Role of Open Source SoftwareTesting tools in school and colleges in making of good software quality professionals. - A case Study on Last Semester BCA students of Darbar College, Bijapur

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Abstract--Although practical training in softwaretesting tools and methodologies are vital for ensuring software quality in industry, academic course curricula do does not appear to be providing students with enough hands-on experience in softwaretesting. Furthermore, there are few research studies that discuss how different pedagogical approaches to such training are helping students to improve their testing skills. In this paper we describe how testing tools are introduced and used in an undergraduate testing course at Rani Channamma University, Belagavi, Karnataka (RCUB). As part of a semester-long course project, students access self-study tutorials on black-box and white-box testing tools via Mozilla Firefox Repository of SoftwareTesting Tutorials. We have captured the results of their experience in a case study. Our findings suggest that (MozTrap and Bugzilla) tools and techniques are an effective tools and motivator for students to improve the quality of their test cases, that simplifies the supply of tests for software in a cooperative way. Along with software life cycle, it suggests test cases documentation, that can be run by several testers using different locales and operating systems. The results of those tests can be recorded and reported in MozTrap with a few fairly simple steps. Also, it is noticed that to use MozTrap or Bugzilla complicated computer skills are not required.

Keywords— *Software testing tools, Open Source, Mozilla, Bugzilla*

I. INTRODUCTION

As software becomes more ubiquitous, the need to improve its quality is becoming more important.Software bugs continue to plague many industries ranging from business to the military, and are costing companies in the global economy in excess of $300 Billion per year.As a result of the high cost of these bugs some companies are now requiring their developers to have some form of training in software testing. This is mainly due to the fact that software testing continues to be one of the most widely used and effective means of software validation.1

Although a larger number of academic institutions are expanding their curriculum to include additional software engineering courses, more needs to be done in exposing students to software testing and the use of software testing tools.1 During the past decade there has been a noticeable improvement in the number and quality of software testing tools that have become available for use by students in academic institutions.1 most of tools are Open Source and are integrated into IDEs and browsers like Selenium and JUnit , The easy access to Open Source testing tools provides interesting pedagogical research questions that can be asked. How are these tools used in the classroom? How is the easy access to tools improving the students’ testing skills?1.

In this paper we attempt to answer the aforementioned questions by describing our experiences of using Open Source testing tools in the undergraduate testing class at Darbar BBA and BCA College Bijapur Karnataka.

We provide an overview of the pedagogy used in the testing class, the structure of the class and the class project with help of Mozilla community. Students are required to access the various tutorials and documentation of Mozilla communities and directly take part in online IRC Chat of Mozilla communities and interacting with different testing engineer from different location around the world.this paper only focus on functional testing for under graduate students of BCA last semester of Darbar BBA BCA College.

In the study reported in this paper we attempt to answer the following questions: (1) Does the use of Mozilla Software testing Communities motivate students to improve their test suites during testing? (2) Do the results generated by the student like number of bugs reported and same will store and assign to developer using Bugzilla ? (3) Dostudents find

Moztrap and Bugzilla and other resources of Mozilla communities useful learning resource for testing techniques and tools? (4) Do studentsfind the features in Moztrap and interecting with other tester support collaborative and real time learning?

II. BACKGROUND

In this section we provide an overview of testing concepts and a brief description of the testing tools used in the class

A. *Testing Concepts*

The Software Engineering Body of Knowledge (SWEBOK)5 defines software testing as the dynamicverification of the behavior of a program on a finite set of test cases, suitably selected fromthe usually infinite executions domain, against the expected behavior. Implicit in the definition isthe execution of a program under specified conditions, observing and/or recording the results of the program execution, and making an evaluation of some aspect of the program. There are many facets to testing including the testing levels (unit, integration, system), the viewof the component under test (white-box, black-box, grey-box), the coverage criteria used to determine the effectiveness of testing (function, control-flow and data-flow), the objectives of testing (regression, acceptance, alpha), among others.1

In this paper we will focus on testing levels, view of the component to be testedBlack-box testing techniques generate test cases based on the specification of the component.the functional test case written in Moztrap and bug is log in to Bugzilla .

B. *Testing Tools*

Testing tools can play a key role in teaching software testing, particularly to students who have never been formally exposed to testing. Tools are categorized based on several criteria the most common being In this paper we focus on the tools students used in the Mozilla Software Testing Communities projects,.1

- Moztrap for test case
- Bugzilla for Bug tracking

III. UNDERGRADUATE TESTING COURSE

In this section we introduce the Software testing subject that is taught at BCA last semester students at Darbar BBA BCA college. In addition, we briefly introduce the Mozilla Software Testing Communities such that students use to supplement the instruction on software testing tools along with real time knowledge.

A. *Pedagogical Approach*

In the testing course we use a combination of collaborative learning and problem-based learning to get students involved in learning testing concepts and how to use testing tools and how to interact with testing communities. Collaborative learning is mainly used in the team project, described in a subsequent section, where students are placed into teams and are required to test the implementation of a software product. Collaborative learning is also encouraged at the class level where students may receive extra credit if sharing a resource helps the students in the class to better understand testing concepts, and/or learn how to better use testing tools and Mozilla communities.By employing collaborative learning in this way students are forced to get involved in the Real time learning process since they are required to complete some aspect of the project. The individual's work isthen validated by the Communities members, the entire class and the instructor through a series of presentations and deliverables which will be using Mozilla IRC channel.

Team work also provides the students with the opportunity to work together, although they may have different views, abilities and personalities. Teams are randomly selected which usually results in teams with teammates who have never worked together. These characteristics of the team force members to assist each other through Telegram which is a cloud-based instant messaging and voice over IP service developed by Telegram Messenger, learn how to resolve their differences and build consensus, all key tenets of collaborative learning.

A key aspect of our approach in the testing class is the use of a problem-based learning strategy. We encourage students to work on real-world problems, in our case, students test software projects developed by Mozilla.

Based on the feedback received from the students in the testing class, the projects assigned to be tested exhibit many of the characteristics of real-world projects e.g., incomplete documentation or Not available of project documentation, a software design that is inconsistent with good design principles (low coupling and high cohesion), and an incomplete implementation of the requirements as they involve in Open Source communities.

We have realized that active participation by students in Mozilla Software Testing communities can be significantly improved by awarding participation points during the class.

B. *Structure*

Course topics as stated in the Mozilla Communities are: test plan test case generation and Bug tracking, GUI testing, the material presented to students during the course is centered on black-box the black-box testing techniques presented include:

random, equivalence partition, boundary-value analysis, Random testing is a technique that selects random independent inputs from the domain. Equivalence partition testing is a technique that selects inputs from each equivalent class in the domain. Boundary-value analysis testing is a technique that selects values on the boundaries of the equivalent classes.

C. Course Project

Team-based project is a key component in the course, particularly from the point of view of the students understanding the difficulty in testing a piece of software written by other developers of Mozilla Communities. The students are expected to gain experience in terms of analyzing and validatingsoftware, writing test cases in Moztrap, and creating test documents in Moztrap. The software to be tested is a project from Mozilla communities like FireFox Browser. The software artifacts include: the requirements document, design document, implementation document, UML diagrams and source code which are all available in IRC channel of Mozilla.

IV. CASE STUDY

The case study reported in this section focuses on the class project, specifically how the testing tools are used in the project to improve the quality of the testing activities. The study reported in this paper was performed in the BCA last semester.

Testing Metric	**Test cases Execution**
Number of Requirement	6
Average nu of Test cases Written per requirement	10
Total No. of test cases written for all requirements	60
Total No. of test cases Executed	20
No. of Test cases passed	10
No. of Test cases failed	5
No. of Test cases Blocked	5
No. of Test Cases Not Executed	40
Total No. of defects identified	10
Critical Defects count	5
High defects count	3
Medium defects Count	2
Low defects Count	0

The specific objectives are:

1. The availability and knowledge of the use of Moztrap and Bugzilla tools motivate students to improve the quality of their black-box test suites.
2. Students find Mozilla Software testing Communities is a useful learning resource for testing techniques and tools.
3. Students find that Mozilla Testing Communities supports collaborative and real time learning.

A. Methods

a) Sample: The students that participated in the study were from the BCA last semester of 2015 batch Software Testing class at Darbar BBA BCA College. The class contained 91
students which were assigned to 15 teams and each team have 5 members.

b) Data Collection: Data for the study was collected using: a review of the artifacts for the project deliverables - documents, presentation slides, and source code; observationof the in-class team presentations; and a survey instrument consisting of 30 questionsdivided into 5 sections. The reason for observing the in-class presentations was to determine if then teams used the tools to fully automate the running of the test cases. All project teams were assigned the same software engineering project of Mozilla which is FireFox browser.

The survey used to evaluate the students interactions with Moztrap and communicate with testing team , the survey used are 1) Overall Reaction to Mozilla testing blogs and Quality Management Websites 2) Testing Related Questions 3) Collaborative Learning Related Questions

*c) Design***:** The software to be tested was made available to the project teams of BCA last semester batch 2015. Their last semester has six months. At the beginning of the semester the students were informed of this study and how the documents would be reviewed. Students were enrolled in Mozilla India Testing Communities and were provided access to the tutorials, blogs and online help at that time. The survey was administered during the last week of the semester.

During black-box testing for the first deliverable, the students were instructed to create test cases based on the use cases of the system as follows. For each use case there should be at least 2 sunny day scenario test cases, and 1 rainy day scenario test case where they are using Moztrap. Table 1: Number of test cases created during black-box functional testing is done using Moztrap and bug is log in to Bugzilla.

Table 1

Percentage of Test cases Executed:	33.30%
Percentage of Test cases not executed:	66.60%
Percentage of Test cases Passed:	50%
Percentage of Test cases Failed	25%
Percentage of Test cases Blocked	25%

Defect Density	1.66
Defect Leakage	55%

Table 2

Defects by Priority	
Percentage of Critical Defects	50%
Percentage of High Defects	30%
Percentage of Medium Defects	20%
Percentage of Low Defects	0%

Table 3

Sample of Survey data are as follows

Overall Reaction to Mozilla testing blogs and Quality Management Websites	
1.Have you ever used a learning resource other than Mozilla blogs and Mozilla wiki to learn about testing concepts or testing tools? Yes no	4.I feel comfortable using the website of Mozilla Quality Management and Indian testing task Force.
10. The interface of the websites of Mozilla Testing blogs and Quality Management site is pleasant.	12. The website of Mozilla Testing Task force and Other Quality Management resources has all the functions and capabilities I expect it to have(such as Date , time and Tasks and reports management)
14. I would recommend the websites to fellow students to get Involved in MozillaTesting Communities.	15. Overall I am satisfied with the Mozilla Blogs and Testing related websites.
Testing Related Questions	
16. The tutorials in Mozilla blogs helped me to better understand testing concepts.	20. The number of tutorials in different Mozilla testing and Quality blogs is adequate
18. The tutorials in Mozilla Blogs and getInvolved in QA helped me to better understand how to use and write Test cases documentation- testing tool Moztrap	21. I would have used LOCALLY testing tools such as Moztrap and Bugzilla in my academic project

Collaborative Learning Related Questions	
22. The use of Telegram app and IRC channel (both desktop and mobile) of Indian Software testimg group encouraged me to visit the website QA links and complete the tasks	25. The Group task showing the activities of the other members in the class encouraged my team to complete my tasks in Mozilla Communities.
23. The use of Telegram app and IRC channel (both desktop and mobile) of Indian Software testimg group encouraged encouraged my team to visit the website links and complete the tasks.	22. The use of Telegram app and IRC channel (both desktop and mobile) of Indian Software testimg group encouraged me to visit the website QA links and complete the tasks

V. CONCLUSIONS

This paper shows the using of tools MozTrap and Bugzilla along with Real time Mozilla Firefox project that is used by an undergraduate software testing class at BCA last Semester Darbar BBA BCA College Bijapur. A description of the pedagogical approach, Mozilla Communities software testing structure, and the project FireFox were presented. In addition, we described how black-box were used during the class to test and log the bug in to Bugzilla and how the students interact with other testers around the world, We conducted a case study during the class and it was determined that 1) the availability and knowledge of the use of Moztrap andBugzilla tools motivated students to improve the quality of their black-box test suites 2) The communication between the other community members 3) Mozilla communities channel like blog and IRC Group meeting and Software Testing Tutorials, is a useful resource for learning real time software testing. We have currently collected additional data for a follow up study and will perform a comparative study to determine if the results presented in this paper are conclusive.

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