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Citation of this paper:

Capretz L.F., Waychal P., Jia J., Basri S.B., Comparing the Popularity of Testing Career among Canadian, Malaysian, Chinese, Indian, and Malaysian Students, *3rd International Conference on Advanced Information Science and Systems (AISS 2021)*, Sanya, China, 7 pages, ACM, New York, NY, USA, DOI:<https://doi.org/10.1145/3503047.3503091>, November 2021.

Comparing the Popularity of Testing Careers among Canadian, Indian, Chinese, and Malaysian Students

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This study attempts to understand motivators and de-motivators that influence the decisions of software students to take up and sustain software testing careers across four different countries, Canada, India, China, and Malaysia. Towards that end, we have developed a cross-sectional, but simple, survey-based instrument. In this study we investigated how software engineering and computer science students perceive and value what they do and their environmental settings. This study found that very few students are keen to take up software testing careers - why is this happening with such an important task in the software life cycle? The common advantages of a software testing career are learning opportunities and easiness of the job and the common drawbacks are tediousness, complexity, and missing the opportunity to do (software) development. Our findings highlight the importance of depicting software testing activities as a set of human-dependent tasks, and emphasizes the need for research that critically examines the way in which software testers view testing activities.

CCS CONCEPTS • Software Engineering • Human Aspects of Software Engineering • Software Verification and Validation

Additional Keywords and Phrases: Human factors in software engineering, software engineering, software testing, software careers, empirical software engineering, social aspects of software engineering, cross-cultural study

ACM Reference Format:

Capretz L.F., Waychal P., Jia J., Basri S.B., Comparing the Popularity of Testing Career among Canadian, Malaysian, Chinese, Indian, and Malaysian Students, *3rd International Conference on Advanced Information Science and Systems (AISS 2021)*, Sanya, China, 7 pages, ACM, New York, NY, USA, DOI: <https://doi.org/10.1145/3503047.3503091>, November 2021.

* This research was conducted while Dr. Capretz was on sabbatical as visiting professor of computer science at Universiti Teknologi PETRONAS in Malaysia.

1 Introduction

Software quality has come under increasing scrutiny in recent years and this scrutiny will likely become even more intense in the future. Software testing plays a vital role in the development of high quality and reliable software systems. Software systems in turn are becoming more complex due to (a) the intricacies of the problems that they are solving, (b) their dependence on a myriad of third-party software components, and (c) the continuous shrinking of the period of time between creation and deployment. This multi-faceted complexity is leading to increased susceptibility to failure. Coupled with that, the sheer pervasiveness of software systems, especially in mission-critical areas, is resulting in dangerous combinations. Vigilant testing with the help of appropriate processes, technology, and professionals can ease the situation. Therefore, the importance of software testing is increasingly being recognized.

Despite its central role in the industry, software testing is both the least understood and most difficult aspect of the software life cycle to execute properly. In spite of its bearing on the success of software testing, and despite the efforts of many researchers and practitioners to address this problem, few studies have examined the human dimension of testing [13, 5, 7]. Instead, the focus has remained on process and technology. However, testers must also understand how to deal with people. This includes the ability to appreciate both the explicit and implicit needs of various stakeholders, be aware of how developers work, both individually and on teams, and also develop the social skills needed to report test results diplomatically and sensitively to stakeholders. The need for such multifaceted skills reinforces the importance of the human dimension in software testing and therefore the need to study it more thoroughly.

The aims of the current study are to address the lack of competent testing professionals through an investigation of the reasons behind the reluctance of students in different geographic areas to enter testing careers. This problem has been studied by Waychal and Capretz [15] and Deak et al. [8] in India and Canada, and in Norway, respectively. Our research compares the results of investigations with Canadian, Indian, Chinese and Malaysian studies with a Norwegian study. The identified research question was: Why are software and computer engineering students (referred to as 'students' hereafter) across the world unwilling to take up software testing careers?

2 Method

Our study analyzed students' opinions about whether they would choose testing careers, and what they felt were the advantages and drawbacks of a testing career. Since we wanted to compare the perspectives of testers in various geographic areas, we followed the same process and used the same questionnaire that we used in the Indian study [16]. Software testing requires competent and motivated professionals [9, 14]. However, very few students across the globe choose testing careers, depriving the industry of competent testers, and consequently, of quality software. This study attempts to understand the reasons for such apathy towards testing careers. The study is cross-sectional and mixed. It does not study students' responses over time but seeks open-ended responses regarding the advantages and drawbacks of the testing career and categorical responses about testing as a career of choice.

The instrument was designed to evaluate the willingness of students to take up software testing as a career and their rationale. Specifically, students were asked about the likelihood that they would choose a testing career. Possible answers were 'Certainly Yes,' 'Yes,' 'Maybe,' 'No,' and 'Certainly not'. Respondents were then asked to expand further on their answers in an open-ended way that explains what it was for them that prioritized the advantages and disadvantages of a software testing career. We decided on a qualitative approach, partly because there has been very little prior research on the issue, particularly in the geographic regions we studied, and partly because it provides a way to understand the real-life reasons for respondents' choices. Some researchers have distilled the advantages and drawbacks of the software testing profession [10], which could have formed a basis for our investigation, however there was no convergence across the four studies, which suggested that there were factors influencing students' perceptions that were not apparent to researchers.

The study used convenience sampling by seeking responses from 336 students from four different countries - 85 from Canada, 70 from India, 99 from China, and 82 from Malaysia. The Indian responses were sought from junior students, who were close to the end of their second semester. The Chinese responses were drawn from senior students before the

start of their first semester, and the Malaysian responses from senior students who were nearing the end of their first semester. While the Indian and Chinese students had not taken a course on software testing, the Malaysian students had.

The sample collection was chosen by convenience since the co-authors teach software engineering courses, their students were the subjects. As the survey was anonymous, and given that no private information nor identifier was shared, no ethics approvals were necessary. The survey questions are listed in Appendix A.1.

3 Findings

Before beginning the survey, the objectives of the survey were explained to the students. They were also reassured that their grades would not be impacted by their responses and were offered the choice of not disclosing their identities. Responses were manually tagged and iteratively coded until no further changes were possible. [Table 1](#) presents the likelihood of a student in each jurisdiction choosing a career in software testing. The subsections which follow enumerate the advantages and drawbacks described by the respondents.

Table 1: Probabilities of Students Taking Up Testing Careers

Response	Canada	India	China	Malaysia
Certainly Not	31%	14%	24%	1%
No	27%	31%	0%	7%
Maybe	33%	47%	74%	52%
Yes	7%	7%	2%	34%
Certainly Yes	2%	0%	0%	6%

Canada: Of those surveyed, only 9% were prepared to become testers, and only 2% of students responded ‘Certainly Yes’. In contrast, fully 58% (a huge number) of students were not willing to take up a career in testing at all, and 31% chose ‘Certainly Not’ as a response, while 33% chose the ‘Maybe’ option.

India: Strikingly, no student selected the ‘Certainly Yes’ option, and a mere 7% of students chose the ‘Yes’ option. ‘Maybe’ was the choice of fully 47% of respondents.

China: The majority of students (74%) chose ‘Maybe’, while 24% were strongly opposed to taking up a career in testing, as indicated by their choice of ‘Certainly Not’. Only 2% of students selected the ‘Yes’ option.

Malaysia: 40% of students were willing to become testers and 6% of them responded with ‘Certainly Yes’. That is a huge number compared to the other two countries. Only 8% of Malaysian students were not ready to take up testing careers, and a mere 1% of them responded with ‘Certainly Not’. Significantly, 52% chose the ‘Maybe’ option.

3.1 Advantages of Testing Careers

Analysis of the responses to the testing career option identified the following 7 factors as advantages:

1. Learning opportunities – Testers can learn about different products, technologies, techniques, and languages as well as domains, such as retail, financial, etc. They also have the opportunity to develop softer skills as a result of more interactions— many of them difficult ones— with developers and customers. Testing activities expose the tester to the full extent of a project’s scope and architecture in a short period of time and their work may span all project stages. Further, testing requires the ability to focus on details, and is an expanding field. Examples of statements about learning opportunities include: *learn broad knowledge in different applications, improve leadership skills, improve communication and technical skills, and will have the chance to touch/experience more products and their use cases, able to understand and test a variety of software, and learn about the software development life cycle.*
2. Importance of job – Testers are accountable and responsible for the product quality. In that sense, testing is an important part of the software life cycle. This aspect was reflected in sample statements such as: *a certain amount of responsibility for the state of the system in Production or Live state, and QA plays a very important role in software development, testing will define the success/failure of a project, and testers focus on finding bugs; a different activity from what developers do.*

3. Easiness of job – This refers to students’ belief that testing does have well defined and easy processes, etc. This dimension was described in sample statements such as: *clearly defined objectives, metrics and structured work schedule, easy work as compared to development, and easy to learn and gain experience.*
4. Thinking job – This encompasses views about testing such as being challenging, creative, innovative, and requiring logical and analytical thinking. This sentiment was evident in sample statements such as: *You get to challenge the system, and you get to think outside the box, the challenge of ensuring that all aspects of a system are tested properly and completely, involves more logical thinking, and that new testing projects provide new challenges.*
5. More jobs – This is the idea that more testing jobs are available, and due to the higher demands, the jobs are secure and stable. This idea shows up in sample statements such as: *stability in employment – the job is always there and is always needed, high demand for the role, and lots of jobs out there for software engineers in testing, and job security in large organizations.*
6. Monetary benefits – Testing jobs do have good salary packages. This is reflected in sample statements such as: *software engineers in testing jobs get paid as much as software developers, and you have the opportunity to work in a very lucrative and fast-paced industry.*
7. Fun to break things – Some students apparently feel a certain joy in breaking things and in finding defects in software. This is reflected in sample statements such as: *testing is creative and fun, and it is fun to break things or change it.*

Responses, categorized by country, appear in [Table 2](#). Because we have excluded advantages that made up less than 5% (too few to consider) of the total responses, totals in each column may not add up to exactly 100%. In addition, respondents could list more than one advantage.

Table 2: Percentages of Salience Advantages by Country

Advantages	Canada	India	China	Malaysia
Learning Opportunities	11%	30%	8%	53%
Important Job	21%	14		37%
Easy Job	21%	9%	44%	28%
Thinking job	8%	38%		20%
More jobs	20%		22%	37%
Monetary benefits	9%		13%	29%
Fun to break things	7%		6%	7%

Canada: 21% of respondents saw testing jobs as important, and the same percentage considered the job to be easy, while 20% saw the number of jobs available in the testing role as an advantage. A total of 11% thought the learning opportunities that testing careers offered were an advantage, and 9% saw strong monetary rewards as an advantage. Finally, 8% chose the thinking aspect of the job as a significant advantage, and 7% thought the prospect of it being fun to break things was a clear advantage.

India: The advantage most often identified by Indian students was that testing was seen as a thinking job (38%). Learning opportunities and the importance of the role garnered 30% and 14% of the votes respectively. Easiness of the job was identified just 9% of the time as an advantage.

China: Chinese students chose testing being easy (44%) and offering the possibility of more jobs (22%) as the two most significant advantages. Monetary rewards accounted for only 13% of the chosen advantages, while learning opportunities (8%) and fun breaking things (6%) were the next most often identified advantages.

Malaysia: 53% of respondents chose learning opportunities offered by a testing career as the most important advantage, while 37% of students characterized testing jobs as important and the same percentage noted the availability of testing jobs. While 29% recognized the monetary incentives offered by a testing career, testing jobs were also seen as a ‘thinking job’ (20%) with the prospect that it could be ‘fun to break thing’s’ (7%).

3.2 Drawbacks of Testing Careers

Analysis of the responses to the testing career option identified the following 9 factors as drawbacks:

1. Treatment as a second-class citizen – This drawback points out that testers are not involved in decision making and are blamed for poor quality, while developers are rewarded for good quality. They also include the evident lack of support from management in terms of unrealistic schedules, poor allocation of resources, and inadequate recognition. This idea is reflected in sample statements such as: *testers are typically regarded as second-class citizens within the organization; they have almost no say on the architecture and design of a system; they are always at the rear end of the development cycle, meaning they are challenged with very little remaining time to ship the product; it is typical to see test teams working overtime over multiple weekends prior to shipping of the system, performing regression tests over and over again, with multiple last-minute bug fixes from the development team; heated debates on whether defects are qualified or not, i.e. whether there are problems with setting up the test environment, and whether there are problems with testers understanding the functionality of the system, etc.*
2. Career development – Students may believe that there is limited growth in the testing field. Some also believe that testers' jobs are less secure and that they are the first ones to lose their jobs during business downturns. Sample statements regarding this disadvantage include: *a hard to build career, one can rise up to only QA managers as there are very few director-level roles, hard to transition into another role, manual testing jobs are very career limiting and are not recognized by companies.*
3. Complexity – This covers the complex situations faced by testers, such as different versions of software products, platform incompatibilities, defects not getting reproduced, and insufficient testing time, while also being held responsible for problems with product quality. This also includes the fact that testers need to look at business and technology artifacts and understand many abstractions. The lack of clarity around requirements also adds to the difficulties. This factor also includes dealing with different versions and vendors of third-party software, problems with testing tools, development environments or a weak infrastructure, and the requirement for inexhaustible patience. Sample statements for related to this disadvantage include: *a great deal of abstraction is needed to perform adequately in the role of tester and unexpected events may happen at any time, rendering the tasks that were performed useless; it is difficult to understand others' code; the pressure is high due to time constraints.*
4. Tediousness – This refers to the repetitive nature of testing. Respondents have also used words such as 'monotonous' and 'boring'. Sample statements reflecting this disadvantage include: *testing is repetitive work, requiring loads of screen time, and that this is the digital equivalent of working as a laborer on a manufacturing assembly line; physically exhausting, mentally boring and tedious, the work is also tedious and repetitive, doing the same tasks over and over.*
5. Missed development – Some of the students surveyed believe that they miss opportunities for professional development by taking up testing careers. While some testers do have the chance to develop test automation systems, the students seem to consider that as different from actual development activity. Some also think that they lose learning opportunities that are available to developers. Sample statements reflecting this sentiment include: *no ability to create new things, the learning scope is small compared with the development field, you're just checking other people's work, creating software can be more exciting than testing software, and we will be away from designing and developing systems.*
6. Lower monetary benefits – Some testers believe that testers' jobs do not have monetary benefits on a par with developers. Sample statements include: *Typically testers are paid less than architects and designers, for both contract and permanent positions, lower salary in turn means less benefits (such as pension, life insurance, disability allowance, etc.), which are usually a fixed percentage of the base salary.*
7. Finding others' mistakes – It is not pleasant to find mistakes in the work of others and to have to tell them. As Kaner et al. [11] point out, testers have to report anything that adversely impacts the value of the product, which may not sit well with some stakeholders. Comments on this drawback include: statements such as: *Sometimes team members may dislike you professionally, due to bugs you have discovered, conflicts with*

developers, the project team may not like you, or may see you as evaluating their work, leading to workplace dissonance.

8. Stressful job: This has to do with work-life balance. Sample assertions related to this drawback include: *hard work, huge responsibility, as a gatekeeper you may be blamed for faulty software, the need to be available all the time, just in case of software failure.*
9. No Interest – Some students mentioned that they simply have no interest in the field of software testing. Sample statements include: *I simply do not have interest in testing, I just want to be a developer.*

[Table 3](#) itemizes the responses of students from each of the countries surveyed. Drawbacks that made up less than 5% of the total were excluded. As a result, not all columns will add up to 100%. Additionally, students were able to list more than one drawback.

Table 3: Percentages of salient drawbacks by country

Drawbacks	Canada	India	China	Malaysia
Second-class citizen	17%	25%		7%
Career development			6%	29%
Complexity	6%	24%	37%	33%
Tedious	50%	24%	35%	38%
Missing development	15%	15%	7%	18%
Less monetary benefits			6%	6%
Finding others' mistakes	6%			34%
Stressful job				15%
No interest		5%		17%

Canada: For Canadian students, the most common drawback cited was tediousness (50%), followed by treatment as a second-class citizen (17%) and missed opportunities for professional development (15%). Complexity and Finding the mistakes of others ranked 6 % each.

India: The most frequently cited drawbacks for Indian students were treatment as a second-class citizen (25%), and the complex and tedious nature of the role (both polling at 24%). Fifteen percent (15% identified missed opportunities for development and 5% a lack of personal interest.

China: For Chinese students, the most significant drawback was complexity (37%), followed by ‘the tediousness of testing jobs’ (35%). ‘Missed opportunities for development’ (7%) and ‘less monetary benefits’ (6%) made up the two least important drawbacks.

Malaysia The most important drawbacks for Malaysian students were ‘tediousness’ (39%), ‘missing development’ (18%) and ‘treatment as second-class citizens’ (only 7%). Complexity and ‘finding the mistakes of others’ polled 33% and 34% each respectively, which are quite high percentages.

4 Discussions

In this section, we discuss the findings of our research. We first compare our findings with another similar study and then discuss the insights gleaned from our study. Capretz et al. [6] briefly described the results from a survey of Canadian, Chinese, and Indian students. Our current work includes an additional cohort of Malaysian students and describes a detailed analysis of the studies by comparing their answers in depth.

Deak et al. [8] studied the same problem, i.e. students’ (dis)interest in testing careers in Norway. In contrast they considered students at different levels in different programs. In contrast, our comparison focuses on a subset of 23 students from their study who were in the junior year of a computer engineering program. Out of the three options of ‘having interest’, ‘no interest’, or ‘being undecided about taking up testing careers’, 61% of the students were not interested in taking up testing career, 30% were undecided, and only 9% were interested. The results are in line with our own observations, especially those for our Canadian students.

The overall empirical results on the advantages identified by students from different countries do not appear to converge. For example, while the opportunity for learning and the easiness of the job were the most commonly cited

advantages among all respondents, the range varied widely, from 8% to 44%. Indian students, for example, identified the thinking aspects and learning opportunities associated with the job as the most significant advantages. In contrast, Chinese students named the easiness and availability of testing jobs as the most important advantages. For Canadian students, easiness, importance and the availability of jobs ranked the highest. There was an even wider divergence when it came to drawbacks. The common drawbacks identified were tediousness, 'complexity, and missed opportunities for development, but the range in these rankings is large, ranging from 6% to 50%. Being treated as second-class citizens ranks high for both Canadian and Indian students.

These findings match reasonably well with an earlier study carried out by Deak et al. [8] in the Norwegian context. Our comparative study showed that while the positive aspects of pursuing testing careers were seen to be limited, they included the chance to gain experience and the importance of the job. Students did not identify other positive aspects of testing, such as the relatively easy nature of the job, the fact that it was a thinking job' the greater availability of jobs, compared with software development, or the better monetary benefits, which our study had identified. The more negative aspects of the job (drawbacks) examined by our comparative study included boredom' (tediousness'), a lack of opportunities for writing code (missed opportunities for development), and poor status and unrewarding (treatment as second-class citizens). The authors of this investigation agree that qualitative studies, such as this, are difficult to replicate, but can help in understanding similar cases and situations in different contexts.

Testing offers the advantage of learning opportunities, as reported by students from all the four countries, but it was not the most highly perceived advantage. For Indian students the biggest advantage was seen to be that testing was a thinking job. In contrast, Chinese students identified the advantages of testing as the ease of the job and the number of testing jobs available. Finally, Canadian students rated the importance of the job, ease of the job, and number of jobs available most highly.

For Canadian students, the most significant drawbacks appeared to be tediousness while for Chinese students both tediousness and the complexity of the job, resulting in stress and frustration, were ranked highest. For Indian students, being treated as a second-class citizen, tediousness and complexity were seen to be the most prominent drawbacks. Respondents from all four countries indicated missing development opportunities as a drawback, with Chinese students feeling the least strongly about that particular aspect.

The results also show that Malaysian students have a more positive attitude towards software testing than their counterparts in other countries where these investigations have been carried out. This is demonstrated by the fact that 40% of the students stated that they would seriously consider a career in software testing, compared to less than 10% in other countries. In addition, 53% of the Malaysian students see testing as a learning opportunity, compared to 11% in Canada and only 8% in China.

There appeared to be some confusion among students since the list included contradictory factors, such as easy and thinking jobs, higher or lower monetary benefits, and tedious and creative jobs. This indicates the importance of proper treatment of testing in the university curricula.

5 Implications for Curricula

The implications of this study for computer and software engineering programs at colleges and universities, as well as for industry leaders are significant. First, it provides useful insights into how educators might work at moving toward a curriculum that offers more software testing courses. With careful attention to the quality of these courses as well as enthusiasm for testing as a career, more students could be inspired to take up careers in software testing. This, in turn, would help industry to draw more talented and competent software engineers into the field and would increase the quality of software testing, and improve productivity and turnaround times for software development.

Astigarraga et al. [2] present a survey of the software testing curriculum in universities in the United States and discuss the efforts that have been made to improve the status of testing in the academic curriculum. They report minimal content on software testing in the undergraduate curriculum. Either testing topics are included in courses such as software engineering, are combined with quality assurance, or are covered through independent, but optional courses. The IEEE guide to software engineering body of knowledge SWEBOK [4] and ACM – IEEE (Computer Society) Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering [1], are the most widely used

sources for developing curricula in software engineering and the allied disciplines. Their treatment of software testing is limited to process and technology dimensions and does not bring out the thinking and communication challenges faced by software testing engineers. Therefore, curricular changes may be required to highlight all aspects of testing activities.

As we move forward, program curricula more broadly, as well as courses on software testing and verification and validation, must reflect the understanding that this profession requires not only technical skills, but also the soft skills needed for communicating with stakeholders. This means that curricula must reflect the social aspects of testing, and recognize that testing is ‘applied epistemology’ grounded in ‘social psychology’ [11]. Course instructors therefore, need to work to dispel the notion that testing is limited to the mechanical aspect of running tests and comparing outputs with expected results. The importance of testing and the philosophy behind it should also be stressed, as well as the possibility of bringing creativity to the role. Part of the challenge of training testers is to help them to understand the varying needs of users in different domains. This means learning to understand the way developers think and to be able anticipate the types of errors that may occur. It also means having the ability to think creatively and work efficiently under difficult conditions. Finally, testers require strong communication skills that include tact and diplomacy when reporting findings to stakeholders.

Since it has been shown that including testing courses in the curricula improves student perceptions of testing careers, colleges and universities should begin offering them. These courses can then be regularly reviewed through continuing research and by consulting with alumni to determine their effectiveness. In addition, since training in software testing offers additional opportunities for employment, including such courses can help to colleges and universities to increase the placement rates of their students. Colleges can also create better awareness of the importance of testing by introducing deployable projects. These projects would help students see the connection between software quality and testing. It would also give them first-hand experience of the advantages of testing, such as relevance and the need for critical thinking as well as the opportunity to learn crucial soft skills.

In addition, a greater awareness of students’ perceptions of the advantages and drawbacks of testing careers can help managers and team leaders in recruiting testing professionals. Increased understanding of the perceived advantages and disadvantages of a testing career, both in specific countries and more broadly, can also help managers to deal with global teams. As already noted, software testing is both a technical and social activity, so those who take up a career in testing have the potential to shape the quality of the final product. For example, since tediousness is perceived to be a major drawback, industry leaders may want to introduce sufficient automation or recruit high-school graduates for testing technician roles, and provide more creative work to engineering graduates. Automation also brings in the development element, which may take care of the drawback of missed opportunities for development. Another important issue that industry leaders need to address is testers’ feeling like second-class citizens; if students experience this discrimination themselves, they will tend to avoid the testing profession. Colleges can counter the second-class citizen problem by organizing interactions with thought leaders in software testing.

Our results may shed some lights at prior studies [17, 18], which point to the tester role as one of the least popular roles compared to others, such as project manager, analyst, designer, programmer, and maintenance. It is important then to acknowledge the significant human dimension of software testing [5, 7], and to make students aware that choosing to take up a testing career, can strongly influence the quality of the final product [14].

Finally, we have to recognize that the human factors related to software testing are influenced by sociological and organizational factors, such as organizational policies and processes [8], and individual characteristics such as personality types [12] and age [3]. Moreover, Zimmermann et al. [19] argue against generalizability in software engineering, due to the nature and diversity of the profession. Therefore, we recommend that college faculty and industry managers use the information identified by this and similar studies as a starting point for evolving factors relevant to their specific situations and developing corresponding action plans.

6 Conclusions

This study presents an analysis of the survey responses of 254 undergraduate students in computer science and software engineering from four different countries, studying at similar levels of education, on their willingness to take up a software testing career, and the factors that have influenced their decisions.

Software testing seems to be a neglected area in the software life cycle. There are not enough testing specialists, and testing schedules are increasingly being squeezed as development overruns occur and delivery milestones are considered non-negotiable. Many times, testing is perceived as a nuisance that is sandwiched between development and deployment, when in fact it is a critical activity that needs to be performed in tandem with design and development, as part of software verification and validation. As a result, the software industry has been facing a shortage of qualified software testers, which has led to problems with quality.

It is heartening to see that work-related advantages such as, testing being a challenging and important job, which relate more to intrinsic motivation than environmental factors such as monetary rewards, are identified by some students as advantages. However, it is important that students feel that they will be valued and respected and not treated as second-class citizen' while working as testers. Since this study provides information on advantages and disadvantages that were identified by many survey respondents, they may be transferable to other situations.

The study has limitations with respect to the sample studied. In terms of future directions, there is a need for increasing the number of software engineers taking up testing, including more variation of gender, more options for testing courses in student curricula, and more coverage geographically (covering European and Pacific Rim nations). Further, willingness to take up a career is influenced by both industry and university/college dynamics, which may require a longitudinal study to better understand the phenomenon. Despite these limitations, our study offers useful insights for educational institutions to appropriately educate their students, and industry practitioners to tackle problems related to recruitment and retention of software testing professionals.

Finally, the testing profession seems to be changing with the advent of Agile methods, DevOps and other paradigms. For instance, developer in test is a new role in many companies and this requires other competences than that of a traditional tester from decades ago. Similarly, test automation, security testing, etc., are other new and different forms of this profession. These aspects should be taken into account in future studies.

ACKNOWLEDGMENTS

We are very grateful to all participants for dedicating their time and attention to our study.

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APPENDICES

A.1 Survey Questions

This appendix describes the questions that comprised the survey.

1. *What are the three PROs (in the order of importance) for taking up testing career?*

- a)
- b)
- c)

2. *What are three CONs (in the order of importance) for taking up testing career?*

- a)
- b)
- c)

3. *What are chances of my taking up testing career?*

Certainly Not No Maybe Yes Certainly Yes

Reasons: