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Open Source Software in E-Learning Environment: Observations and Experiences

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Abstract

It is the need of current era that just like medical students who get training by working with the senior doctors, IT students should also have an environment and opportunity to work and getting experience and training of object oriented programming techniques and developing various UML models and diagrams by working with highly skilled and experienced professionals. Software industry hesitates to engage students in their projects because, due to lack of experience and required skills, they consider them burden on their business. Therefore, the best alternative is to engage students on open source software applications where every person is welcome by the concerned community. Open source software domain provides a very good opportunity for IT students to improve their skills of writing code and developing various UML models by working with the highly skilled and experienced professionals. In this paper, authors intend to present their observations and experiences of creating an infrastructure for and engaging students in implementing, working and contributing in an enterprise resource planning open source software application --- AdempiereERP in an e-learning environment.

Keywords: Open source, e-learning, methodology, challenges, feedback

1. Introduction

Software whose source code is free of charge and may be distributed to or modified by other developers or community is called an open source software (OSS) [3][6][7]. Research, development and use of open source software are rapidly increasing from the last few years [4] [5][8]. Some examples of high quality OSS systems are Linux, Apache, MySQL, and FreeBSD [1]. Open source software development thrives with the development of computer networks and internet, which allows software developers to communicate and share their ideas with other developers while being at different geographical location [1][9]. Unlike closed source projects [12][13], open source software applications are built in loosely managed environment by volunteers and developers [1, 2]. The volunteers of the open source projects are fairly dispersed all around the world and contribute through internet and their contributions are freely available to use and change [10]. The open source community welcomes new members to participate in their projects. This helps new members in learning and improving their skills.

Usually, fresh graduates are not skill enough to handle real world problem. It has been found that fresh graduates generally lack technological expertise, experience of working in teams, and project management skills [11]. Because of these deficiencies, fresh graduates are treated as trainees and offered low income. In general, Software industry does not involve fresh graduate in real world projects. Consequently, fresh graduates do not an opportunity to work with senior software developers and analysts.

Therefore, it is voice of current era that there should be an infrastructure where student can work with experienced developers and analysts to learn and improve their skills. The setup can mimic atmosphere of medical students who get an opportunity to work with and get trained by experienced doctors. To achieve the stated objectives a project titled “Integration of Open Source Software Projects in IT Education” was initiated by National University of Computer and Emerging Science (FAST-NU), Punjab University College of Information Technology (PUCIT), University of the Punjab, and Virtual University of Pakistan (VUP), Lahore, Pakistan.

As a team of VUP that is dedicated for the implementation of the infrastructure project in an e-learning environment, we have been working on various open source software applications like AdempiereERP, OrangeHRM, SugarCRM and PostBooks. However, our focus and attention remained on AdempiereERP project, due to constructive, and welcoming feedback and timely responses from the international community of AdempiereERP project. At first we developed a complete infrastructure for AdempiereERP and following that involved forty four students from CS and IT disciplines to contribute in the AdempiereERP Project. In the remaining part of the paper, we use ‘the OSS project’ and ‘AdempiereERP project’ interchangeably. The rest of the paper is organized as, section 2 contains the literature work, section 3 contains the adopted methodology to train students, section 4 provides results and discussion on the selected methodology and section 5 gives conclusion and future directions.

2. Literature Survey

In the case study [15], Sofiane M. Sahraoui discussed that higher education institutes are natural habitats of open source software because they both follow the path of open learning model. The Business School (B-school) of Gulf National University (GNU) integrated open source into the Management Information System (MIS) curriculum and they run the project for about 3 years. In the start, the project was running successfully, but later on, due to withdraw of key resources, dissatisfactory performance of some instructors and development of a new testing center, the project not only stopped its progress but also roll backed from its initial achievements. Major IT organizations like IBM, HP, Google etc. hired the number of IT Professionals that have worked on the open source projects and methods. So, where do these professionals come from? In [16] Gregory DeKoenigsberg asked the question that whether open source projects and methods should be involved in the education system?

3. Research Methodology

In this section, we describe the adopted methodology to develop infrastructure and engage students in AdempiereERP. The methodology is described in the following major steps. The whole methodology is represented by figure 1.

1. Choosing AdempiereERP
2. Developing infrastructure/ Designing Milestones
3. Student selection
4. Mentorship
5. Students Ranking System
6. Viva voce examination

3.1 Choosing AdempiereERP

It is the first step of our methodology. Selection criteria for an OSS project include the following points: 1) The project should have ranking from 1 to 500. 2) It should have maximum activity (99% to 100%). 3) It should have at least 5 full time community developers. Because AdempiereERP fulfills criteria point, so we selected it for the students of 1st batch of OSS project. Other foremost reason to decide to work AdempiereERP is an amusing feedback and timely responses from the community.

3.2 Developing infrastructure

Being part of an e-learning university, we configured a web server (http://oss.vu.edu.pk) to host all software applications (like Mantis, VisualSVN) required by students to perform and submit their tasks. In order to guide students following guides and tutorials were prepared and sent them via registered mail and also uploaded on the Virtual University Learning Management System (VULMS):

- VisualSVN Installation and user guide.
- TortoiseSVN Installation and user guide.
- Mantis Installation guide.
- AdempiereERP Installation Guide (Prepared by VOSS Com)
- PostgreSQL (Database)
- ADempiere Project Overview Tutorial
- A guide to install and configure JDK 1.6
- Eclipse Debugging tutorial
- XAMPP/WAMP Installation Guides
- Video training on UML and Object Model

3.3 Students' selection

We select students of BS(CS) and BS(IT) enrolled in sixth semester and having cumulative grade point average (CGPA) greater than or equal to 2.5. Students then are assigned modules by the teacher and a road map called 'Deliverable Submission Calendar' is provided to proceed on the work. This calendar displays deliverables, with their deadlines, to be submitting. Students work on OSS project for two semesters i.e. sixth and seventh. In final (eighth) semester, students mentor their juniors. Since, we have been working on the OSS project since the session of spring 2009; therefore, up till now we have 44 students belonging to various sessions and cities. Table 1 shows the detail.

Semester Session	Enrolled Students	Students by City
Spring 2009	12	Attock 3, Chakwal 2 Faisalabad 2 ,Vihari 1, Karachi 1, Lahore 2, Islamabad 1
Fall 2009	8	Mianwali 2, Rawalpindi 2, Islamabad 1, Lahore 1, Faisalabad 1, Karachi 1
Spring 2010	14	Karachi 3, Lahore 3, Rawalpindi 1, Taxila 2, Sahiwal 2, Attock 1, Sialkot 1, Sargodha 1
Fall 2010	10	Lahore 3, Gujranwala 2, Karachi 1, Bahawalpur 1, Sahiwal 1, Taxila 1, Bhakkar 1.
Total	44	

Table 1: List of students with their session and cities

Column labeled as 'Semester Session' shows the sessions in which students are selected to work the on the OSS project. 'Enrolled Students' column shows enrolled students in each session. VUP has students from all cities even from far away places of Pakistan. 'Students by City' shows this reality.

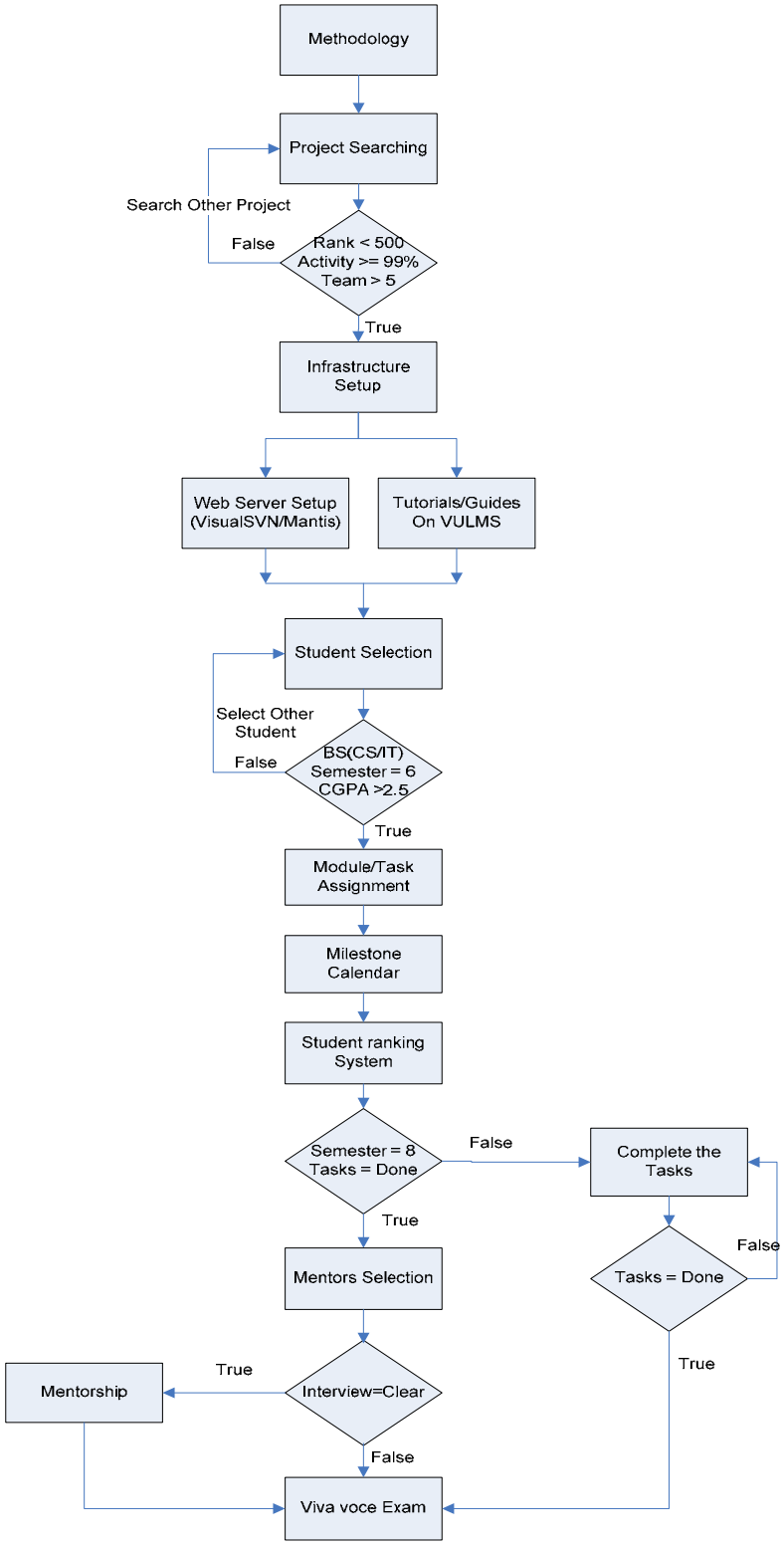

Figure 1. Graphical representation of the methodology

3.4 Mentorship

The students, who complete their project in first two semesters, are selected as mentors in their final semester. They provide technical guidance to their juniors by acting as a middle layer between teacher/Research Officer (RO) and students. Each mentor works as an assistant to an RO. In VUP each type of communication is performed via email or VULMS. A mentor checks deliverable sent by a student and sends it to RO. RO, then instructs mentors regarding their performance or rejection/approval of the deliverable. Mentors put RO in loop (by putting RO in cc) while providing any type of information/guidance to their juniors. In this way, RO watches all types of activities of mentors. Figure 2 depicts this model.

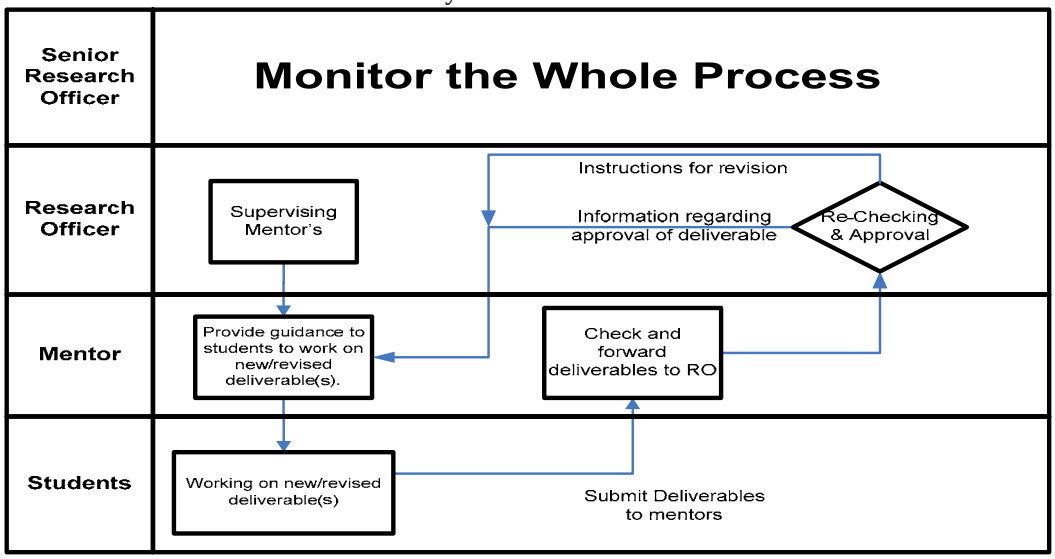

Figure 2. A graphical view of mentorship

3.5 Students Ranking System

One of the core elements to work on an open source project, especially in an e-learning environment, is to encourage and motivate students and monitor their performance. For this purpose, we adopt an approach called as Student Ranking System (SRS) to create competition among students working on the OSS Project. The idea is to assign some points to various activities performed by students. The SRS calculates points based on performance of every student and is published on VULMS each week. SRS plays a vital role in improving performance of students. SRS is used to divide and assign points to various activities as shown table 2.

Measures	Points
Daily Activity Report (DAR)	1 point per day
In-time Deliverable Submission (IDS)	3 point per submission
Intelligent Question (IQ)	1 point per Question
E-mail Response (within 24 hrs) (ER)	1 point per Response
Submission Correctness (SC)	Percentage from 5 points
Participation in Chat/Tutorial Session (TS)	5 points per session

Table 2: Various parameters with their points used in SRS

If a student sends daily activity report he/she is assigned 1 point. Second element is “In time Deliverable submission”. This implies only to the timely and very first submission of a deliverable (not the revisions) within a scheduled deadline. If a student submits his/her deliverable on or before a due date, 3 points will be awarded to that student. Third grading element assigns 1 point to a student who asks an intelligent question. This element encourages students to ask intelligent questions only. Fourth element is based on response of an email. Its purpose is to compel that a student has gone through his inbox. Fifth element assigns points based on correctness of the deliverables submitted by students. This element assigns maximum five points which are calculated by dividing 5 by 100 (5/100) and then multiplying this by the percentage correctness of the deliverable (5/100* % correctness of the deliverable).

For example, if a document is 70% correct, the students will be awarded by 3.5 points. It encourages students to work efficiently and submit a correct document. Sixth and final measure to calculate points based on the participation of students in chat sessions arranged on weekly bases. This is a group discussion session, in which participation of the mentor and all students is mandatory.
This practice is to ensure that each and every student actively participates in the project activities and tries to give the best performance.

3.6 Viva voce Examination

At the end of final (eighth) semester, we conduct viva voce examination of the students who successfully complete their work. Viva examination is conducted via video conferencing in designated VUP own campuses.

4 Results and Discussion

This section describes our achievements, conclusions, and feedback to educational institutes and the challenges faced while working on the OSS project. We describe achievements and feedback by three perspectives, Students, Mentors, and Authors;

Achievement and feedback of students

Currently, 44 students are working on OSS projects which are of various sessions. In first session (Spring 2009), twelve students are selected to work on the OSS project. Eight out of twelve students have successfully completed their work and passed viva voce examination. Four students failed to complete their work. Mathematically we can show that 66.67% (8/12*100) students successfully completed their work on the OSS project. In the session of fall 2009, eight students are enrolled in the OSS project and seven students successfully completed their work and are eligible for viva voce examination. Mathematically, relationship between passed and failed students of the session of fall 2009 can be described as: passed students' percentage is 87.5% (7/8*100) and fail students' percentage is 12.5% only. In spring 2010, fourteen students are selected to work on the OSS project. Eleven (78.57%) students are predicted to successfully complete their work. Predicted successful students in spring 2010 are 78.57% (11/14*100). All this discussion is summarized in figure 3 shows relationship among the enrolled, pass/predicted pass and fail students.

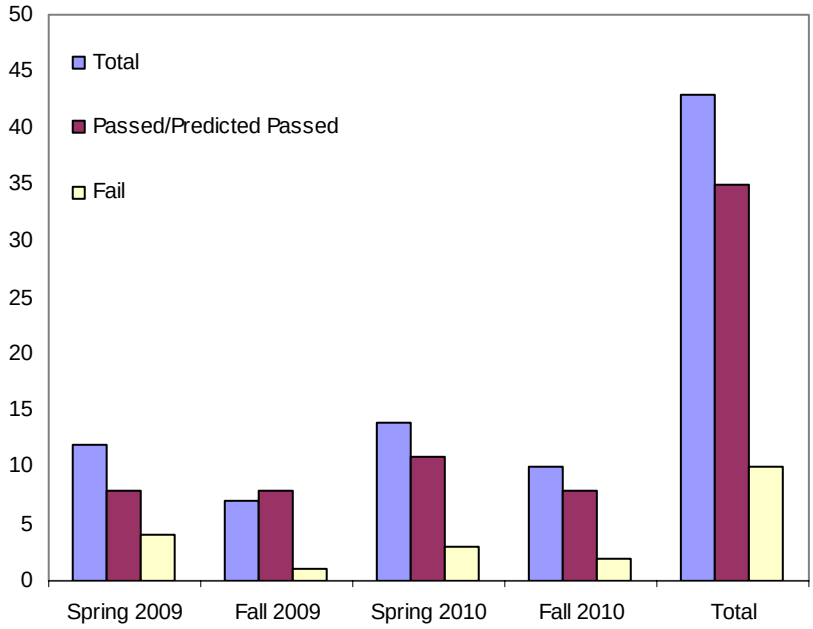

Figure 3. Graphical representation of students' enrollment in OSS project and their rate of success.

Our contribution in the OSS project in form of reverse engineering (developing use case and class diagrams of various modules of the OSS project), bug fixing and feature addition, and other information can be viewed by visiting following sites:

- On twitter: http://twitter.com/vosscommunity
- VossCom Blog: http://vosscomm.blogspot.com/
- VossCom on Adempiere: http://www.adempiere.com/index.php/User:Vosscom

Because of our contribution, Pakistan is now included in contributors' list of the OSS project.
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We also collected students' feedback. The purpose of feedback is to

1. Know the reasons, because of which some students fail/left to work on the OSS project,
2. Improve performance of the authors by collecting flaws students observed during working on the OSS project
3. Provide a guide to other educational institutes interested or planning to involve their students in OSS projects.

In this section, we include some important questions from the feedback form sent to students and their replies. Replies are pasted in actual words of students and any grammar/spell mistake should be ignored.

Do you think, working on an Open Source Project, is beneficiary for you and other students, How?

Student 1: "Yes, because in Open Source project one has to work with professionally written code, which will help the students to be familiar of Professional coding techniques".

Student 2: "If a student who is already working in some kind of software related company then it will be more beneficent for him in improving his skills."

Student 3: "Yeah, it was beneficial. For me it was helpful in enhancing my abilities to work as a team leader also it helped me to clarify my concepts about programming. For students, I think it is a very good chance to gain the field experience by understanding the code, OOP techniques of high level software".

Do you think that there are any disadvantages of working on Open Source Project?

Student 1: "Yeah I feel some disadvantages of working on Open Source Project that student are force to work on existing available Project, their inventive and new ideas those offer in regular Project are discourages, and in OSS we work on Desktop application".

Student 2: "OSS project advantages and disadvantages are dependent on the nature of student environment. If he is regular student then this project is good for him and if he is working in non software related company then it will be a difficult task for him because this kind of project requires more time than he can spend on the project".

Student 3: "Nopes! I don't think that there is any major disadvantage of working on OS project".

Here, we show feedback, of three students in favor and of three students in opposition of the OSS project.

Achievement and feedback of mentors

The mentors act as an intermediate layer between the student and the teacher in the final semester. Students send their deliverable to mentors; mentors after putting feedback on the students' work send the document to the concerned teacher. The teacher sees work/performance of both the mentor and the student and putting his own comments on the document returned back to the mentor and then mentor return the document back to student. Purpose of involving students as mentors is equipping them with some managerial as well as teaching skills and experience.

We also collected mentors' feedback. The purpose of feedback is to:

1. Know the challenges/difficulties they faced as mentors especially in an e-learning environment.
2. Know about the skills they got during mentorship.
3. Know the skills they acquired during mentorship.

In this section, we include some important questions from the feedback form sent to mentors and their replies. Replies are pasted in actual words of mentors to maintain originality and any grammar/spell mistake should be ignored.

Write down few pros and cons of Mentorship?

Student 1: "Mentorship is very helpful to give the student confidence, after mentoring the students now I am confident about my concepts, the only problem I faced was the time management, because the job-holder students under my mentorship were difficult to facilitate because they don't have enough time to chat at regular basis".

Student 2: "Mentorship is good from new student perspective, mentors help them and quite fast and treat them well, and also they got replies to their queries quickly".

What knowledge and skills, you have learned, by working as a mentor in Open Source Project?

Student 1: "The most important skill I learnt is Discipline, secondly time management, and the Team management. Also my concepts of OOP and Software Engineered became clearer."

Student 2: "Basically this activity purified my documentation concept, as we work on different module I also learn those things those we not got in our working module, it also give us broader view at where RO's think and we also able to control student, as in professional life if task given to us like mentoring we can perform it easily."

Achievement and feedback of Authors

Authors of this article act as developers of the OSS project and guide students in developing and improving various coding techniques and UML models. Our achievements are as follows:

1. We learnt the skills to guide students of an e-learning university. Students are distributed throughout the country and are not in immediate contact of the authors. Therefore, we developed and designed various tutorials and guides of installing the OSS projects like Mantis, Visual SVN PostgreSQL etc.
2. We also learnt and improved coding and developing skills by contributing in the OSS project. The most exciting experience was the reverse engineering of various modules of the OSS project and interaction with the community of the OSS project.

3. We have an opportunity of a vast exposure and creating links with international developers.

As a feedback, we recommend other educational institutes to adopt the same or similar methodology and indulge their students in an OSS project. There are many benefits of involving students in an OSS project like they learn object oriented techniques, for example, the practical experience of creating relationships of associations, composition and aggregation. They also learn and clarify their concepts about various UML models like use case, sequence and class diagrams during the process of reverse engineering.

Challenges of the OSS Project

Students' response in distance/e-learning mode

A major challenge we face is latency in students' responses. In a distance or e-learning mode when students do not find their teachers in front of them, they usually respond late. Therefore, to monitor performance and activities of the students in such a mode is really a challenge and teachers also feel lack of control and grip over the students.

Load shedding

Power outages are a serious problem that affects productivity. Lack of uninterrupted power supply (UPS) especially on the end of students is causing a delay, to meet deadlines and in their responses.

OSS Community Response / Patch Acceptance Response

Because of lack of direct communication between the developers and the community (owners) in an open source software development model, efficiency effect even if there is a dedicated team at the owners' end. To work in an open source software project is same as having an experience of distance learning.

ERP Functional Concepts

Initially a lot of effort is consumed in infrastructure setup and resolving various configuration issues, for instance, almost one month was spent to install and configure AdempiereERP. Domain understanding of developed software is really a very tedious and cumbersome job.

5 Conclusion

We spent two years working on the OSS project. Total forty four students contributed in the OSS project and their feed back shows that they recommend the involvement of students on OSS projects. There are several advantages to select an OSS project as a final year project. Firstly, students have an opportunity to work and gain experience by working with highly experienced and professional developers and analysts. Secondly, they have a real taste and observation of how to implement object oriented programming techniques like generalization, specialization, polymorphism, method overloading, method overriding, composition and aggregation etc. They also have an opportunity of how to develop and design various UML models and diagrams in a professional manner. According to our observations and experiences, the approach presented in Fig. 1 is suitable for improving the software engineering skills of IT students in E-Learning. Final and one of the foremost benefits of working on an OSS project is that students don't have to worry about the licensing problems of tools and technologies they want to use for the development purposes.

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