Analysis and Design of Course Website for Software Testing Based on SPOC

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Abstract. Technologies of the architecture on SSH(Struts-Spring-Hibernate), database interface access, and web data mining are used to analyse and design of a lightweight course website for software testing which is based on SPOC(Small Private Online Course) for blended teaching on campus. Functions of learning topics releasing on the course, organizing and coordinating learners‘ discussion to promote the learning process can be achieved through the website for teachers, and the website can also provide learners with selecting some social learning tools(BBS, QQ, WeChat) to complete online communication for the course learning. Finally, further work is expected in the paper. Firstly, the targeted and distinctive mobile learning resources and smart education mode should be constructed which is based on SPOC. Secondly, the visualized, diversified third-party platforms and tools in the course website should be integrated effectively which are enable learners to complete the process of online exercising or examining for some types of subjective testing items. Thirdly, how to ensure the reliability, toughness, running performance, safety, stability for the course website which is formed by cutting out some non-essential functions from existed MOOC(Massive Open Online Course) platforms, and improve the functions of multiple data statistics with web data mining technology and motivational observation for the website development.

1. Introduction
SPOC (Small Private Online Course), as the blended learning model for online and offline which is emerged in post-MOOC (Massive Open Online Course) era, and is the product of MOOC’s in-depth integration with classroom teaching [1]. Compared with MOOC, SPOC has some advantages obviously as the following: it is aimed at small-scale specific learning groups, redefines the role of teachers, improves the effect of blended learning, serves the process on college teaching easier, and so on. SPOC activities on campus in some well-known universities in China and some new local universities have been carried out actively in recent years.

However, blended learning has higher requirements for students ‘autonomous learning in post MOOC era. The online learning in blended learning is mainly depended on the many well-known MOOC platform that are existed whatever in domestic or abroad to complete the autonomous learning process, and it tends to be disconnect SPOC with actual teaching [2]. Additionally, some of the existing MOOC platforms still have a series of difficulties in completing qualifications for learners, performance evaluation, and how to connect and recognize credits for similar courses in the universities [2-4]. Through some teaching platforms or course website are developed in most of the universities, they are just the simple pile of all kinds of static course resources, lacking of the functions of comments, feedback, interaction, and so on. The development of the SPOC will be limited too. Therefore, as a case, we try to analysis and design a lightweight course website with the architecture...
on SSH (Struts-Spring-Hibernate) for the course of software testing which is based on SPOC, and apply to the actual teaching process for local learners on campus. In this paper, the structure is organized as follows: some key technologies of the development on this course website are analysed in Section 2. Section 3 presents the requirement for users and the architecture on the course website. Section 4 describes the realization on functions for some core modules of the course website. Section 5 points out further work in this paper.

2. Key technologies
The designing of the website is based on the construction of SPOC for the course of software testing on local campus, and some key technologies and their descriptions on development are shown as Table 1.

| Technology               | Brief description                                                      |
|--------------------------|----------------------------------------------------------------------|
| SSH                      | SSH (Struts-Spring-Hibernate), as the three layers on architecture based on J2EE for web server. |
| Database interface access| JDBC, which encapsulates some of the common operations that used by website designing into a different collection class in a namespace, and the data is presented in the form of tables by Grid View. |
| Web data mining          | Technology of web data mining is used to analyse learner's access behaviour on learning frequency, resident time, and so on [5-6]. |

3. Requirement analysis and architecture design of the website

3.1 Requirement for users
The requirement for users is focused on the functions of resource sharing and teaching interaction of website, user roles are divided into three categories: teachers, learners (students), and system administrators. Different users have different access authorities. The website provides teachers with releasing course unit and activities, organizing and coordinating between learners’ discussion to promote the learning process, it also provides learners with selecting BBS, QQ, WeChat and other social learning tools for online communication and interaction and study to achieve purpose [7]. The use case diagram for the requirement is shown as Figure 1.
3.2 Design of the physical architecture
The physical architecture of the site is shown in Figure 2. Web server (Microsoft IIS 8.0) uses the SSH architecture and is separated from the database server (SQL-Server 2015) in physical structure, which can reduce the amount of data transmission, improving data access speed, and ensure data security. Client users use the website through web browser in PC.

By the way, the data Map/Reduce method is used to solve the problem of rapid increase in data scale by us in order to handle a large number of concurrent requests [8]. To ensure that the website can be quickly responded to the requests using for user's learning resource.

3.3 Analysis on the database
According to the characteristics on SPOC, some new data tables and their E-R relationships are added in the website, such as course forum, discussion topic, post bar, learning behaviour, and so on.

4. Realization on core modules

4.1 Course center
The course center is the main body of the website. Teachers could upload relevant information on software testing course (such as course introduction, course guide, learning plan, various learning
resources, etc.) through the course center, and release learning topics for students learning instruction. Teachers can carefully organize and design a learning topic according to the hierarchy of "learning themes-learning courseware or expanding resources-organizing learning activities" and design one or more related learning activity sequences to interpret a certain knowledge point [9]. Here, an example on learning topic on software testing process of software testing course is shown as Table 2.

By the way, teachers need to provide expanded resources that related to learning content (course-related E-books or auxiliary information materials, etc.) to design learning topics, and release online communication to organize students’ online or offline discussions [7].

When learners register and log on to the course center successfully, some operations such as query, browse, and download files for various electronic resources of the "Software Testing" course could be done. But for the unregistered learners, they don't have permission to download files.

Table 2. Learning topic on software testing process.

| Topic | Software testing process |
|-------|--------------------------|
| No.   | Learning content         | Teaching strategy | Learners behaviour |
| 1     | Unit testing             | Case study        | Watching video     |
| 2     | Integration testing      | Case study        | Watching video     |
| 3     | Validation testing       | Case study        | Watching video     |
| 4     | System testing           | Case study        | Watching video     |
| 5     | Acceptance testing       | Case study        | Watching video     |
|       | Course video             | Testing process.MPG4 |
|       | Extended resource        | 1.Relationship on unit testing and integration testing.pdf  |
|       |                          | 2.Regression testing.ppt |
|       | Learning resource        |                       |
|       | Course forum             | Optimization on software testing process |
|       | Communication online     | Relationship on software development process and testing process |
|       | Resource sharing         | http://www.51testing.com |
|       | Blog writing             | Improvement of testing process. |
|       | Exercise                 | Single-choice question |
|       |                          | 1. 2. 3. 4. ....... Multiple-choice question |
|       |                          | 1. 2. 3. 4. ....... |
|       | Thinking                 | 1. Test strategies on integration testing? |
|       |                          | 2. Basis on system testing? |
|       |                          | 3. Agile testing? |

4.2 Communication and discussion
The module of communication and discussion mainly integrates some social learning tools such as QQ, WeChat, blog, and so on, to provide the learning environment for learners to participate in course discussion.

In this module, on one hand, both registered learners and anonymous learners can make fully discussions through the course forum real-time. Such as posting and replying for course topics which are released by teachers. On the other hand, learners can share the learning topics and content on discussion by their personal communication tools of QQ and WeChat, and maintain real-time contact with teachers and other online learners to achieve positive interaction[2][7].

Of course, learners can also share their learning experience to their blogs quickly and easily through the website.
4.3 learning behaviour management

The most function of this module is to help teachers to analysing, tracking and recording learner's learning state on the course by using web data mining technology, which is reflected by the learner's relevant learning behavior data.

Through this module, teachers can see some statistics on students' learning course, some important data for learning behaviour which are included in learning topics of each course chapter, such as time duration of learning, learning frequency, resident time, the number of students' submissions, watching videos, reading all sorts of E-learning materials, replying posts, blogs writing and sharing, rates of average completion for exercises, and so on [8].

Teachers can query a certain type of learning data according to actual teaching. Administrators can export various types of learning data from the backstage system of the website in the form of visual reports and provide them to teachers, so teachers could understand the relevant learning behaviours on students in a more realistic and objective form. Using web data mining technology to analyse learner's access behaviour

5. Further work

Although we analysis and design of the course website for the course of software testing which is based on SPOC above, in my opinion, some further work will be researched in the future for development and application on blended teaching and learning actually.

Firstly, with the influence of rapid development of knowledge updating and the concept of life-long learning, the ubiquitous learning that based on mobile terminal devices, such as smart phones and tablet PCs will be further developed [8][10]. The construction of targeted and distinctive mobile learning resources and smart education mode which is based on SPOC is an important direction for development [11].

Secondly, the process of exercising or examining should be completed on line by peer assessment system in SPOC.

Now, the implementation of this process can be realized basically in most of the famous MOOC or SPOC platforms, and the application of choosing question algorithm is relatively mature in examining system. However, discrepancy will be existed by students peer assessment and lack of impartiality [11]. So, in further work, how to according to the features on the course and cognitive ability of small-scale learning group, integrating the visualized, diversified third-party platforms and tools in the course website effectively which enable learners to complete the process of exercising or examining online for some types of subjective items more conveniently, and develop standardized, scientific, and systematic scoring standards to enable students to evaluate each other relatively fair [11].

Thirdly, as a lightweight course website with the characteristics of good expansibility, usable and flexible, some functions which are auxiliary and non-essential should be cut out from the website for a certain local students group on campus.

It is also the future work in this paper that how to ensure the course website which is formed by some existed MOOC platform functions cutting out but without affecting the reliability, toughness, running performance, safety, stability, and so on.

And the fourth, the diversification on requirements of learning behaviour for different learners in different learning phase will be achieved in big data era [12]. Functions of multiple data statistics with web data mining technology and motivational observation in development of this course website should be improved by course teachers and website developers together. It is also the future work.

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