An Interactive Web-based Application as Educational Tool for SCM Course by Using FOSS

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ABSTRACT
This paper presents the application of free/open source software (FOSS) for teaching and learning one specific topic in Supply Chain Management (SCM) course. In the last few years, there is abundant FOSS for educational tools. However, educator still faces problems to implement such an education FOSS for improving the quality of education i.e. customizing of software function, developing of a specific educational media, and illustrating of a course content. The purpose of this research is to design an educational tool for increasing efficiency in conveying subject matter especially distribution problem. It has a module of real distribution problem in commodity paddy was captured. We created an interactive Web-based application by using WSDL, PHP and MySQL and SOAP. The result of the research will be able to improve the pedagogic approach for learning of SCM course.

Keywords:  
Educational tool, FOSS, interactive media, SCM course.

1. INTRODUCTION
Free/Open Source Software (FOSS) is application that is made available along with source code as a distinctive feature [1]. There are some reasons why FOSS implemented in a majority of the higher education as follow. With limited budgets, FOSS applications can be used for making ICTs as educational tools [1],[2]. Based on survey conducted by [2], FOSS is gaining mindshare from four directions: spill over from commercial initiatives (such as Linux, Apache, Open Office), grant-funded open source initiatives (course management, portal, financial systems, student portfolios), market-driven initiatives in specific application areas (course management), and open source compatible higher education specific applications (course management, portal). The higher educational institutions can use FOSS in front-line curriculum for the reason of possibility of localization [3].

Learning tool or educational tool is a tool to deliver the message of learning [4]. Recent advances in internet technologies have transformed the World-Wide-Web from delivering static text to providing an easily accessible multimedia channel for dynamic and interactive communication [5], [16], [17]. Furthermore, the development of Information and Communication Technology (ICTs) devices, such as Personal Digital Assistant (PDAs), Server, Modems, Laptops and Tablet PCs, reform the development of an interactive learning media become easier, faster, and cheaper. Web-based media offers an effective alternative to deliver the message of a course and involves a fusion of sounds, images, and texts that enable students to interact with complex system. A good educational tool can activate learner in analytical, computational, and experimental practices of a course.

In the last few years, there is plentiful of web-based application as educational tool which made by FOSS. Some applications are described below. A LearNet (www.learnet.de) is learning and experimenting on real technical plants can be used in manufacturing education [6]. The EDICS created by [7] is FOSS application for learning the course of engineering design instructional computer program. An open source educational software for basic photogram metric tasks is dedicated by [8]. Also, there are many free e-Learning tools, for instant: 3D modeling software tool (Google Sketch Up, http://sketchup.google.com/); an advanced online assessment management system (TOIA, http://www.toia.ac.uk/); an alternative browser for young children (KidRocket, http://www.kidrocket.org/); the open source portfolio (http://www.osportfolio.org/) and flash quiz creator (HotPotatoes, http://hotpot.uvic.ca).

The development of ICTs encourages Supply Chain (SC) entities (from supplier’s supplier to customer’s customer) changes to improve the competitiveness of the company; from efforts of internal efficiency towards inter-entities collaboration for leveraging benefits to achieve [9]. Therefore, for the learning process of SC course needs innovative teaching and learning methods to improve the ability of our students to solve complex problems. We still have not the application of FOSS for teaching and learning one specific topic in SCM course in the Department of Industrial Engineering/Department of Informatics Engineering, Sebelas Maret University. In conclude, we still have some problems to implement such an education FOSS for improving the quality of education i.e. customizing of software function, developing of a specific educational media, and illustrating of a course content. This study aimed to design an interactive web-based application as educational tool for SCM course, so that teaching objectives can be explained effectively to the students.
This paper is organized as follows. In Section 1, we propose the background of our research. Then, we resume several special cases of the web-based educational tools. In Section 2, we provide the methodology for solving the problem. In Section 3, we design the web-based application for blending face-to-face and distance learning model. We introduce the guidance for learning in Section 4. Section 5 is summarizes and future research.

2. RESEARCH METHODOLOGY
Figure 1, we describe the methodology to design web-based application for teaching SCM course. An interactive web-based application can be proposed to improve of existing teaching method. The proposed teaching method will apply a blended learning model with learners completing an online learning module followed by a hands-on, face-to-face small group session.

2.1 A case study of real distribution problem in commodity paddy of after-harvest [10]

2.2 A. Problem-based Learning preparation
Simplify the real system of distribution problem to illustrate the integrated system
Determine the relevant system to illustrate the relationship among structural aspect, functional aspect and business object

2.3 B. The Development of Prototype O-A-S-E
Improve the application from previously research [11]:

B1. Capture PBL to System
   Software Requirement
   Specification
   Use Case Diagram

B2. Design System
   Design model
   Design database
   Design interface

B3. Development web-based application
   (making the SC database, coding the program, building the Web Service, and debugging the application)

2.4 C. The Guidance for Learning
   (the design of course content, instruction for lecturer, and the hardware requirement to implement new method)

Figure 1. The design of Educational tool for SCM Course

Next, the previously research should be redesigned to develop a prototype of O-A-S-E (Open Application for SCM course Education). UML (universal model language) can be used to model the system [13]. Simple Object Access Protocol (SOAP) was considered as web service technology for delivering text in dynamic and interactive communication [14]. The PHP and MySQL was used as relational database structure [15].

Finally, the guidance for learning. It discusses a user guide to use the application for teaching distribution problems. This contained information about the design of course content, instruction for lecturer, and the hardware requirement to implement new method.

3. PROBLEM-BASED LEARNING PREPARATION
The real business process of distribution system in commodity paddy of after-harvest is mapped by [10]. The Distribution System adopted in PBL system is in Fig. 2. There are three types of flows in each arrows as follow: flow material, information and financial. We propose SC-client as the business services centre of commodity paddy of after-harvest for learning distribution system (or Pusat Layanam Bisnis Distribusi Padi Paskapanen). The main problem simulated in the SC-Client consists of four business activities (BA) as follows: order consolidation/planning; receiving/record keeping; inventory management and distribution planning.

Figure 2. The Distribution System adopted in PBL system
4. THE DEVELOPMENT OF PROTOTYPE O-A-S-E

We improve the application from previously research [11] to develop OASE prototype. The phenomenon was solved using three stages as follow: capturing PBL to System, designing system, and developing web-based application.

4.1. Capturing PBL to System

The SC entities consist of three components as follows: (i) SC-User-1 as supplier, SC User-2 as consumer, and SC Client. For capturing real distribution problem to system, we make Software Requirement Specification (SRS) and use case diagram. The Software Requirement Specification (SRS) is detailed to answer the functional aspect of PBL system. We propose 15 SRS functional and 14 SRS non functional. All SRS is aimed to design use case diagram for user and client (Fig. 3)

![Use Case Diagram sample of SC-User](image)

4.2. Designing System

The design system consist of 3 steps as follow: to design model application, to design database and to design interface. The activity diagram is used to breakdown the responsibility of each SC entities. We propose 14 diagrams as follow.

(i) SCM client (to login-log out, to manage inventory, and to evaluate supply and to evaluate demand).
(ii) SCM user for supplier (to bargain supply, to buy product, to evaluate the price, to evaluate the quantity, to collect information from client, and to receive orders).
(iii) SCM user for consumer (to order product, to get feed-back from the client and to change user-ID).

The sequence diagram is used to describe the algorithm of application running steps. Then, the class or static diagram is designed to show the class and object structures (Fig. 4.)

![Package Mapping for SCM Application](image)

The application uses component diagram to determine the relationship inter-component. We use MySQL to develop Database Management System. We design tables needed in database after normalization process. In Figure 5, we show diagram scheme for SCM Application

![Diagram Scheme for SCM Application](image)
In Figure 6, we show the architecture of the SCM application. The web interfaces developed in PHP, which has three layers as follow: operating system, application, and interface. The SCM application is implemented by two sides, that is the client side and the server side.

4.3. Developing web-based application

The web-based application developed using free open source software which is WSDL, Object Oriented programming method with PHP and MySQL PHP, and Simple Object Access Protocol (SOAP). WSDL interface (web service definition language) was used to communicate information between different platforms that owned by each entity in the SCM through the HTTP protocol. Simple Object Access Protocol (SOAP).

SOAP was developed that consist of 23 services that these can be accessed by J2ME, Java, and PHP platforms. WSDL has been created by SOAP web service application. There are 23 SOAP Web Service as follow: loginSCM, order, getDataPemesanan, getBank, getProduk, getBerita, getLelang, setLelangReply, getAccount, updateAccount, getPenawaran, getLelangResult, getListOfPemesanan, makeLelang, getLelangWinner, increaseStok, decreaseStok, changePrice, and prosesOrder.

Web Server was developed by using OS Linux Slackware, Apache 2.0 Web Server and Web Traffic Tools. Database Server was developed by using IBM OS and MySQL. On Client side, the PC must has minimum requirement: OS Windows 98 or up and web browser IE version 6.0 or Firefox version 3. The prototype of OASE is consist of five interfaces for visitor, administrator, supplier, customer and system management. The interface can be used to input, process, and give feedback to system. The samples of interface is showed in Fig. 7 - Fig. 9.
The web also provides the instruction method: to create and deliver content, to monitor student participation and to assess student. The hardware requirement for implementing this educational tool is as follows:
- personal computer for server with minimum specification: processor intel dual core 2.4 Ghz, RAM 2Ghz, and Hard disk 40Gb SCSI.
- Database server with minimum specification IBM Server, RAM 8Ghz, and Harddisk 240Gb SATA,
- PC Client with minimum specification: processor Pentium III, RAM 256 Mb, Harddisk 20Gb and internet connection 10kbps.
- Server Hosting : control panel (CPANEL), mail account (10), anti virus, SpamBlocker, SpamBox, WebMail, POP & SMTP Access, Mail Forwarder, FTP Account (5), Sub Domain (unlimited), Database (MySQL), Web Statistic, Fantastico (Pre-Installed Scripts), Crontabs and Shell Access (SSH)

6. CONCLUSION
In this paper, we introduced OASE as an Open Application for SCM course Education. The OASE can be used to explain college students about phenomena of distribution problem as follows: order consolidation/planning; receiving/record keeping; inventory management and distribution planning. The OASE is web-based application was created by using FOSS. The PBL system can be held using OASE in blended learning model with learners completing an online learning module followed by a hands-on, face-to-face small group session. Furthermore, they can exercise to solve distribution problem using appropriate analytical, computational, and experimental practices. The result of the research will be able to improve the pedagogic approach for learning of SCM course.

The OASE still has certain limitation, so as any other open source application, this application invites people around the world to complete the model. We have some works for completing this prototype as follow: testing OASE prototype, completing to all module of SCM course and designing the experiment method to assess the student’s performance.

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8. REFERENCES
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