SUITABLE INTEGRATED LEARNING EXPERIENCES FOR INCREASING INDUSTRIAL MANAGEMENT STUDENT'S COMPETENCY

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ABSTRACT

According to dynamic global industry situation, the firm's manager has to understand and develop their product and service to meet the customer's requirement. Therefore, one of the challenges in industrial management education is the demand for high quality teaching. The Conceive, Design, Implement and Operate (CDIO) approach as tools for increasing learner's performance and 21st century skills competencies. Consequently, the objectives of this experimental study were to investigate the learning outcome applying Deming's quality cycle to develop integrative thinking skills and study the opinions of student regarding the proposed model. The target group of this research composed of 85 students major in industrial management in academic year 2020. An integrating approach (i.e., Deming's quality cycle, problem based leaning technique, and innovative teaching approach) was used to develop conceptual framework in this study. With regarding to develop learning efficiency, this study integrated the different students from both subjects (i.e., operation management and factory warehouse). Operation management subject for second year students and factory warehouse subject for third year student. The student groups were assigned different project, which related to the objective of each subject. Moreover, one group consisted of 6 members: 3 members from second year students and 3 members from third year students for one factory or enterprise to increase communication skills, teamwork, and assist each other to learn and share idea together. For quantitative data analysis, the descriptive was administered using frequency, mean, and standard deviation. Content analysis method was employed for qualitative data analysis. The results showed that the proposed model (the integrating of PDCA cycle and CDIO principle) can improve the students' integrative learning performance through applying knowledge, multiple skill, and real firms' situation particularly.

KEYWORDS

Active learning, integrative thinking skill, Deming's cycle, industrial management, CDIO standards: 3, 5, 7, 8.

INTRODUCTION

According to global business and economic situation are changing rapidly. Moreover, the business enterprise organization to new staff or organization members ability applied talents, multidisciplinary skills, and professional knowledge continue to increase(Orlandi, 2010). Therefore, the both fields in professional approach and educational sector have come closer to create new strategy model and management system that suitable for new graduate generation and support the real world in 21st century business (Malmqvist, Östlund, & Edström, 2006; Tran, Pham, Bui, Thi Duong, & Tran, 2020). Therefore, quality is an important factor and challenge for higher education or university level, which educational sector is one of the most complicated sectors to evaluate and improve. PDCA cycle is used as quality assessment tools for assessing student's point of view and study performance and outcome.

According to the principle for improving quality in higher education, CDIO (Conceive-Design-Implement-Operate) principle was established for reforming educational framework, which emphasized in engineering programs particularly. Moreover, the CDIO initiative is employed to support quality improvement and increase student's learning outcome. The CDIO application had positive effect on entire program specification's design, personal competency that related to learner's year learning outcome and interpersonal skills. Furthermore, the concept was employed to increase quality continuous improvement for higher educational sector (Kohn Rådberg, Lundqvist, Malmqvist, & Hagvall Svensson, 2018; Malmqvist, Kwee Huay, Kontio, & Thi Minh, 2016; Tran & Phan, 2020).

With regarding CDIO for business administration field, the concept was constructed at business administration faculty, Rajamangala university of technology Isan in 2018 through program specification design for graduate's 21st century training, which the training was created for enhancing faculty competence and teaching competence such as course specification design, active learning approach, integrated learning experiences, and problem-based learning (PBL) technique. According to management department stakeholders' interview results, graduate student competency and characteristic of management department were thinking approach (i.e., creative thinking, analytical think, critical thinking, system thinking, and divergent thinking, feeling factor comprised of principled, open minded, and reflective, and Doing approach (i.e., operation skills, entrepreneurship, teamwork and collaboration, ICT skills, communication, and problem-solving skills.

Therefore, this study proposes a suitable integrated learning experiences for increasing industrial management student's competency of business administration faculty of Rajamangala university of technology Isan (Nakhon Ratchasima province) through learning design under the concept of learning together and sharing experience. The remainder of this research is organized as follows. Literature review is provided in Section II, which described a background of the PDCA cycle and CDIO principle. Section III illustrates research methodology. Subsequently, research results are provided in Section IV. Finally, Section V presents conclusion and suggestion for future research.

AN INTEGRATING PDCA AND CDIO APPROACH

PDCA cycle or Deming cycle was created by Dr. W. Edwards Deming. The PDCA concept focuses on the need of customers and then designing a product to meet the need and planning suitable production to validate the product's viability. That has become the Plan section of the cycle. The production plan was to be executed in the second quadrant of the cycle. That has become the Doing process. After producing the product, the firm was to sell the product. Whether it sold well or poorly provide information on whether the firm had correctly chosen a product type. This has become the Check section. Having sold the product, the firm was urged to find out from its customers whether the product met their expectations and how

the product could be changed to better serve the customer, which it has become the Act or adjust approach (David L. Goetsch, 2014; Malmqvist et al., 2016).

With regarding the education system to increase learner's quality of learning outcome and 21st century skills competencies, the CDIO principle was established to assist as guidelines for educational program reform and evaluation(Kohn Rådberg et al., 2018; Li, Wen, & Yang, 2015). Moreover, it also provides a framework for continuous quality improvement through 12 standard items (Torsakul, Memon, Triwanapong, & Kuptasthien, 2019), which the integrating PDCA cycle and CDIO principle are presented in Table 1 as follows,

Table 1 the integrating PDCA cycle and CDIO principle

PDCA Cycle	Description	CDIO Standard	Description
Plan (P)	Before any corrective action is taken on the problem at hand, a member of activities should be undertaken. The problem must be defined, relevant information gathered, the root cause of the problem identified, possible solutions developed and considered. All of this needs to be done by organizational members carefully selected on the basis of their association with the process involved and their special relevant knowledge, skills, experience.	Standard 1	CDIO as context, which it is an adoption of the principle that product and system lifecycle development of CDIO process approach
		Standard 2	CDIO syllabus outcomes which is the learning outcome detail for personal, interpersonal, and product and system building skills.
		Standard 3	Integrated Curriculum, which it designed with mutually supporting disciplinary subjects.
		Standard 4	The introduction framework for professional practice in product and system building, and essential skills.
		Standard 5	Design-Build Experiences
		Standard 6	CDIO Workspaces such as Workspaces and laboratories
		Standard 9, 10	Faculty for CDIO skill and teaching skill competency enhancement
DO (D)	Implement the solution chosen as best way.	Standard 7	Integrated Learning Experiences
		Standard 8	Active learning teaching and learning based on active experiential learning methods.
CHECK (C)	Monitor the implemented solution and gather data relevant to the original problem and any other areas of concern.	Standard 11	CDIO skills assessment of student learning in personal, interpersonal, and product and system building skills
ACT (A)	If the check step result confirmed that the problem has been eliminated and that it is not likely to recur, then the job is done. If, however, it was found that the solution has not accomplish the intended result or that there is still a possibility of recurrence, then it will be necessary to adjust the implemented solution.	Standard 12	CDIO program evaluation, which evaluates programs against these twelve standards, and provides feedback to students, faculty, and other stakeholders for the purposes of continuous improvement.

METHODOLOGY

According to Table 1, this research was created to develop student's integrative think skill through combining the CDIO (Standard 3, 5, 7, and 8) and PDCA Cycle principle, which the research framework represents in Figure 1. The target group was 85 students major in industrial management of business administration faculty, Rajamangala university of technology Isan, academic year 2020, which consists of 45 second year students and 40 third year students. The 2nd year students registered in operation management subject and the 3rd year students registered for factory warehouse subject.

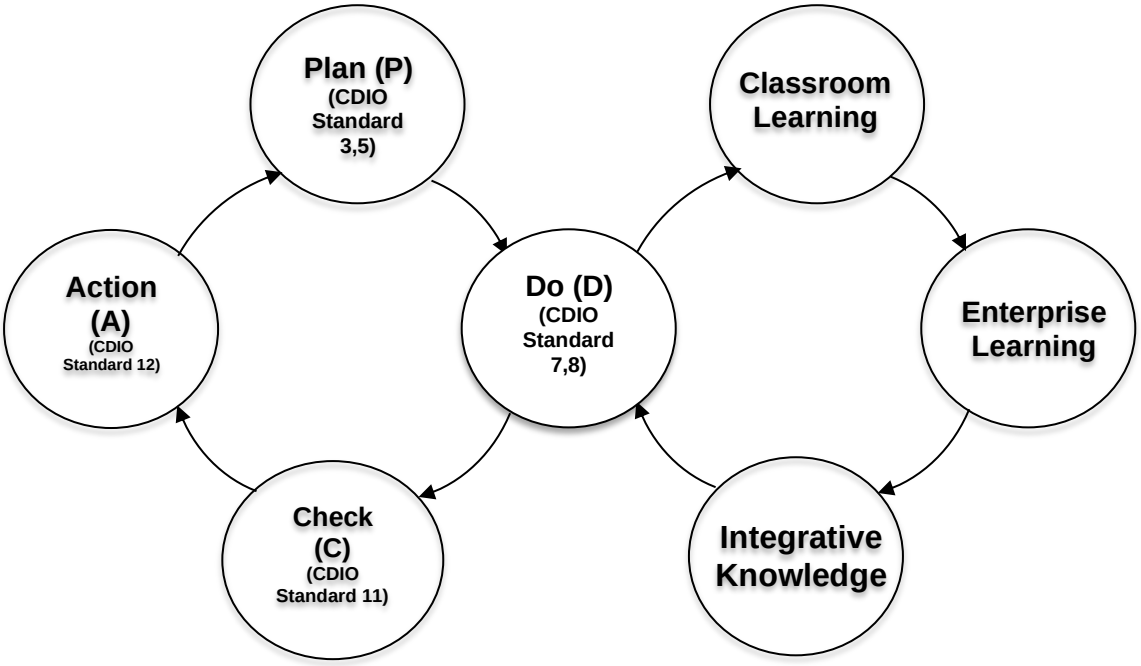


Figure 1. Integrating PDCA cycle and CDIO framework

According to Figure 1, the combined PDCA cycle and CDIO approach for "learning together and sharing experience" to support different year learning outcome, which comprises the following steps,

Step 1 "Plan" as defined the plan of integrative teaching preparation through integrating CDIO standard 3 and 5. Course specification of both subjects (i.e., operation management subject and factory warehouse subject) was designed using previous course report results and program specification as guideline or information to create elaborate course specification and course syllabus. Moreover, to increase creative thinking skills, RMUTI e-learning system was employed.

Step 2 "Do", CDIO standard 7, 8 were adopted. Classroom learning, and enterprise learning were developed to create integrative thinking skill. Classroom learning was designed for developing learner's knowledge, skills, and attitude in industrial management field. Furthermore, to develop English skill and ICT skill through personal assignment, the students have to search the article from international database such as ScienceDirect, Scopus etc. and then analyze comparing between the article and the chapter. With regarding team project, to create operation skills, entrepreneurship, teamwork and collaboration, ICT skills, communication, and problem-solving skills, team project was used, which the student groups were assigned different project, which related to the objective of each subject. one group consisted of 6 members: 3 members from second year students and 3 members from third

year students for one factory or enterprise Figure 2 (A) - (F), which 2nd year student will be assigned to explore entire firm's operational management and 3rd year student will be assigned to study and define problem enterprise's warehouse management then create solution to solve problem using mobile application for warehouse management system. There were 12 enterprises that support and collaborate to this study as follows,

1. Pimai Salt Company Limited
2. Chia Meng Marketing Co., Ltd. (Hongthong Rice)
3. Chok Yuen Yong Industry Co., Ltd.
4. Thai Mitsuwa Public Company Limited
5. Karma Mobility Co., Ltd
6. Isuzu King's Yont
7. Neastern Industry Co., Ltd.
8. K7 Business Group
9. Big C Supercenter Public Company Limited
10. Siam Makro
11. Namphirk Mae Chira Factory
12. Toy Orange Juice Factory

Step 3 "Check" or assessment and evaluation process as CDIO Standard 11, to evaluate learner's understanding by pretest and posttest in each chapter, midterm test 30 percent and final test 30 percent. Individual evaluation for personal assignment 10 percent. The contents for personal assessment such as taking responsibility by completing assignments in a thorough, accurate, and timely manner that achieves expected outcomes.

For term project focus on quality and project participants 30 percent. The presentation evaluation and peer evaluation are the judgment methods. In details, the evaluation for each participant is composed of individual evaluation and team evaluation, which the lecture marks the team by observing the participants how to organize the development process, evaluating the project outcome and presentation. The contents for team assessment such as problem solving/ creativity, collaboration/ teamwork, communication/ Interpersonal skills. For the team presentation assessment includes quality of presentation, time management, and report.

Step 4 "ACT or ADJUST", according to step 3 results, continuous improvement process was employed using learners' assessment result, course report adopting CDIO standard 12. If it was found that the result has not accomplish the intended result or that there is still a possibility of recurrence, then it will be necessary to adjust course specification for next semester.

(A) Siam Makro

(B) Isuzu King's Yont

(C) Chia Meng Marketing Co., Ltd. (Hongthong Rice)

(D) Karma Mobility Co., Ltd

(E) Pimai Salt Company Limited

(F) Namphirk Mae Chira Factory

Figure 2 Enterprise learning for factory warehouse and operation management.

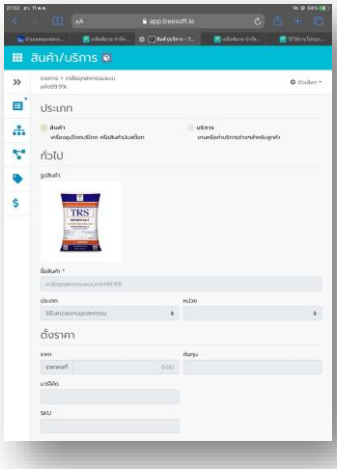
RESULTS

this study proposes a suitable integrated learning experiences for increasing industrial management student's competency of business administration faculty of Rajamangala university of technology Isan (Nakhon Ratchasima province) through learning design under the concept of learning together and sharing experience. With regarding data collection, the data was collected from 85 students major in industrial management, business administration faculty through using RMUTI's teaching assessment system, which the students were asked regarding teaching satisfaction 5 factors such as teaching preparation, knowledge, teaching technique, and activity, tools and information for teaching, evaluation, lecturer personality, and entire teaching satisfaction. For data analysis, frequency, mean, and standard deviation were used. Course report results are provided in Table 2 as follow.

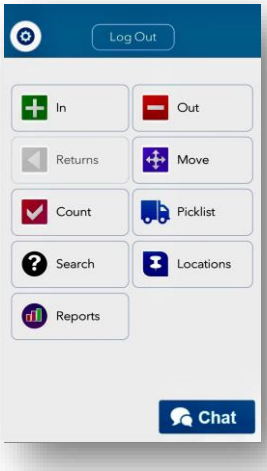
Table 2 course report

Teaching Satisfaction Details	$\bar{x}$	*S.D.*
Teaching preparation approach	4.42	0.69
Knowledge, teaching technique and activity	4.47	0.69
Suitable tools and information for teaching	4.43	0.68
Assessment and evaluation	4.45	0.68
Lecturer personality	4.42	0.68
Entire teaching satisfaction	4.45	0.69

Table 2 represented course report, which it can be explained that learners' entire teaching satisfaction score (mean = 4.45, S.D. = 0.69) seem to be on a high level of agreement of all questions. Moreover, the attitude towards "knowledge, teaching technique and activity" had the highest mean score of 4.47 and followed by assessment and evaluation (mean = 4.45, S.D. = 0.68), entire teaching satisfaction (mean = 4.45, S.D. = 0.69), and suitable tools and information for teaching (mean = 4.43, S.D. = 0.68), respectively. Moreover, the 3rd year students can integrate mobile application (Figure 3 (A)-(C)) to solve the problem for factory warehouse management particularly, 12 applications such as treesoft.io, stock zure, stock-envanter yonetim uygulamasi, stock management system, eStock: Stock Manager, inventory, Loyverse POS, Power Barcode, inventory management, Mon Stock, BP Stock, and WMS.



(A) treesoft.io



(B) Stock Zure

(C) Stock – Envanter Yonetim Uygulamasi

Figure 3 Warehouse management system on mobile platform

According to interviewed results, we collected the data from 45 2nd year students and 40 3rd year students. The 2nd year students said that the proposed model was a good teaching and can develop the students to understand regarding firm's operation management well. Moreover, it was an inspiration to study in industrial management way. Moreover, the 3rd year student suggested that the proposed model was an effective teaching, which can develop students integrative ability, integrative skill well such as communication skill, self-confident,

system thinking, and divergent thinking, teamwork and collaboration, ICT skills, and problem-solving skills.

CONCLUSION

The objectives of this study were to investigate the learning outcome applying Deming's quality cycle to develop integrative thinking skills and study the opinions of student regarding the proposed model under the concept "learning together and sharing experience". The target group of this research composed of 85 students major in industrial management, business administration faculty, RMUTI in academic year 2020. An integrating approach (i.e., Deming's quality cycle, CDIO principle) was created as conceptual framework in this study, which CDIO approach was combined with PDCA cycle to enhance quality improvement that suitable for business administration context in higher education or university level. The results of this study concluded that the proposed model can improve students' integrative learning performance, thinking skill through applying knowledge, multiple skill, and real firms' situation particularly.

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BIOGRAPHICAL INFORMATION

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