



# Research on Practical Teaching of Employment-Oriented Web Technology Based on CDIO

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**Abstract.** This paper integrates and improves the teaching resources of “Web programming (Java Web)”. Based on CDIO and under the guidance of CDIO-CMM (Capability Maturity Model), this paper puts forward a new practical teaching system of Web programming courses and a new method of course teaching on content, form, and the assessment method, in view of the actual situation of undergraduates major in computer in Xinjiang Normal University and the existing problems in the teaching of this course. This paper also summarizes the effectiveness and experience in actual teaching of this technology and makes a useful exploration to train qualified software personnel better to meet the needs of the companies and improve the employability of the students.

**Keywords:** Web programming · CDIO · Practical Teaching

## 1 Introduction

Web-based software development occupies an important position in the IT industry and is an important employment direction. If students can master this technology in school, it can improve the employment rate of students to a certain extent. Therefore, the Web programming course undertakes the task of cultivating students’ practical ability of Web programming engineering. The training goal of the course is to enable students to understand the basic principles of Web program development, master a specific technology of Web development (JavaWeb), have the ability to develop server-side programs, and finally cultivate the ability to write high-quality code, and be able to debug code defects and complete Engineering-oriented and application-oriented talents of primary Web development for module design work. The course “Web Programming (JavaWeb)” is a professional course based on the development of the computer software industry and the actual situation of the current undergraduate students majoring in computer science in our school. It adopts the cooperation model of project teams, which can also overcome the laziness of some students. Increase team awareness.

## 2 Teaching Organization and Learning Objectives

An effective teaching organization scheme proposed in Reference 4 has achieved very good teaching results from the experimental data provided by it. On this basis, combined with the reality of Xinjiang education, we analyzed the CDIO teaching for Web programming design. The goal is to divide the learning goal of Web technology into two parts, one is the technical goal, and the other is the CDIO ability training goal [4]. The technical goal is mainly the specific requirements that students need to master the technology in the course. It consists of 6 aspects: 1), have the ability to edit requirements analysis documents, design documents and instruction documents; 2), explore the comprehensive influence between system analysis, system design, system implementation and actual operation effects; 3), master MyEclipse platform development method; 4), apply object-oriented ideas to design the system; 5), use multi-threading technology to optimize system efficiency; 6), analyze the inconsistency between system conception and system design and the reasons for it. The CDIO ability training goal is mainly to cultivate students' technical knowledge and reasoning ability, personal ability, professional ability and attitude, interpersonal ability, and the ability to conceive, design, implement, and run systems in corporate and social environments at four levels, as shown in Table 1 shown.

**Table 1.** CDIO capability objectives

CDIO capability	Name	CDIO capability	Name
Technical Knowledge and Reasoning	Programing basic	Interpersonal skills, team work and communication	Organizing effective teams
	Web Design Fundamentals		Team work run
	Data structure		
	Object-oriented programming		
Personal competencies, professional competencies and attitudes	Identifying and expressing problems	Conceive, design, implement, and operate systems in corporate and social contexts	Technology entrepreneurship
	Analysis with Uncertainty		Work successfully in an organization
	Solutions and Recommendations		Establish system goals and requirements
	All-round thinking		Define function, concept and structure
	Appearance and Interaction of the System		Management of development projects
	Determine priorities and Priorities		Designing process
	Perseverance and flexibility		Application of knowledge in design
	Creative thinking		Software implementation process
	Critical thinking		System test
	Management of time and resources		Operational Design and Optimization

### 3 Instructional Design

Aiming at the reality of the undergraduates majoring in computer science in Xinjiang, this paper reforms and redesigns the teaching content of Java-based Web technology, and builds a teaching content system that integrates theory and practice. Cancel the teaching content that has nothing to do with the actual experimental development project requirements, reduce the content skeleton, target the successful development of the project, not the high performance, cultivate and guide students' ability to discover and solve problems independently, while retaining the original necessary. In addition to the practical training, phased development projects are added to lay the foundation for the development of the final product, and the total learning time remains unchanged. The course is divided into two parts: theoretical teaching and project teaching. The two are interconnected and completed together. Through staged practical training and imitation training, students can finally come up with a product (Table 2).

Java-based Web technology involves a lot of knowledge. If it is only assessed in the form of traditional knowledge points, it is difficult to reflect the actual development

**Table 2.** Design of practical teaching content

Teaching content	Teaching objectives (knowledge, ability, quality)	Case
Java Web overview and environment construction	Master the overview of JavaWeb applications; master the construction of the operating environment and development environment; understand the development history of JavaWeb.	Online bookstore app
Web input and JavaScript processing	Master the input methods of Java Web applications; master the usage of common form elements; master the use of JavaScript for common client-side processing.	
Instructions and Actions in JSP	Master the usage of instructions and actions in JSP;	
Requests, responses, and information transfer between pages	Master the use of JSP internal objects; master the method of page interaction; master the method of page components to transmit information.	
File and Database Programming	Understand the configuration files and property files in web applications; master the creation and processing methods of folders; master the creation and processing methods of files.	
Business processing (JavaBean)	Master the server-side processing method JavaBean application; Write and deploy JavaBeans; Access existing JavaBeans in Java code.	

(continued)

**Table 2.** (continued)

Teaching content	Teaching objectives (knowledge, ability, quality)	Case
Common output (expression language, standard tag library)	Can use expression language to output various information; can use JSTL to complete output; can use various techniques to format output information; can initialize input elements; can dynamically generate form elements.	Shopping cart application
Internal object	Master the objects related to input and output; master the objects related to attributes.	
Servlet and controller	Master how to write a servlet; master the function to be done as a controller.	
Storage and Access of Dynamic Information	Master how to store information in web applications; master how to access information in application, session, and request related objects in memory; master how to use cookies to save information on the client side; master access to configuration information in web.xml; master XML files Access to the information in the property file; master the access to the information in the property file; master the access to the Excel file information.	
JDBC Technology	Master the use of the main interfaces of JDBC-API; master the basic process of using JDBC to connect to the database; master how to use JDBC to query information from the database; master the configuration of the database connection pool in Tomcat; master the use of the connection pool.	
Program debugging and testing	Master the debugging and testing methods and processes of programs.	Caiya online shopping Co., Ltd
Security Control and Internationalization	Security control and internationalization methods and processes.	

ability of students, and it will give students a wrong direction. The assessment method of the course is to assess the students' mastery of knowledge points by means of examination papers. By improving the score ratio of the stage development ability assessment and the overall project design and development ability assessment, the students will be comprehensively evaluated, and the students will discover problems and problems independently. Problem-solving skills, evaluate students' project documentation, level of

development, and the overall effect of their work. The proportion of students' assessment results is: total score = test paper\*30% + stage development ability assessment\*30% + overall project design and development ability assessment\*40%.

## 4 Conclusions

The Java-based Web technology course has carried out exploratory reform under the premise of ensuring the smooth transition of students' knowledge structure under the funding of the school's teaching research reform project, and has achieved certain results. Students have mastered the basic knowledge points of the course, and can learn independently, solve practical problems, especially their engineering and professional abilities have been improved, and they have cultivated team awareness and the ability to think in all directions, which basically reflects CDIO's "knowledge, ability, and quality". Trinity teaching goals.

Through the reform, students have been helped to establish systematic thinking, including the development of projects and the study habits of individuals and groups, because a reality of the previous students in this course is that a large proportion of students lack the ability to study initiative and systematic time arrangement, so The overall learning objectives are not well achieved. Through the reform, the habit of students to carry out project training by rote has been basically changed, and a correct engineering thought has been established.

Using the teaching method based on the CDIO concept has changed the negative effects of similar cramming teaching, and improved the students' comprehensive ability and understanding. In the actual teaching process, most students no longer feel boring. At the same time, we interspersed the organizational form of software enterprises, management activities and capital use in the teaching reform, and simulated when appropriate, so that students have a certain understanding of professional knowledge, employment prospects, and corporate environment. Discussion and learning efficiency are significantly improved. Through the "learning by doing" method of simulating enterprise projects, the phenomenon of disconnection between theory and practice has been eliminated. Improve students' interpersonal skills, teamwork skills and system thinking skills.

Under the funding of the school's teaching research reform project, through teaching reform and practice, the research group has compiled the "JavaWeb Programming Experiment Teaching Guide" and the project-based multimedia courseware system, as the main carrier and platform for the application of the research results of the project. The future research and development of the course lays the foundation.

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