The Open Source Project Approach: Finally A Better Way to Teach the Project Class

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ABSTRACT
A systems project class or classes is part of most computing curriculums. The form that it takes on when implemented in practice is quite diverse. This paper briefly looks at the project class from both a systems and a stakeholder perspective. Given this context an examination of many of the issues and problems that occur in the project class these is made. One of the major process variables or decisions that an instructor has control over, the actual system project is discussed. The use of FOSS projects and the inherent process and infrastructure they bring is shown to address many of the problems that arise in the computing project courses.

Categories and Subject Descriptors
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1. Introduction

The joint task force on computing curricula from the IEEE Computer Society and the Association for Computing Machinery stated in their final report it is important for all undergraduates to complete a significant project as a team that involves both design and implementation. While the task does not explicitly state the educational purposes several reasons can be easily identified as follows:

- Desire for students to understand from first hand experience the impact of design decisions on the subsequent development and implementation.
- Help students learn how to work in a group on a significant projects, similar to what they will face in industry.
- Understand how a large project can be broken up and managed.
- Understand the role of system quality assurance and testing

While an internship approach was recognized by the task force as one way of achieving student involvement in a "significant team project", most programs have chosen to insure the quality of the students experience with a course or courses that they have more control of.

2. The Project Class: Stakeholders and Process Variables

The placement of a significant team project that involves both design and implementation in a curriculum can take many forms. This diversity of how the project is implemented in curriculums is based on the uniqueness of each curriculum and on the diversity of stakeholders involved in the course. The stakeholders that have a stake in a specific section of the course consist of the students and the instructor for the course. In addition when real world problems are attacked by the students the user is a stakeholder. When unique computing facilities or resources are needed the campus support staff may become a short term stakeholder. Others stake stakeholders could be accreditation groups, industry advisory boards, school administration and educational textbook industry.

There are several process variables that the instructor of the systems project class has within their control in designing how to run the class. These decisions potentially impact some of the stakeholders. They include the composition and evaluation of groups, use of class room time, the role the instructor plays in the process, the expected course content, environment constraints, and the system project worked on. It is this last variable the system project which is the focus of this paper.

3. Experience in Practice

Over fifteen years I have personally taught project classes using students in groups at three different institutions with real users. The time frame to do this has varied from a six week summer class to a two semester long sequence of classes. I have tried varying many of the factors listed above. Almost every time I have taught the class the outcomes are quite similar. Overall the educational objectives are accomplished satisfying the main stakeholder in the course the students. My student teaching evaluations are generally quite good.

The final projects produced however are seldom of a quality that I am satisfied with. I would venture that less then 10% of the projects are still in use by the user a year after the course is over. While project failures are not uncommon in industry I have found the low quality and project failures to be a disturbing reality. While I personally contact users at the start of projects and inform them that there is a large chance of failure I still feel a personal

disappointment in the failure to deliver to one of the stakeholders a usable product.

Some of the common problems that have existed exist with the projects are as follows. Parts of the system are not complete, the system is poorly documented, the user is not trained properly, or the system has significant bugs

These problems of course are due in part to the inexperience of students, but are also due to some aspects that have been out of the control of the students. In particular:

- Time limitations: the semester ends. Delays occur in projects due to the fact that the students often have to wait days or even weeks for a user to clarify a project requirement.
- While deliverables are defined and methodology has been taught the students do not have any experience with the process. The student struggle with the issues of how to organize work done on a project by a group.
- Expectations of what is required of them by the student is generally not understood at the beginning of a project.
- The scope of the project is often not appropriate to the time available or skill level of the students. While as the instructor I intervene to minimize this problem, students are often more optimistic then they can deliver.

As an instructor I also encounter the typical problems of projects done by groups. Often it is difficult to determine who has contributed what. In dysfunctional groups with finger pointing the truth is often difficult to sort out.

4. The System Project

As mentioned earlier one of the choice the instructor controls is the project that will work on. While there are some instructors who use case studies many institutions including the three I have worked at have a culture of using life projects. There are advantages to real projects in that the student gets to experience and practice the interpersonal skills in interacting with a real user. The use of real projects however introduces a greater degree of uncertainly and less control by the instructor. In addition if multiple projects are used the scope and complexity of the projects that teams are working on can vary greatly. When more then one group is assigned to the same live project, this can require users to have multiple meetings with different sets of groups. In addition the lining up of real projects is a process that can delay the students working on the projects. It is for many of these issues, that some prefer to use case studies. In the next section the option of using open source projects for live projects is shown as an excellent alterative to the traditional live project of meeting with a real user in person.

5. Open source approach

When one looks at using open source projects as an alterative to traditional live projects for the project class one finds that many of the problems identified are reduced or eliminated. The nature of open source development has created an approach and methodology that inherently addresses many of the weaknesses.

While some of the open source project development is carried out by paid computing professionals the a lot of the development is done by people who are donating their time and effort. This work is carried out by these individuals on a part time basis. The individuals who work on these projects are often geographically scattered and have never personally met a majority of the other project members. Open source projects inherently have project members of different skill levels.

In many ways open source projects should never succeed in that this development environment would at first glance tend to increase the probability of a computing project failing. In fact many open source projects do not succeed for a variety of reasons. The question that should be asked is how do any manage to succeed when the odds are stacked against them. There are many reasons but perhaps the main one is the methodology and process of open source development. Open source projects due to the geographically distributed volunteer nature have developed an asynchronous communication, system. The open source process has build into it formal mechanisms to handle the many issues that naturally arise including the following:

- Abilities for people to provide suggestions on project features
- Methods for voting or providing feedback on project related decisions
- Methods of reporting and tracking bugs.
- Version control of project components.
- A repository of the project history and communication

It is the very nature of the open source approach that addresses many of the problems mentioned before.

Open source projects by their nature have more flexible completion dates. While the course ends the project development does not have to end. Students can be evaluated on the work completed in the semester of the course. The fact that some contributors, in this case the students, withdraw from the project involvement is a common occurrence in open source projects. The project users in this case are not hurt by the constraints of the academic calendar. Open source projects provide an excellent audit trail of activity allowing the evaluation of students to have more documentation. When students join an existing open source project the past history of the project is available for them to review. As part of the course and orientation to the project the instructor can require the student to familiarize themselves with the project history. Students can read about discussions related to past design decisions and the resulting consequences.

If one examines the four educational objectives that were stated earlier. Each of these objectives can be met by and arguably better achieved by using open source projects.

In project classes where the requirement definition phase of the project is included the open source project approach would involve identifying a piece of an existing project that could be extended. Identifying and interacting with the user may have to be a role played by the instructor.