

# Practice of Integrated Project Teaching of *Management Information System* Course Based on the "Conceive, Design, Implement and Operate" (CDIO) Concept

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## ABSTRACT

The establishment of the course objectives of *Management Information System* is based on the "Conceive, Design, Implement and Operate" (CDIO) education concept and the ability demand of the marketing position. At the same time, by referring to enterprise information management or innovation practice, the system development process-oriented "learning situation" teaching unit is developed. The orientation of learning output is strengthened to make teaching reform of integrating theory and practice. What's more, diversified assessment methods are adopted, allowing students to perceive and experience working scene with phased fruit as guideline. The practice training of multiple learning situation project teaching helps students to improve professional ability and accumulate comprehensive skills and quality needed to adapt to the future post.

**Keywords:** CDIO, Management Information System, learning situation, integrated project teaching

## I. INTRODUCTION

*Management Information System*, a systematic, marginal and comprehensive interdisciplinary subject including covering information technology, management technology and system engineering, is an important elective course for students majoring in computer science in senior grades and also the core course of information management major. Many colleges and universities take it as a compulsory course of information management and system, business administration, marketing, financial management and other majors. This course plays an important role in the cultivation of applied talents [1]. The course requires both theoretical knowledge and practice. Students are required to have a solid theoretical foundation and systematic planning, analysis and design skills. Therefore, the CDIO teaching mode is integrated into the teaching reform of this course, and the integrated project-driven teaching mode based on professional ability cultivation is explored and practiced in combination with the training objectives of marketing major. The teaching idea of engineering practice is adopted to construct multiple learning situations with students as the center and learning output as the guidance. Students are the leaders of practical projects in the implementation of integrated project teaching, which greatly stimulates students' learning enthusiasm,

improves their practical ability and innovation, and enhances their internalization of knowledge and skills.

## II. THE CDIO CONCEPT

CDIO engineering education model is the latest achievement of international engineering education reform in recent years, which has been implemented in many universities around the world and achieved good results. CDIO ability outline and 12 standards are the two most important documents to check when implementing CDIO engineering education model [2]. CDIO is short for "Concept, Design, Implementation, and Operation". Its concept not only values the "teaching" and "learning" of abstract theoretical knowledge, but also emphasizes the importance of "doing" in teaching process, which fully embodies the leading thought of "student-centered" and changes the traditional teaching mode of "teacher-centered" [3]. It serves as the reflection of the principle of "learning by doing" and the concept of "PBL". By taking the life cycle of engineering projects (including products, production processes and systems) from planning, R&D to operation and maintenance as the carrier, it enables students to establish connection between courses and knowledge modules of courses through practice. Originated in the field of engineering, the CDIO model has been developing and improving itself, and has achieved fruits in such fields as humanities and social sciences, such as the construction of the teaching system of international trade major, of financial management, etc. [4] Curriculum teaching is the core

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element of talent training, while practice teaching is an important way to deepen and consolidate theoretical knowledge, and also an effective teaching method to improve students' professional skills and practical ability.

From the perspective of system theory, engineering practice is a practical activity including many subsystems, which determines the reproducibility and generation of its implementation process. All kinds of contingency factors will emerge randomly and lead to unexpected chain reaction, which also makes engineering activities full of exploration, uncertainty, risk and creativity. "Integration", the core idea of CDIO engineering education mode, is directly reflected in CDIO standard 3 (integrated course plan) and standard 8 (integrated learning experience). Such "integration" mainly aims to solve the binary split between theory and practice, knowledge and ability. The implementation of systematic and integrated teaching process allows students to acquire more comprehensive ability by establishing relevance of knowledge while mastering subject knowledge. The training objectives of the basic theories of *Management Information System*: system theory and information theory, are also to understand the cognitive methods of the system and master the strategies and methods of system modularization. In the exploration of information system projects, the understanding and abstraction of the environment from the perspective of information are usually based on the specific needs of the objective world. The conclusions formed by students through exploration are also diversified, which is consistent with the principle of inquiry contained in engineering education.

### **III. DEFECTS OF TRADITIONAL TEACHING MODE OF MANAGEMENT INFORMATION SYSTEM COURSE**

At present, many universities or majors still follow the traditional teaching mode in teaching *Management Information System*: taking teachers and teaching material as the center, and imparting knowledge to students in a cramming manner. In the whole teaching process, the teacher occupies the dominant position and the students are in the passive receiving state, which leads to the low learning interest and initiative of the students. In addition, students do not firmly grasp the basic knowledge, methods, skills and application tools needed, failing to meet the curriculum requirements of knowledge, ability and quality. The teaching effect is also affected to some extent, failing to meet the training standards required by the curriculum syllabus.

What's worse, traditional teaching mode tends to ignore the cultivation of students' professional ability, but takes course content or textbook as the standard and requirement of teaching implementation, which

inevitably results in the split of "knowledge" and "ability", and fails to demonstrate the priorities of different majors on knowledge and competency goals (for example, business administration focuses on system analysis and design, and information management focuses on system implementation). Research shows that knowledge and ability complement each other. Therefore, the "ability-oriented" teaching, which takes knowledge and basic theory as the carrier, employs appropriate methods and tools, and cultivate students' ability to discover and solve problems in practical application, is more in line with the basic pursuit of undergraduate education and more conducive to students' sustainable development.

The interdisciplinary characteristics of *Management Information System* make it more difficult for teachers, and the abstractedness of the basic theory and the complexity of the development methods also require more for the teaching model. CDIO education mode focuses on the cultivation of students' four abilities (theoretical knowledge, individual learning ability, teamwork ability and systematic comprehensive ability), which requires students to change their roles, and teachers to update their educational concepts.

### **IV. TEACHING PRACTICE OF MANAGEMENT INFORMATION SYSTEM**

CDIO concept stipulates that the implementation of practical projects should be combined with professional positioning and course teaching. Starting from the post capacity requirements of marketing practitioners, this project divides marketing jobs into the following 8 categories according to the similarity of the requirements through interviews with enterprise marketing managers and statistics on relevant headhunter websites: market research post, sales post, customer service post, public relations/media post, sales managers, planning managers, customer managers, and public relations managers. Specific requirements and job responsibilities are omitted.

#### *A. Setting up talent cultivation objectives, and analyzing requirements of professional positions*

The essence of CDIO concept is to cultivate students' professional ability. It is a must to set up talent cultivation objectives according to market demand, make clear the professional ability requirements, and achieve the objectives of the ability training through different courses of the curriculum system. In this paper, combined with the training objectives of applied and versatile senior marketing management talents of this major, the above post categories and tasks are analyzed, and the ability requirements of marketing major are expounded from the aspects of regular practice, professional practice, research and innovation, entrepreneurship and social adaptability. For example, market research ability refers to analyzing market

information and discovering potential markets through surveys. It is necessary to be capable of using scientific methods to systematically and purposefully collect, record, sort out, analyze and study information related to products, information of competitors and similar

products, and put forward reasonable suggestions, thus providing a basis for decision-making of enterprises. The rest is not listed for space cause. The specific content is shown in "Table I".

**TABLE I. OUTLINE OF THE CAPABILITIES OF A MARKETING MAJOR**

1. Regular practice	2. Professional practice	3. Research and innovation	4. Entrepreneurship and social adaptability
1.1 Computer professional skill 1.2 Network capability 1.3 English ability of listening, speaking, reading and writing 1.4 Professional business English 1.5 Ability to operate and manage information systems	2.1 Market research 2.2 Marketing planning 2.3 Business negotiation 2.4 Public Relations 2.5 Marketing management	3.1 Comprehensive ability to complete the marketing planning, promotion and investigation of a real product or project in a real marketing environment on the basis of regular practice and professional practice	4.1 Reflection and innovation 4.2 Ability to learn and adapt, pioneering and innovative 4.3 Professional ethics, integrity and sense of responsibility 4.4 Interpersonal skills 4.5 Teamwork 4.6 Written and oral communication

**B. Clarifying the teaching objectives and constructing the matrix of competence objectives**

According to the outline of professional ability defined by the requirements of vocational ability, and combining with the characteristics and nature of the course, the teaching objective of "trinity" is designed. The knowledge goal is to enable students to systematically understand the development of MIS, grasp the basic theory, concept, principle, structure and function of MIS, and master the methods, techniques, processes and procedures of MIS organization, management and application development. The ability goal is to master the system planning, system analysis, system design, system implementation and maintenance of MIS, train students' basic ability of MIS planning, analysis, design and implementation, and focus on the ability of relevant analysis report, model construction,

communication and outreach. The quality goal is to foster students' professional quality, professional ethics, working attitude, team cooperation consciousness, strong study interest, the desire of lifelong learning, communication skills, and ability of accumulating knowledge. Students are guided to understand information systems from multiple perspectives of management, organization and technology, and learn to effectively combine information systems with business strategy, organizational control and business processes in different environments to gain competitive edge. Based on this and in combination with the CDIO curriculum syllabus, the correlation matrix between curriculum modules and ability objectives is formed, and the teaching requirements are defined according to the importance and difficulty of the teaching content. The specific content is shown in "Table II".

**TABLE II. CORRELATION MATRIX BETWEEN COURSE MODULES AND COMPETENCE OBJECTIVES**

First-level indicators	Second-level indicators	Third-level indicators (course module)	Teaching requirements
1. Regular practice	1.1 Computer professional skill	3.3 Database technology	T、I
		5.5 MIS system analysis	T、I、U
	1.2 Network capability	3.4 Computer Network	I
		4.4 Business process reorganization	T、I、U
	1.5 Ability to operate and manage information systems	5.3 Data requirements analysis	T、I、U
4.1-4.4 MIS planning		T、I	
2. Professional practice	2.1 Market research	7.1-7.4 MIS system implementation	T、I、U
		2.5 Case Analysis-Feasibility Analysis	I、U
		4.5 MIS development strategy	T、I、U
		5.1 Information System Analysis and Investigation	I、U
		5.2 Management business survey	I、U
3. Research And innovation	3.1 Comprehensive ability of project practice	5.3 Data requirements analysis	T、I、U
		4-7 MIS structured life cycle	T、I、U
		8.2 Object-oriented modeling	T、I、U
4. Entrepreneurship and social adaptability	4.1 Reflection and innovation	4.4 Business process reorganization	T、I、U
		6.2 System functional structure design	T、U
	4.4 Interpersonal skills	6.3 Code design	T、U
		4.1-4.3、5.1-5.3	T、I、U
4.5 Teamwork ability	Analysis report, design specification and course design	T、I、U	
4.6 Written ability			

<sup>a</sup> Note: T is Teach, I is Introduction, and U is Utilization; the three-level index serial number is the syllabus chapter number.

### C. Creating course learning situation and optimizing practical project design

The situated cognition theory holds that the essence of learning is a process in which individuals participate in practice and interact with others and the environment. Situational learning is a design process that summarizes the learning conditions and accelerates learning, also a process that the individual cultivates ability of practical activities and improves their social ability. It embodies the characteristics of situational learning, authenticity, guidance, practice, inquiry, reflection, consultation, motivation and initiative. To improve students' learning interest and classroom teaching effect, a teaching model combining cases and practical projects is introduced. The premise is that, before the implementation of classroom teaching, the

learning situation should be constructed, ability objectives should be defined, "through-type" teaching cases should be designed, and practical tasks and outputs should be defined. Six scenarios of basic knowledge, technical basis, system planning and analysis, system design, system implementation and object-oriented analysis and design of *Management Information System* are set up, covering the whole life cycle of structured method and object-oriented development method. In addition, four practical projects are combined to integrate theory and practice. It should be noted that each learning situation should have corresponding learning output, and the case design should run through the whole teaching system, reflecting the stage of the work process and the integrity of the system. The specific design is shown in "Table III".

TABLE III. CONSTRUCTION OF *MANAGEMENT INFORMATION SYSTEM* LEARNING SITUATION

Learning situation	Competence objective	Case	Practice project	Learning output
Scenario 1 Basic knowledge of MIS	1. Master related concepts, applications and development of <i>Management Information System</i> ; 2. Understand the challenges facing the <i>Management Information System</i> and its relationship with the enterprise.	Dell Computer Corporation-Pioneer in E-Commerce	Practice one: MIS case analysis	Case study report (individual)
Scenario 2 MIS technology foundation	1. Understand data processing, data organization, database, computer network and other technologies; 2. Grasp the supporting system and operating environment of the <i>Management Information System</i> .			
Scenario 3 MIS system planning and analysis	1. Master MIS development strategies and methods; 2. Ability to prepare feasibility analysis report; 3. Ability to conduct structure survey and management function survey, and use PowerDesign to build conceptual models, including the drawing of organization structure chart, business flow chart and data flow chart, and the writing of data dictionary;	Case 1: Supermarket Invoicing System Case 2: Library Management System of University Case 3: WeChat group buying marketing system	Practice two: MIS system analysis	System Analysis Specification (Group)
Scenario 4 MIS system design	1. Capable of functional module design; 2. Capable of code design; 3. Able to design data storage; 4. Able to carry out I/O design.			
Scenario 5 MIS system implementation	1. Understand the process and management of the system; 2. Master the system switching and operation mode			
Scenario 6 Object-oriented analysis and design	1. Understand the difference between object-oriented methods and structured methods; 2. Master the construction of static models; 3. Master the construction of dynamic models; 4. Master the UML unified modeling language specification and the use of StarUML tools.		Practice Four: Object-oriented analysis and design	OO analysis and design report (group)

#### D. Launching comprehensive ability evaluation and promoting the all-round development of students

CDIO education mode requires the cultivation of various abilities of students, and advocates different abilities to be evaluated in different ways [5]. The assessment of students' practice must take into account their performance, analysis reports, teamwork, comprehensive qualities, etc. It is necessary to establish a diversified curriculum assessment system for the purpose of cultivating students' ability. Students should be evaluated according to their performance in the process of project implementation, task completion, project effect, etc., and a comprehensive evaluation

mechanism should be established with the completion of related indicators of actual work tasks as the main focus, and project and theoretical assessment as the auxiliary. In addition, the students' class attendance, questions and answers, operation process, homework and project work should be evaluated. After two semesters' trial and adjustment, the grade of this course is mainly composed of classroom performance, basic theory assessment, basic practice assessment and comprehensive practice assessment. The change of assessment method plays a role in improving students' ability of knowledge application, self-learning, solving practical problems and cultivating team spirit. The specific content is shown in "Table IV".

TABLE IV. DIVERSIFIED ASSESSMENT METHODS FOR *MANAGEMENT INFORMATION SYSTEM*

Evaluation project	Evaluation content and proportion	Capability indicators	Evaluation method	Evaluation subject
Classroom performance	Class attendance (5%) Class participation (5%)	Learning process, learning attitude, learning interest, etc.	Sign in, roll call Class record	teacher student
Basic theory assessment	Chapter Quiz (10%)	Mastery and application of theoretical knowledge, learning track, time skills, etc	Test questions	teacher
Basic practice ability assessment	Training 1 work description (10%) Training 2-Training 4 (20%)	Application of software operation skills, comprehensive skills, etc. Research ability, creative interpretation ability, communication ability, system planning, system analysis, system design, teamwork, etc.	Group evaluation Teacher Comments Report evaluation	student teacher
Comprehensive practice ability assessment	Course design (50%)	Comprehensive design capabilities (innovation awareness, project awareness, system design, teamwork, information gathering, communication skills, etc.)	Design evaluation	teacher enterprise

## V. CONCLUSION

The practice shows that the above teaching design of constructing learning situation, implementing case teaching and combining with integrated project task is helpful to stimulate students' learning enthusiasm and enhance their awareness of problem inquiry. What's more, the questionnaire results prove that students generally advocate course content design, teaching method and achievement evaluation method, and take that study and practice of the course enhance their learning ability, learning initiative, teamwork, communication, modeling software operation ability, innovation consciousness, anti-pressure ability, and even responsibility, especially their understanding of currently popular network application system and management system, which shows the feasibility and effectiveness of the teaching mode of integrated project design based on CDIO concept. The author proposes

the following suggestions to ensure the successful implementation of the instructional design.

#### A. The change of teachers' roles and concepts is the premise for the implementation of CDIO curriculum reform

Teacher, the direct designer and implementer of classroom reform, should realize four changes in educational roles and concepts in combination with CDIO ability outline and cultivation standards. The first is to pay attention to the transfer of knowledge to ability training, the second is to change from teacher-led teaching method to student-centered direction, the third is to focus on the transformation from scientific system to comprehensive engineering, and to build engineering awareness [6], and the fourth is to value the transformation from unit knowledge to integrated teaching process, reflecting the correlation between subject knowledge and curriculum knowledge.

*B. The integrated project design is the basis for implementing CDIO curriculum reform*

The integrated design of the project can start from the following two aspects. The first is to relieve the disconnection between theoretical foundation and practical ability through course content that combines both theory and practice, so as to realize their integration. The second is the integration of teaching, learning and doing. The teaching combining theory and practice to cultivate students' ability should be considered as a whole, so that teachers and students can teach, learn and practice at the same time to build a framework of quality and skill training, and enrich classroom teaching and practical teaching.

*C. Specific learning output is the key to implement CDIO curriculum reform*

Engineering activities are themselves designed to build tangible results, and what best demonstrates the quality of teaching is the result of teaching and learning: the learning output. Therefore, teachers must have a clear understating of the teaching objectives and students' abilities, and then design appropriate learning outcomes to ensure that students achieve these objectives.

*D. Comprehensive ability evaluation is the guarantee for implementing CDIO curriculum reform*

Integrated project teaching is a complete process, a synthesis of a series of activities, and the evaluation and feedback of comprehensive vocational ability. The assessment approaches with diversified forms and scientific methods should be adopted to evaluate students' research ability, comprehensive application ability, professional quality and problem-solving ability. A comprehensive assessment system based on vocational competence should be established to ensure that students can demonstrate their knowledge, understanding and ability.

Education Model in Shantou University [J]. *Researches in Higher Education of Engineering*. 2014 (01): 27-37. (in Chinese)

- [6] Xu Juanling. Review on the Teaching Reform of China Higher Vocational Colleges Based on CDIO [J]. *Journal of Higher Education Finance*.2019,22(03): 11-20.(in Chinese)

## **References**

- [1] Tang Lihua, Zhang Zhiyuan. The Application and Research of CDIO in the Teaching Reform of Management Information System Course [J]. *China Management Informationization*. 2014, 17 (24): 119-120. (in Chinese)
- [2] Gu Peihua, Bao Nengsheng, Kang Quanli, Lu Xiaohua, Xiong Guangjing, Lin Peng, Chen Yan. CDIO in China (Part I) [J]. *Researches in Higher Education of Engineering*. 2012 (03): 24-40. (in Chinese)
- [3] Ying Hong. Teaching Practice of Database Principle Course Based on CDIO Engineering Education Concept [J]. *Education and Vocation*. 2013 (06): 139-140. (in Chinese)
- [4] Zhao Rongying, Wang Xu, Qi Yongkang, Wei Xuqiu. Teaching Model and Practice of Knowledge Management Curriculum under the Concept of CDIO [J]. *Library*. 2019 (03): 75-79. (in Chinese)
- [5] Gu Peihua, Hu Wenlong, Lin Peng, Bao Nengsheng, Lu Xiaohua, Xiong Guangjing, Chen Yan. OBE Engineering