INTRODUCTION TO INFORMATION TECHNOLOGY

Information Technology

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ABSTRACT

Information Technology

for the first-year students. The main purpose of this course is to introduce the concepts of computing and computer, and to present a hierarchy of information technology (IT) knowledge from basic to advance through the introduction of syllabus system, research trends of our faculty, IT applications in society, ethics and career potentials in IT. The content of this course is set up to meet the Standard 4 in CDIO. We divide the introduction into two courses and teach the first-year students in the first and second semesters. The first course is the introduction of computer, computing, internet, ethics, and some technical skills of analysis, design, implementation, and testing. This is an overview of IT from the outsiders. The second is a hierarchy of IT knowledge from basic to advance through education systems and research in our faculty. This is an overview of IT from inside viewpoint. We also present some experiences about the project-based approach for labs and explain how we train personal skills and professional attitude for our students. Finally, we conclude by providing comments with pros and cons in operating the courses.

KEYWORDS

Information Technology

INTRODUCTION

In CDIO standard, the standard 4 [1] plays an important role to provide a general view about curriculum, syllabus system, future career and beginning concepts of CDIO for the first-year students in our university. Many similar works in engineering have been published in the CDIO conference. Ramon Bragós, et. al. [2], presented a method that they have conceived, designed and implemented "Introduction to Engineering" course at Telecom BCN, UPC, Barcelona using the CDIO syllabus and standards. The basic concepts and professional skills were given to the students through lessons and simple projects. From that, the students were able to recognize problems of which solutions we were going to teach in the following courses of the curriculum.

Civil Engineering

Design". The difference is that students are put into an environment where they could learn and

one approach of multi-disciplinary project for the introduction course. In his class, the students were divided into different disciplinary groups and joined in project-based learning. That project

This process helped students to understand the different modules and the input/output of each module. As a result, the multi-disciplinary project is a good approach to introduction courses.

year introductory course was discussed and shared to improve and increase student motivation. They have identified projects and teamwork as important parts of the first-year courses. With the CDIO approach, a new model for engineering education is developed to be able to implement this projects and professional skills. In many previous works, we rarely see the first-year introductory course to information technology (IT). In this paper, we present our experience in Information Technology

one hand, the main purpose of this course is to introduce the concepts of computing and computer, and to present a hierarchy of IT knowledge from basic to advance through the introduction of syllabus system, research trends of our faculty, IT applications in society, ethics and career potentials in IT. On the other hand, the purpose of this course will introduce the relationship between the contents of 4 year learning in the university with IT career after graduation to first-year students. The IIT course also shows students the social requirements to IT not only in Vietnam but also worldwide. After studying this course, the first-year student will have another point of view about their role in the development of IT. From that starting point, it will help students to think and navigate their future career in IT. It also influences to students' decision in course selections for undergraduate program at the current time or their intention to enter the graduate program in the future. This course will also help the students to identify the importance of engineering skills and appropriate attitudes for the success in their future career path. From the above motivation, the design and implementation of this course have been considered seriously by our senior lecturers and professors in our faculty. We have already spent more than one year to prepare the learning outcome, syllabus, teaching/learning documents, and workspace for this course [6]. This paper will present our experiences in design, building, teaching, and evaluation of this course to the first-year students in 2012.

The content of this paper is presented as follows; Section 2 presents the design and building of course goals and learning outcomes for IIT course. Section 3 presents the approach of project-based learning to embed CDIO concepts in teaching and training for students. Section 4 presents the meeting and feedback between IT companies and the first-year students. Section 5 presents the assessments and some rubrics for this course. Section 6 is our discussions about pros and cons in operating this course at our faculty. Section 7 is the conclusions.

COURSE GOALS AND LEARNING OUTCOMES

Design and building the course goals and learning outcomes of one course in CDIO system is not easy because the scope of course goals must be suitable to the learning outcomes of the curriculum. Figure 1 presents our workflow in the design of course goals and learning outcomes in IIT Fig

defined from the course goals while the course goals are defined by the learning outcomes of our curriculum. In practice, the number of course goals is less than or equal to 8 and there are about 2 to 4 learning outcomes corresponding to each course goal. We can see that the content of course goals is presented more in details by the learning outcomes. Most important contents in the course goals will be the objectives of the assessment corresponding to Source of Evidence in Fig.1. It is noticed that the course goals and the learning outcome will involve directly to the design of the course. The solid lines in Fig.1 show the task order in workflow and the dash lines show the revision and comparison. The total score is the final score of students after studying the course. We divide the content of IIT into two courses and teach the first year students in the first and second semesters.

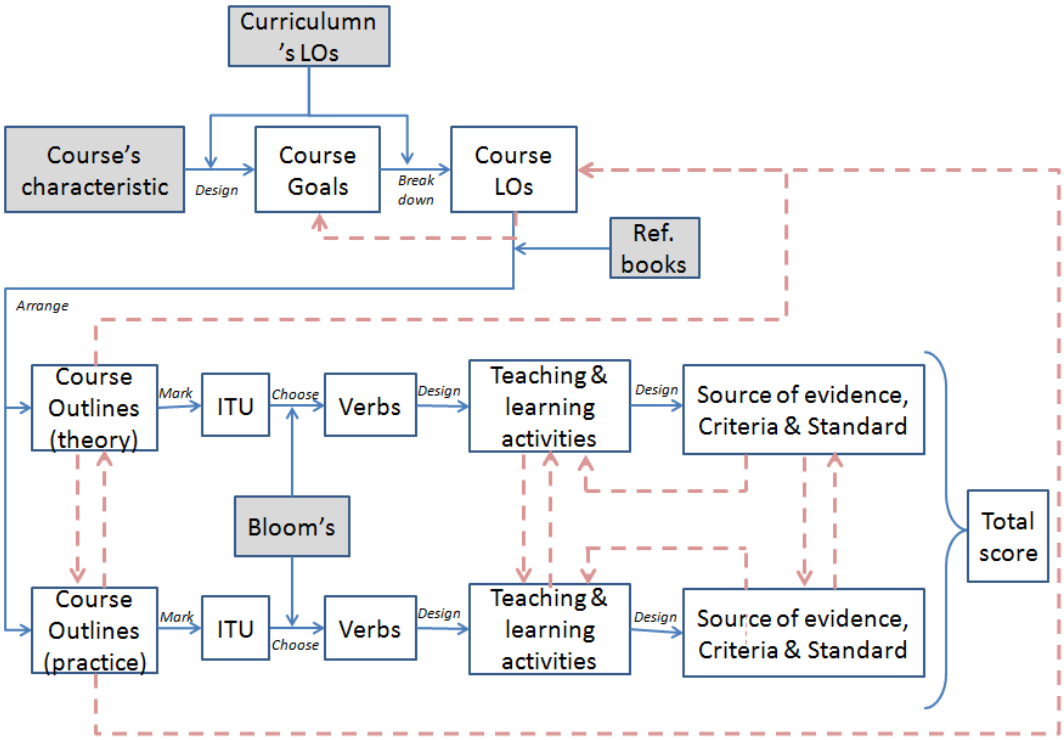


Figure 1: Workflow to build a CDIO syllabus

The first course is the introduction of computer, computing, internet, ethics, and some technical skills of analysis, design, implementation, and testing. This is an overview of IT from outside viewpoint. The second is a hierarchy of IT knowledge from basic to advance through systems of education and research in our faculty. This is an overview of IT from inside viewpoint of our Information Technology

as follows;

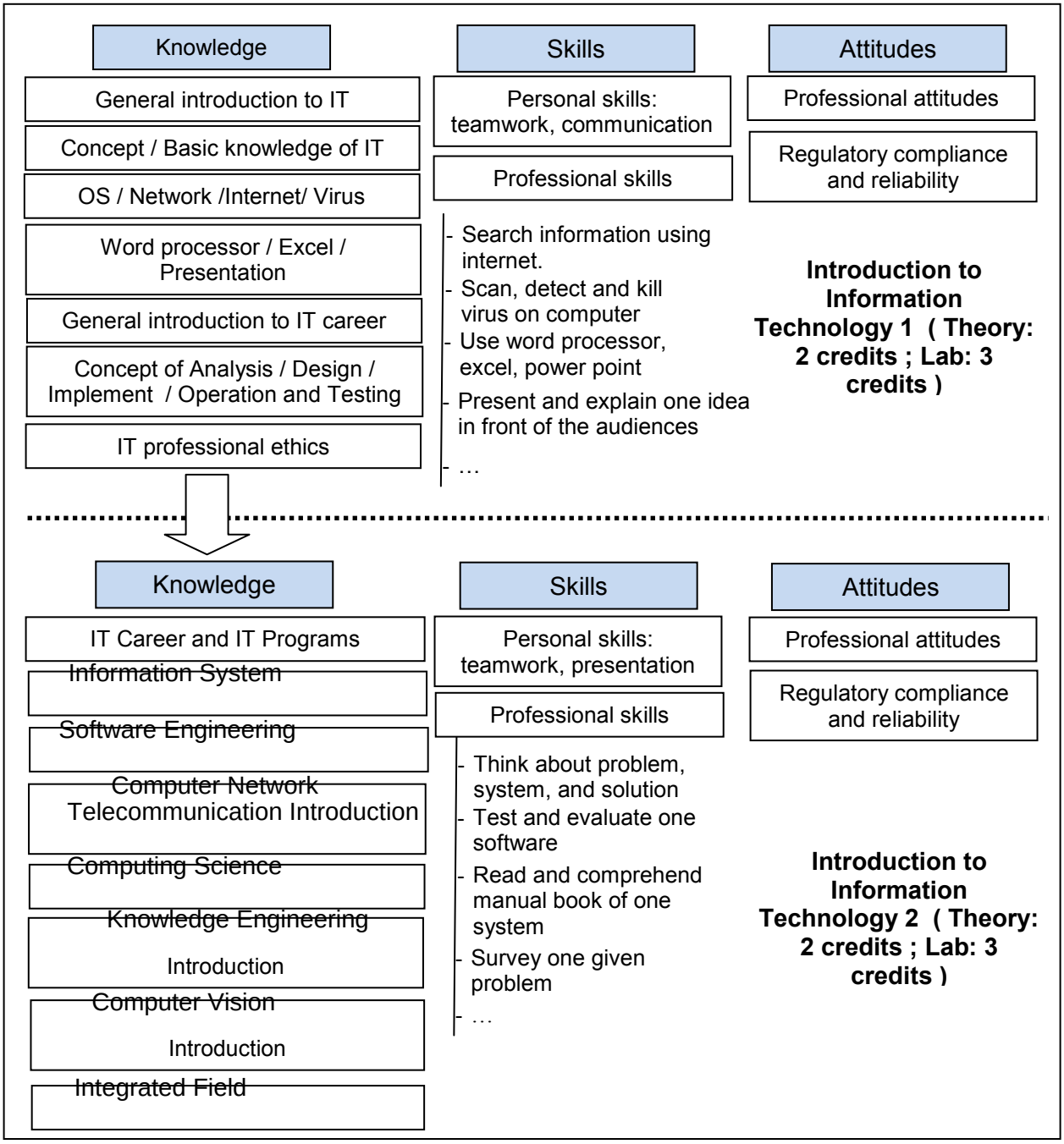
a) The course goals of the first course
   - Explain general knowledge of IT include basic knowledge about counting system, operating system, internet, email, and office applications.
   - Describe the basic values related to professional ethics of those working in IT sector.
   - Describe the work and job position in a company, related to IT, which is one IT student can undertake after graduation.
   - Recognize the importance of self study, teamwork, and communication skills.
   - Recognize the professional attitude, regulatory compliance, and reliability.

   The first course is taught in ten weeks with 15 hours in class, 20 hours in lab and 15 hours of self studying at home (*Note that details of weekly classes will be provided by contacting the authors*).

b) The course goals of the second course
   - Describe relationship between the syllabus system, researches, and the IT career Information Technology

     Hochiminh city, Vietnam. Information Systems
   - Engineering, Computer Networking & Telecommunications, Knowledge Machine Vision

Harvard University Harvard University



Information Technology

- Describe outline of jobs which directly and indirectly related to the above IT fields.
- Recognize the importance of self study, team work, and problem solving.
- Recognize the professional attitude, regulatory compliance, and reliability.

The second course is similar to the first course. It also takes ten weeks with 15 hours in class, 20 hours in lab and 15 hours of self studying at home.

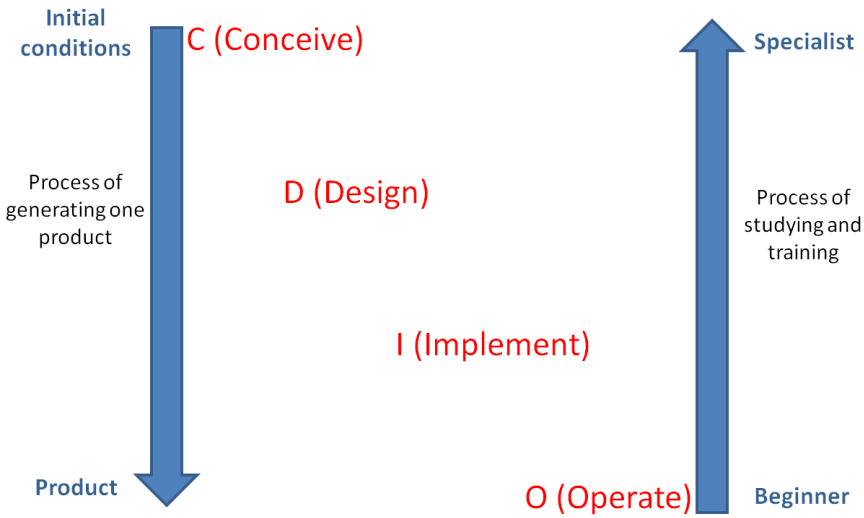


Figure 3: The concept of CDIO for studying and training in our IIT courses.

Based on the course goal of the 1st and 2nd courses, the outline of two IIT courses is presented in Fig. 2. We can see that the content of the second course describes more in details about the system of research and education in our faculty. It provides experiences and case study about the influence and importance of advanced courses in the syllabus system to career selection of students. Through the content of this course, we also give students a general view of IT applications and potential fields, where IT can be integrated successfully.

Besides providing knowledge, we apply the project-based approach to embed skills and attitudes into the teaching/learning activities of two IIT courses. Here the CDIO concepts can be explained easily to our students by using a simple project first, and then the requirements in the second project are upgraded to higher level in order to give students a chance of thinking, recognizing, and implementing their knowledge, skills and attitudes. Figure 3 presents the concept of CDIO for studying and training in our two IIT courses. In the first course, one simple project is proposed to introduce the first-year students about D-I-O. Meanwhile, the project in the second course is designed to train the first-year students all stages of C-D-I-O.

PROJECT-BASED APPROACH

As mentioned above, the project-based approach is applied in both two IIT courses in our IT program. When we design the project system, our expectation is to present the four stages of C-D-I-O to students as soon as possible. However, most first-year students cannot understand the concept of conceives when we give them a set of initial conditions to produce software. The limitation of students to recognize and understand all stages of C-D-I-O is describes as follows;

- Limitation of knowledge and time.
- Limitation of personal skills and professional skills.

As a result, we propose one project, where students will study D-I-O instead of C-D-I-O. In the content of the first course, we see that there is a relation between the concepts of analysis/design/implement/operation and testing to the concepts of D-I-O. In practice, it takes a short time, around 2 classes, for the first-year students to understand D-I-O concepts. We divide the class into many groups, with 5 members for each.

House Prototype

A. Build a prototype of house by using paper and bamboo stick such that :
   a) It can be waterproof.
   b) Shape of house must be stable when we put 330 gram on the roof for diagnostic load test.
   c) Maximum size of house is 20 cm x 20 cm x 20 cm.
B. Material:
   3 daily papers, 250 bamboo sticks (0.2 cm x 5cm / stick), 3 glue bottles (50 ml / bottle).
C. Outputs:
   - House prototype.
   - Report and documents of design, solution, workload (time and position), balance sheet, salary & price, and explanation of testing result.
   - Slide and presentation.

Some of first-year students wonder why we give them the above project. The question is why IT students must study to build a house prototype instead of one software. The answer comes from the output of the projects, where using IT applications such as Word processor, Excel, and Power point is one of the important requirements and the concepts of D-I-O must be reflected in the report of students. Teamwork can be evaluated by the quality of house prototype and sheet of workload. We can also check students' communication skill through their slides and presentation. Figure 4 presents some examples of house prototype from the above project.

Figure 4: Some examples of house prototype.

In the second course, the level of project is upgraded to present the concept of C-D-I-O. We group the contents of Information System, Software Engineering, Network and Computing Science
Computer Vision

instances, a three-month project is to build a small social network where students must study and work with web design, web programming, database management, and network management to release the first and second demos. This project asks students work in team and gives them a large freedom to generate ideas, make design, find solution, and implement both software and hardware. The lecturer and TA play a role of the end users or customers of their service. The output of this project is evaluated by checking demo softwares, reports, and presentations. One other kind of the project is to build a system of data analysis for multimedia data such as video information retrieval or video / audio processing by using freeware. Additionally, we have also provided some projects related to research of our departments by using available toolboxes or open sources.

Harvard University
Massachusetts Institute

MEETING OF COMPANIES AND STUDENTS

Beside the course, we have organized a meeting between company and the first-year students. The purpose of the meeting is to give our students a chance to listen the vision, tendency, and demand from companies. Through the meeting, students, our faculty staffs, and company members can share viewpoints about the development of IT in Vietnam and in the world. After the meeting, we can have some thoughts about important demands from IT companies in Vietnam such as :

- Personal skills, specifically teamwork and communication, play an important role for the success of one's career path.
- Problem solving capability is the key of admission to company.
- For most companies, reliability and loyalty are the most precious characteristics.

ASSESSMENT AND FEEDBACKS

Assessment is the main difference between CDIO approach and the conventional teaching methods. We divide 70% of final exam and 30% of project in the first course. Meanwhile, the ratio of final exam and project in the second course is 60% and 40%, respectively. The assessment of each project is checked monthly in three months. Figure 5 presents some rubrics of project and report evaluation. The detail of assessment has been shown to students at the beginning of the course. During the course, students have been reminded about the assessment and we have also encouraged them to provide a good strategy of learning for each group so that all members of the same group can receive a good result. In practice, the peer review gives objective evaluation. It helps students have a strong responsibility and a serious thinking about their contributions to the final results of their group.

Order	Outputs	Evaluation members	Applicants	Ratio
1.	Hardcopy of report	Lecturer	Group	30%
2.	Demo software	Lecturer	Group	30%
3.	Presentation	Lecturer	Group / member	10%
4.	Member performance	Inside group (peer review)	Member	15%
5.	Group performance	Other group (peer review)	Group	15%

a) Project evaluation

Order	Outputs	0	1	2	3	Ratio
1.	Introduction, motivation and survey	None	Unclear	Clear but not enough	Enough and logical	**15%**
2.	Description of basic concepts	None	Unclear	Clear but not enough	Enough and logical	**15%**
3.	Formulation of problem	None	Unclear	Clear but not enough	Enough and logical	**15%**
4.	Experiment explanation	None	Unclear	Clear but not enough	Enough and logical	**15%**

5.	Description of demo software	None	Unclear	Clear but not enough	Enough and logical	**10%**
6.	Creativity	None	Unclear	Clear but not better	Clear and better	**10%**
7.	Presentation	None	Unclear	Clear	Clear and logical	***10%***
8.	Documentation	None	Not enough	Enough but not logical	Enough and logical	***5%***
9.	Reference	None	Not correct	Correct and not enough	Enough and correct	***5%***

b) Report evaluation

Figure 5: Some rubrics of project and report evaluation.

After assessment, we make some QA to receive the feedbacks from students. There are 170 of 450 students returning feedbacks. The result of feedback is presented as the following table;

Table 1: Feedback of students

	1	**2**	**3**	**4**	**5**	**NC**
Homework/Project is evaluated fairly and positively.	65	74	25	4	1	1
Homework/Project is evaluated on the fixed schedule exactly.	48	72	45	4	0	4
Syllabus is well prepared.	44	86	31	6	0	3
Syllabus content is presented in a suitable order.	56	83	26	3	0	2
Syllabus content is easily understandable.	43	78	43	4	0	2
Course slide and other resources are provided on time to be useful for teaching and learning.	50	80	34	4	1	1

a) Theory

	1	**2**	**3**	**4**	**5**	**NC**
Homework/Project is evaluated fairly and positively.	76	74	17	3	0	0
Homework/Project is evaluated on the fixed schedule exactly.	59	71	36	3	0	1
Lab's documents are well prepared.	49	79	37	4	0	1
Lab's documents are presented in a suitable order.	48	93	25	2	1	1
Lab's documents are easily understandable.	38	82	45	4	0	1
Slide and other resources of Lab experiments are provided on time to be useful for teaching and learning.	52	79	33	4	0	2

b) Lab

Table 2: Benchmark

Absolutely agree	Agree	Neutral	Object	Absolutely object	No comments
1	**2**	**3**	**4**	**5**	**NC**

Table 1 presents the feedbacks of 170 students and Table 2 gives the benchmark of score value. We can see that most distribution of feedbacks stays on "Agree" corresponding to the score value of 2. It means that the feedbacks of students are positive toward CDIO approach. However, there are still some complaints about overloaded and stressful because the first-year students have got a lot of project and homework deadlines from the first semester of the undergraduate program in the University.

DISCUSSIONS

After one year implementing CDIO to IT program, we found some interesting points and difficulties in CDIO implementation. The approach of CDIO helps us to clarify the quality of the syllabus easily. By checking the learning outcome and course goals, we can see an overview to our whole program and find whether there is any inconsistence or overlap in the undergraduate program. The introduction of IT course provides the students motivation, prospective view of their career, and important concepts of IT. Besides the advantages, this course still has some difficult problems in teaching and learning activities

- Some students feel stressful because of overloaded projects and homework. Most courses designed in CDIO approach have a requirement of project-based learning. Consequently, the number of projects that a student needs to work on during one semester increase considerably. As a matter of fact, the requirements of project become more difficult because it will check both knowledge and skills in the learning outcomes. It takes students a lot of time and effort to catch up projects' deadlines and requirements. One solution of the above is to design one big project which can be applied for multiple courses. However, there is always a limitation about time and the coverage of learning outcomes in a project. It is not easy to make decision whether we should select or not one learning outcome from a bunch of multiple courses.
- The number of lecturers and teaching assistants (TAs) are not enough to cover a class of 450 students. Originally, CDIO program has been developed from engineering school, where the number of students in each class is just a few dozen. Now the number of first-year students in our IT faculty is around 450 a year. As a result, we need more space and more TAs to organize Teaching and Learning activities in class. One solution is to divide into many small classes with a few dozen students. However, this also brings some difficulties in scheduling and funding for extra-hour payment.
- Lecturers and TAs are still familiar with the conventional teaching approach. It will take time to change their thinking and teaching approach. We have already organized some training programs for lecturers to explain CDIO program and enhance their professional skills.
- The CDIO approach requires students, lecturers, and TAs spend more time in preparation. Hence we need an efficient administration to support and encourage them in long run. As mentioned above, scheduling and workspace management play a very important role in our CDIO program. If administration staff could be trained well, they will help us to save much time in learning and teaching activities.
- We need a sufficient funding to set up the workspace, evaluate the learning outcomes, and revise the program every year.
- CDIO-based program is usually applied for the first-year students and we must wait until four years later, when all the first-year students graduate, in order to receive the feedbacks from the stakeholders to decide the CDIO program successful or not. Absolutely, nobody wants to see it failed after four years. Therefore, we must clarify what we should evaluate and revise periodically (e.g. yearly) in order to ensure that the CDIO program is developed with high efficiency. Since we invest more time, money, and human resource to follow the CDIO program, we really need the positive evidence to persuade our students, faculty staff, the university, and the society for supporting us to keep it going on.

CONCLUSIONS

We present our experience of designing a course of Introduction to Information Technology (IIT) for the first-year students. We design two courses for IT introduction: One is a general view from outsiders to IT and the other is an introduction of research in IT. We have experiences to teach those two courses for 450 students and receive both positive and negative feedbacks. Most of the students think that those two courses are useful to motivate them to IT and give them a near vision of their career in the future. Students have been trained personal and professional skills. It makes them more confident than students of the conventional classes. Although most students think that CDIO-based approach is interesting, it makes them a bit pressure with deadlines. Lecturers and TAs also find it difficult in handling a few hundred student class. Last but not least, the CDIO-based program needs a sufficient and stable fund to support it in the long run. In fact, once we decide to start CDIO program, we must keep it going until the result of our program comes up (i.e. feedback from stakeholders once student graduation).

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BIOGRAPHICAL INFORMATION

Son Thai Tran is lecturer at the Faculty of Information Technology (FIT), University of Science, Hochiminh city, Vietnam. He is the Deputy Head of Department of Computer Vision and Robotics. He joined the CDIO program as a designer of Introduction to Information Technology course in 2012. His research interests are in Statistical Data Analysis, Computer Vision, and Discrete Optimization.

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