A CASE STUDY DESIGNING TRAINING CURRICULA TO SUPPORT IMPLEMENTATION OF CDIO

Andrew Marchand[1], Gam Thi Hong Luong[2], Tham Thi Hong Vo[3]

[1]Department of Curriculum and Instruction, University of Victoria
[2]Office of Quality Assurance, Thu Dau Mot University
[3]Faculty of Engineering and Technology, Thu Dau Mot University

ABSTRACT

For trainers and faculty developers, helping instructors learn to design and deliver constructively aligned courses that integrate authentic, higher-order learning tasks is fundamental to implementing the CDIO framework. Encouraging instructors to change their practices and attitudes about teaching and learning, however, can be a formidable and ongoing challenge at many universities where teacher-centered instruction and passive, rote learning is common. This paper addresses this problem by sharing a case study of an ongoing Vietnam-Canada project at Thu Dau Mot University (TDMU) and Tra Vinh University (TVU), two schools that set out in 2015 to create a comprehensive set of faculty development curricula with the goals of changing teaching and learning practices and supporting the implementation of various frameworks and standards like CDIO.

Since becoming a member of the CDIO community in 2015, TDMU has been designing faculty training programs to promote active, authentic, and practical learning to support implementation of CDIO. To date, TDMU and TVU have designed an integrated framework of instructor competencies and training interventions, including seven intensive multi-day training workshops focusing on various core topics like course design, assessment design, online design and instruction, presentation skills, facilitation skills, and so on. Modeled after the Instructional Skills Workshop, a faculty training program from Canada, the training workshops analyzed in this case study were designed to help new and experienced faculty practice and authentically apply various theories, tools, and strategies that can help them implement active learning and higher-order learning-by-doing tasks.

Based on program evaluation surveys with workshop trainers and participants, this case study explores the problem of how universities can better support faculty in adopting new learning-centered practices that align with CDIO by answering several core questions, including:

- What competencies should faculty meet to be able to effectively implement CDIO in their courses?
- What training curricula best serve the needs and competencies of faculty in implementing CDIO? and
- What attitudes towards teaching and learning do faculty have, and how must these attitudes change to implement CDIO?

KEYWORDS

Faculty Development, Teaching Competencies, Training Curricula, Program Evaluation, Standards 8, 9, and 10

INTRODUCTION

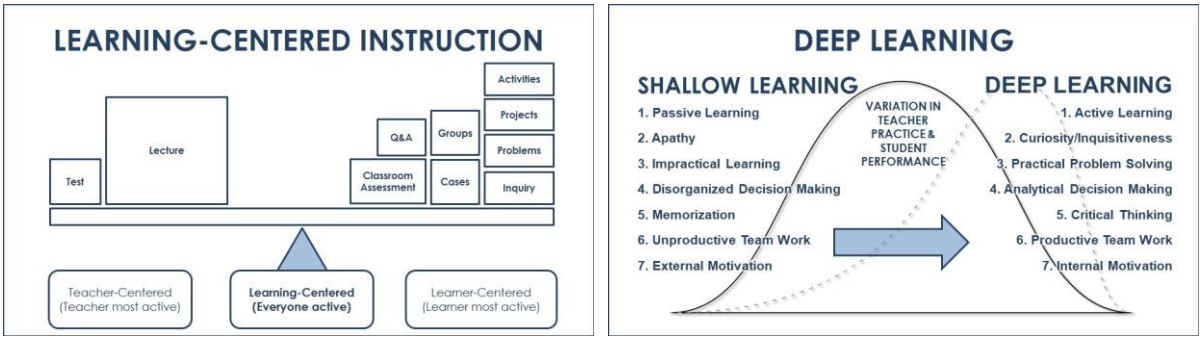
Originally developed for engineering education, CDIO standards and tools have been used to support program reform in various fields by encouraging faculty to use learning-by-doing models like the CDIO design process, case-based learning, project-based learning, and problem-based learning (Johan Malmqvist, Huay, Kontio, & Minh, 2016). Even though CDIO's explicit set of standards and tools has contributed to its international popularity, implementing CDIO can be challenging within educational cultures where faculty are used to teacher-centered instruction that emphasizes transferring content via lecture rather than learning-centered instruction that emphasizes authentic practice via higher-order learning-by-doing tasks. Previous CDIO literature has addressed this challenge, demonstrating that teachers can be resistant to change when adopting the framework and highlighting the importance of effectively training and motivating teachers with carefully designed faculty development curricula (Rouvrais & Landrac, 2012).

This paper shares the experiences of Thu Dau Mot University (TDMU) and Tra Vinh University (TVU) in Vietnam, two schools which have been co-designing faculty development curricula since 2016 to support the implementation of CDIO. This paper relates TDMU and TVU's experiences developing new training curricula to serve as a case study for other institutions that are struggling to determine how they might train and support their own faculty when implementing CDIO. To achieve this aim, this paper reviews TDMU and TVU's faculty development project to date and shares the results of program evaluation surveys which were used to identify strengths and weaknesses of the training program as well as possible future curricular improvements that might better support CDIO implementation.

PROJECT OVERVIEW

The impetus for TDMU and TVU's training program began in 2015 when TDMU staff were tasked with implementing a comprehensive program that would help the university meet the goals and standards of various international frameworks and quality assurance organizations like CDIO and AUN-QA. Since then, TDMU and TVU have worked in partnership to design a training program that currently consists of manuals and facilitator resources for seven different multi-day workshops, with a further four multi-day workshops in development.

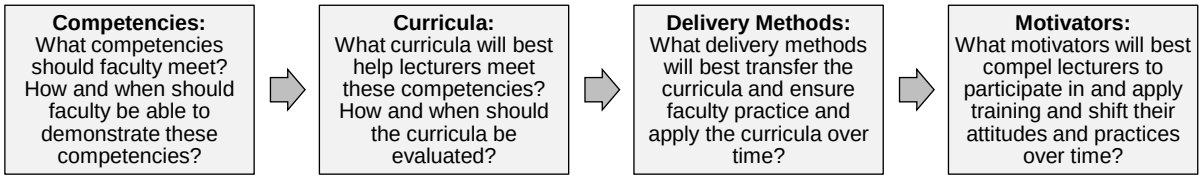
Figure 1: Theoretical Foundations for Program Design



Illustrated in the figure above, two concepts were identified at the beginning of the design process to act as theoretical foundations that might help designers integrate the program's curricula and help faculty quickly envision why the training program is necessary. As TDMU

and TVU's educational culture often stresses lecturing and testing, the concept of *learning-centered instruction* was useful in helping designers and faculty understand the need to balance teacher-centered methods with active learning and learning-by-doing strategies. Similarly, the concept of *deep learning* was also useful in helping designers and faculty understand the need to shift student and teacher attitudes and behavior away from rote, passive learning and towards higher-order, authentic learning.

Figure 2: Core Questions Guiding Program Design



After defining foundational concepts to guide the design process, project staff identified several core questions related to the program's targeted competencies, curricula, delivery methods, and motivators. The sections that follow provide an overview of the design decisions that have been made to date with regard to these elements and questions.

Instructor Competencies

Determining faculty competencies that align with university objectives for teaching and learning is an important early step in designing a faculty training program. In 2016, TDMU and TVU began developing a competency framework for faculty with the goals of:

a) Identifying all of the skills and competencies lecturers should have at various professional levels or stages in their careers;
b) Reviewing and adapting these competencies to encourage lecturers to shift away from traditional, lecture-based instruction towards learning-centered methodologies and higher-order application tasks; and
c) Aligning these competencies with international standards and frameworks like CDIO and ASEAN University Network-Quality Assurance (AUN-QA) to support TDMU and TVU's future accreditation efforts.

To achieve these goals, TDMU and TVU drafted a framework of instructor competencies that were designed by writing competency statements, linking these statements to literature from international frameworks and standards organizations like CDIO, and describing different levels of achievement for each competency that faculty might demonstrate over their careers. Summarized in Appendix 1, the current framework contains 33 competencies categorized into five themes including general professional skills, learning design skills, instructional skills, assessment skills, and technological skills. Table 1 below illustrates a detailed example of one competency statement related to active learning.

Table 1: Detailed Competency Statement for Active Learning

Competency Statement	• Lecturer demonstrates effective use of various active learning strategies and tasks during class time
Related Standards	• Lecturer ensures that teaching and learning based on active experiential learning methods like small-group discussions, demonstrations, debates, concept questions, etc. (Worldwide CDIO Initiative, 2018)

Criteria Levels	• Beginning Instructor: is aware of competencies and standards related to active learning like those above; designs, uses, and improves various active tasks that allow learners to practice using curricular skills, concepts, and values; • Experienced Instructor: meets beginning criteria above; evaluates and chooses most effective activities and tasks for given aims, outcomes, situations, and learners; listens to learner needs and feedback to improve strategies for active learning; provides support to other lecturers in designing and using effective active learning tasks; • Department Head: meets experienced criteria above; evaluates and guides lecturers in designing and using effective active learning tasks.

As illustrated in Appendix 1, while the majority of the competencies make sense in most instructional contexts, some competencies were specifically written to ensure faculty would learn skills that would support for CDIO implementation. For example, statements were written related to designing learning-by-doing tasks, planning for active learning, integrating program curricula, blending instruction, supporting meta-learning, and so on.

Training Curricula

After identifying an initial framework of competencies, curriculum designers then considered what curricula could be used to help faculty most efficiently and effectively meet these competencies. TDMU and TVU staff explored existing training curricula and delivery models used in universities to support similar competencies for faculty. One model explored that was already in use at TVU was the Instructional Skills Workshop (ISW). ISW is a Canadian training program consisting of multi-day workshops that require faculty to give and receive peer feedback while they deliver micro-lessons demonstrating active learning strategies and outcomes-based instruction. Designed by Douglas Kerr and Diane Morrison in 1978 for Vancouver Community College, ISW has been supported and improved over the last 40 years by an informal network of trainers and facilitators who have shared the program with different colleges and universities in more than 30 countries to date (ISW Network, 2018). The training program was originally introduced to Vietnam in 2009 at Tra Vinh University, and TVU supported TDMU in implementing ISW in 2015.

The ISW program consists of two core workshops—Instructional Skills Workshop and Facilitator Development Workshop (FDW)—which are each usually delivered over four days and five days respectively. ISW is a prerequisite for FDW, and participants who complete FDW are certified to conduct their own ISW workshops. Both ISW and FDW require participants to microteach, but while ISW focuses on helping participants apply behaviorist and constructivist lesson planning models, FDW focuses on helping participants apply various group facilitation strategies. Although the workshops are reasonably flexible in how they can be delivered and what curricula is included, both workshops are standardized across institutions by manuals supplied by the ISW Network as well as a series of requirements for the workshops' delivery. For example, ISW workshops must be at least 24 hours, provide three opportunities for participants to microteach, and provide peer feedback to participants on their teaching that is communicated verbally, in writing, and with video (ISW International Advisory Committee, 2006a, 2006b).

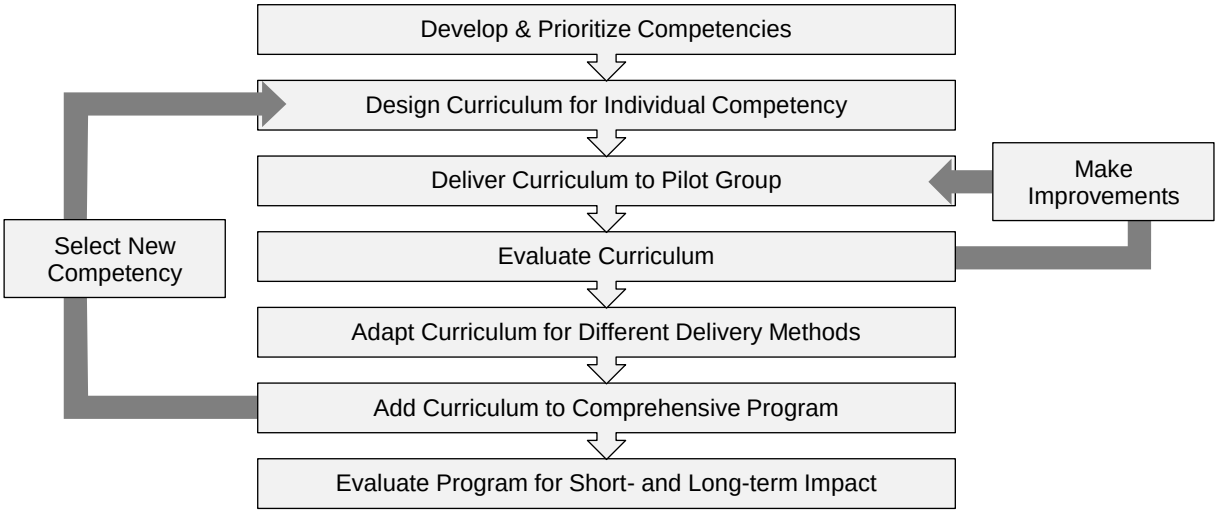
When exploring ISW as a potential training model to support the implementation of CDIO, TDMU identified several strengths and weaknesses for ISW, which are listed in the following table. Based on the identified weaknesses, it became clear that although ISW supported key competencies relevant to CDIO implementation, the core workshops needed to be adapted to better meet TDMU and TVU's specific needs and support a larger competency framework.

Table 2: Strengths, Weaknesses, and Required Adaptations of ISW Core Curriculum

Strengths	Weaknesses	Required Adaptations
Existing curricula focusing on active learning, outcome-based instruction, valid assessment, etc.	Insufficient curricula in its core program to meet a comprehensive set of faculty competencies	Design new curricula that integrates with ISW but meets more competencies
Existing curricula supported by an international network of facilitators and institutions	Foreign curricula that may not always be culturally appropriate in Vietnam context	Evaluate and adapt existing curricula to ensure it is culturally appropriate to local needs
A participatory delivery model that encourages application and demonstration of learning	Low facilitator-participant ratio (usually 1:6) so lots of finances/time for large-scale implementation	Adopt a delivery model that allows for larger groups of faculty to easily participate at the same time
Well-structured workshop schedule and resources that are easy to adapt and implement	Emphasis only on large workshops for delivery of training curricula	Explore additional delivery models besides long, face-to-face workshops

Further elaborated in Appendix 2, TDMU identified nine additional workshops that might be designed and integrated with the core ISW and FDW workshops to meet a more comprehensive set of competencies. Using the curriculum development process illustrated in the figure below, TDMU and TVU have designed five of the nine planned workshops to date, including Assessment Design Workshop, Course Design Workshop, Presentation Skills Workshop, Online Instructional Skills Workshop, and Online Course Design Workshop.

Figure 3: Curriculum Development Process for Additional Training Interventions



The additional workshops are modeled after ISW in that they require participants to not only learn theories and skills related to targeted competencies but also apply those theories and skills by creating and sharing authentic products and performances and receiving feedback from their peers. Rather than teach mini-lessons like in ISW, for example, participants in the Assessment Design Workshop must design, present, and receive feedback on assessment products that they will use in their teaching, including a test blueprint with example test questions, an assignment rubric, and a self- or peer-assessment activity.

To more explicitly support CDIO implementation, some of the new workshops require participants to use planning tools and templates promoted in CDIO literature. For instance, the Course Design Workshop requires participants to design, present, and receive feedback on a course map, a course syllabus template, a course syllabus, and a course assessment template

(Doan & Nguyen, 2014; J. Malmqvist, Östlund, & Edström, 2006). Similarly, the Program Design Workshop, which is currently in development, requires participants to present completed templates, including the program's curriculum structure, curriculum matrix, and assessment model (Doan & Nguyen, 2014; J. Malmqvist et al., 2006). Appendix 2 further describes the types of products and performances participants must present in each of the workshops currently designed.

Program Implementation and Delivery

After TVU supported 12 TDMU staff in becoming certified ISW facilitators in 2015, both universities had staff who could facilitate workshops using the ISW training model, allowing TDMU and TVU to begin designing and piloting the additional curricula throughout 2016 and 2017. The following table lists the workshops that have been designed to date as well as the extent of their implementation at both schools.

Table 3: Implementation of Faculty Training Program at TDMU and TVU*

Assessment Design Workshop (ADW)	• Designed in 2017 with translation support from TDMU • Piloted in 2017 at TDMU, with 47 participants to date
Course Design Workshop (CDW)	• Completing design in first quarter of 2018 with translation support from TDMU • To be piloted at TDMU mid-2018
Facilitator Development Workshop (FDW)	• Offered at both TDMU and TVU • 33 participants from TDMU, and 15 participants from TVU
Instructional Skills Workshop (ISW)	• Offered at both TDMU and TVU • 106 participants from TDMU, and 57 participants from TVU to date
Online Course Design Workshop (OnCDW)	• Designed in 2017 with translation support from TDMU • 47 participants from TDMU, and 167 participants from TVU to date
Online Instructional Skills Workshop (OnISW)	• Designed in 2017 with translation support from TVU • To be piloted in 2018 at TVU
Presentation Skills Workshop (PSW)	• Designed in 2016 with translation support from TVU • Piloted at TVU, with 27 participants in total to date

*Participant totals as of January 2017

To remedy the identified weaknesses of ISW core curriculum, workshop facilitators experimented with different adaptations during the program's initial implementation, including:

- Having multiple staff facilitate ISWs to support larger groups (e.g. 3 facilitators for 21 participants), where curricula is taught to a large group, after which individual facilitators simultaneously support participant presentations and feedback in small groups;
- Having critical discussions during the workshops about the appropriateness of the curricula with regard to school's goals and cultural context;
- Adding introductions to translated workshop manuals that help participants reflect on the curricula's appropriateness with regard to school's goals and cultural context; and
- Having discussions about how workshop curricula can be adapted for blended delivery to reduce face-to-face workshop hours.

PROGRAM EVALUATION

Having provided an overview of TDMU and TVU's faculty development program to date, this section shares the methods and results of surveys conducted in early 2018 at TDMU to evaluate the design and delivery of ISW and FDW core curricula and further explore how new workshop iterations and adaptations can better support faculty in implementing CDIO.

One survey was conducted in early 2018 which was designed to gather feedback from ISW facilitators at TDMU, a group totaling 33 instructors and staff who participated in the ISW and FDW core workshops between 2015 and 2017. The aim of surveying this specific group was to gather data from respondents who had experienced all of ISW's core curricula and could therefore provide informed feedback on what core curricula should be changed or what supplementary training should be added.

Out of the total of 33 instructors and staff who completed ISW and FDW at TDMU, 30 responded to the survey during a meeting where researchers explained the purpose of the survey and answered participant questions, after which respondents completed the survey in-person using an online form. Open-answer responses were then coded into categories for quantification and ranking, while Likert-scale responses were scored and ranked for comparison and analysis.

The aims of the survey questions were to gather feedback on participants' and facilitators' reactions to, learning from, and behavioral change after completing ISW and FDW. Questions were designed to target four general areas of inquiry, including:

1. What participants remember and apply most from their past ISW and FDW training,
2. How much participants think ISW and FDW training changed their understanding of targeted competencies relevant to CDIO,
3. What participants define as their training needs and preferred delivery methods, and
4. What attitudes participants have towards teaching-centered and learning-centered instruction.

Memory and Application of ISW Training

When the group of 30 respondents was asked open-ended questions about what they remember and apply most from their training, 23 of the participants stated that they remember and use new lesson planning models. ISW curriculum uses the two acronyms BOPPPS and CARD to help participants more easily remember key elements of behaviorist and constructivist lesson planning models (ISW International Advisory Committee, 2006b). Although 23 participants specifically referenced these acronyms, the survey did not gather feedback on how and how often these models were used, nor what effect their use had on student learning.

In addition to using new lesson planning models, 18 of the 30 participants stated that they remember and apply new teaching strategies and skills from their ISW training. 13 of these respondents wrote generally about the strategies they learned—for example, that they learned new methods for supporting team work, providing feedback, activating learners, or creating a positive learning environment—while only five made reference to specific teaching strategies sometimes demonstrated in ISW, including graffiti, fishbowl, role play, placemat, and group agreement activities.

In addition to learning new planning models and instructional skills, a third major theme in the responses related to affective outcomes from the ISW training. Eight of the 30 respondents stated that their ISW and FDW training helped them emotionally or relationally, for instance, by feeling friendship, attachment, and/or connection with other participants, by enjoying learning from their colleagues, by appreciating the workshop's fun atmosphere, or by feeling a new sense of sincerity and enthusiasm towards teaching.

Understanding of CDIO-related Competencies

The group of 30 participants was asked about ISW and FDW outcomes that are more related to supporting CDIO implementation, including using outcomes, using active learning strategies, teaching critical thinking, and ensuring practical application of curriculum. Illustrated in the table below, most respondents indicated that they experienced a large or very large change in their understanding related to these four outcomes. Although this suggests that most respondents felt positively about meeting these outcomes, more than a quarter of respondents indicated that they experienced no change or a small change in their understanding of how to teach critical thinking or how to ensure practical or authentic application of curriculum.

Table 4: Perceived Impact of ISW Training Targeting CDIO-related Competencies

Targeted Competency	No Change	Small Change	Large Change*	Very Large Change*	Articulated Responses
Outcomes	0	2 (7%)	21 (70%)	7 (23%)	17 (57%)
Active Learning Strategies	0	0	26 (87%)	4 (13%)	17 (57%)
Critical Thinking	0	8 (27%)	21 (70%)	1 (3%)	17 (57%)
Practical/Authentic Application	3 (10%)	6 (20%)	15 (50%)	6 (20%)	13 (43%)

*Categories were moderate/large in English, but translated to large/very large in Vietnamese for final survey

Participants were also asked open-ended questions about how ISW and FDW training improved their understanding of the four outcomes. For the first three outcomes, 17 of the 30 respondents articulated clear answers that specifically detailed how ISW changed their practice, while only 13 articulated clear answers for the fourth outcome. This lack of articulated responses indicates that although most participants felt they underwent a large change in their understanding, only approximately half were willing or able to articulate the change.

Training Needs and Preferred Delivery Methods

Besides providing data on the impact of core ISW and FDW training, the 30 respondents also provided feedback on the training they feel they need and the delivery methods they feel would be most convenient. The aim of assessing participant needs was to determine what topics should be integrated into new training curricula and what other delivery methods might be as or more effective than ISW's multi-day workshop format. For the needs assessment component of the survey, the respondents completed Likert matrices that allowed 18 training topics and 12 delivery methods to be scored and ranked from most to least needed or desired.

Ranked from most to least needed, the 18 training topics included in the survey were student motivation, lesson planning, assignment design, subject matter knowledge, active learning, learning-by-doing, test design, course planning, fostering supportive classroom environments, classroom technologies, needs assessment, blended/online learning, meta-learning, course syllabus design, management of classroom behavior, learning outcomes, feedback, educational theory, and student-teacher relationships. In addition, the 12 delivery methods included in the survey, ranked from most to least desired, were mentoring, online modules/courses, informal groups, printed or digital handouts, borrowable or downloadable books, short (multi-hour) workshops, observation of others' classrooms, long (multi-day) workshops, one-on-one consultations, attending conferences, multi-course graduate certificates, and personal feedback from classroom observation.

One implication of these rankings is that long workshops are much less desired by faculty compared to other training methods. Since long workshops ranked eighth out of 12 different

types of training methods, the delivery of future training interventions should be more varied than ISW's multi-day workshop model, focusing on informal and independent means of learning.

Attitudes Towards Learning-centered Instruction

As discussed above on page 2 and illustrated in Figure 1, the training program's designers used the concepts of *learning-centered instruction* and *deep learning* to guide curricular decisions and communicate the need for new workshops. The final area of inquiry in the program evaluation was to measure faculty attitudes towards learning-centered instruction to see if and how much faculty would be motivated to participate in new training and change their practice to support CDIO implementation.

A Likert matrix with 11 statements was included in the survey to gauge respondents' agreement with teacher-centered practices that encourage shallow learning and learning-centered practices that encourage deep learning. Teacher-centered statements were structured so that the teacher was the primary actor in making curriculum choices, transferring content, conducting learning activities, and solving problems. Learning-centered statements were structured so the student was the primary actor in solving problems, influencing the outcomes and methods of instruction, and learning through independent practice.

Table 5: Participants' Agreement with Teaching-centered and Learning-centered Statements

Statements	Strongly Disagree	Disagree	Agree	Strongly Agree
Learning-centered Statements (5 total)	0.4 (1%)	2.0 (7%)	11.0 (37%)	16.6 (55%)
Teaching-centered Statements (6 total)	9.0 (30%)	8.7 (29%)	9.5 (32%)	2.8 (9%)

After averaging the responses from each type of statement, 92% of respondents agreed or strongly agreed with learning-centered statements while only 41% agreed or strongly agreed with teaching-centered statements. The responses illustrate that although many still value teacher-centered instruction, the majority of respondents have a positive attitude towards learning-centered instructional practices, implying that most would see value in future training that helps them implement active learning and learning-by-doing strategies to support CDIO implementation.

SUMMARY REFLECTIONS ON DESIGNING TRAINING FOR CDIO

This overview and evaluation of TDMU and TVU's emerging faculty development program illustrates how two universities have adopted and begun modifying existing training curricula to support implementation of CDIO. For other universities wanting to design faculty training for CDIO, this case study raises several important considerations related to existing training models, competencies, needs assessment, delivery methods, and ongoing program evaluation.

- Using existing training models: A great deal of curricula exists that align with CDIO objectives. TDMU and TVU's experience with ISW illustrates, however, that universities need to be careful in adopting and adapting existing curricula to ensure they meet competencies relevant to university goals and CDIO as well as the needs of faculty.
- Using competencies for curriculum design: Competency frameworks support a deductive approach to curriculum design that helps to ensure that training interventions align with a comprehensive set of instructor skills, integrate with and complement each other, and support faculty and program evaluation. Aligning competencies with CDIO

standards and literature helps provide evidence that faculty training programs support CDIO implementation.

- Using needs assessment for curriculum design: Needs assessments support an inductive approach to curriculum design that helps to ensure that training interventions prioritize curricula based on what faculty need and use the most appropriate delivery methods. TDMU and TVU's experience illustrates that evaluating the needs of faculty helps to find gaps in current training that can be addressed in future iterations of curricula.
- Varying delivery methods: Once curriculum is selected for a training program, designers must carefully consider how that curriculum is taught or shared with faculty. TDMU and TVU's experience illustrates that although ISW's participatory workshop model helps faculty practice core theories and skills, participants prefer informal and independent methods of delivery.
- Conducting ongoing evaluation: Ongoing evaluation is integral to ensuring that training programs effectively support faculty in gaining increasing mastery of targeted competencies throughout their careers. TDMU and TVU's program evaluation illustrates that surveying faculty can yield data about what faculty learn from past training, what they want to learn in future training, and how much they value different approaches to instruction. The program evaluation also illustrates that it can be hard to measure how much faculty apply training curricula in their classrooms, and if their training has any effect on student learning.

In conclusion, to help other universities learn from their experience, this paper has demonstrated how two universities have begun working in partnership to solve the problem of implementing CDIO in an educational culture that traditionally prioritizes teacher-centered instruction. There are, of course, a great many related challenges that need to be addressed as the training project progresses, including:

- Partnering with other universities to share the program and learn new curricula and delivery methods that might improve on and integrate with it;
- Completing the comprehensive set of curricula that aligns with CDIO and other standards while meeting the expressed needs of local faculty;
- Motivating more faculty to invest the extra effort and time required to participate in and meaningfully apply the new training; and
- Continuously evaluating the application and impact of the program to make ongoing improvements and clearly link it with progress towards CDIO goals.

To address these challenges, TDMU and TVU will continue their partnership to achieve CDIO standards by developing and piloting curricula until a comprehensive program is designed that effectively supports faculty in shifting TDMU and TVU's educational culture towards learning-centered instruction and deep learning. Given the positive feedback and participation rates of ISW, both universities will continue modeling new training interventions after ISW's workshop format with the addition of supplementary curricula and delivery methods that might better meet faculty's ongoing needs for training.

REFERENCES

Doan, T. T. M., & Nguyen, N. H. (2014). The CDIO-Based Curricular Framework and Guidelines For an OBE Implementation. In *Proceedings of the 10th International CDIO Conference*. Barcelona, Spain: UniversitatPolitècnica de Cataluny.

ISW International Advisory Committee. (2006a). *Facilitator Development Workshop:*

Participant Handbook & Facilitator Resources. Vancouver: ISW Network.
ISW International Advisory Committee. (2006b). *Instructional Skills Workshop (ISW) Manual*. Vancouver: ISW Network.
ISW Network. (2018). ISW Around the World. Retrieved January 29, 2018, from https://iswnetwork.ca/about/isw-around-the-world/
Malmqvist, J., Huay, H. L.-W. K., Kontio, J., & Minh, T. D. T. (2016). Application of CDIO In Non-Engineering Programmes – Motives, Implementation And Experiences. In *Proceedings of the 12th International CDIO Conference* (pp. 84–101). Turku, Finland. Retrieved from http://julkaisut.turkuamk.fi/isbn9789522166104.pdf
Malmqvist, J., Östlund, S., & Edström, K. (2006). Integrated Program Descriptions – A Tool for Communicating Goals and Design of CDIO Programs. In *2nd International CDIO Conference*. Sweden: Linköping University.
Rouvrais, S., & Landrac, G. (2012). Resistance To Change in Institutionalizing the CDIO Standards: From a Cascade To an Agile Improvement Model. In *8th International CDIO Conference*. Brisbane, Australia.
Worldwide CDIO Initiative. (2018). CDIO Standards 2.0. Retrieved January 29, 2018, from www.cdio.org/implementing-cdio/standards/12-cdio-standards#standard8

APPENDIX 1: SUMMARY OF COMPLETE COMPETENCY FRAMEWORK

COMPETENCY THEME	COMPETENCY STATEMENTS
PROFESSIONAL SKILLS	
Growth & Development	Demonstrates commitment to continuous professional growth
Self-evaluation	Objectively self-evaluates professional skills and competencies
Educational Theory	Maintains up-to-date knowledge of educational theory and applies it to their instruction
Subject Knowledge	Maintains up-to-date theoretical knowledge and practical field experience within subject area
Ethics	Adheres to professional and legal standards of ethics
LEARNING DESIGN SKILLS	
Outcomes & Competencies	Uses outcomes during lesson and course design to align with course, program, and professional competencies
Needs Assessment	Evaluate learner needs, abilities, and motivations when designing lessons and courses and makes modifications to curriculum or delivery methods when necessary
Lesson Design	Designs lessons to maximize learning and align with course competencies/outcomes using varied instructional techniques, learning activities, and assessment tasks
Course Design	Designs engaging and challenging courses with sequenced lessons that build towards higher-order competencies and authentic application of course skills, knowledge, and values
Blended Design	Designs courses that utilize eLearning to reduce in-class lecturing and increase learners' in-class authentic practice
Syllabus Design	Write clear and accessible course syllabi that guide student expectations, behaviour, and learning during the course
Universal & Personalized Design	Make courses as accessible and engaging as possible to the widest variation in learner abilities, backgrounds, and styles
Design for Learning-by-doing	Design larger authentic tasks that require learners to reflect on, practice, and apply higher-level skills and thinking
Integrated Design	Integrates their courses and lessons with other courses in their learners' program
Design for Student Portfolio	Design product or performance assessments for learners to include in their portfolios for integration of learning and future employment
INSTRUCTIONAL SKILLS	
Motivation & Engagement	Stimulates and sustains learner motivation and engagement throughout courses and lessons
Learner-Teacher Relationships	Develop respectful, productive, and empowering relationships with learners based on clear communication, roles, and responsibilities
Learning Environment	Creates productive, cooperative, and supportive learning environments that help learners feel relaxed and safe
Active Learning	Uses various active learning strategies and tasks during class time
Meta Learning & Learning Skills	Teaches learning skills and strategies in addition to curricular content to help learners improve their own learning processes
Presentation Skills	Demonstrates effective verbal, written, visual, and physical communication skills when presenting curriculum
Facilitation Skills	Uses effective facilitation strategies during collaborative activities, tasks, and discussions

Questioning Skills	Use questioning techniques during instruction to probe for critical thinking and target different learning levels and domains
Classroom Management	Uses varying classroom management techniques that respect learners and maintain a productive learning environment
ASSESSMENT SKILLS	
Formative Assessment	Uses of varying classroom assessment techniques to gauge learner understanding
Feedback	Provides rich and personalized feedback to learners during activities and assignments
Test Design	Designs valid and reliable tests that align with and target desired outcome domains and levels of learning and use appropriate question types
Rubric Design	Create valid and reliable rubrics that support teacher's and learner's evaluation of assignments
Peer- & Self-assessment	Uses peer- and self-assessment strategies during activities and/or assessments
TECHNOLOGICAL SKILLS	
Information Technologies	Uses appropriate technologies to manage information, learning resources, and student data
Visual Aids	Creates and modifies effective visuals for use as instructional aids, including PowerPoint presentations, photographs, illustrations, diagrams and charts
Online & Learning Management Systems	Uses Learning Management Systems, ePortfolio systems, blogging systems, and other online tools to support instruction and professional development
Online Lecture Production	Uses video recording and production tools to create effective lectures for online or blended

APPENDIX 2: DESCRIPTIONS OF MULTI-DAY WORKSHOPS

Assessment Design Workshop (ADW)	Participants learn to design test blueprints, tests, rubrics, and other assessment tools that align with course competencies and outcomes. ADW focuses on validity and reliability, instructional alignment, test question types, test blueprints, learning-by-doing assignments, rubrics, scoring sheets, self- and peer assessment, etc. Participants must design and present a test blueprint, rubric, and self- or peer-assessment tool and receive feedback from their peers.
Course Design Workshop (CDW)	Participants learn to develop course outcomes, course maps, and course syllabi, focusing on such themes as sequencing lessons, incorporating learning-by-doing strategies and assessments, designing for varying learner abilities and styles, and so on. Participants must design a comprehensive course syllabus and course map and revise them after receiving feedback from their peers.
Facilitator Development Workshop (FDW)	Participants learn to facilitate ISW, as well as the above workshops if they wish to apprentice further with facilitators. Participants must present three mini-lessons and facilitate feedback for three other participants. FDW requires completion of ISW before participants can register.
Instructional Skills Workshop (ISW)	Participants learn to practice lesson planning and instruction that focuses on active learning, by reviewing outcomes-based lesson planning models, delivering three videotaped micro-lessons, and receiving peer feedback from their colleagues
Learning-by-doing Workshop (LBD)	Participants learn how to plan lessons and larger projects that promote learning by doing using models like case-based learning, problem-based learning, project-based learning, inquiry-based learning, and CDIO. Participants must design a comprehensive assignment using one of these strategies (e.g. write a case; design a problem assignment; design a project assignment; design an inquiry assignment; design a design-implement assignment), and revise the assignment after receiving feedback from their peers.
Narrative Skills Workshop (NSW)	Participants learn how to tell stories to highlight core concepts and values and to engage learners. NSW focuses on storytelling techniques, narrative structure, and how and when to use story in the classroom. Participant must plan and deliver three short educational stories and receive feedback from their peers.
Online Course Design Workshop (OnCDW)	Participants learn to structure online lessons and course websites to maximize learner usability and success when teaching online or blended. OnCDW focuses on online course site structure, course and lesson outcomes, online learning activities, online assessment, supporting online learners, using learning management systems, designing blended instruction, planning learning-by-doing assignments, etc. Participants must design online lessons in Moodle and revise them after receiving feedback from their peers.
Online Instructional Skills Workshop (OnISW)	Participants learn to design and deliver video lectures for online delivery. OnISW focuses on lesson planning, designing quality visual aids, video capture and production, using learning management systems, and supporting online learners. Participants must design online video lectures and revise them after receiving feedback from their peers.
Presentation Skills Workshop (PSW)	Participants learn to design and deliver effective presentations, focusing on audience assessment, engagement strategies, presentation structure, facilitating questions and discussions, physical and visual communication, etc. Participants must plan and deliver short presentations and receive feedback from their peers.
Professional Portfolio Workshop (PPW)	Participants learn how to create and maintain a professional teaching portfolio, focusing on such themes as structuring and designing ePortfolios, writing teaching philosophies, collecting and reflecting on teaching artefacts, self-evaluating professional competencies, and so on. Participants must design and present a teaching portfolio and teaching philosophy, and receive feedback from their peers.

BIOGRAPHICAL INFORMATION

Andrew Marchand, a PhD Candidate at the University of Victoria, is an educational consultant and instructor who specializes in faculty development, curriculum design, and online instruction. He has worked with various universities in Canada, Vietnam and Ghana and is the author of multiple training workshops and programs currently in use at different universities. His current research focuses on post-colonial approaches to cross-border educational sharing.

Gam Thi Hong Luong obtained her PhD from Southern Cross University, Australia. Her current research focuses on student assessment in higher education, quality assurance, change management and professional development. She is Deputy-Head, Office of Quality Assurance, Thu Dau Mot University.

Tham Thi Hong Vo is a PhD candidate at Lac Hong University, Vice Head of the Department of Information Technology, Faculty of Engineering and Technology, Trainer of Institute for Strategic Development at TDMU, Binh Duong, Vietnam. Her current research focuses on data mining, information management, and developing teaching methodology training programs.

Corresponding author
Andrew Marchand
Thu Dau Mot University (Vietnam) & University of Victoria (Canada)
06 Trần Văn Ơn St, Phú Hòa Ward,
Thủ Dầu Một City, Bình Dương Province, Vietnam
armarcha@uvic.ca