PROJECTS EVALUATION IN IT ENGINEERING CURRICULUM OF TRA VINH UNIVERSITY

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ABSTRACT

The IT engineer program has been designed in the CDIO approach at Tra Vinh University. Student outcomes of the curriculum are built according to the CDIO syllabus, including the skills: Specialized knowledge; personal and professional skill and attitudes; Communication skills and behavioral attitudes; the ability to form ideas, design ideas, implement and operate in social and corporate contexts. Student outcomes of students are met by building an integrated chain of learning experiences in courses and projects. Moreover, students experience and test their abilities through projects have designed for the 2nd, 3rd, and final years of the curriculum. This article aims to evaluate the student outcomes of the integrated program in the courses and how students use student outcomes to solve a specific requirement through the projects each year. At the same time, this article also analyzes the achieved level of proficiency of the student outcomes in projects each year to evaluate the level of proficiency in students' ability to conceive, design, implement and operate in a social and corporate context. Based on the evaluation, we will review to enhance CDIO skills for students.

KEYWORDS

Projects evaluation, Student outcomes, basic IT project, specialized IT project, Standards: 1, 2, 3, 5, 7, 11, 12

INTRODUCTION

At the national level, Resolution No. 29/2013/NQ/TW on "Fundamental and comprehensive reform of education and training", which emphasizes: "Continuing to innovate teaching and learning methods in a modern direction strongly; promote the activeness, initiative, creativity, and application of knowledge and skills of learners; overcome imposing one-way communication, memorize the machines. Focus on teaching ways of learning, thinking, encouraging self-study, creating a basis for learners to update and renew their knowledge, skills, and capacity development. Moving from studying mainly in class to organizing diverse learning forms, paying attention to social activities, extracurricular activities, scientific research..." (MOET, 2013). At the same time, the Vietnam National University-Ho Chi Minh has introduced many educational framework approaches to improve the quality of Vietnamese education to prepare the following graduates to meet the needs of society, and the applying CDIO standards are used to build an appropriate educational framework for curriculum reform in Vietnamese higher education institutions (Phan et al., 2010). (Phan et al., 2011) has improved the educational framework based on applying and adjusting the CDIO approach, a technical education reform initiative being applied by many Vietnamese universities.

Besides improving the quality of higher education and being recognized by international standards, many universities have turned to international accrediting organizations. Therefore, CDIO stands out as the most suitable educational framework to prepare for international recognition for universities. (Nguyen et al., 2014) described how successfully to implement the CDIO framework for their ABET program accreditation, and (Wah et al., 2015) concludes that CDIO plays an important role in matching the ABET evaluation criteria and accreditation success a short period. Furthermore, (Burbano, 2016) has effectively used the CDIO approach to meet student outcomes (Criterion 3) and the curriculum evaluation process for the continuous improvement (Criterion 4) of ABET.

Since 2014, Tra Vinh University has reformed IT program following the CDIO framework. In 2019, Tra Vinh University became an official member of the CDIO initiative. The program IT following the CDIO approach aiming at an educational environment based on the program educational objectives and student outcomes is clearly outlined thanks to stakeholders' contribution. The IT training program reform process has adopted 12 standards CDIO to guide program evaluation and continual improvement. Standards can be grouped into one or more focus areas: program objectives, curriculum, teaching and learning methods, learning environments, learning assessment, and teaching staff development, as illustrated in Figure 1.

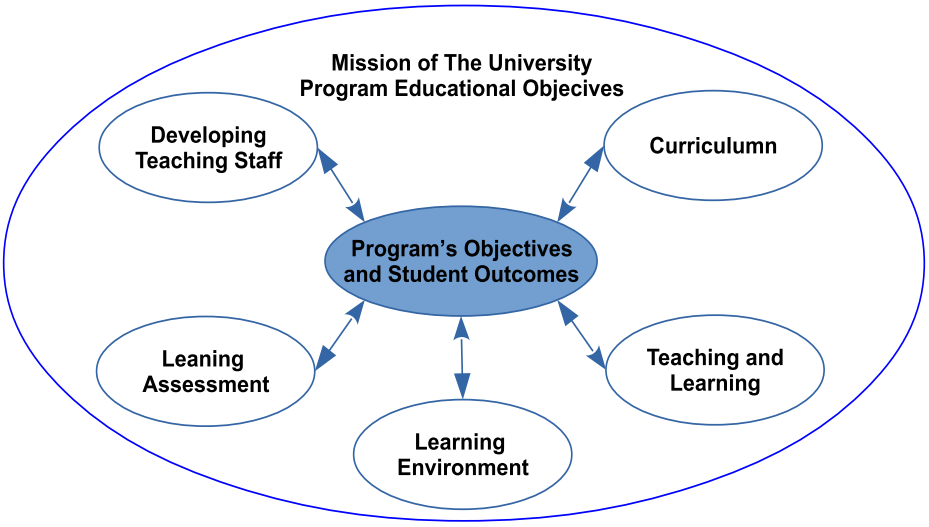

Figure 1. Program Evaluation based on CDIO Standards CDIO

THE CDIO IMPLEMENTATION

The curriculum is updated from 140 credits to 150 credits applied from the 2020 school year onwards. These include 88 credits of theory, 52 credits of practice, and the remaining 10 credits for graduation. The training program's content is designed with a reasonable structure and sequence, with cohesion between subjects is continuously updated. The program framework consists of two knowledge blocks: General education accounts for 40% of the entire program block, and Professional education accounts for 60% of the remaining block, as illustrated in Figure 2. The percentage of knowledge block in the curriculum framework must be in accordance with the provisions of the training program framework of the Ministry of Education and Training of Vietnam. The IT engineer program of Tra Vinh University has a training period of 4 years. After the second year, students have completed all knowledge block general

education courses and core basic technical and assessed by the basic IT project. At the end of the third year, students are assessed through specialized IT projects after completing specialized technical knowledge blocks. After completing all curriculum courses, students will then be required to participate in a postgraduate internship at a company or enterprise for 4 to 12 weeks, respectively. Evaluation results are based on internship results in the company. After that, students access their graduation thesis in 10 weeks to complete their study program. (Shown in figure 2).

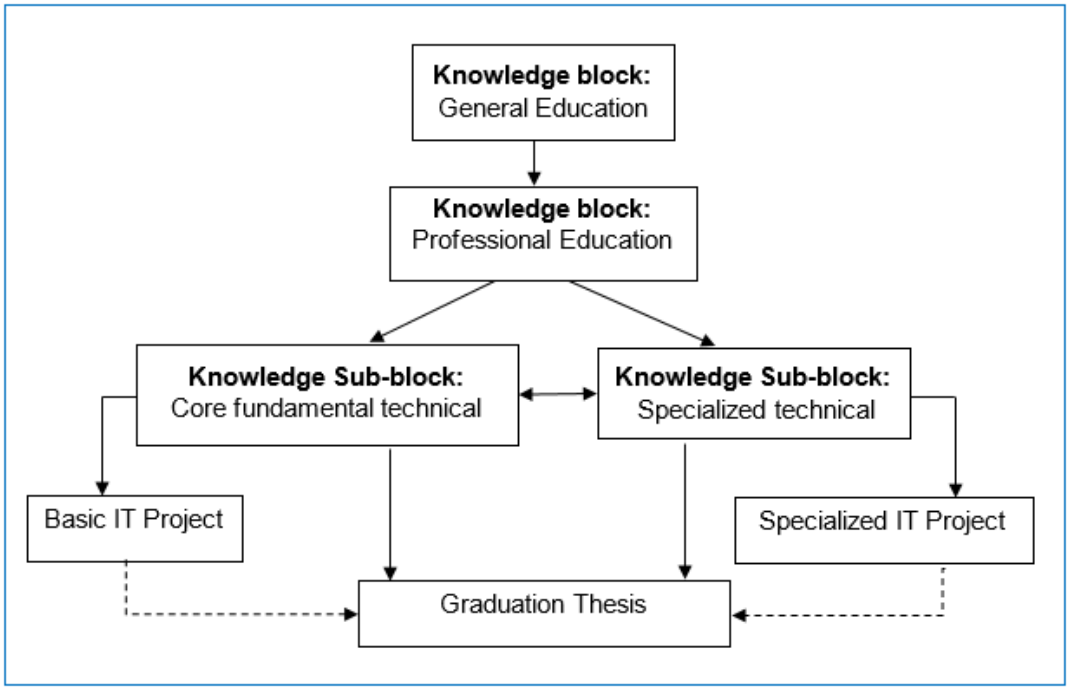

Figure 2. The curriculum structure of IT engineer

To achieve the program quality training, teaching, learning, and soft skills goals. The IT engineer program's student outcomes (SOs) are built on the CDIO model, based on a survey, researching labor market requirements and future development trends. The student's learning progress assessment includes assessing each course and project evaluation of each knowledge block to record each course's learning results, the knowledge block, and the completion of SOs and updated. The student assessment process is done based on SOs, the assessment criteria of the program are identified and converted into the expected learning results of the course (Course Learning Outcome-CLO); from CLO, assessment methods, teaching methods (pedagogical methods), teaching content, and assessment are planned to implement, which are indicated course syllabus. Assessment of course learning is to help students and the University to track students' progress and achievement of CLOs in each course as personal, interpersonal, product, process, and system building skills; at the same time, the assessment results are an essential input for the implementation of continuous improvements to the program (individual subject, assessment methods, teaching methods, supporting resources for teaching and learning). Besides, the project assessment is also a part of the assessment of student learning. The project evaluation is an excellent opportunity to evaluate student's learning experiences in standard CDIO 7 and design-implement experiences in standard CDIO 5. To evaluate the SOs and the level of achievement of the SOs of each type of project, we have designed SOs for basic IT and specialized IT projects according to the SOs' structure of level-3 according to the CDIO syllabus (shown in Table 1).

Table 1. SOs for basic IT and specialized IT projects

Number of SO	Level-3 SOs	Evaluation project	
		Basic IT Project	Specialized IT Project
Block 1: SPECIALIZED KNOWLEDGE AND TECHNICAL REASONING			
1.2.1.	Analyze the requirements of computing problems, designing algorithms, and building appropriate data types	X	
1.2.2.	Apply effectively programming techniques to solve problems	X	
1.2.5.	Presenting the network model and architecture	X	
1.2.6.	Design, install and manage network systems	X	
1.3.1.	Survey, analyze and design Information Systems	X	X
Block 2: PERSONAL, PROFESSIONAL SKILLS AND ATTRIBUTES			
2.2.1.	Information searching and collecting	X	X
2.2.3.	Experimental inquiry	X	
2.4.4.	Self-development of professional knowledge	X	X
Block 3: TEAMWORK AND COMMUNICATION SKILLS			
3.2.2.	Written communication	X	X
3.2.3.	Multimedia communication	X	X
3.2.4.	Presentation and negotiation skills	X	X
3.3.2.	Using technical terms	X	X
Block 4: CONCEIVING, DESIGNING, IMPLEMENTING AND OPERATING SYSTEMS IN PROFESSIONAL AND SOCIETAL CONTEXT			
4.2.1.	Setting goals and requirements	X	X
4.3.3	Utilization of knowledge in design	X	X
4.3.4.	Designing components of the system	X	X
4.4.1.	Processes and methods of realization		X
4.4.2.	Realizing the design system	X	X

All students are required to work on two projects according to the attributes shown in Table 2. Students must defend their dissertation in front of the board and be graded on a project defense scorecard with an Assessment Rubric that includes clear criteria and scores.

Table 2. Show the properties of each project according to the CDIO standards

Group or Individual	Project topic	Products	Adviser	Defense	Time	Reviewer and Assessment
Individual	Lecturers provide topics (Students can propose topics with lecturer's consideration)	1. Report document (Essay) 2. Presentaion slide 3.Application program (Source code)	1 lecturer/ 1 student	Board	4 weeks	2 lecturers

Table 3 (see Appendix) shows the detailed evaluation criteria that lecturers use to evaluate SOs with appropriate CLOs: applying basic and specialized knowledge, technical analysis, investigation, design, tool use, communication skills, project management, and self-study skills. Assessment Rubric will be going to published to students as soon as they choose a project topic. Base on the Assessment Rubric, students identify their assessment criteria and what SOs will be assessed.

RESULT AND DISCUSSION

Project evaluations of different years will have different SOs. There will also be SOs that are replicated in assessing the basic IT project and the specialized IT project. Especially the SOs on personal skills, communication skills, and CDIO skills aim to create training to gradually improve the CDIO skill attainment level for students by years of practice, which will get the higher the level of assessment in the coming years.

The SOs assessed cover 4 blocks of CDIO: Specialized Knowledge and Technical Reasoning; Personal, Professional Skills and Attributes; Teamwork and Communication Skills; and Conceiving, Designing, Implementing and Operating Systems in Professional and Societal Context. Each of the above blocks will be evaluated on some level-3 of SOs, which are described in Tables 1 and 3; besides, the result of the project's evaluation has analyzed by Course Assessment Portfolio software, what we are using to review, and continuous improvement for CLOs for standard CDIO 12.

The evaluation results of the basic IT project

The evaluation results for the basic IT project are presented in Figure 3.

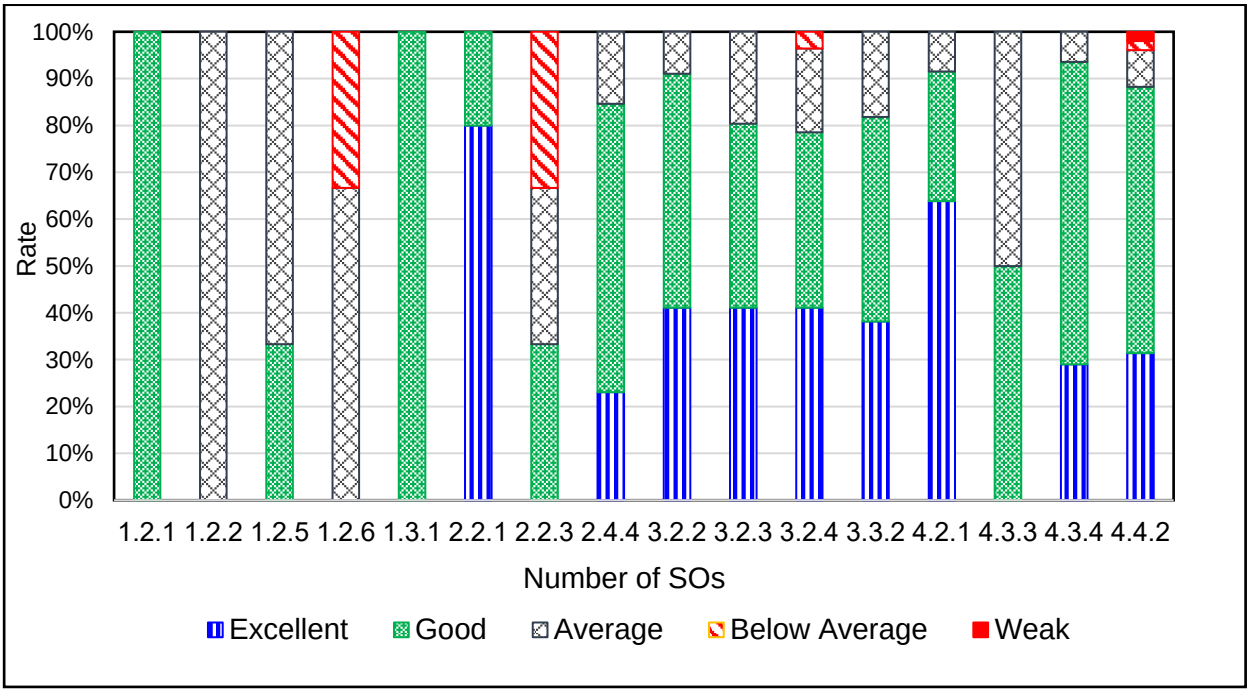

Figure 3: Chart of evaluation results for Basic IT Project

The data presented in Figure 3 shows that the evaluation results of Block 1 in table 1 (number of SOs from 1.2.1 to 1.3.1) have the highest result as good, no weak. Specifically, the number of SOs 1.2.1 and 1.3.1 achieved 100% is good; the number of SO 1.2.5, with more than 30% of the students attain good results; the rest achieved average marks. Besides, the number of SO 1.2.2 is only average. The number of SO 1.2.6 is about 65% of the students achieving average; the rest are below average. The students' fundamental technical knowledge assessment results were nearly 50% of the students achieved the average grade. Still, nearly 25% of the students did not meet the SO requirements, which is a sign to help us pay attention to the attainment level of CLOs, SO identified in the course syllabus of fundamental technical knowledge block and basic IT project to review teaching methods, assessment forms, assessment contents, course contents. We select the best data for continuous improvement according to standard CDIO 12 to improve the quality of the program.

The number of SOs for Block 2 has the highest rating of excellent with 80%, only 20% achieve well at the number of SO 2.2.1. However, the number of SO 2.2.3 is expected 30% for each level of good, average, and below average. The results number of SO 2.2.3 help us pay attention to the students' experience learning activities or the students' experiential activities are not enough or diverse enough. Approach to accumulating the necessary knowledge and skills for this project at the individual student or project level to consider adjusting the teaching form, assessment method, and project's experiential activities to improve this skill further. The number of SO 2.4.4 has the most satisfactory result (60%), the excellent has 25%, and the average is 15%.

In general, the SOs of Block 3 scored the best. Specifically, the number of SO 3.2.2 has the highest result with 40% excellent, 50% good, and 10% average. The number of SO from 3.2.3 to 3.3.2 accounts for 40% good, 20% average. Only 5% is below average for the number of SO 4.2.4. The number of SO 4.2.1 has the highest number of pretty good students, accounting for nearly 65% excellent, 25% fair, 10% average. The number of SO 4.3.4, 4.4.2 had the same excellent results of approximately 30%, the good one accounted for 60% of each SO; the rest were average, below average, and insignificantly weak. The number of SO of 4.4.2 and the percentage of students who do not achieve this helps us reconsider relevant CLOs in the courses taking on this skill to help students achieve higher results than before.

The evaluation results of Specialized IT Project

The results of the project evaluation are presented in Figure 4. In general, the SOs assessment results of specialized projects are higher than those of basic projects. Specifically, in all SOs, there are students with excellent results. For the number of SOs 1.3.1 and 2.2.1 have 100% of students achieve excellent grades, which is higher than the basic IT Project. The number of SOs 3.2.3 and 4.2.1 have 80% and 90% excellent grades, respectively; the remaining number of SOs have from 35% to 55% excellent. The rest ranked good, and the average type or below accounts is less than 5 - 10%. With the rate of unsatisfactory students (below average and weak), special attention should be paid to training these skills with experiential learning activities and increasing participation in writing and skill activities presented to improve the level of competency achieved for these skill groups so that when assessing the results of the final internship and the thesis, all SOs are at the average level or higher.

Comparing the results of the basic project and the specialized project is shown in figure 5. Each project type is conducted in different training years to evaluate the evaluation criteria of varying degrees. Some SOs of Block 1 are selected for evaluation differently depending on

each project's essential purpose. However, the SOs of Block 2, Block 3, and CDIO Skills are repeatedly assessed on the basic project and the specialized project. This repetitive assessment is now intended to provide practice over and over to achieve a more substantial skill.

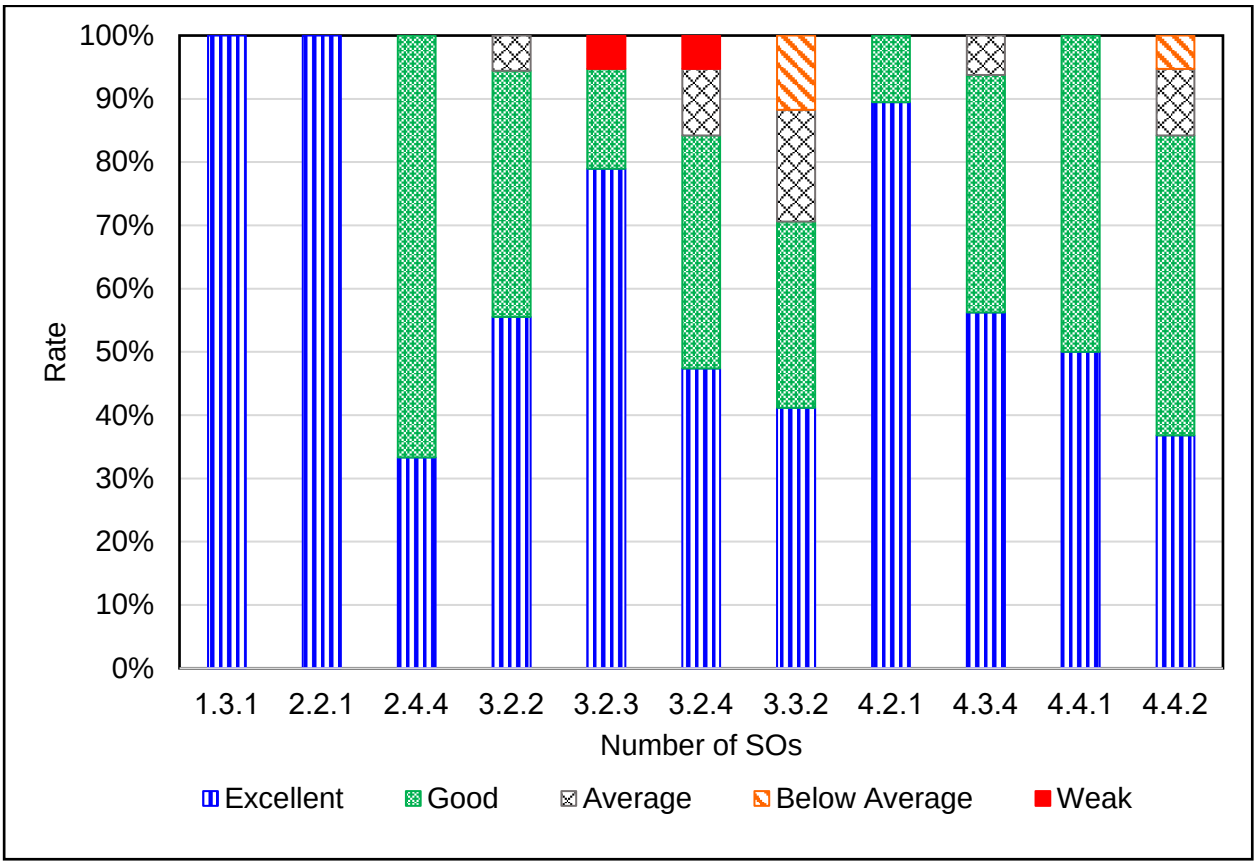

Figure 4: Chart of evaluation results for the Specialized IT Project

Figure 5 shows that most SOs for basic IT projects and specialized IT projects have achieved good and excellent grades. For the average category, the Specialized IT Project has fewer SOs than the basic project. Meanwhile, two SOs are achieving below average and weak for both basis projects and specialized projects. In the end, there is only SO rated ineffective in the basic project. Students are unsatisfactory (below average and weak). We suggest that we consider CLOs in the core fundamental knowledge block, specialized technical, skill proficiency, assessment methods, content assessment, and training methods by engaging students in writing, presentation skills, and experimental activities. To improve the competency achieved for these skill groups to evaluate the final internship results and the thesis, all SOs are from average or highter.

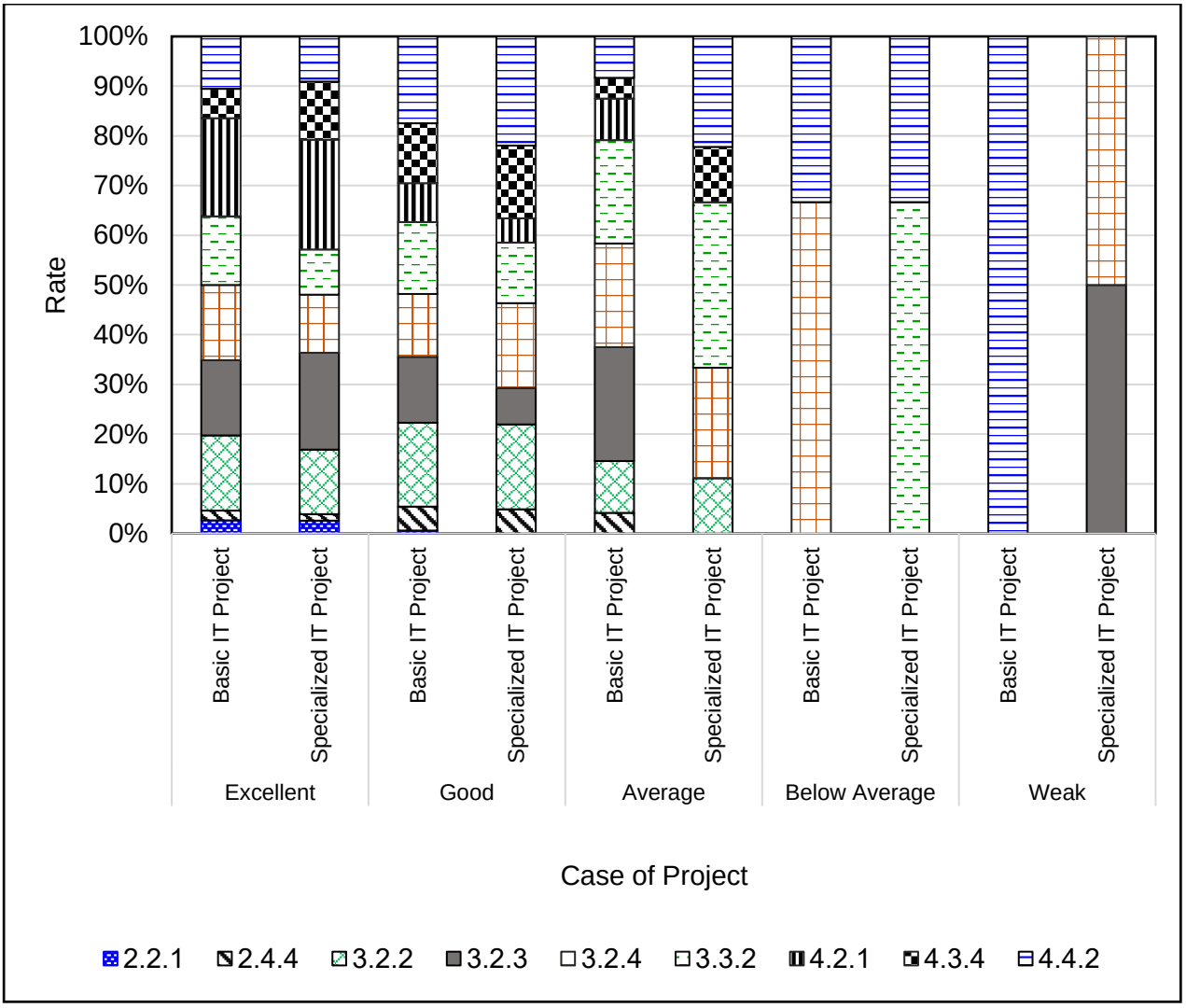

Figure 5: Chart comparing the achievement level of Basic IT Project and Specialized IT Project

CONCLUSIONS AND SOLUTIONS

Through the above analysis and results, the knowledge-based CDIO project courses play an important role in being able to conclude that experiential learning (standard CDIO 7) has an essential contribution to improve student learning outcomes (standard CDIO 11) and update the curriculum framework (standard CDIO 12). Simultaneously, these are the preparatory steps and the specified procedures for implementing an evaluation system for the program by combining evaluation of results and several mechanisms for implementing continual improvement to develop and improve the quality of the program. Usually, the evaluation of an accrediting organization's program is based on two processes. One outer round evaluates the Program Education Objective (PEO) every four or five years. The inner one is performed more frequently to evaluate course results and program conducted annually. However, the curriculum's annual evaluation is sometimes still insufficient information to evaluate because of the student's competence (knowledge, skills, attitude) of a block of curriculum knowledge that has not yet passed fully loading leads to inaccurate measurement of learning outcomes for continual improvement of

curriculum. Therefore, designing and building a curriculum on how to manipulate an adequate standard CDIO 2 to define SOs describes what students are expected to learn in each block of knowledge and do after graduation.

Simultaneously, the knowledge blocks' project evaluation process combined with the knowledge modules is used to measure the achieved knowledge block results (CLOs). The CLO describes the knowledge, skills, and attitudes or competencies that students must have or be able to demonstrate after completing the block. The results of the CLOs are then combined with other program-level assessment tools (e.g., student surveys, graduation exams, interviews, course evaluation, ...) to measure the achievement of the SOs at each stage. One proves that we consider Block1's SOs 1.2.1, 1.3.1 (Table 1) to be very important and necessary for further evaluation and improvement. Nevertheless, the course syllabus of the Specialized IT Project lacks SOs 1.2.1, 1.3.1. Therefore, through this article, we can update and supplement the course syllabus of relevant knowledge blocks and Specialized IT Project.

Therefore, TVU's IT Engineer Program is evaluated and continues to develop and improve each sub-curriculum corresponding to each real block to ensure that it brings the necessary learning results for students, accreditation organizations, and industry that they are looking for in the future.

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BIOGRAPHICAL INFORMATION

Nhiem Ba Nguyen is a lecturer in Department of Information Technology at Tra Vinh University, Vietnam. His research interests such as Computer networks, Information management, network security and curriculum development methodology.

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Appendix

Table 3. Assessment Rubrics for Basic/ Specialized IT Project for mapping CLOs versus SOs

No	Student Outcomes (SOs)	Evaluation criteria (based on CLOs)*	Grade	QUALITY LEVEL				
				Excellent	Good	Average	Below Average	Weak
I. Report presentation format								
1.	3.2.2. Written communication							
II. Introduction								
2.	4.2.1. Setting goals and requirements							
III. Content								
3.	1.2.1. Analyze the requirements of computing problems, designing algorithms, and building appropriate data types (only visible Basic IT Project)							
4.	1.2.2. Apply effectively programming techniques to solve problems (only visible Basic IT Project)							
5.	1.2.5. Presenting the network model and architecture (only visible Basic IT Project)							
6.	1.2.6. Design, install and manage network systems (only visible Basic IT Project)							
7.	1.3.1. Survey, analyze and design Information Systems							
8.	2.2.1. Information searching and collecting							
9.	2.2.3. Experimental inquiry (only visible Basic IT Project)							
10.	2.4.4. Self-development of professional knowledge							
11.	3.3.2. Using technical terms							
12.	4.3.3. Utilization of knowledge in design							
13.	4.3.4. Designing components of the system							
14.	4.4.1. Processes and methods of realization (only visible Specialized IT Project)							
15.	4.4.2. Realizing the design system							
IV. Presentation skills								
16.	3.2.3. Multimedia communication							
17.	3.2.4. Presentation and negotiation skills							

Note: ***** Describe the specific evaluation criteria in the Basic IT/ Specialized IT Project syllabus