CDIO-BASED CURRICULUM DEVELOPMENT FOR NON-ENGINEERING PROGRAMS AT MASS COMMUNICATION TECHNOLOGY FACULTY

Uravis Tangkijviwat, Wanchanok Sunthorn, Natchaphak Meeusah

Faculty of Mass Communication Technology,
Rajamangala University of Technology Thanyaburi

Natha Kuptasthien

Faculty of Engineering, Rajamangala University of Technology Thanyaburi

ABSTRACT

Faculty of Mass Communication Technology (MCT) at Rajamangala University of Technology Thanyaburi (RMUTT) has adopted CDIO framework as a context for producing professional hands-on graduates since 2015. MCT faculty has adopted CDIO framework in curriculum development for all six programs; namely, Multimedia, Digital Media, Television and Radio, Photography and Cinematography, Advertisement and Public Relations, and Digital Printing and Packaging Technology. Curriculum development process consisted of (1) a stakeholder survey focusing on future of the world of professional work (2) an implementation of CDIO standard 2 to identify program outcome and graduate attributes and (3) an implementation of CDIO standard 3 for integrated curriculum. The introductory course for each program was introduced to the first year students. With a support from the university, a major renovation of workspace and laboratories was undertaken. The state of the art workspaces supporting students' learning experiences are studio, theatre, render farm lab, 7.1 sound studio, stop motion studio, printing house, TV master control room, and fabrication laboratory. This paper showed similarities and differences of six programs when implementing CDIO concept. Program self-assessment regarding CDIO 12 standards revealed a high commitment to continuous improvement for quality of education.

KEYWORDS

Curriculum development, non-engineering programs, CDIO standards: 1-12

INTRODUCTION

Mass media is one of the most useful essences of human life. There are a variety of mediums from which people can pick and access information from press, radio, television and film. It educates people about the world outside of their locate boundaries and also acts as an important accountability mechanism by acting as a watchdog of society. Consequently, the media holds a very powerful capacity to set a social issue. In the recent years, the mass media industry is undergoing significant change, with digital distribution platforms joining traditional media. New era media, for instance internet and social media, has evolved over the last decade and became an important driver for acquiring and spreading information in

different aspects, such as entertainment (Shen et al., 2016), business (Stefan et al., 2018 and Hatem et al., 2018), and so on. In an aspect of academic, most of education in mass communication is devoted to social science and art domains. These programs approach to a message design regarding sender and receiver behaviors. In a differential domain, the programs in the faculty of Mass Communication Technology (MCT), Rajamangala University of Technology Thanyaburi (RMUTT), are integrated with science, technology, and design. The graduates were expected to possess various skills to develop instruments and techniques for making mass medium that meet stakeholders' requirements

The CDIO framework was first adopted in mechanical and aerospace engineering. The improvement of several programs based on Conceive – Design – Implement – Operate, hence, has been widely implemented in the field of an engineering education (Crawley et al., 2007). However, CDIO is not limited to application in engineering programs. It is also applied to non-engineering programs. Doan et al. (2014) proposed the generalized CDIO standards for other disciplines to make them more applicable to any program. Malmqvist (2015), furthermore, revealed a practical experience of how to translate CDIO standards to non-engineering contexts. Although the guidance for implementation of CDIO in non-engineering programs was explored (Malmqvist at al., 2016 and Hladik at al., 2017), there is a lack of an application for mass communication. This paper, therefore, aims to address this gap in the field of mass media.

This study illustrates the way to apply CDIO in the field of mass communication and how to improve students' performance. First, we describe the implementation and experiences of non-engineering CDIO programs. The next section exposes case studies in the subjects of principles of media production for multimedia and light and sound technology for stage. Finally, the paper is concluded.

THE CDIO APPROACH

The program outcome for MCT is to produce the hands-on professional graduates who meet the industrial and social requirements. CDIO framework shows high committed results for enhancing a quality of mass communication education. As stated in CDIO context (CDIO standard 1), the CDIO principle was presented and promoted to all faculty members in the annual seminar in 2014. One year later, six curriculums of undergraduate programs; namely, Multimedia (MM), Digital Media (DM), Television and Radio Broadcasting (TR), Photography and Cinematography (PC), Advertisement and Public Relations (AP), and Digital Printing and Packaging Technologies (PT), were developed based on CDIO framework. Due to faculty's policy, conceiving, designing, implementing, and operating in terms of media and production lifecycle development are aligned in the senior project and subjects that carry out a mass media production. The students learn to solve problems and complete their projects following the stages of CDIO. Furthermore, the CDIO framework is appointed as a one of key performance indicators of faculty, such as increasing the faculties who have a CDIO advanced experience and stakeholders' satisfaction on working space.

For curriculum development regarding CDIO Standard 2, CDIO syllabus v.2.0 was used as a guideline. The stakeholder survey was conducted to acquire CDIO knowledge and skills proper to MCT context. The learning outcomes from mass media industries and fourth-year students who have experiences in cooperative education were shown in Table 1. In each section of CDIO syllabus, top three of desired learning outcome were showed as first, second, and third ranking, respectively. The overall result was a general response from all stakeholders rather than in particular programs. In the section of disciplinary knowledge and reasoning (section#1), the overall response showed that mass media industries concern the

fundamental (CDIO syllabus 1.2), advanced (1.3), and mathematics and sciences knowledge (1.1), respectively. The same result occurred in the student point of view. It is noted that the skills of mathematics and sciences (1.1) is secondarily needed in the industries of DM, TR, and PC. In the section of personal and professional skills and attributes (section#2), the result is not unanimous. We found a different requirement among the programs and also between industrial and student aspects. However, a skill of experimentation, investigation and knowledge discovery (2.2) is founded as the smallest requirement. There is clearly a result in the section of interpersonal skill (section#3). The consensus is as followings: teamwork (3.1), communication (3.2), and foreign languages (3.3). Last but not least, in the section#4 the skills of conceiving and working system (4.3), implementing (4.5), and designing (4.4) are required in general, but there are different in the detail. For instance, a leadership skill (4.7) is exposed in DM, PC, and AP programs and an enterprise and business context (4.2) is occurred in PT program. In sequentially, the obtained CDIO skills are integrated into each curriculum to ensure that a qualification of graduates will meet to industry expectation (CDIO standard 3).

Table 1. Desired CDIO knowledge and skills set of six programs responded by stakeholders

<table>
<tr><th></th><th rowspan="2">Programs</th><th colspan="3">Industrial aspect</th><th colspan="3">4th year student aspect</th></tr>
<tr><th>1st Rank</th><th>2nd Rank</th><th>3rd Rank</th><th>1st Rank</th><th>2nd</th><th>3rd Rank</th></tr>
<tr><td rowspan="8">Section #1</td><td>Overall</td><td>1.2</td><td>1.3</td><td>1.1</td><td>1.2</td><td>1.3</td><td>1.1</td></tr>
<tr><td>MM</td><td rowspan="7">1.2</td><td>1.3</td><td>1.1</td><td rowspan="7">1.2</td><td rowspan="7">1.3</td><td rowspan="7">1.1</td></tr>
<tr><td>DM</td><td>1.1</td><td>1.3</td></tr>
<tr><td>TR</td><td colspan="2">1.1 and 1.3</td></tr>
<tr><td>PC</td><td>1.1</td><td>1.3</td></tr>
<tr><td>AP</td><td rowspan="2">1.3</td><td rowspan="2">1.1</td></tr>
<tr><td>PT</td></tr>
<tr><td rowspan="8">Section #2</td><td>Overall</td><td>2.3</td><td>2.4</td><td>2.5</td><td>2.1</td><td>2.3</td><td>2.5</td></tr>
<tr><td>MM</td><td>2.4</td><td>2.3</td><td>2.1</td><td>2.1</td><td>2.3</td><td>2.5</td></tr>
<tr><td>DM</td><td>2.3</td><td>2.4</td><td>2.5</td><td colspan="2">2.1 and 2.5</td><td>2.3</td></tr>
<tr><td>TR</td><td colspan="2">2.1 and 2.5</td><td>2.3</td><td rowspan="3">2.1</td><td>2.3</td><td>2.5</td></tr>
<tr><td>PC</td><td>2.3</td><td>2.4</td><td>2.1</td><td rowspan="2">2.5</td><td>2.4</td></tr>
<tr><td>AP</td><td>2.4</td><td colspan="2">2.3 and 2.5</td><td>2.3</td></tr>
<tr><td>PT</td><td>2.3</td><td>2.5</td><td>2.4</td><td>2.3</td><td>2.1</td><td>2.5</td></tr>
<tr><td rowspan="8">Section #3</td><td>Overall</td><td>3.1</td><td>3.2</td><td>3.3</td><td>3.1</td><td>3.2</td><td>3.3</td></tr>
<tr><td>MM</td><td rowspan="7">3.1</td><td rowspan="7">3.2</td><td rowspan="7">3.3</td><td rowspan="7">3.1</td><td rowspan="7">3.2</td><td rowspan="7">3.3</td></tr>
<tr><td>DM</td></tr>
<tr><td>TR</td></tr>
<tr><td>PC</td></tr>
<tr><td>AP</td></tr>
<tr><td>PT</td></tr>
<tr><td rowspan="8">Section #4</td><td>Overall</td><td>4.3</td><td>4.5</td><td>4.4</td><td>4.3</td><td>4.5</td><td>4.4</td></tr>
<tr><td>MM</td><td>4.3</td><td>4.5</td><td>4.4</td><td rowspan="6">4.3</td><td rowspan="4">4.5</td><td rowspan="2">4.4</td></tr>
<tr><td>DM</td><td>4.5</td><td>4.7</td><td>4.3</td></tr>
<tr><td>TR</td><td>4.6</td><td colspan="2">4.3 and 4.5</td><td>4.1</td></tr>
<tr><td>PC</td><td rowspan="3">4.3</td><td rowspan="2">4.7</td><td>4.5</td><td>4.4</td></tr>
<tr><td>AP</td><td>4.4</td><td>4.1</td><td>4.7</td></tr>
<tr><td>PT</td><td>4.5</td><td>4.2</td><td>4.7</td><td>4.5</td></tr>
</table>

For introducing a basic knowledge in mass communication (CDIO standard 4), the subjects in principles of media production and mass communication technology are adopted as profession's context of practice in the first-year class to expose a scenery of industry. These subjects involve a media and system lifecycle development, consisting of theory and

principles, methodology, tools and instruments, production process, project management, and factors that affect to medium. The conceive – design – implement – operate experiences are demonstrated in these classes. In the conceive stage, students learn how to fulfil the receiver or customer needs and expectations, what proper tools and techniques are, what environmental factors affect to, and how to solve the problems with the suitable solution. Planning, drawings, script writing, story boarding, and so on are proposed in the stage of pre-production stage (Design). In the implement stage, students transform their designs into products. Finally, the products are delivered to customers in the real working world in the operate stage.

For enhancing an experience of design and build (CDIO standard 5), furthermore, students are experienced with basic and advanced media production course and senior project. MCT has invested in setting up and renovating learning and workspace. These state-of-the-art laboratories are photography and cinematography studios, theatre, render farm lab (media server), 7.1 sound system studio, stop motion studio, printing house, TV master control room, and fabrication laboratory (CDIO standard 6). Examples of laboratories are shown in Figure 1. All MCT programs offer a Cooperative Education which exposes students with work integrated learning experience (CDIO standard 7). Students spend at least one semester working at a company. They have a chance to integrate their knowledge and skill to the real-life situation. To improve teaching and learning, faculty members are encouraged to apply active experiential learning (CDIO standard 8). Learning assessment uses a variety of methods matched appropriately to learning outcomes (CDIO standard 11). With the aim to promote a community of practice, RMUTT provides a number of professional development training courses. Faculty members have been working in the industries which enhance the faculty competence (CDIO standard 9). To boost teaching competence (CDIO standard 10), faculty members must attend at least one training course per year. MCT has a long-term plan to offer a CDIO-related training course annually for a continuous improvement.

Figure 1. (left) Example of workspace: the photography studio
and (right) the TV master control room

CDIO PROGRAM EVALUATION

In order to track the continuous improvement of CDIO implementation, program self-evaluation using 5-score rubrics were conducted by the faculty members. The result was shown in Figure 2. Within each program, each bar represents the CDIO standard from standard 1 to standard 12, respectively. The result showed that some CDIO standards reached the maximum score, for instance CDIO standard 6 workspace for MM, AP, and PT programs, and CDIO standard 9 enhancement of faculty competence in DM and TR programs. However, a lower score was found in the program of PC with CDIO standard 1, 2,

3, and 6. The management, then, can use this program evaluation to plan for improvement further.

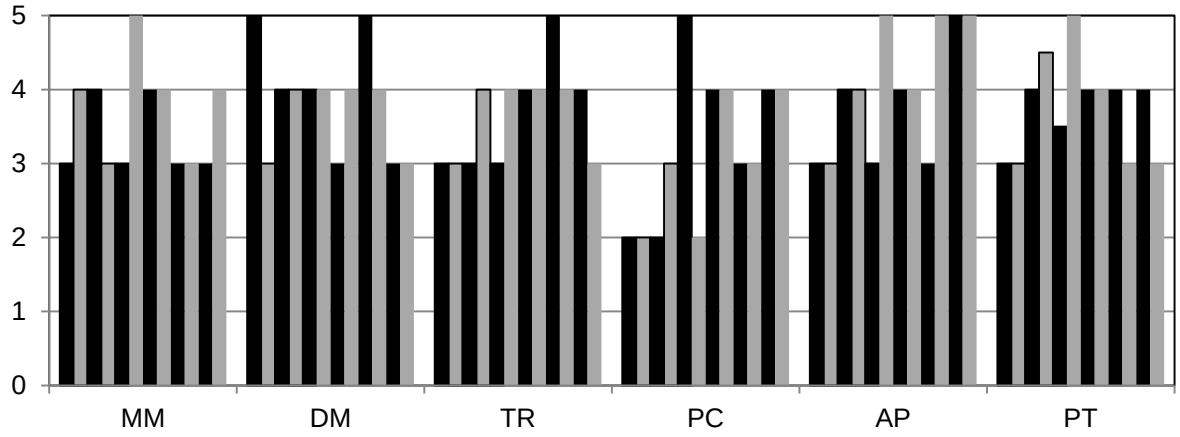

Figure 2. The result of CDIO program self evaluation

CASE STUDIES

The example of the subject that applied CDIO as a teaching technique are principle of media production for multimedia in the MM course and light and sound technology for stage in the DM course. The CDIO context applied in the projects was exploded.

Principles of Media Production for Multimedia

Background of the subject: In this subject, students will achieve a basic knowledge of media planning and production as well as financial management. There are several medium the student should be familiar with, for example, website, print media, animation and advertising media. The student reflection revealed that they found the course unattractive and boring. They are not satisfied with the outcome. Therefore, the instructor has reconstructed the applying the CDIO concept and a number of active learning activities.

Conceive: In the class, a variety of teaching and learning methods are applied, for example think-pair-share, brainstorming, problem-based learning, role-play, step by step and discussion. We found that the most powerful method is an instructional model of cooperative learning. This method is applied with a cooperative project in the last part of the course. As a cooperative project, a team of students is given a role as a design company. They are required to set up the company with employees in some job positions such as a producer, a designer, a copywriter, a photographer, etc. Each group visits an assigned community to find out their needs to create a suitable media and packaging for products.

Design: After analyzing the customer requirement, the planning of media production is developed. It is composed of logo, labels, advertising media, product packaging, website, and financial management. Then, a proposal is presented to the customer for improving the design.

Implement: Each group of the student creates all media and packaging of products as following to the detail they obtained from the previous stage. They make a prototype or mocked-up to verify the customer's needs. The evaluation includes a suitable production technology, time management and teamwork skills.

Operate: In this stage, students present their work to the community. Community members select the best work that is suitable to their community for actual production. Figure 3 shows a presentation and the packaging design for natural beauty products.

Feedback from Students and Community: The feedback from students is a positive reflection. The CDIO project based learning gives students a chance to a real working world. They learned not only a professional skill but also a social skill. On the other hand, a community reflects the positive response. A community and students were collaborated as university social engagement. Both feedback from community and students' reflection is used to improve this course for the next semester.

Figure 3. (left) Presentation of design proposal
and (right) the developing packaging for beauty products

Light and sound technology for stage

Background of the subject: Light and sound technology for stage course is a selective course for the third year student in Digital Media Technology. After taking this course, students should be able to create and manage lightning for stage shows and be able to work well as a team.

Conceive: At a starting point of the CDIO adoption, the DM program committee paid a visit to a number of companies in a light and sound industry. The information on industry expectations and the student competency were collected. They are technology usage, conceptual development, time and project management, proper equipments, and utilization of manpower. The information was used to design the course. This course focused in developing personal skills as well as technical skills. Students were grouped and assigned to organize a show. The students' learning experienced consisted of obtaining customer's needs, project planning, team-working, be creative, be able to work under pressure and capable of finish project as scheduled. For second semester in 2017, the students selected to run a fashion and wedding show events.

Design: With the customers' requirement information, students analysed the needs, plan the project time line and develop a prototype. A storyboard of stage performance and a script planning of light and sound were developed. Moreover, they identified proper equipment and assigned duties for their team members.

Implement: The students used a computer software to simulate the show according to their analysis. This simulation allowed students to see whether their show would turnout as planned as well as which hardware and manpower should be used. The simulation was

presented to the customers to check if it accurately matched with their needs or any further modifications are needed.

Operate: As the implementation stage turned out successfully as planned, students would be able to determine equipment needed and allocate manpower to the jobs. In this operation stage, teamwork is very crucial as it involved high personal responsibility and strong commitment. Since students were assigned to different duties, they needed to contact different people and worked under pressure.

Feedback from Students and Customers: Students' feedback was positive, as the process illustrated the real-life working. The customers had high level of satisfaction. As a result of the project, some of the students were offered jobs at the company.

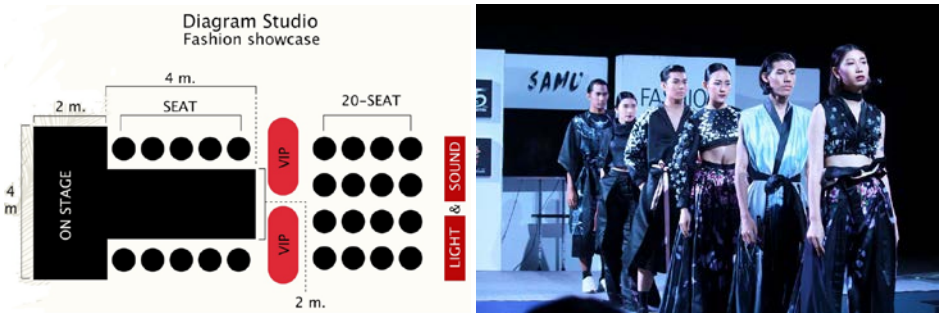

Figure 4. (left) Stage diagram for fashion show and (right) exposing on the catwalk

CONCLUSION

In this paper, we have shown that the CDIO approach can be applied to non-engineering program. The CDIO-base education can enhance the competency of graduates and faculty members that meet stakeholders' requirements. In general, we found the similarities in core competency of knowledge and skills among different programs in CDIO Syllabus 1.1, 1.2, 1.3, 3.1, 3.2, and 3.3. 12 CDIO standards can be used as a guideline how to implement into non-engineering program. Future work for MCT is to create a database for industry-related projects with CDIO concept for courses to cover all six programs. Therefore, the faculty member and student can benefit from experiential learning.

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BIOGRAPHICAL INFORMATION

Uravis Tangkijviwat received Master of Engineering and PhD in Integrated Science and Engineering from Ritsumeikan University, Japan and is currently as an assistant professor at the digital printing and packaging technology, faculty of Mass Communication Technology, RMUTT. His professional interests focus on colour science and human vision. As a deputy dean for academic and research affairs, he promoted the CDIO to faculty members and adopted the CDIO to undergraduate programs for enhancing the graduates in the field of mass media.

Natha Kuptasthien is currently as assistant to president for International Relations and an associate professor at the industrial engineering department, faculty of engineering, RMUTT. She has conducted a number of CDIO workshops at the faculty of Mass Communication Technology to promote CDIO with non-engineering programs. Natha graduated with a Bachelor of Engineering in Industrial Engineering from Chulalongkorn University, Master of Science and PhD in Engineering Management from University of Missouri-Rolla, USA.

Wanchanok Sunthorn received Master of Science in Technical Education and Bachelor of Science in Applied Mathematics from King Mongkut's University of Technology North Bangkok, Thailand. She has been teaching in Digital Media Technology programme in Faculty of Mass Communication Technology, RMUTT since 2011. In addition, she is a CDIO master trainer in RMUTT and participated in advancing CDIO training.

Natchaphak Meeusah got Master of Science in Mass Communication Technology and Bachelor of Technology in Multimedia Technology from Rajamangala University of Technology Thanyaburi. She works as a lecturer at the multimedia technology, faculty of Mass Communication Technology, RMUTT. Her professional interests focus on Principle of Media Production for Multimedia and Infographic. She adopted the active learning principles in her class to achieve better learning outcomes.

Corresponding author

Uravis Tangkijviwat
Faculty of Mass Communication Technology
Rajamangala University of Technology Thanyaburi
39 Rangsit-Nakornayok Rd., Klong 6,
Thanyaburi, Pathumthani, 12110 Thailand
uravis_t@rmutt.ac.th