# The Emerging Role of Software Testing in Curriculum

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## ABSTRACT

Software testing is important to the software industry, with over 50% of the cost of managing the software lifecycle spent on test and quality assurance, yet it receives little attention in universities and polytechnics. This poster paper, identities the gap between industry demand, technology education and research, then outlines a postgraduate (Level 8) course offering, that is exclusively devoted to software quality assurance and testing. A discussion is presented here to address the contemporary issues in software testing.

**Keywords**: Software testing, postgraduate courses.

## 1. INTRODUCTION

Software testing is an important and critical activity in the process of delivering quality software products. It is needed continuously at every stage of development and deployment and accounts for over 50% of software management costs, yet it receives little attention in universities and polytechnics.

In 2002 a study conducted by the National Institute of Standards and Technology reported that software bugs cost the US economy an estimated $59.5 billion annually, and that more than a third of that cost could have been saved by improved software testing (Wong, 2011).

Recent software-related problems that have resulted in social problems and financial losses are largely due to lack of testing. It is expected that software testing will in future play an even more vital role, as software complexity and related legal complications increase. Between 1985 and 2005, 30,000 deaths and 600,000 injuries were reported due to medical device software failures. In 1999, the $165 million dollar Mars Polar Lander Space Probe was destroyed in its final descent because its software shut the engines off 100 feet above the surface.

## 2. EFFECTS OF INDUSTRY ON SOFTWARE TESTING EDUCATION

Graduates of software engineering and computer science enter the work force with exceptional development skills, but lack proficiency in testing, debugging, and analytical skills. This is because the majority of the current emphasis on software development much concentrated on development life cycle, namely: requirements gathering, architecture design, and implementation. It is believed that test skills are often learned ad-hoc while in the process of learning programming and implementation-oriented courses. The lack of formal education in testing among graduates forces industry to spend substantial resources to educate graduates the state-of-art of software testing. Therefore, the impact to software development organizations is lower productivity, lower quality of testing and additional training costs.

## 3. QUALITY ASSURANCE COURSE AT LEVEL 8

Software testing has been widely adopted in industry. Nowadays software quality has become the dominant success criterion in the software industry. A lot of advanced techniques, automation tools, and effective processes of software testing have been proposed and developed by researchers and practitioners (Chen, Zhang & Luo, 2011). In addition to these advancements, achievements and contributions, the testers' should have the skill, passion, enthusiasm and commitment to play a key role in a successful journey.

There are three fold-challenges which are of concern to Level 8 Postgrad students. Students are required to implement these testing methods in practice skillfully, so that they are capable of transferring these methods into industry. The second challenge for students is to implement these testing methods in practice by overcoming the gaps between academia and industry. The third challenge is to research and identify the contemporary testing methods to test modern-day applications. The challenges and opportunities for future research are open still.

## 4. QUALITY EMPHASIS IN THE CURRICULUM

Recently, the software industry has gradually increased the awareness of the importance of software quality, domestic software enterprises have gradually attached great importance to software testing activities. However, even if the importance of the software testing and its position in the whole
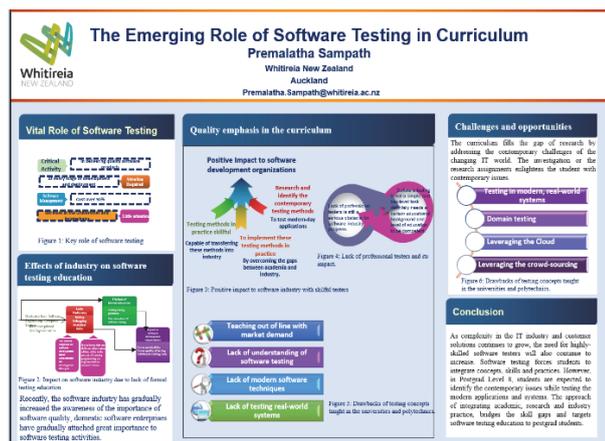
development process is known, lack of professional testers is still a serious obstacle for software industry progress. Software testing is not a simple and low-level task (Bin & Shiming, 2013); it certainly needs to have a certain educational background and level of education to be competent.

In many universities and polytechnics, software testing courses as stand-alone courses are relatively very low in numbers compared with other computer courses (Bin & Shiming, 2013), especially in New Zealand where they are very few (Sampath, 2013). With the development of software, the way in which technology is tested is constantly changing. Teaching content and methods for software testing needs to be updated according to the industry requirements and changing trends in the IT market. In many universities, most of the software testing course focus on theory in order to explain and test methods, ignoring an important practical aspect. In fact, practice teaching of practices in software testing courses is very important. Therefore, the better teaching case and experimental environment are the key teaching good software testing course.

Testing concepts taught in the universities and polytechnics found the following drawbacks:

- Teaching seriously out of line with market demand.
- Lack of deep understanding of software testing.
- Lack of testing in modern, real-world systems.

# 5. CHALLENGES AND OPPORTUNITIES

For software testing courses, the goal is to enable students to understand the important role and status of software testing in the software development process through theoretical study. This course could enable the students to use the software testing technology to solve practical problems and can understand the requirements of software testing professional characteristics and quality of software testers. To address the contemporary issues of the modern IT world and Postgrad course requirement, the course contents and teaching resources are reformed. Software testing course content should reflect imparted knowledge and ability to improve unity, and focus on the development of ability.

The curriculum fills the gap of research by addressing the contemporary challenges of the changing IT world. The investigation or the research assignments enlightens the student with contemporary issues.

## 5.1 Testing Modern, Real-World Systems

Many testing techniques, and especially the academic techniques have not yet found their way into industrial practice. Specifically, many modern software systems consist of components of diverse nature, with different degrees of coupling with one another, and they are often distributed and highly dynamic.

## 5.2 Domain Based Testing

Researchers propose testing techniques that address relatively new application domains, such as component-based systems, web applications, mobile applications, and so on. Therefore, the need to address emerging languages and application classes will clearly continue to be important, and will remain one of the larger opportunities for testing researchers. Re- searchers are currently considering techniques for testing dynamic multi-tier web applications, techniques for testing software product lines and testing of Android applications.

## 5.3 Leveraging the Cloud and the Crowd

Cloud computing has emerged as new technology in the last decade. Cloud testing is a form of testing in which web applications use cloud computing environment and infrastructure to simulate real world user traffic by using cloud technologies and solutions. Another opportunity that is loosely related to cloud computing, but pushes the boundary even further, is the use of crowd-sourcing to improve software testing.

# 6. CONCLUSION

As complexity in the IT industry and customer solutions continues to grow, the need for highly-skilled software testers will also continue to increase. Software testing forces students to integrate concepts, skills and practices. However, in Postgrad Level 8, students are expected to identify the contemporary issues while testing modern applications and systems. The approach of integrating academic, research and industry practice, bridges the skill gaps and targets software testing education to postgrad students.

The approach presented in this poster paper, while not comprehensive, deals with important aspects of both the practice and research dimensions of software testing at a postgraduate level (Level 8).

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