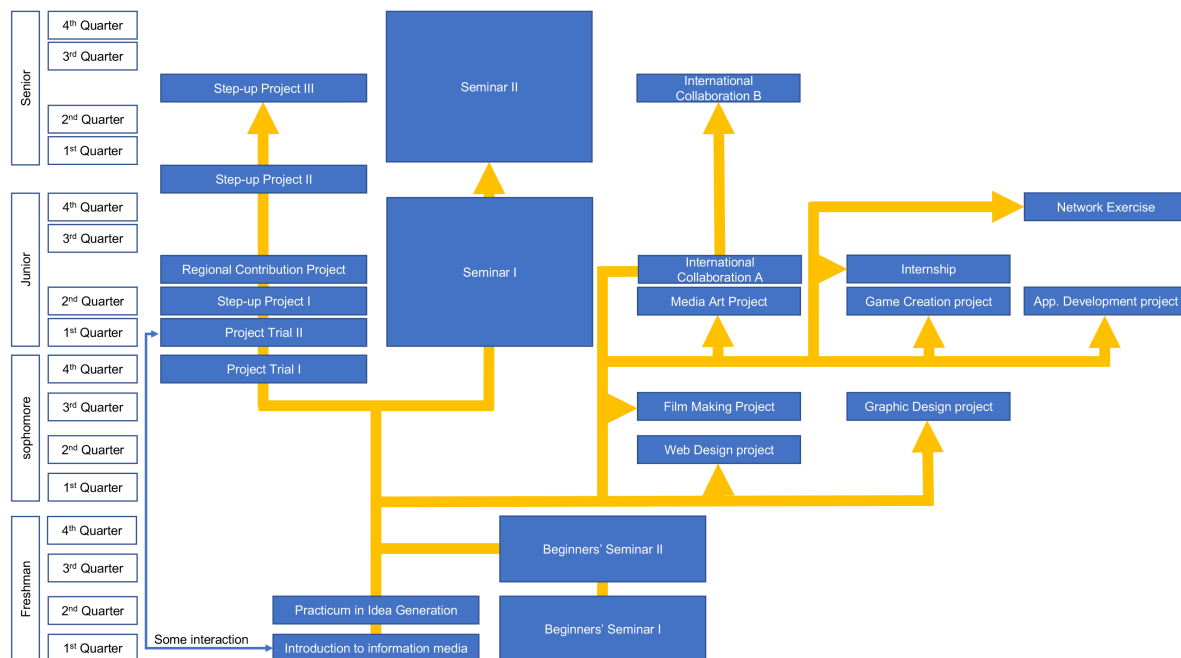

Figure 3. Integrated Curriculum (Teamwork, Communication, Critical Thinking, etc.)

Trial II." In the new "Project Trial I," beginning from academic year 2018, students will write a proposal of their projects and make a prototype within two months. The final assignment of this course is the presentation of their proposals. If the students pass this course they can take the next course, new "Project Trial II," and implement their proposals (standard 5). In this way, dividing the project into two levels and establishing a halfway mark is an attempt to reduce students' lack of perseverance to overcome barriers and make time management easier for them. The above strategy will help reduce dropout of students.

Since the new "Project Trial I" will start in the end of school year 2018 and the new "Project Trial II" in the beginning of school year 2019, the results of the trial will become clear after one year. After taking the Project Trial I&II, students can take a course named "Step-up Project" which is a project course across all departments of HIU for junior students. In this course, students with different backgrounds, such as business administration, systems and informatics, medical management and informatics, and media design and technology, will be together and conduct projects intensively for two months. For teams with different backgrounds, more advanced interpersonal skills are required. This course will start in the second quarter of 2019. There are many other project courses in the fourth curriculum as show in Figure 3.

CONCLUSION

Since the number of diverse students is increasing, many of them cannot complete the former curriculum. The concept of the fourth curriculum is to improve students' motivation. 1) In order to keep students' motivation, it is important to split a task into smaller more manageable tasks, e.g., split a course into multiple courses, split a big assignment into smaller assignments, and so on. 2) Small assignments for the first-year experience should lead to successful experience to students and contribute to fostering students' confidence. 3) By showing presentations of Project Trial I and II, first-year students should be able to imagine easily what they will be able to do in one or two years. These efforts will raise the feelings of students with low motivation and low self-esteem. 4) In order to provide an effective education to diverse students, the authors believe that integrated curriculum is very important not only for acquiring communication skills, critical thinking skills, and so on, but also for acquiring positive mindset.

The fourth curriculum started from the academic year 2017 for first-year students. With the conversion from the semester system to the quarter system and beginning of new courses, the faculty had not enough time to evaluate the curriculum. An examination of the outcomes of the drastic curriculum reform are going to be needed and the problems of each course will be gradually solved. In particular, it is important to verify how to maximize the education to motivate diverse first-year students, and to maximize the outcomes of the project courses.

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BIOGRAPHICAL INFORMATION

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