CARD MODEL IMPLEMENTATION AT TDMU ALIGNED WITH CDIO STANDARD 8

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ABSTRACT

According to CDIO, the main goal of teaching is to help learners achieve expected learning outcomes after completing their courses. To accomplish this goal and meet CDIO standard 8, it is very important for teaching and learning to be based on active learning approaches and for teachers to develop appropriate lesson plans. The more elaborate a lesson plan is and the more clearly-defined goal-related activities are, the more successful the teaching process will be. In this paper, we introduce a model for designing lesson plans called CARD, which has four steps including Context, Activity, Reflection, and Documentation. This model enables learners to use personal knowledge and experience to connect with and reflect on new content and thus promotes active learning, participation in learning activities as well as learner creativity by encouraging them to generate new ideas and create new products. Therefore, CARD is very significant for teachers to design and arrange learning activities to help learners achieve expected learning outcomes. With the real experience of applying CARD in teaching at Thu Dau Mot University (TDMU), Vietnam, in this paper, we present and analyze the strengths of CARD, explain why this model helps learners to easily attain the expected learning outcomes, and demonstrate that the model is appropriate for developing learners' creativity. Then, we illustrate with detailed examples to prove the effectiveness of the model in supporting CDIO standard 8.

KEYWORDS

CARD, Active Learning, Participation, Creativity, CDIO Standard 8.

INTRODUCTION

Vietnamese students in general and students in TDMU in particular study hard, work hard, and respect their teachers. However, a large number of these students are also limited by a lack of initiative in learning, a dependence on their teachers, and a lack of creativity. Learning by memorizing, imitating teachers and passive learning have been ingrained in them from primary school to high school. When starting college, many students cannot easily adapt to a new learning environment that requires a high degree of self-study and independence. In recent years, Vietnam's educational sector has proposed a wide range of solutions to transition from high school learning to university learning. Each school itself has its own solutions based on its own circumstances and students.

At TDMU, students come from many provinces in Vietnam with different learning styles, yet most of these students are quite passive in receiving new knowledge. To solve this problem, since its establishment in 2009, TDMU has focused on finding effective solutions, especially related to teaching methods for lecturers. TDMU has adopted a philosophy of education that includes "active, blended learning aligned with CDIO spirit", which the university has been pursuing since 2015. To this end, the university has promoted training programs that enhance its lecturers' capacity for learning design and instructional skills that align with CDIO. A large number of training programs have been launched since December 2015, including ISW (Teaching Skills), FDW (Facilitating Skills), ADW (Skills for Assessment), OnCDW (Design Online Course Skills) and OnISW (Online Teaching Skills). These training programs were developed to help lecturers create active learning environments, help students move from passive learning to active learning, and promote learner participation and creativity based on their individual experiences. In addition to these goals, in particular, stimulating the creativity and active participation of learners is extremely important to meet the CDIO philosophy. For this reason, TDMU continues to find and apply appropriate models, teaching methods, and evaluation tools to improve education quality (see model in Figure 1).
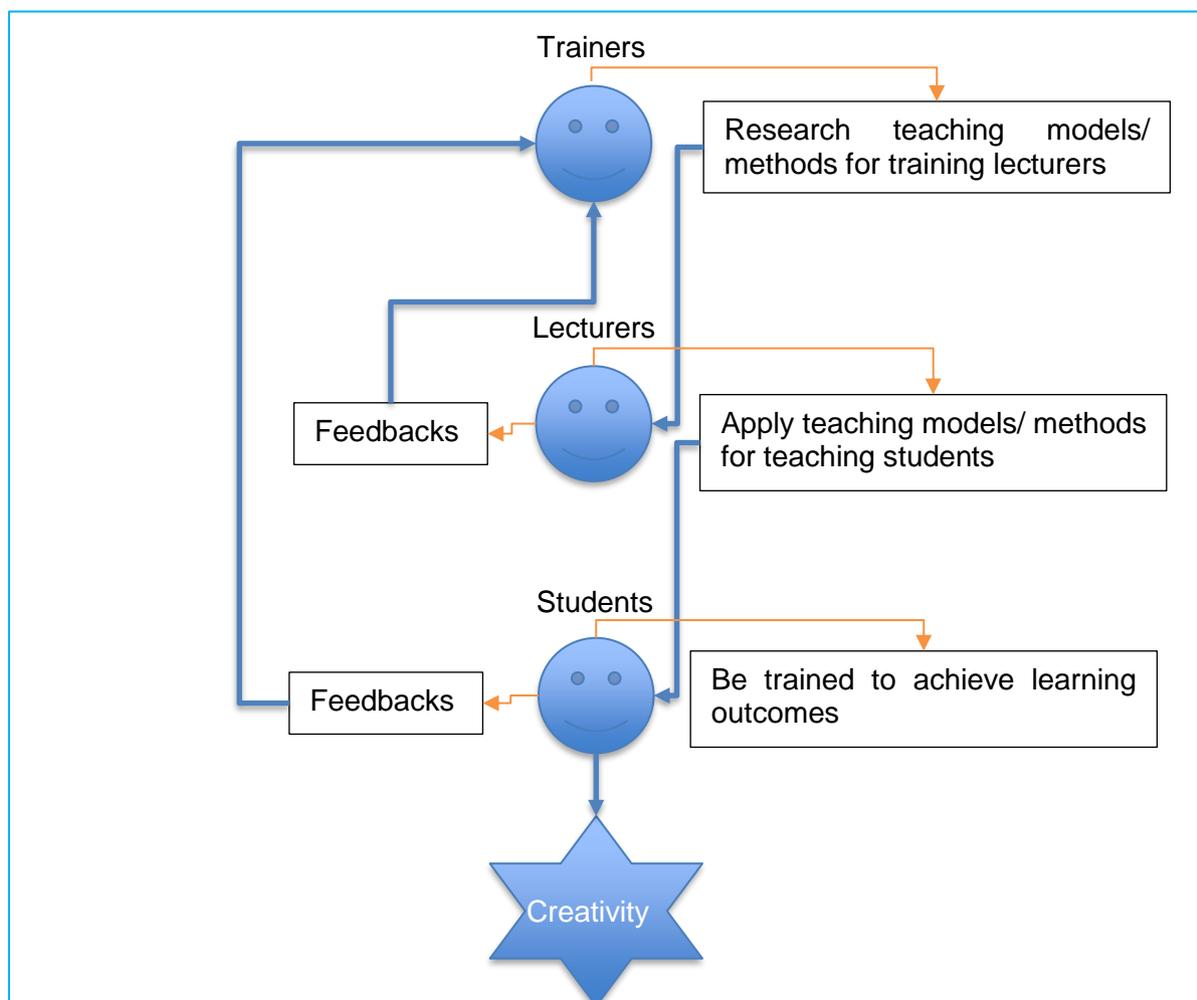

Figure 1. Enhancing teaching competency model in CDIO context at TDMU

To help teachers make good instructional activities for comprehensive and effective lessons, TDMU trainers share models, which have been tested, and evaluated by experts. Based on the experiences of lecturers in applying active and blended classroom models and using lecturer and student surveys to support analysis, we would like to introduce CARD, one of the two models for designing lesson plans, which are taught in ISW, a workshop that we will discuss in detail later, and are applying at TDMU. In this paper, we analyze the strengths and limitations of CARD based on a teacher and student survey. In addition, we also present a sample lesson plan used for teaching first year students in ours Information Systems department, faculty of Engineering and Technology. We would like to share our experience of using this model to enhance learner participation and creativity when we are a CDIO member and we expect to apply CDIO framework for improving education quality.

THE RELATIONSHIP OF ISW, CARD, AND CDIO STANDARD 8

Instructional Skills Workshop (ISW)

ISW is a program, based on a student-focused process. This program involves 24 hours of structured intensive instruction to enhance instructors' skills in planning, teaching, giving feedback and critical reflection. For over 30 years, it has been offering to more than 100 institutions worldwide as a method of facilitating the student-centered development and reflective instructors. Although it is designed for teaching adult learners (Day & Committee, 2005), an empirical research has been carried out to assess the impact on the faculties participated in the ISW (Macpherson, 2011). Research has typically shown that individuals who participate in this workshop agree that it is transformative to their teaching in the classroom (Macpherson, 2011). Another study tried to extend these findings by conducting a pre-post analysis of ISW and non-ISW participants. The goal of this research was to investigate the influence of ISW on developing a student-centered approach to teaching at university and college. ISW is also used for training professors teaching methodology (Fenrich & Johnson, 2016).

(Dawson et al., 2014) found that ISW participants were less teacher-focused, whereas the non-ISW participants showed no change in teacher-focus. This suggested that ISW had an effect on ISW participants teaching behavior types. In addition, the research also found that participants frequently described replacing part of their lectures with a range of active learning methods, thereby reducing the instructional focus on transmission and implementing teaching methods known to boost deeper learning. As a result, it concluded that ISW made a shift towards increasing student focus in terms of thinking about student motivation, planning activities to engage students, and seeking student feedback.

CARD and ISW

ISW brings learners 2 main models for lesson planning. CARD is one of those models. Created by David Tickner, Vancouver Community College, including 4 main parts (see figure 2), CARD supports teachers to design lesson plans which enhance student participation and creativity.

CARD and CDIO Standard 8

(CDIO_Intiative) says that CDIO standard 8 is about Active Learning known as using active experiential learning methods for teaching and learning. These methods engage students directly in critical thinking and problem-solving activities such as manipulating, applying,

analyzing, evaluating ideas, etc. Active learning in lecture-based courses can include methods such as small-group discussions, demonstrations, debates, concept questions, and student feedback. Active learning is also known as experiential learning when students take on roles that simulate professional engineering practice such as design-implement projects, simulations, case studies, etc. By engaging students in thinking about concepts, new ideas, and require them to make an overt response, students not only learn more, they can recognize what and how they learn. Therefore, this process helps to enhance student motivation, expected learning outcome achievements and form student habits of lifelong learning, as with active learning methods, students are able to make connections among key concepts and apply the application of this knowledge to new settings.

(Crawley, Brodeur, & Soderholm, 2008) said that the theories of constructivism and social learning have been applied to a wide range of curriculum and instruction models and practices. CDIO focuses on a method called experiential learning, in which students take on roles that simulate professional practice in engineering. With this method, students are engaged in problem-solving, critical thinking, and decision-making. They are relevant to personal and connected to academic expected learning outcomes. As a result, CDIO requires teachers to create opportunities for students to question, combine ideas and skills through reflection, feedback, and apply ideas and skills to new situations (Kolb, 2014).

To meet these requirements, teachers need models for lesson planning such as CARD. It is a model based on constructivism theories, so lesson plans applying CARD are often in an inductive manner. Therefore, it is easy for these lesson plans to effectively use the prior knowledge of learners and encourage learners to develop their creativity because learners achieve expected learning outcomes by thinking, doing, solving problem and working with others. Teachers are just responsible for directing learners to the right topic, guiding them to reflect on, to draw lessons, or to present their ideas following lesson plans. Besides, teachers also provide additional scientific evidence.

The strength of CARD is that it helps learners achieve expected learning outcomes in a natural and easy way through empirical experience and reflection. Learners learn from their participation in activities with others, their connection with prior experience, and individual reflection process.

In short, these above characteristics of CARD adapt to CDIO standard 8.

CARD IN DETAIL

CARD has 4 main steps as shown in figure 2, but in fact, there are 5 steps. The hidden step is "Determining expected learning outcomes", which is important when developing lesson plans using Bloom's taxonomy. Once the expected learning outcomes are clearly determined, the 4 steps as follows outline a simple and effectively strategy for conducting lesson plans.

- Context: When starting the lesson, teachers can create a lesson context to engage learners.

- Activity: Teachers can use several learner-centered teaching activities to give learners opportunities to express their views, knowledge as well as listen and acquire knowledge from others. This step has a direct effect on the next step, which promotes learner reflection and awareness, so they may create their own knowledge.

- Reflection: After a series of activities, teachers create situations where learners have to think about themselves. Teachers can create a situation by asking questions or identifying problems for learners to solve. When seeking answers or solutions, learners have opportunities to connect to their prior knowledge and experience, so they may learn the lessons on their own ways. This is a strength of CARD because it forces learners to express their opinions or attitudes, so teachers may be able to observe student behaviors and contributions to evaluate the learning outcomes although they are not always required to do so when using CARD.

- Documentation: Both teachers and learners can show documentation in this last step. Teachers may use excerpts from experts to reinforce student beliefs, or they may give learners a call-to-action, so teachers may evaluate the expected learning outcomes through learner actions. Furthermore, it can be useful to let learners share what they have learned, or to encourage them to create products that describe their attitudes towards the issues, which have addressed in the lesson.

When using CARD, teachers do not always need to evaluate the expected learning outcomes. However, it is necessary to have a connection between CARD steps and the expected learning outcomes of the lesson.
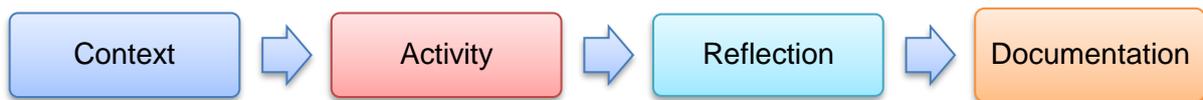

Figure 2. The 4 main steps of CARD

A SAMPLE LESSON PLAN USING CARD

In this section, we present a lesson plan that applies CARD to achieve the expected learning outcome of "Being aware of coding style and the importance of writing code in a correct format, a clear structure, and an easy to read manner". (See Table 1).

Table 1. Lesson plan, topic "Should we write nice codes?"

Step	Description	Time (min)
C	**Context** - Teacher shows some pictures about correct and incorrect format codes - Teacher ask learners to guess the topic - Quick Survey: Teacher asks learners to describe the way they write codes	5
A	**Group games** - Teacher asks each person to write down a small piece of code on a paper and his/her name on the back of the paper - Teacher collects their papers - Teacher sticks the papers on the board and randomly ask learners one by one to read the codes in 30 seconds. A reader gets 0.5 points if he/she reads correctly and the author of this paper gets 1.0 point (teacher calls students from groups by turns)	25

	- The group with highest points win the game - Teacher selects some papers and asks learners to find out high quality codes	
R	**Questions**: - Do your codes follow any format? - Why do you write like that? - What is the advantages/disadvantage of writing codes properly and readable? - Do you enjoy reading the right format codes? - According to you, should you write codes properly and readable?	12
D	**Documentation** - Prove by showing companies that pay higher salaries to candidates who write properly and readable codes - Prove the importance of writing good codes such as being easy to read and inherit - Ask the groups to create slogans or posters, which describe their attitude toward code writing. Ex: "Say no to unreadable codes"	8

It can be said that the 4 steps of CARD allow learners to approach, feel, think and draw their own conclusions as well as express their attitudes towards their code writing styles.

CARD IMPLEMENTATION EVALUATION

In order to find out the advantages and disadvantages of CARD application at TDMU, we conducted a survey from a focused group of 95 lecturers who have been approaching and appying CARD since early 2018. The aims of the survey were to gather lecturer feedback about the strengths and limitations of CARD.

Furthermore, we also surveyed for student feedback in Social Affairs and Development Center at TDMU. This center teaches students Social Skills such as team working, communication, problem-solving, effective learning methods, critical thinking, etc. Its courses use active learning methods, and almost teachers have joined ISW, so they could use models, especially CARD.

Table 2 shows the general information of survey participants at TDMU. Participants come from different faculties, teach different class size, have different teaching experience, etc. They have participated in ISW and they learned how to use CARD. However, in this research, we do not focus on these differences of the participant majors.

Participants

The survey participants includes 95 lecturers come from different faculties. They are trainers, facilitators and lecturers (see table 2)

Surveys

Each lecturer completed a survey, which included questions related to CARD such as "How often you use CARD? What do you recommend about CARD? Does CARD help you create student interaction and collaborative learning easily? Does CARD make students be more active? Could you apply CARD for various subjects? What do you think about the

implementation of CARD? How about the time consuming of CARD compared to other models? Does CARD stimulate student creativity? Does CARD increase student participation?" etc.

Table 2. General information of survey participants

	Attribute	Participant Number	Percentage
Field	Natural	16	17%
	Human Society	35	37%
	Technology	18	19%
	Economy	17	18%
	Pedagogy	9	9%
Average Class Size	Less than 30	6	6%
	From 30 – 50	72	76%
	From 50 – 100	15	16%
	Over 100	2	2%
Seniority	Less than 5 years	33	35%
	5 - 10 years	42	44%
	10 - 20 years	18	19%
	Over 20 years	2	2%
CARD lesson plan usage number	Never	17	18%
	Less than 5	32	34%
	5-10	26	27%
	More than 10	20	21%

Results

Table 3 shows that the biggest advantage of CARD is that teachers can interact easily with students (77.5% of participants agreed) because all CARD steps require students to actively participate in the class. While using CARD, teachers could avoid teacher-focused methods, transmitting in one way, so learners were more active (75% of participants agreed that CARD helped learners be more active) as they must continuously participate in activities such as brainstorming, problem solving, working in groups, etc. In addition, learners had their reflection, connected with their prior knowledge and experience, discussed with their classmates, so they could acquire their own new knowledge.

The second advantage agreed by survey participants is that CARD is quite easy to apply in many subjects and topics (36.3% of participants agreed). Some lecturers, who teach in the science and technology fields, thought it was difficult to help learners achieve the learning outcomes of attitude. Therefore, they often used oral-presentations to lead students to good behaviors. This method was quite boring if the lecturer was not talented in speaking, and it was difficult to persuade learners. However, when using CARD, lecturers were able to organize their lessons in a lively manner, set clear learning outcomes so that they might be able to fully observe and evaluate these learning outcomes through the way students express their ideas or respond to the given situations.

In addition, CARD got some agreements of saving time for preparing lesson plans (23.8% of participants agreed). When joining in ISW, each participant needs to compose and deliver 3 micro-lectures during 3 learning days and he/she needs to use CARD at least for one lesson. In fact, more than 60% of participants choose CARD for their 2 lesson plans because of the main reasons such as easy implementation, interesting, and time saving.

For learners, CARD stimulates creativity, maximizes individual thinking (76% of people agreed). Based on the constructivism theory, lesson plans applying CARD are often in inductive manner. With this structure, it supports learners to reflect their prior knowledge and experience, helps them develop their creativity, so they can achieve expected learning outcomes on their own and by working with others. The teachers only have the role of facilitators such as giving learners to the right topics, putting them into the right contexts, directing them to reflection process so learners can draw their lessons, present their views, or create their products. As a facilitator, teachers also provide additional scientific evidence.

Table 3. Advantages and disadvantages of using CARD for teachers and students

Description	Feedback about CARD	Percentage
Advantage for teachers	Simple steps, easy to use and time-saving when making lesson plans	31%
	Applicable to many different subjects/ areas	35%
	Easy to measure expected learning outcomes	23%
	Can be used for high school students	12%
	Easily get student interaction	77%
Disadvantages for teachers	Complex steps, tricky and time-consuming when making lesson plans	24%
	Applicable only to certain subjects	48%
	It is difficult to measure/ control expected learning outcomes	29%
	Can only be used for small-size classes	53%
	Difficult for teachers to persuade students	22%
Advantage for students	Stimulate student creativity	76%
	Exploit individual strengths and experiences	57%
	Learners are more active when attending classes	72%
	Learners can create their own new knowledge	51%
	Learners change their perceptions and behaviors after finishing class	58%
Disadvantages for students	Does not help learners create new ways of thinking, new methods	5%
	Does not support individual strengths and experience of learners	8%
	Learners are passive when attending classes	7%
	Learners can hardly create new knowledge	14%
	Hard to evaluate learners perception or behaviors' changes after classes	49%

However, a small number of people did not agree with strengths of CARD like helping learners be creative (8% of participants disagreed), be active (7% of participants disagreed) and create new knowledge (14% of participants disagreed).

CARD also has certain limitations. Many lecturers say that the model can only be implemented for classes with sufficient number of students and it is difficult to apply for the big-size classes with a large number of students (53% of participants said that). Furthermore, with a large

number of activities, the interaction between teachers and students becomes more difficult to deliver in the narrow classrooms where tables and chairs are difficult to move. It is a big challenge for teachers to design right activities when applying the model. Another limitation is that it is hard for teachers to evaluate immediately the change in the learner's perceptions because attitude changing often needs time. These limitations are challenges for lecturers when they first use CARD. However, once being mastered, they are able to overcome these challenges.

Table 4 shows participant expectations about how to use CARD better. There was 47% of participants were engaged, so they wanted to join more training programs and 35% of participants wanted to visit other classes to learn from others.

Table 4. Participant expectations about methods to master of CARD

Participant expectation	Percentage
No expectation	11%
Visiting other lecturers' classes	35%
Being visited and commented by other lecturers	11%
Joining competitions on teaching skills	24%
Joining more training programs	47%

To collect participant opinions about CARD, a 5-point Likert Scale is used for participant agreement survey with some statements about CARD (see table 5). Participants were asked to respectively select from 1 point to 5 points which stand for strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree. The average of participant ratings for each statement was calculated. Most participants agreed with the advantages of CARD, for example, a practical model supports learners to be more active, engaged and cooperative.

Table 5. Lecturers' opinion about CARD

Opinion	Point					Average
	1	2	3	4	5	
CARD is a practical model	1%	4%	25%	46%	24%	3.9
The biggest advantage of CARD is to help learners achieve learning outcomes of attitude	7%	32%	35%	22%	4%	2.8
My students are more motivated while learning with CARD	1%	3%	9%	51%	36%	4.2
My students show more opinions, personal experience while learning with CARD	8%	24%	39%	23%	6%	2.9
My students are very cooperative and excited while learning with CARD	1%	2%	24%	51%	22%	3.9
I acquire a lot of new knowledge, new perspectives from my students	1%	5%	25%	44%	25%	3.9
I will continue to apply CARD to my career	1%	9%	22%	46%	22%	3.8
I will recommend CARD to my colleagues	0%	4%	16%	61%	19%	3.9
I am willing to modify CARD for specific classes and subjects that I teach	0%	4%	26%	45%	25%	3.9

CONCLUSION

In this article, we introduce about CARD, highlight its advantages towards creating new knowledge that means reaching higher levels in Bloom's taxonomy, enhancing student participation and creativity. In addition, CARD is a simple, easy-to-use model that supports learners to achieve expected learning outcomes in a natural way. TDMU has been using this model and getting significant results. Further, learner feedback about this model is very positive. Survey from the TDMU Social Affairs and Development Center showed that students highly appreciate the dynamics, creativity of the classes (4.67/5 points). We believe that teachers can easily make lesson plans, select creative learning activities based on flexible use of this model in teaching to meet specific learning outcomes of various subjects. To improve education quality, TDMU follows CDIO philosophy. To adapt CDIO standards, especially standard 8, TDMU always aims to bring teachers appropriate teaching methods for enhancing student active learning. However, we have not analyzed how the difference of participant majors affects their point of views about CARD. We have not clarified how CARD compares to and integrates with other well-known active learning methods, neither. We are going to keep carrying out our further research with these aspects.

REFERENCES

CDIO_Intiative. The CDIO Standards 2.1.

Crawley, E. F., Brodeur, D. R., & Soderholm, D. H. (2008). The education of future aeronautical engineers: conceiving, designing, implementing and operating. *Journal of Science Education and Technology, 17*(2), 138-151.

Dawson, D., Borin, P., Meadows, K. N., Britnell, J., Olsen, K., & McIntyre, G. (2014). *The impact of the instructional skills workshop on faculty approaches to teaching*: Higher Education Quality Council of Ontario.

Day, R., & Committee, I. I. A. (2005). The instructional skills workshop: The heart of an educator learning community in British Columbia and beyond. *Proceedings of the ISSoTL, Vancouver, BC, Canada*.

Fenrich, P., & Johnson, R. (2016). Instructional skills workshops: A model for training professors how to teach. *Research Highlights in Education and Science 2016*, 9.

Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development*: FT press.

Macpherson, A. (2011). *The instructional skills workshop as a transformative learning process.* Education: Special Arrangements.

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