To Incorporate CDIO into Social Innovation and Entrepreneurship Participation Project

Yao Chuan Lee
Center for Teaching and Learning Resource, Feng Chia University
Wei Chieh Hsu, Chun Wen Teng
Graduate Institute of Public Affairs and Social Innovation, Feng Chia University
Bing Jean Lee
Department of Civil Engineering, Feng Chia University
Ju Chuan Wu
Department of Business Administration, Feng Chia University
Vey Wang
Department of Economics, Feng Chia University

ABSTRACT

For the purpose of improving students' ability to deal with real life issues, Fen Chia University has adopted a "problem-based learning" orientation, hoping that "Standard 7: integrated learning experiences" will enhance students' social and humanistic solicitude. To demonstrate the efforts, this paper will introduce a series of courses which are conducted in association with Taiwan Fund for Children and Family (a NPO) and aim at solving the issues regarding underprivileged families on an offshore island – Peng Hu. In these courses, students from different backgrounds would work in teams to make contributions to solutions; an interdisciplinary group of teachers would adopt "teaching and learning based on active experiential learning methods" under CDIO concept, helping students gradually build up their "ability to act and solve problems" and acquire the basic knowledge of "service ethics." Conjointly, the full participation of mentors and a thorough field investigation would ensure feasible projects that can solve the issues of underprivileged families in Peng Hu.

KEYWORDS

Keywords: CDIO, Integrate Learning Experiences, Social Innovation, Entrepreneurship Participation
Standard: 1, 2, 3, 5, 7, 8, 11, 12

INTRODUCTION

In January 2016, The World Economic Forum (WEF) in Switzerland published a report, "The Future of Job," indicating that the most needed skill in the future is the ability to solve complex issues. As a pioneer educator, Feng Chia University has adopted a "problem-based learning" orientation, training and enhancing students' ability to deal with real life problems, in the hope that besides professional knowledge, students have the ability to solve complex issues and can adapt to the rapidly evolving society after graduation. This project is designed according to a "learning by doing" teaching model emphasized in the CDIO concept; it layouts a series of consecutive courses, underlining the cultivation of students' imagination, creativity, innovation, and teamwork spirit. Moreover, through this series of courses, students are given the chance to incrementally apply their knowledge to solving real issues in society.

Meanwhile, the current trend in interdisciplinary education around the globe is to incorporate humanistic qualities into science, technology, engineering, and mathematics (STEM). In response to this trend, Feng Chia University also attempted to raise the awareness among students of social issues as one of the goals of this project. Students participated in this project are from different backgrounds, working in teams to make contributions to finding solutions. It is to our expectation that the well-established boundaries and gaps between disciplines can be bridged through this arrangement. After all, social issues, as well as interpersonal ones, are usually perplexing and thus will be better resolved by interdisciplinary efforts.

This project, "Social Entrepreneurship in Peng Hu," is a series of courses conducted in association with Taiwan Fund for Children and Family (TFCF, a NPO) and aims at solving the issues regarding underprivileged families on an offshore island – Peng Hu. Figure1.

Figure1. The Social Entrepreneurship in Peng Hu

In general, there are two main stages in this project: first is to attain social innovative outcomes by applying CDIO method; second is the implementation of that solutions. As for now, the first stage has been completed throughout three courses, that is Local Resources Investigation, Oceanic Culture Tourism Design, and Field Investigation.

The area of project implementation is Peng Hu – an island where local industries are severely limited by its geographic location and weather. Generally, the majority of residents on this island make a living out of fishing, tourism, and temporary jobs. Every year from March to September is the tourist season, while the weather conditions in autumn and winter with constant Northeastern seasonal winds render outdoor work impossible. Therefore, residents face a situation where they have to survive on unstable incomes for almost one third of a year. As a result, numerous residents can barely take care of their children and have become underprivileged families. To alleviate this situation, Taiwan Fund for Children and Family's Center in Peng Hu is currently helping 600 children by providing them with resources and help, hoping to drag them out of the cycle of poverty. Nevertheless, financial assistance from a single source is still rather powerless to break the cycle. It is in this dire need that the TFCF in Peng Hu and Feng Chia University came together and have been putting joint efforts to help the underprivileged group escape poverty and realize self-reliance.

At the first stage of "Social Entrepreneurship in Peng Hu," an interdisciplinary group of teachers would adopt "teaching and learning based on active experiential learning methods" under CDIO concept while incorporating Service Design and Design Thinking methods. Students are led to develop their abilities to observe, analyze, empathize, and think creatively. In addition, they are pushed to come up with an innovative model that can combine oceanic culture with the information and communications technology (ICT) services; a model that can be implemented in the future to help the underprivileged come out from poverty and become self-reliance. In brief, this article will introduce how the interdisciplinary group of teachers designed the whole set of courses according to the CDIO's standards, took the student step-by-step

from understanding concepts to taking actions, and built up their abilities to resolve complex issues.

Attain the First Stage Outcomes of Social Innovation by Applying CDIO Method in "Social Entrepreneurship in Peng Hu"

Bloom' s taxonomy has six stages which can be separated into two sections; first of which is remembering and understanding. Being of rather basic learning, this section is advised not to take up too much class time. (Dennis, 2017) Therefore, we provide some materials on the online learning platform for students to learn basic knowledge and engage in discussions. This way, we leave large section of the class time for most needed teacher-student interactions.

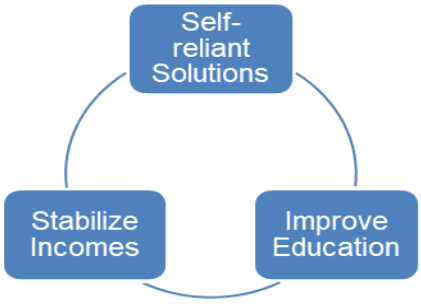
About Local Resources Investigation

On the design of "Social Entrepreneurship in Peng Hu," we make a clear announcement in the first lesson that this is a Learning by Doing project; that students are encouraged to utilize and apply the knowledge of their own professions in discussions and practices; and most importantly, that this will be a course requiring interdisciplinary collaboration. Besides the introductory course, which allows student to understand the goal of the course and the subject concerned, and the concluding course in the last week, we span three sections throughout 16 weeks.

For "Tool Learning", students are guided with thinking methods such as 6-3-5 Brainwriting and Focused Conversation Method(or ORID) to present what they have learned about Peng Hu after reading some materials of background knowledge of the island.

Upon designing of these courses, we set two goals for this stage: 1. Present the Cognitive Domain and Psychomotor Domain of thinking tools in class; 2. Through participation, students are guided and would realize their leading roles in fulfilling this project. From students' performances and feedback, we believe not only that we have reached both goals but also that active and interactive teaching can transform students into self-motivated learners.

In the second section "Focusing on Issues," we hosted 5 lectures where teachers with social service experiences shared their practices, leading students to better understanding of social service and service design. During the lectures, students learned more about the future "service recipients" – Peng Hu residents; some students even learned the side they have never known about Peng Hu. By diverging and converging thinking process, students learned how to combine surroundings with business models to produce suitable proposals. After this lecture, we arranged again a time for brainstorm. This time we used the cycle provided by the lecturer to go through multiple times the process of "discover, define, develop, deliver." Figures 2. and Figure 3.:



Figures 2. Cycle mechanism in Peng Hu

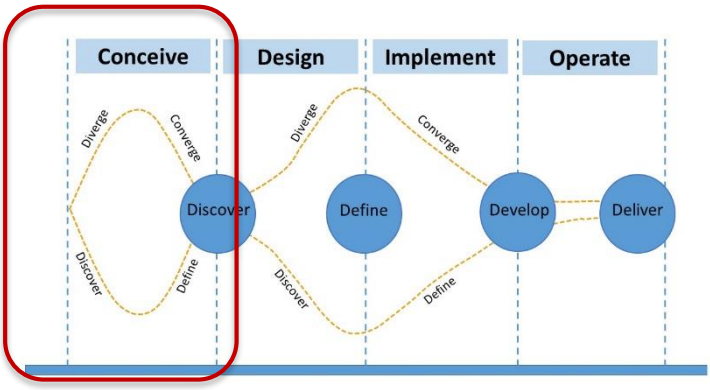


Figure 3. The 4D (discover, define, develop, deliver) process of “Conceive”

After few rounds of discussions, students soon arrived at a conclusion that “in-depth travel” is the theme of this project. Moreover, they hope that by the design of innovation and entrepreneurship, the underprivileged will be able to stabilize their life and gain an opportunity for upward social mobility.

The third section is “Field Investigate”. Its arrangement is to ensure that the solutions formed by students will be fit for the reality. Some social workers led four groups of classmates on a tour of four areas of implementation, which are Magong, Huxi, Baisha, and Xiyu. At first, students observed local humanistic settings and natural sceneries. Afterwards, they reorganized collected data, brainstorm, and share on the stage what they had learned about Peng Hu from this field investigation.

About Oceanic Culture Tourism Design

The second course of this project is a 2-day/16hr workshop, which was participated by 32 students (6 of them had studied in the first course). Interdisciplinary teams were formed in the hope that perspectives from different fields would help organize a better visit schedule. Furthermore, this workshop cooperated with teachers and teams who previously worked on Peng Hu projects; seniors and master students who had practiced in “CDIO” and “service design” projects were also invited to join the class as TA. With TA’s participation in group discussions, students had focused better on the heart of the issues at hand.

It was of Taiwan Fund for Children and Family Center in Peng Hu’s hope that when designing the in-depth travel plans, we took into account the expertise of the recipients. If the project become successful, recipients will be able to continue the project and attain stable incomes. Therefore, we introduced our students the Stakeholder theory in our project, explaining the key to designing a trip, teaching the techniques of shooting and editing promotional videos. At last, they completed their users’ interviews through a role-play exercise, in which half of the students would be the tour guides while the rest play the tourists. Having learned comprehensive skills from those professional courses, students had shown in their solutions a deeper understanding and thinking on the contents of service design.

About Field Investigation

The last course at the first stage has 15 participants, who all had attended the “Oceanic Culture Tourism Design Workshop”; this course lasted for 7 days and contained 4 major lessons and

practices; moreover, it invited a few experts to introduce different aspects of local humanistic settings and natural resources in Peng Hu and how the resources can be utilized. Because of the training received in the previous workshop, students had displayed high maturity in skills and attitude. With the help of local social workers, students met with families in need and saw first-hand the humanistic background and natural resources; hence, they became aware deeply of the actual developmental needs and limits of each case.

With the data collected from field investigation and interviews, students had produced two proposals of in-depth travel plans:

Plan A: " The Lost Treasure: An In-Depth travel in Peng Hu Baisha and Xiyu"

This project includes three topics, which are "On the Margins, the Lost Heritage, and Bring back the Warm" On the Margins: Allows tourists to take part in community building, during which they will experience in person the local innovations and features. The Lost Heritage: Tourists are to participate in the repair of stone weirs, to see the ingenious invention of early fishermen, and to understand the uniqueness and preciousness of stone weir culture in Peng Hu. Bring back the Warm: After customers learn to make cuisine with local materials and establish bonds with the communities, it's likely that they become more willing to purchase unique products from the locals, to promote local communities, and to help the target families in TFCF.

Plan B: "Qimei, an Island of Culture and Art"

This travel plan targets tourists who specialized in education and design. It is organized to be a mid to long term travel plan in Qumei, including 4 stages: "Dabble in the Pool, Fully-Immersive Journey, Plough and Saw, Harvest and the Sweetness." Travellers can relive every stage to their content. By incorporating residential and all kinds of resources, this plan attempts to rebuild the community and advance the education for local children and teenagers.

How this Project Was Benefited by the CDIO Standards

CDIO is an innovative teaching approach, which was formed based on the inputs of multiple parties, such as academy, business, engineering and students; it has evolved into a model which can be reorganized and adopted by any engineering departments in universities. Via the attempt of this project, it is already clear in the first stage that CDIO approach can also be applied to courses on social innovation and entrepreneurship participation. The applicability of such approach will be demonstrated in 5 sections: 1) Foundational Principle; 2) Course Development; 3) Design-Implement Experiences and Space; 4) New Teaching and Learning Methods; and 5) Assessment and Evaluation.

1) Foundational Principle

CDIO Standard 1 – The Context
The practitioners must recognize that CDIO approach is "the appropriate context for engineering education" and can be used as a guideline for continuous improvement.

Teachers can employ the CDIO process in designing and contriving an operational process from creating, innovating to entrepreneurship. At the beginning of the course, students should acquire a clear picture of the lifecycle of "Conceive, Design, Implement, Operate" in innovation and entrepreneurship, as well as the principle of course arrangement; they should also bear in mind that what they learn in these courses is not fragmented knowledge but an ability that they can utilize in the future, so as to motivate them. Having laying out a clear principle for

assessment, teachers can adjust promptly the corresponding parts according to students' learning outcomes.

2) Course Development

CDIO Standard 2 – Learning Outcomes
The learning objectives must be concrete, detailed, and consistent with program goals; furthermore, they need to be validated by program stakeholders.

Learning outcomes can be divided into three sections – creativity, innovation, and entrepreneurship. Actual products should be presented at every stage, and teachers should interact with students during presentation and ensure the realization of desired outcomes. Courses well designed beforehand will allow teachers to keep track of students' performance. Therefore, the contents and schedule of the courses can be adjusted easily according to the needs of stakeholders. As for the first stage of this project, there are two outcomes achieved: 1) students had attained deep understanding of "Peng Hu" and the concept of "social innovation", both of which were later integrated creatively and included in the outcome report edited by students; 2) The service projects designed by students were eventually accepted by TFCF in Peng Hu, which since then had been recruiting Peng Hu residents who are willing to participate in this entrepreneurship project.

CDIO Standard 3 – Integrated Curriculum
Refers to a curriculum designed with mutually supporting disciplinary courses, with an explicit plan to integrate personal, inter-personal, and product, process and system building skills. It is to prevent students from falling into one-dimensional learning.

Service Design has become the pivot. We believe that simply sitting in the classroom will only bring futile speculations and poor learning outcomes, resulting in services that fail to meet the needs of the recipients. Therefore, when designing courses, we included subjects on design thinking, service ethics and tour planning. Thus, we arranged 12 lectures at the first stage, where 4 of them are about practices in the local community; in addition, 2 field investigation trips were provided for the same purpose. It is worth noting that the significance of "Integrated Curriculum" is due to the complexity of social issues, making it necessary for students to learn multiple skills in order to resolve comprehensive issues.

3) Design-Implement Experiences and Space

CDIO Standard 5 – Design-Implement Experiences
Recommends a curriculum containing two or more design-implement experiences, including one at a basic level and one at an advanced level.

Repeated exercises are required at any stage of creating, innovating or entrepreneurship in order to accumulate more experiences. Hence, design-implement experiences are very much needed for the benefits of students. To assure this, we introduce Design-Implement exercises in the courses at the first stage: "Local Resources Investigation", "Oceanic Culture Tourism Design", and "Field Investigation". Our design encompasses "data collecting and reorganizing" as the basic level and "the project proposals" which are to be implemented in the future as the one at advanced level. In short, courses designed with progressive stages will ensure that students achieve learning goals at every stage.

4) New Teaching and Learning Methods

Standard 7 – Integrated Learning Experiences
Integrated learning experiences that lead to the acquisition of disciplinary knowledge as well as personal and interpersonal skills, and product, process, and system building skills. This is one of the most crucial standards considered by many teachers who implement CDIO approach.

In this Social Innovation and Entrepreneurship Participation project, we attempt to meet real social needs, which is complicated and require different perspectives, comprehensive information, and the collaboration between multidisciplinary-teams. For this reason, we arranged two visits to Peng Hu, fostering interactions between students and the local communities, furthering their knowledge on local natural environment, and enhancing student's humanistic solicitude. On top of that, they will learn about systematic thinking skills as for individual level; and communication and teamwork skills as for interpersonal level. This is a type of student learning outcome traditional courses couldn't have provided.

Standard 8 – Active Learning
Proposes using more progressive and active methods to guide students in applying, analyzing, and evaluating issues; and engaging students directly in thinking and problem solving activities.

When it comes to social innovation and entrepreneurship participation, no issue is one-dimensional. More often it is interwoven with wide array of problems. If the courses are taught by one teacher, not only would it not have been intriguing but also may have not been inclusive as it should be. Therefore, we employed different creative thinking methods in the courses so that students could properly learn about Peng Hu and contemplate on local issues. Once this active and interactive learning process gained its momentum, students became more and more involved and began to identify their roles within this project.

As for subjects like Children and Teenagers in Peng Hu, Peng Hu Natural Sceneries, Long/Short-Term Travel Planning, Local Entrepreneurship, and so on, we invited prestigious lecturers from those professions.

5) Assessment and Evaluation

Standard 11 – Learning Assessment
Assessment of student learning in personal and interpersonal skills, and product, process and system building skills, as well as in disciplinary knowledge. This will serve as the reference for future course revision.

For any stage is correlated to another, we value students' learning progress and opinions at every stage. In practice, at the end of every course, we collected feedback from students by a questionnaire; we recorded student opinions and suggestions as a reference for the course revision at the next stage. Here we provide the questionnaire at the first class on "Local Resources Investigation":

Generally, the traditional way of teaching social innovation was rather of a top-down fashion, causing great amount of pressure on students, with professional knowledge not registering for long in students' mind after learning. To address this shortcoming, CDIO method has been adopted in the course design and manipulation of this project.

So far, not only has students' vigorous performance in class brought satisfaction among teachers, the outcomes and plans proposed by students also have gained the favor from our project collaborator, TFCF in Peng Hu.

Conclusion

As the world faces the dawning of A.I. era, higher education around the globe embarks in haste on the reform of the way we nurture talents needed by the future society. When thinking on "how to learn" at the time of A.I., Feng Chia University believes that incorporating "Learning by Doing" approach into our courses will cultivate students' creativity and the ability to resolve complex issues, which will help them create their values in the future.

The CDIO engineering education reform approach has put an emphasis on "Learning by Doing" and "Project-based Learning Process", which are exactly the key to nurturing future talents. Hence, Feng Chia University has been pushing for its application in every professional fields at school, even in the general education courses. Furthermore, we use CDIO approach as the structure of our projects and include "Design-Implement Experiences" to foster students' abilities. And it was because students learned empirically from the real social environment that they were able to produce service design outcomes that address the real needs of the community in Peng Hu.

Besides, we have observed that when putting students, practice and skill trainings, and social needs at the center of the courses, applying CDIO approach has brought about fruitful outcomes, where students enjoyed learning, where learning contents were multi-dimensional, and where learning outcomes were advanced. And it was with this momentum that students became self-motivated and took the initiative in continuous learning — they utilized the "Independent Start Class" mechanism in Feng Chia University after the end of first stage and participated in course design with teachers and mentors before the launch of the second stage courses.

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BIOGRAPHICAL INFORMATION

Yao Chuan Lee is currently a post-doctoral fellow of Center for Teaching and Learning Resource at Feng Chia University. She received her Ph. D. degree in Graduate Institute of Chinese Literature from Feng Chia University, Taiwan. Her research interests include Chinese Classics, literature, imagination, higher education.

Wei Chieh Hsu is currently an assistant professor in Graduate Institute of Public Affairs and Social Innovation at Feng Chia University also the vice chief of the Public Policy Research Center. He received his PH. D. degree in Department of Sociology from Tung Hai University, Taiwan. His research focuses on cross-strait relationship, regional development and Enterprises Industry Sociology.

Chun Wen Teng is currently an associate professor in Graduate Institute of Public Affairs and Social Innovation at Feng Chia University. He received his PH. D. degree in Department of Education from National Cheng Chi University, Taiwan. His research focuses on Education Administration, Education Policy and Research on Textbook.

Bing Jean Lee is currently a professor in Department of Civil Engineering at Feng Chia University. Also, he is a president of Feng Chia University. His research interests include mechanics of materials, earthquake engineering and disaster monitoring system. He is the principle investigator of debris flow monitoring system project of Soil Water Conservation Bureau, Taiwan.

Ju Chuan Wu is currently an associate professor in Department of Business Administration at Feng Chia University and also the CEO of the d.School Feng Chia and the Center for Taiwan Intelligent Manufacturing System. She received her PH. D. degree in National Cheng Kung university, Taiwan. Her research focuses on Knowledge Management, Electronic Business, ICT Innovative Service and Project Management.

Vey Wang is currently a professor in the Department of Economics, the Dean of the Academic Affairs, and the Director of the Center for Teaching and Learning Resource at Feng Chia University. Her previous experiences include the Dean of the College of Business, and the Chair of the Department of Economics at Feng Chia University. Her research interests include industrial organization, agricultural policy, and theoretical dynamics.

Corresponding author

Dr. Chun Wen Teng
Feng Chia University
No. 100, Wenhwa Rd., Seatwen, Taichung,
Taiwan 40724, R.O.C.
+886-4-24517250ext.2853
cwteng1@gmail.com