

# Exploration and Research on Web Programming Course in Higher Vocational College Under 1+X Certificate Pilot System

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## ABSTRACT

Shanghai Polytechnic University is one of the universities that carry out the web development 1+X certificate pilot system. 1+X certificate pilot system has pointed out the direction for China's vocational education. Web programming course is the core course for web development 1+X certificate, which requires students to cooperate the knowledges from several prerequisites together and highlights a lot on programming practice. Under the web development certificate system, the professional goals are in line with the requirements of web development engineers from IT industry. To meet the new requirements, some reforms should be carried out in our web programming course. Some novel ideas on teaching contents, teaching methods or modes and evaluation measures have been introduced into our course. Project-driven method is adopted to train students practical abilities. At the same time, flipping class teaching mode is used in our teaching practice in order to make good use of students after-class time. From our teaching practice, these methods have been proved effectively.

**Keywords:** 1+X certificate pilot system, web programming, project-driven, flipping classroom

## 1. INTRODUCTION

In 2019, the State Council and the Ministry of education of P.R.C. successively issued the implementation plan on national vocational education reform[1] and the pilot scheme for implementing the system of academic certificate plus several vocational skill level certificates in colleges and universities(1+X in short) [2]. At the national level, it is of great significance to put forward the overall implementation plan for the reform and development of vocational education. The program clearly points out that vocational education and general education are of the same importance though they are two different types of education. In the new era, the reform and development of vocational education calls for the transformation from general education to vocational education. It aims to improve the modernization level of vocational education and provide high-quality talent resources for promoting social and economic development and improving national competitiveness[3].

With the development of Internet plus and new emerging technology industries, our society is in great demand for technical talents on web development and mobile terminal development. It is clear that colleges or universities should focus on the new trend and cultivate students to have professional ethics and professional skills to meet the new demand. Web development pilot certificate is a certificate to meet the new demand. The professional goal and professional ethics of web development certificate is just in

line with the requirements of IT enterprises on web development engineer post.

After careful preparation, Shanghai Polytechnic University is been chosen one of the colleges or universities that firstly carry out the web development 1+ x certificate. To meet the new demand of job market and the requirements of web development certificate, there are some transform need to be carried out in our teaching plan on web development program. In teaching practice, the skill level standards of web development certificate should be integrated into our major professional courses. At the same time, we should optimize our professional curriculum system to improve our personnel training quality. Our primary goal is help our students to obtain the professional qualification certificate. In the long run, our ultimate goal is to help our students more adaptable to the job market and achieve high in their careers.

Web programming is a highly comprehensive and highly practical course, which is one of the most important core curriculum in web development certificate used to cultivate the comprehensive ability on design and development on web-based applications. It will involve the knowledge points from several prerequisites, such as Hypertext Markup Language(HTML in short), Cascading Style Sheet(CSS in short), responsive website development, relational database and sql language, client-side scripting languages and etc. Now the popular web programming languages are the followings: ASP.net, JSP, PHP and so on. PHP is one of the most popular server-side scripting language, which is of the following features: open source, cross platform and easy to use. According to statistics,

more than 70% of the world's top 1 million websites are developed with PHP server-side scripting language. And that is why in web development certificate, PHP is the choice of server-side scripting language. According to the data statistics of some leading employment websites, there is a great need on web programming talents. And at the same time, the number of graduates from web development program who are able to satisfy with the industry need is less. Even those students who passed web programming course with a high score still have stilled failed when facing a real task. The main aim of 1 + X certificate pilot system is to cultivate the talents that can meet the industry requirements. To meet the ability requirments of web development post, some reforms should be performed in our web programming course.

The rest part of the paper is organized as follows: section 2 introduces the characteristics of web programming and the current situation of web programming course. And then the reform schema on teaching contents and teaching methods reform is proposed in section 3. The practice of teaching reform is presented in section 4. We cooperate project-driven teaching method and flipping classroom together. Finally concludes the paper in section 5.

## **2. CURRENT SITUATION ANALYSIS**

Web programming course focuses both on theory and programming practice at the same time. And it requires the students have solid practical skills. In the teaching practice, there are several issues needed to be solved well.

### ***2.1. Emphasis on the systematicness of theory and ignorance the cultivation of ability***

In some traditional teaching model, teachers control the whole class entirely and take up a lot of time. Teachers are the center of the class and students are the passive listeners. Teachers try their best to give all the knowledge to students and they are too busy to teach and have no time to cultivate students' professional abilities. This is the typical teaching-oriented mode. This mode is good for the teaching organization and the regulation of the teaching process. Students are trying their best to absorb the knowledge that teachers tried to teach them and they have no time to develop their own practical skills. Consequently these students will feel tired to absorb these knowledge without knowing how to use them in their practice.

### ***2.2. Teaching contens are hard to meet the requirements of industry***

Now most of web programming course, the teaching contents are arranged according to the sequence of the knowledge system. During the process of teaching, some trivial sized or independent demos will be introduced to explain these knowledge. Studnets have no idea how to

design and develop a whole web-based application from scratch. They don't know how to use all the knowledge to fulfil a whole application. When these students face a real task, they are in short of the experience of analysis the problem and solve the problem. They can do some mini-sized problems while they don't know how to cooperate these problems together. These students will be at a disadvantage for IT enterprises need graduates with some practical experience so they can be used after a few training.

### ***2.3. Students' learning time and learning space are limited in the classroom***

Web programming course pay much attention on cultivating students' practical skills. It means students need pay much time on it and do more practice out of class. Contemporary college students are growing up in the environment of modern information technology, they are more likely to accept information-based learning mode and Internet social media. It is necessary to change the traditional talent training and teaching mode to make good use of students after-school time. We'd better build an educational information system that everyone can learn, everywhere can learn, and always can learn, and actively explore new teaching modes and teaching means.

## **3. INNOVATION ON TEACHING ORGANIZATION AND TEACHING IDEAS**

### ***3.1. Innovation on teaching contents***

In most of traditional teaching mode, the teaching contents are arranged in the sequence of the knowledge system. And some simple examples will be showed to explain these knowledge. Students have no direct idea of how to apply these knowledge into real work. One of the most important factor that affects teaching quality is the teaching contents. In order to change the status quo, we carry out some innovation on teaching contents. A real and complete project from IT enterprise is selected as the example in our teaching contents. All the teaching contents are centered on the well-selected project. Tteaching activities are designed based on the project. The sequence of how to design and how to develop the project is the sequence of how to organize all the teaching activities. To fulfil the project, the project is divided into several subproject in line with the process of web-based project development. And there are several task in one subproject. All tasks are arranged in a gradual and spiral way. Next task may be developed on the previous task. There are some knowledge points need to be introduced during the prcess of fulfilling each task. Project leading and task driven are the main features of our teaching contents' arrangement. The new knowledge points are learned during the process of completing every task.

Students not only learn the knowledge points but also know how to apply them into practice. And at the same time, we cultivate students how to analysis a problem and how to use the knowledge points into solving a problem. We pay no attention on the integrity of the whole knowledge points. All the knowledge points are instructed on the principle of necessity and sufficiency. There is no need for students to know every detail of the entire knowledge system. The principle of "sufficiency and necessity" is proposed in particular as the basic requirement for the curriculum.

Based on the analysis and decomposition of "news management system", web programming course integrates the knowledge, ability and professional quality that web programmers should have into the project case development. Table 1 is the established curriculum system based on working process. Taking an news management system project as an example, it is divided into seven sub-projects. Each sub-project is composed of one or more tasks, and the learning of knowledge points is integrated into the task.

**Table 1. Curriculum system design based on working process**

Units	Reference Hours	Learning tasks
Building PHP website development platform	2	Task 1: Building PHP website development platform
Project requirements analysis and database design	2	Task 1: Requirement analysis of news management system
	2	Task 2: System database design
Design and implementation of users' registration function	4	Task 1: create a user registration web page
	4	Task 2: data validation of user registration
	4	Task 3: upload user's head image
	4	Task 4: save the registration information into database
News type and browsing news	2	Task 1: design and implementation of browsing news type information
	4	Task 2: design and implementation of browsing news information
	4	Task 3: design and implementation of news search function
User login and user post comments and reviews on news	4	Task 1: design and implementation of user login function
	4	Task 2: add statistics of news' visitors and news' likers
	2	Task 3: comment on news
Design of web site Homepage	2	Task 1: design the master page of web site
	4	Task 2: using the master page to redesign the pages in foreground of website
Design and implementation of website back-end system	2	Task 1: design and implementation of administrator login page
	2	Task 2: the home page of website background
	4	Task 3: design and implementation of user management
	2	Task 4: design and implementation of news type management
	2	Task 5: design and implementation of news management
	2	Task 6: design and implementation of news comments management
	2	Task 7: project packaging and deployment

### 3.2. Innovation on teaching methods

Teaching method refers to the general principles, pedagogy and management strategies used for classroom instruction. Since teachers and students are the most important two parts in the teaching process, teaching must be a combination of teaching methods and learning methods. Web programming course is a very special course which focus not only on theory learning but also on cultivation of students' practical skills. And it pay more attention on

students' practical skills. In order to improve teaching effects, some teaching methods should be used together to cultivate students' ability on web-based application.

- Project-driven approach

Project-driven approach is a teaching method in which students learn by actively engaging in real-world and personally meaningful projects. Students work on a project that engage them in solving a real-world problem. As a result, students develop deep content knowledge as well as critical thinking, collaboration, creativity, and communication skills. In our course, all the teaching activities are surrounded by the real project from real-world.

Teacher is no longer the center of the class. Students are the center and the teacher is the guider or facilitator of the class. And students are no longer the passive receiver and they become the active participants.

- Analogy teaching method

During the process of instructing theory teaching, we can connect the new topic with some familiar information to make it visually and vividly. The examples in the daily life can be used to analogy some knowledge points.

- Heuristics teaching method

During the teaching process, we pay much attention on guiding students to analyse and solve problem. For example, at the beginning of each task, we will raise some problems and then inspire students to solve them, or students also ask some questions and try to find the answers by themselves. And when we finish each task, teachers will guide students to see whether the proposed issues have been solved or not.

### **3.3. Innovation on teaching mode**

The introduction of the project-driven teaching method, students use the way combining learning with working: training highly skilled personnel in the process of "learning by doing" and "doing by learning". The introduction of project driven teaching method in skill teaching is effective, but there are still some problems and deficiencies.

- Firstly, It is difficult to realize personalized teaching. Due to the lack of relevant knowledge before class, and the project driven teaching method is more open to teachers. It can not take into account the learning needs of different levels of students, so it is difficult to achieve personalized teaching.
- Secondly, it is hard to grasp the teaching procedure. It is difficult for teachers to grasp the degree and progress of each group of students' practical training results, which leads to the difficulty of reasonable arrangement of teaching procedure.
- Thirdly, it is hard to measure teaching evaluation. In project-driven teaching method, it pay more attention on the ability of teamwork. Some excellent students will do all the teamwork while some lazy students will do nothing and it will affect the teaching effects.

In order to solve these problems, flipping classroom teaching method will be introduced into project-driven teaching method.

## **4. FLIPPING CLASSROOM COMBINED WITH PROJECT-DRIVEN TEACHING METHOD**

### **4.1. Flipping classroom**

Flipping classroom is also called inverted classroom. A flipping classroom consists of students completing direct instruction, such as viewing a lecture online, prior to the in-class discussion of the material. The intent is for students to see the material beforehand, also known as first-exposure learning, so they can learn the concepts at their own pace. By doing so, students are better able to focus on participating in class and receive feedback on their efforts during the lesson — not just after. Teachers that utilize a flipped classroom model are better able to help their students engage in active learning. In essence, a flipped class switches the activities traditionally done in class with those completed after class. In a flipped classroom, teachers serve more as facilitators, rather than traditional instructors lecturing to students. Students take a much more active role in the flipped classroom model than in a traditional classroom. The primary benefit of a flipped classroom is enabling students to take charge of their learning process. Additional pros for a flipped classroom model include more interaction time between students and teachers, better test scores, and less stress for students. Since students have online access to the lesson material, they are able to review it at their own pace as many times as needed to help understand it. In a flipping classroom, the key to success is the design of inside classroom and the design of outside classroom [4,5].

### **4.2. Design of outside classroom**

#### **4.2.1. Building teaching resources library**

In a flipping classroom, the teaching process is based on modern information technology and the constructed teaching resources library. Teaching videos are the most important teaching materials. Teachers can record videos by themselves or use the excellent education resources platform on the Internet according to their own needs. The teaching videos should take "micro course" as the main form, the time should be 6-10 minutes, and the content should take a certain subject knowledge point as the main body. Students can make full use of fragmented time to study the micro courses. Since micro class is short and concise, the knowledge in the micro class is not comprehensive and can not deep into the knowledge. The reconstruction of curriculum knowledge points and the correlation between micro classes are the key to the production of micro courses. Taking the user management sub-project in web programming course as an example, the

structure of knowledge point reconstruction is shown in Table 2.

**Table 2. Example for micor class**

<b>Original knowledge points</b>	<b>Reconstruction of knowledge points</b>
Task 1: add new user	Design of user interface; data validation; insert a new record
Task 2: list of users	Design of user interface;data query; data display;pass a parameter between web pages
Task 3: delete user	Design of user interface;delete a existing record
Task 4: edit user's information	Design of user interface;display the record needs to be edited; update a record
Task 5: sort the users' list	Design of user interface; data query; sort records

#### *4.2.2. Building exercises beforehand*

When students finish one micro class video, teachers should design some exercises with moderate difficulty according to students actually status. Students can not enter the next micor class video until they can finish those exercises. On one way, it can ensure the qulity of outside class learning. On the other side, students not only can have a certain sense of achievement, but also a certain degree of challenge. And they will not lose interest on learning the course. After learning the teaching resources, students should use the teaching resources platform to record the gains and questions in the practice before class. Teachers should pay attention to the collection of students' problems.

### **4.3. Design of inside classroom**

The design of inside classroom is not only the supplement and extension of outside classroom, it is the core of flipping classroom.

#### *4.3.1. Identify the problems that need to be studied in the classroom*

Teachers need to sum up some valuable problems that need to be discussed inside class. The problem maybe the common problems students showed in outside classroom or the problems have some kind of difficulty need to be further discussed.

#### *4.3.2. Analyze and solve problems independently*

Students can analyze and solve problems independently according to their professional knowledge. This is of great importance in a flipping classroom. In this process, students need to consult a large number of relevant materials. After information filtering, analysis, comparison and summary, they can solve the problem. Through this process, students can build their own knowledge system systematically, and have a deeper and better understanding of the relevant knowledge points.

#### *4.3.3. Carry out collaborative learning activities*

In the flipping classroom of "web programming" course, a project can be introduced as a course design project. Students are required to design and implement a curriculum design in groups. All members should participate in the process of fulfil the project. There are different roles in the project. Some students can act as the project manager, some students can act as the front-end designer and some students can be the web back-end designer. In this process, teachers should pay attention to observe the learning dynamics of each group and guide students to improve their learning strategies and learning abilities.

#### *4.3.4. Share learning achievements and experiences*

Members of each group can hold regular academic salons to show their website design works. And they can share their learning gains and learning experiences during this process. Both teachers and students can be the evaluators and students can gain a lot from the show and the evaluations.

#### *4.3.5. Evaluate in Multi-dimensional evaluation criteria*

Various evaluation criteria should be introduced in flipping classroom. We abandon the traditional method of "one final test" to determine results and set up multi-dimensional teaching evaluation which pays attention to the learning process, learning ability, practical application, and intermittent learning results.

In web programming course, the teaching evaluation can be divided into three parts: pre-class learning effect evaluation, in-class project practice evaluation and after-class project achievement evaluation. The evaluation of pre-class learning effect is based on the completion of students' pre-class learning tasks and autonomous learning ability. The evaluation of project practice results in class is based on the ability to analyze and solve problems independently. The after-class course design evaluation

system is composed of achievement presentation, group mutual evaluation and project innovation.

## 5. CONCLUSION

The effective implementation of 1 + X certificate pilot system in higher vocational colleges is based on professional curriculum education. Web programming is an important core course of Web development certificate. The combination of flipping classroom and project driven teaching method effectively expands the learning space and learning time of students. Teachers server as facilitators rather than traditional instructors during all teaching activities. Students take a much more active role in the flipping classroom. It reflects the deep integration of modern information technology and education teaching. And educational informatization supports the cultivation of high-quality talents and comprehensive reform in the field of education. From our teaching practice, these methods are proved effectively.

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