



**Investigating Common Traits and Improving
Recruitment of IT Quality Assurance Personnel**

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BA Business Information Technology

Bachelor's Thesis

2024

Abstract

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Degree Bachelor of Business Administration
Thesis Title Investigating Common Traits and Improving Recruitment of IT Quality Assurance Personnel
Number of pages and appendix pages 48 + 3
<p>To date, the vast majority of research into software testing has been devoted to technical aspects such as the enhancement of testing processes, test criteria, techniques and tools. Meanwhile, there has been very little research into the individual testers themselves, their personal characteristics, backgrounds, motivations and skill acquisition. Through an extensive literature review and analysis of views elicited from software testing professionals via a questionnaire, the aim of this thesis is to gain an insight into the qualities required for success in the field of software testing.</p> <p>Comprehensive, qualitative analysis and discussion of the research results revealed the importance of the following traits in particular for shaping effective testing teams: communication and interpersonal skills, continuous learning abilities, problem-solving and critical thinking skills, conscientiousness, diversity, and collaboration, along with the need to promote employee satisfaction and development.</p> <p>Based on there insights, a set of comprehensive recommendations was produced to help guide recruitment processes and promote ongoing skill development and employee satisfaction within testing teams. These recommendations include strategies for assessing candidates' skills and traits, in order to find the most suitable candidates for working in the testing field. Additionally, recommendations are provided for making the role as attractive and fulfilling as possible for new employees.</p> <p>Through actively involving recruitment personnel in the dissemination and implementation of these recommendations organisations can enhance their recruitment processes and create an environment that attracts, retains and develops top talent. Ultimately, it is hoped that the successful implementation of these recommendations will lead to improved testing outcomes, enhanced software quality and greater professional growth and satisfaction among testing professionals.</p>
Key words Testing, Recruitment, Communication, Diversity, Motivation, Development

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1 Introduction

I am currently working as a test automation specialist at the Vallila headquarters of OP Financial Group, one of the largest financial companies in Finland. Prior to commencing this role, I studied for a bachelor's degree in business information technology (BITe) at Haaga-Helia University of Applied Sciences. While the degree covered a wide array of topics and technologies, software testing was not one of the components featured in the curriculum. In fact, it was barely touched upon during the software development courses at all. At most there was a cursory mention of unit testing during one of the classes. The only committed quality assurance course I could find on offer at the university was a three-week intensive summer course which, unfortunately, I could not participate in. A study by Garousi, Giray and Tüzün (2019) found software testing to be one of the main knowledge gaps in software engineering education.

This lack of consideration for the subject would seem to suggest that software testing is not considered as such an important part of the software development lifecycle as some other roles, or at least it is not seen as a unique role in itself which would require different skills (both soft and hard) from that of say a developer or designer. This is especially surprising given that the BITe degree course is focused on Business IT, a world where one would have presumed that testing was more critical than ever.

While it is widely acknowledged that testing is a crucial aspect of software development: "Successful software projects outcomes are highly dependent on the skills and commitment of the testers involved. Having good testers will significantly improve the odds of project success and the delivery of high-quality products." (Deak, 2014). It seems far from accepted that the role of tester is a specialist one requiring certain traits of personality, ways of thinking and skills entirely different from that of other IT professionals.

"There have been many studies carried out on the characteristics, personality types and other human traits which are common amongst developers, and other IT related roles." (Cruz, da Silva and Capretz, 2014). However, there have been very few studies of this type concentrated on software testers and quality assurance specialists. "To date, the majority of software testing research has been devoted to the enhancement of testing processes, test criteria and to the development of new techniques and tools for different types of testing" (Bertolino, 2007). This would seem to suggest an underlying assumption that testing is just a case of following a systematic, standardised and often automated approach, and therefore can be carried out by pretty much anyone. "The abilities and expertise needed to apply such techniques and tools - such as personality traits, education and experience - have attracted a comparatively small amount of research attention" (Kanij, Merkel and Grundy, 2014).

This apparent lack of interest in the individual within the testing process may be due to the common view of testing roles as inferior to those of other members of the software development team. Florea and Stray (2019) emphasise the lack of respect for software testers in their paper, saying: “No earlier than ten years ago, testing was seen as a side-activity, with testers sometimes regarded as second-class citizens whose role was considered a junior- or entry-level position”. Capretz, Varona and Raza (2015) go further still, stating that testing is the least desirable task in software development: “Among the people working in software development, tester and maintainer are the least popular roles. The vast majority of engineers do not like testing and would not choose the role of tester.”

Prior to studying at Haaga-Helia I had zero formal IT training or professional working experience of any kind. Therefore, I feel I have a unique perspective on the process of transitioning from a non-IT background to becoming a working software tester. With this in mind, coupled with observations made during my time working at OP, it seems clear to me that the skills, mindset and mentality required for software testing and quality assurance as a whole are entirely different from what had been required for the software development work I had been employing in my studies. Testing is a creative human endeavour requiring a balance between technical skill and intrinsic human qualities. Understanding the human factors at play in software testing is not just an academic pursuit but holds substantial implications for various stakeholders within the field.

In this thesis I will seek to answer fundamental questions about the skills, mindset and backgrounds that are required to facilitate a successful transition to becoming a qualified quality assurance specialist, challenging the notion that a technical background is the sole requirement. Moreover, I aim to challenge conventional wisdom surrounding software testing, for instance the belief that one must possess an extensive IT background to excel in this field, or on the other end of the scale, the belief that someone from any background or with any skill set can become a competent software tester when presented with the tester’s tool set. These are just a couple of the many assumptions about software testing that this thesis will seek to challenge.

I aim to do this by firstly exploring literary sources covering these study areas in order to gain an insight into the research which has previously been done in the field. I will then utilise these findings to construct a questionnaire that, with the support of my current employers and colleagues at OP financial group, will produce data to hopefully help build upon previous research. I then plan to discuss and qualitatively examine the responses, as well as compare them to findings from the literary review. Given effective testing’s synonymy with successful software projects, the ultimate goal of the thesis will be to produce a set of recommendations to aid recruitment at OP financial group and recruitment of software testing professionals in general, helping to identify, motivate and reward high-performing testers. Furthermore, by recognising the importance of

human factors, employers can cultivate an environment that not only attracts skilled testers but also retains them. This, in turn, will enhance the overall quality of software products and contribute to future project successes.

Additionally, individuals considering a career in software testing can glean valuable information from this research as it sheds light on the personal attributes and skills that contribute to success in the field. Aspiring testers can use this knowledge to tailor their learning journey, focusing not only on mastering testing techniques but also on developing the intuition and creativity highlighted by industry experts. Also, students undecided about their future career path can find clarity through insights provided by experienced testers. Understanding the human-centric aspects of software testing may influence their decisions when choosing study paths. Moreover, the research offers a glimpse into the diverse and dynamic nature of testing careers, potentially steering students towards a field that aligns with their skills and inclinations.

2 Literature Review

Having decided the focus of my study, the next logical step in the research process is to delve deeper into pre-existing literature covering the same or similar themes. In this section I will lay out some of the most relevant and interesting findings from current literature on the subject with a view to adding context to my own investigation. Understanding previous research findings will help build a strong foundation on which to develop my own research plan. Furthermore, it will provide data which can be used to compare and contrast with my own findings, to help produce more robust and substantiated recommendations for employers and recruitment professionals.

2.1 What Is Software Testing?

There are a number of different definitions of what the function of a tester is. Rothman (1998) argues that the purpose of a tester is to assess and report on the quality of the product. "Quality involves a wide range of attributes. Your staff will be assessing code, documentation, entertainment value, usability, performance, conformance to written and implicit customer requirements, hardware compatibility, and lots of other stuff. Additionally, if they are serious about publishing assessments, the group will benefit from staff who understand statistical theory and measurement theory". Kaner, Falk and Nguyen (1999) believe on the other hand that the testers function is much more clear-cut, "the role of the test group is to discover, report, and advocate for the repair of defects". Weinberg (1989) puts it more concisely still when giving his definition. "Quality is value to some person."

However it is defined, consistently in the literature is the acceptance that the role of the tester is vital to the success of software projects. "Successful software projects outcomes are highly dependent on the skills and commitment of the testers involved. Having good testers will significantly improve the odds of project success and the delivery of high-quality products." (Deak, 2014). Furthermore, it is also a major part of the overall project. "Software testing is a crucial part of the process of producing high quality, reliable software systems. It can consume more than fifty percent of the total development effort" (Merkel and Kanij, 2010).

2.2 Current Research

What is also consistent in the literature, and surprisingly so, is the apparent lack of research into the characteristics of the types of people who are working in the quality assurance industry. In particular, the personal characteristics of those testers who are markedly proficient at software testing and so bring the most value to a project. “Although there is extensive work on characteristics of software engineers, to our knowledge there is a lack of research focusing specifically on the characteristics of software testers” (Deak, 2014). “To date, the majority of software testing research has been devoted to the enhancement of testing processes, test criteria and to the development of new techniques and tools for different types of testing. Underlying such research is the assumption that software testing should be, for the most part, a systematic, standardised, and automated process.” (Merkel et al, 2010). If this were true, then the only prerequisite for a quality tester would be the ability to choose and manipulate the correct tools and techniques to do the job.

2.3 Personal Characteristics

The relatively small amount of research that has been done in this area seems to point to the fact that certain character traits are present in testers which are not present in, for example, developers. Kaner, Johnson, Falk, Nguyen and Lawrence (2000) emphasise the importance of intuition and creativity in testing, asserting that “good testers possess a unique sense of what and how to test”. This would seem to suggest that personality traits, experience and individual motivations could significantly contribute to the success of testing and therefore to software projects as a whole. This prompts the question of exactly how human factors and personality traits of software testers impact on their effectiveness.

Deak (2014) states: “Since testing projects often occur under tight deadlines, budget constraints and organisational challenges, the success of a project can be highly dependent on the employee’s characteristics.” This study is one of only a few that actually aims to bridge this research gap by specifically focusing on the personal characteristics of testing professionals. It notes that for software engineers, factors such as growth orientation, need for independence and a low need for social interaction are common traits found in significantly higher proportions in the subgroup than in society as a whole. The author aptly notes the lack of similar research on *software testers* and therefore aims to rectify this by asking which characteristics are perceived as important for software testing to try to determine if there are specific traits that differ between software testers and software developers.

The methodology used involved interviews with fourteen participants from four Norwegian companies. Seven interviews were performed in agile working teams from two companies, while the other seven interviews were done in two companies following traditional development methodology. Semi-structured questions were used in the study in order to encourage the respondents to provide the researchers with their own reflections and in their own terms. Anonymity was guaranteed to ensure honesty, and the participants were assured that records will be accessible only to the researchers.

The characteristics which the interviewees asserted were important were then ranked in descending order of how often they were mentioned. Communication skills emerged as a recurring theme and was the most desired characteristic in the study. The inclusion of participant quotes added a qualitative dimension to these findings. "Communication skills are seen as a valuable characteristic both from the participants of this study and from the research literature. During the communication process the testers must be able to know how to provide the right information and how to communicate it properly to all the parties involved" (Deak, 2014).

This need to be communitive seems to be one of the major differences between the personality traits of a good tester and a good software developer. In studies of software developers, having a low need for social interaction, or being Introverted, was a significant personality trait, while in this study it was not mentioned at all by the interview subjects. "If you are introverted, then spending most of your workday behind a computer screen alone, as a developer, is a good choice, but not necessarily for a tester. Testers often have to report problems and they have to be comfortable with conflict, which lead to a vast amount of communication on a daily basis." (Deak, 2014). Other characteristics seen as valuable for testers but not developers include patience and curiosity, while testing knowledge and domain knowledge were also valued, but not as strongly.

Another paper which also seeks to tackle the subject is: "Does The Individual Matter In Software Testing?" (Merkel and Kanij, 2010). In it the question is posed as to whether techniques and tools are the most important determiner of successful testing or are human factors as important or even more important. Again, the views of practising software testers were collected to conduct the study. However, in this case rather than interviews, a survey on the factors influencing testing effectiveness was used to gather the research data. This allowed for a larger sample group to be consulted (104 respondents completed the survey). The survey included sections on many of the possible factors influencing the effectiveness of testers, as well as open-ended questions allowing participants to express their own ideas on the subject.

The first interesting finding from the study was that at high percentage of respondents believe that the “best” testers were at least fifty to eighty percent more valuable to the project than an “average” tester. This would suggest testers themselves believe that the individual matters a great deal in testing. Ninety percent of respondents believed that good knowledge of the specific problem domain is a desired quality of a software tester. In other words, experience is considered important, more specifically, experience of the exact domain being tested.

Intelligence and dedication are also considered particularly important qualities, as the significance of both were actually mentioned by more than ninety percent of the respondents. Communication and interpersonal were deemed vital too, “to accurately describe faults, persuade developers as to their existence and importance, and to teach them how to avoid such faults in future.” (Merkel and Kanij, 2010).

All of this would seem to confirm the study’s conjecture that human factors are crucial in software testing, supporting the idea that identifying good testers and identifying individuals with the potential to be good testers may be improved by taking personality traits as well as other human factors into account. The study also asked what would be considered a good measure for the effectiveness of existing testers and a number of factors were suggested by the respondents. One clear finding was that the number of bugs found by a tester is not considered a good measure of performance (this is more a good measure of bugs present in the project). Instead, the ability to produce high-quality bug reports, and the ability to communicate them effectively to developers, were considered much better measures. Only half of respondents at least somewhat agreed that a person’s academic record was a good predictor of their software testing ability. Overall, the study indicates that testing-specific tools and techniques are important for good testing. However, factors like intelligence, dedication, interpersonal skills and motivation were viewed as crucial in being an effective tester. As such, yet again, the study would seem to reaffirm that the individual does very much matter in software testing.

“A Preliminary Survey of Factors Affecting Software Testers” (Kanij, Merkel and Grundy, 2014) again notes the lack of research into individual traits of testers and sets out to study the abilities and expertise needed to apply testing techniques and tools, not just the tools themselves. The paper utilises an online survey to gather the opinions of professional software testers as the basis for the research. It attempts to discover the importance of a variety of factors that influence effective testing, including testing-specific training, experience, skills and human qualities like dedication and general intelligence. The survey results strongly suggest that while testing tools and training are important, human factors were considered much more important. As in the previous studies, domain knowledge, experience, intelligence and dedication amongst other traits, were considered crucial for a software tester to be effective. The findings reaffirm the idea that

individual attributes significantly influence software testing outcomes which prompts a deeper exploration into how these could be used to improve tester recruitment and training.

In “An Empirical Investigation of Personality Traits of Software Testers” (Kanj, Merkel and Grundy, 2015) the researchers delve further still into the subject, again noting the importance of methods and technologies used in testing, but crucially on the human aspects of testers too. They also note that the role of a software tester is fundamentally different from that of other software development jobs. “While software designers and programmers are largely constructive, in that they design and ‘build’ something that meets customer requirements, a tester's job is often in a sense fundamentally destructive, in that they attempt to ‘break’ the software constructed by programmers. This fundamentally different task set, mindset and work approach of the testing profession raises an interesting research and practical question: might the effectiveness in the particular role of a tester be somehow related to their personality?” (Kanj, Merkel and Grundy, 2015). This distinction forms the basis for the research paper's supposition that certain personality traits are significantly common among software testers.

The researchers collected the personality profiles of a group of software developers and a group of software testers, via a web-based survey (around 200 subjects in total). The objective of the research study was to conduct a comparative analysis to find out if there are any significant trends or notable differences between the two groups. The personality profiles of the participants were prepared based on the ‘big five factor’ model of personality (Extraversion, Neuroticism, Openness to Experience, Conscientiousness and Agreeableness).

The main finding in the analysis of the results was a significant difference in conscientiousness between the software testers and other software developers with testers displaying a significantly higher prevalence of this trait than the developers. The researchers conceded that they used quite a broad scale of personality traits and in fact the big five factor traits have sub-traits that could have revealed differences between the groups more accurately. However, the fact remains that yet again it was found that testers have unique traits, particular to them in the development world.

2.4 Exploratory Testing

Exploratory testing is a paradigm designed to reduce cost by utilising human intuition and experience. It is different from other testing techniques as it depends more upon the tester's imagination. "An Empirical Evaluation of the Influence of Human Personality on Exploratory Software Testing" (Shoab, Nadeem and Akbar, 2009) investigated the relationship between human personality traits and the effectiveness of testing, focusing specifically on exploratory testing in software development. It presupposed that the personality of the tester has a significant influence on the success of the testing process. The central hypothesis of the study was that personality traits, including intelligence and extroversion, play a pivotal role in shaping the outcomes of exploratory testing. The research methodology involved the creation of an Exploratory Testing Aptitude Test (ETAT) designed to evaluate testers personalities before statistically analysing and scrutinising the results.

The paper's final conclusion suggested a strong relationship between testing and human personality traits. In particular, extrovert personality types were found more likely to be good exploratory testers. Although this research is specifically related to exploratory testing it further strengthens links between personality traits and testing in general.

2.5 Experience

As well as personality traits, another human factor that has a more obvious impact on the ability of a tester to perform is experience. This has already been referenced in some of the earlier papers in this review, in the form of 'domain knowledge'. However, in "The Role of Experience in Software Testing Practice" (Beer and Ramler, 2008) the researchers set out to better understand the role of experience for effective testing in order to develop successful testing strategies and tool support.

The case study involved three software projects conducted at Siemens Austria. Each was unique and therefore gave the study varying context and attributes. The objective was to discover ways in which experience shapes software testing practices and how this adds value. Interviews, document analysis and real-time observations were employed to gather insights. As expected, analysis of the results revealed that experience was crucial in all studied projects, in particular substantial domain knowledge (area specific prior experience) was found essential for effective testing. The study also found that despite the availability of cutting-edge technology in the projects, tools fell well short in leveraging experience for effective testing. This further backs up the overall theme of this literary review that human characteristics are vital to testing success.

2.6 Employer Preferences

So far, this review has looked at which human characteristics and personality traits are common among software testers, as well as what kind of skills professionals in the field consider as important. The next couple of papers switch attention to the employers and consider what kind of skills they perceive as important for the role. In the paper “The Skills That Employers Look for in Software Testers”, Florea and Stray (2019) pose the question “What skills do software testers need to have, according to industrial demand?”.

Four hundred job advertisements for software testers were collected from thirty-three countries and analysed. Data collected included job descriptions, responsibilities and requirements. This data was then organised and coded, creating a structured taxonomy for the demand in the software industry for testing-related skills. The study calculated the percentage and mean number of skills mentioned in adverts for each category and subcategory in the testing-skills taxonomy, aiming to identify a profile of the type of testers sought by employers. The study also investigated significant differences in requirements for various tester roles, such as software testers, test analysts and test managers.

The results of the analysis reinforce the belief that software testing is a distinct role in the industry that involves a high number of specific competencies demanding individuals with a blend of technical prowess and managerial acumen. Meticulous planning and execution were a very highly demanded skill set for test design. Employers also commonly sought proactive individuals but displayed fewer requirements for skills like bug identification and meticulous documentation. The industry exhibits a clear preference for testers with broad technical skills, emphasising adaptability and versatility. While surprisingly domain-specific knowledge is not heavily emphasised. The evolving nature of software testing could explain the desire for traits such as adaptability, technical acumen and a holistic approach. The study yet again underscores the distinctive personality traits that contribute to making an effective tester.

In “On the Roles of Software Testers: An Exploratory Study” (Florea, Stray and Sjøberg, 2023), this research was taken a step further. The primary objectives of the study were to identify the roles that exist within the realm of software testing, understand the role preferences of professionals, and assess how well these preferences align with the roles sought by employers in job advertisements. The researchers conducted in-depth interviews with nineteen software testing professionals and analysed four hundred job advertisements, to try to uncover this information. The interviews sought to gain information from the experiences and insights of the professionals, while the analysis of job ads added a quantitative dimension to the research, allowing for a broader understanding of industry trends and employer expectations.

The results revealed a significant mismatch between the preferences of professionals and the expectations set by job advertisements. While many job ads sought testers with a diverse skill set, professionals leaned towards specialising in one role. This misalignment highlighted the challenge within the industry of trying to find the right balance between specialisation and versatility. Another notable problem highlighted was the difficulty professionals faced when job ads combined highly technical and less technical skills. The study suggested a practical solution in the form of a checklist for job ads to enhance clarity in role expectations, hopefully attracting candidates with the most suitable skills for the advertised positions. Finally, the study emphasised the importance of clear communication in job advertisements and recognised the ongoing dynamic between specialisation and versatility in software testing.

2.7 Skill Acquisition

“A Qualitative Study of the Background, Skill Acquisition, and Learning Preferences of Software Testers” (Florea and Stray, 2020) examines how current testers acquired their skill set, and what their preferred method of study is. Nineteen senior professionals were interviewed, all with significant experience (from eight to thirty years). The interviewees had a diverse tertiary educational background, including economics, informatics, military, mathematics, engineering, physics, biology and linguistics. They had also previously worked in a wide range of industries, such as accounting, banking, logistics, telecommunications, automotive industry, IT services, appraisal, tourism and medicine, emphasising the diversity of background in software testing. Just over half of those interviewed did not have any IT education and of those that did, none had learned about software testing as part of that education. The researchers noted that there is an ongoing need for universities to include information or courses on software testing.

One major revelation in the study was that all the interviewees reported securing their first testing job as a result of a guess, or by chance. Most hadn't paid attention to the details of the advertisement as their lack of experience made them unable to fully comprehend the role-specific details. Otherwise they said they probably wouldn't have applied. The respondents also noted that they found programming tests being part of the hiring process for software tester positions discouraging and didn't understand the point.

In terms of learning preferences, the interviewees found that doing the work was the best and most efficient source of learning, as well as continuous learning from multiple sources, rather than a one-time effort. Most of those interviewed preferred informal learning sources, for example using internet searches to find information when it is required for specific tasks. The need to master the vocabulary of testing was seen as an important hurdle to pass, in order to work

effectively with other team members in a project. Working together with these other team members was also seen as a hugely beneficial for skill acquisition.

2.8 Motivation

Deak, Stålhane and Sindre (2016) conducted a study focusing on understanding the factors that influence the motivation and job satisfaction of software testers, as well as exploring the strategies implemented by companies to encourage their testing staff to perform well. Data was collected through both semi-structured and in-depth interviews with experts from various companies in Norway. The research investigated both positive and negative aspects of testing work and sought to gain descriptive knowledge of current strategies employed by companies.

The study found that motivating software testing teams is a genuine challenge, primarily due to the perceived lack of excitement in testing compared to other areas of software development. This is compounded by the industry's tendency to undervalue testing, often viewing it as a time-consuming and unattractive task. Additionally, there's a scarcity of skilled testers, creating a pressing need for comprehensive training programs to address this skill gap.

The paper concludes that it is crucial to shift perceptions of testing by emphasising its pivotal role in ensuring software quality. Furthermore, success stories should be showcased to emphasise how effective testing contributes to superior outcomes. It also suggests the implementation of strategies to integrate testing with development tasks to provide a comprehensive view of the software creation process. Offering interesting and challenging tasks keeps the team engaged and fosters professional growth. Recognising the significance of testing within the overall project is vital, and well-structured training programs contribute to building skilled testers.

2.9 Summary

The role of the software tester is critical to ensuring the success of any good software project. It is therefore surprising, as the literature points out, that there is a gap in research focusing on what makes a good tester. Plenty of research has been carried out on software developers, while very little attention has been given to similar examinations of quality assurance professionals.

Those few studies that have been carried out have indicated that certain traits, such as intuition, creativity, communication skills, patience and curiosity are crucial for effective testing. One study in particular emphasised the importance of characteristics like growth orientation and

independence, while communication skills consistently stood out as the most important trait overall. Various papers also explored whether individual traits matter in testing, with intelligence, dedication, communication and investigation skills identified as crucial. Notably, some studies suggest academic records might not be important or reliable predictors of testing ability. Exploratory testing relies on human intuition and experience much more than other testing roles and, as such, requires unique skills. The research suggests a strong link between extroverted personalities and success in exploratory testing. Despite the distinct nature of the role, this still further underlines the impact of human characteristics on testing outcomes. In contrast, when it came to traits sought by employers, technical prowess, adaptability and versatility were emphasised as most desired. There was also a notable mismatch between professionals' role preferences and employer expectations, indicating a challenge in balancing specialisation and versatility, which would indicate a need for clearer communication in job advertisements.

Beyond personality traits, the literature also explored the impact of experience on effective testing, emphasising the importance of domain knowledge. Despite technological advancements, tools often fall short in making up for a lack of specific testing experience. However, many current testers have diverse educational backgrounds, had little or no prior experience before entering the field or took unconventional paths into their testing roles. Furthermore, it was also highlighted that formal higher education for testers is severely lacking in IT education. Thus, a lack of experience is something that can be overcome, certainly at the beginning of a career in testing. Current professionals also stated that their preference for skill acquisition was to learn on the job and by continuous learning from multiple sources including internet searches rather than one-time prescribed education, this is ideal for testers looking to overcome a lack of experience.

The literature also notes that motivating software testing teams can be challenging due to factors such as a perceived lack of excitement and undervaluation of the role within the industry. However, these obstacles can be overcome by employing strategies such as integrating testing with development tasks, showcasing success stories and providing interesting challenges and diverse skill building tasks to try to shift perceptions and help foster motivation.

3 Methodology

The literary review has highlighted a number of key subject areas which, when investigated further will help to address the subject of this thesis: Investigating common traits and improving recruitment of IT quality assurance personnel. By looking deeper into trends in general skills, personality traits and backgrounds of current successful software testers, this thesis will endeavour to produce a set of recommendations for potential employers to follow. Furthermore, through investigating areas such as educational trends and preferences, and motivational factors, further insights can be gained to help improve the development and motivation of new recruits as well as to attract a better prepared next generation of quality assurance professionals into the industry. The Ultimate goal of this thesis is to produce a set of guidelines for employers to understand, select and motivate future testing professionals and answer the following Research Questions:

RQ1: Which common traits and skills do software testers need to prosper in the industry?

RQ2: How can recruitment of testing professionals be improved?

RQ3: How can quality assurance professionals be best motivated, rewarded and retained in the industry?

In order to help accomplish this a study was undertaken to collect and analyse perspectives and insights from active IT professionals.

3.1 Research Design

A questionnaire was designed to elicit the most pertinent and useful information from active software testing professionals, as well as several professionals working closely with software testers. The decision to use a structured questionnaire (appendix 1) rather than perform semi structured interviews was taken to allow consistency in test conditions to facilitate better comparison of answers and hopefully also reliability in responses. To allow for the most detailed and useful information to be produced from the results, the analysis of the data gathered was mostly of a qualitative nature.

3.2 Questionnaire Design

The questionnaire was specifically developed to dig deeper into the areas of interest highlighted in the literature review and to give a better picture of up-to-date views from current working professionals. Meticulous consideration was given to the selection of questions to ensure a comprehensive exploration of views, while also trying to prevent the scope of the research becoming too wide. Room was also provided for elaboration from the participants to hopefully increase the quality and volume of data gathered. The following is a detailed breakdown of the reasoning behind the selection of each question:

1. Can you briefly describe your educational and professional background? (If you are a software tester, how did you enter the field?)

This question aimed to provide foundational context for interpreting the perspectives shared by the study participants. Additionally, participants were encouraged to share insights into how they entered the field of software testing to try and offer a nuanced understanding of the varied potential pathways into this area of work.

2. What is your current role and how long have you been working in it?

The purpose of this question was to explore the participants' current roles and the duration spent in those roles to add a temporal dimension to the responses, hopefully adding more context to the overall data collected. It also provided some examples of the roles available within the industry.

3. What skills do you believe are crucial for success in software testing? Are there specific technical or soft skills that you find particularly valuable?

Having gathered some context on the participants, this next question aimed to compile a list of skills perceived as crucial for success in software testing (both technical and non-technical) along with some reasoning for the choices. Hopefully unveiling insights into potential competencies employers should be searching for in potential recruits.

4. From your point of view, in IT education, do you think software testing is adequately taught and recognised in comparison to other IT roles (e.g. development)? Why or why not?

By exploring participants' opinions on the recognition and adequacy of software testing education within the broader IT landscape, the aim of this question was to gauge the standing of software testing within teaching curricula, and to reveal whether participants believe the subject is given due emphasis and consideration compared to other IT roles.

5. How do you view software testing as a career path? Do you see it as a stepping stone to other IT roles, and if so, why?

This aim of this question was to investigate participants' views of software testing as a career path by understanding whether they see software testing as a standalone profession or a stepping stone to other IT roles. Its intention was to try and gauge perceptions and attractiveness of the occupation, and to identify possible discriminations. This may help to provide insights into how to attract and retain employees in the long-term.

6. In your opinion, is software testing a role that anyone can learn, or do you believe only individuals with a specific characteristic set can succeed in the field? (Please explain)

Question six aimed to look at participants' views on the perception that software testing is an easy discipline to learn given the appropriate tools, or if it requires specific personal characteristics for success. The intention was to uncover insights into the perceived inclusivity and exclusivity of the field and to try to delve further into ideas of an 'ideal candidate'.

7. Without considering technical skills, are there specific personality traits that you believe contribute to success in software testing? How do these traits differ from other IT roles?

Exploring the non-technical traits contributing to success in software testing, this question's aim was to identify unique personality characteristics deemed valuable in the field. The goal was to differentiate these traits from those considered useful in other roles and to provide a nuanced understanding of how these distinct qualities may be used by recruiters when selecting candidates.

8. Reflecting on your experiences, do you believe there is a standard "profile" for a successful software tester, or is the role more flexible, accommodating different backgrounds and approaches?

Following on from the previous two questions, and by reflecting on personal experiences, participants were encouraged to share insights into whether there exists a standard "profile" for a software tester which could help further develop the blueprint for identifying well suited candidates. If on the other hand, the role can accommodate diverse backgrounds and approaches, this information could inform a widening of the scope for considering potential candidates.

9. In your experience, how important do you think effective communication skills are for a software tester? (Rate on a scale of 1 to 10 and briefly explain your choice.)

The aim of this question was to quantify the significance of communication skills by providing a numerical measure coupled with a qualitative explanations supporting the chosen rating. By drawing on participants' experiences in the field the goal was to understand the perceived importance of effective communication skills in the context of software testing.

10. In your experience, how important do you think conscientiousness is for a software tester? (Rate on a scale of 1 to 10 and briefly explain your choice.)

This question aimed to gauge the significance of conscientiousness in the field. Explanations accompanying the rating provide context for participants' assessments on the significance of conscientiousness for a successful software tester, offering a deeper understanding of its importance.

11. In your experience, how important do you think extroversion is for a software tester? (Rate on a scale of 1 to 10 and briefly explain your choice.)

Through asking participants for their rating of the importance of extroversion in software testing, this question aimed to capture professional perspectives on the significance of the trait. Participants were again encouraged to provide a numerical rating and supporting explanation to help gauge the relevance and provide context.

12. How do you see the role of software testing evolving going forward, and how should the tester adapt to this?

Concluding the survey, this open-ended question invited participants to share their thoughts on the future of software testing. By exploring anticipated evolutions in the field and recommendations for adaptation, the aim was to gather diverse perspectives on the trajectory of software testing and the proactive measures recruiters might consider when selecting, developing and motivating testers in response to these forthcoming changes.

3.3 Participants

The candidates selected to complete the questionnaire were mostly software testers currently working within OP financial group's software development team. They were chosen firstly due to the access afforded by my role at the company, but also because they provided a unique perspective from within a high-profile software testing team working in a current, real-world software project. Several other testers and developers from other software development firms were also selected, to try to provide a richer data set for the study.

In total eighteen candidates were selected this number was chosen to allow for a balance between detail in results and meticulousness of analysis. Moreover, the number also allowed personal vetting (as a pose to cherry picking) of participants to improve validity, credibility and reliability of results. Unfortunately, data from two of the submissions was corrupted and so was excluded from the final results. This left 16 participants from which the study data was produced. By guaranteeing their anonymity and assuring them that the record of their responses would only be accessible by myself, it was hoped that the subjects would be more likely to give honest and useful answers.

3.4 Data Collection Procedure

The data collection process began by approaching participants. To ensure consistency and facilitate better comparison of answers the questionnaire was administered in written form, either in person or through online questionnaire deployment platforms. An introduction to the study was provided, outlining the purpose, confidentiality measures and the voluntary nature of participation. Informed consent was obtained from each participant before they completed the questionnaire. This approach aimed to uphold ethical standards, ensuring participant confidentiality and obtaining honest and useful answers.

3.5 Data Analysis

Upon completion of data collection, a mainly qualitative approach was employed for analysis. Responses were subjected to thorough examination, identifying key themes and patterns. The intention was to provide a nuanced understanding of participants' experiences, opinions, and expectations. Quantitative data was also gathered with some questions answered on a scale of one to ten. It is essential to note, however, that even though these questions were presented on a numerical scale the analysis primarily relied on qualitative insights. The inclusion of these quantitative results aimed to present a more comprehensive and multifaceted perspective on the software testing landscape. However, the ultimate analysis relied primarily on a qualitative exploration, forming opinions and insights based on the examination of results rather than relying extensively on statistical analysis.

3.6 Limitations

While the study aimed for a balanced sample of eighteen and then sixteen participants, limitations exist. The sample primarily consisted of software testers from OP financial group's development team, potentially introducing biases related to the specific projects and practices within this organisation. Additionally, the exclusion of two corrupted data submissions may have impacted the diversity of perspectives.

Furthermore, the voluntary nature of participation may have led to a self-selection bias, with individuals choosing to participate based on their interest in the subject. These limitations should be considered when interpreting the findings and generalising them to the broader software testing community.

3.7 Validity and Reliability

The validity of the study was strengthened through a rigorous questionnaire design process, informed by the literature review. The questions were crafted to delve into specific areas of interest highlighted in the literature, ensuring a comprehensive exploration of perspectives.

To enhance reliability the questionnaire was piloted before the actual data collection, allowing for adjustments based on feedback. The selection of eighteen participants aimed to strike a balance between detail in results and meticulousness of analysis, contributing to the validity, credibility, and reliability of the study. The final count of sixteen participants still managed to retain this balance.

4 Empirical Findings

Having gathered responses from the study participants via the questionnaire (appendix 1), the data was thoroughly and systematically examined and the most relevant of the findings are presented in this section. Among the various dimensions explored are the background of the participants, desirable skills for software testing, useful personality traits, individual suitability, education, transiency of the role and the future trajectory of software testing.

4.1 Background of the Questionnaire Participants

Understanding the context of gathered data is pivotal in any empirical study. Therefore, the first two questions put to the participants aimed to provide a picture of their background and previous work experience. All of those interviewed were information technology professionals, of which the majority had a substantial history in software testing. Twelve of the sixteen participants worked actively as software testers, two as test managers and the other ten were testing specialists (both automated and manual). Two more worked as penetration testers and the last two as software developers working closely with testers. The experience level of the participants varied between two and thirty years in the field with the majority somewhere in the middle, between ten and twenty years.

In terms of tertiary education, the interviewees all had very similar backgrounds, almost all had degrees in IT of one type or another with only three exceptions. These exceptions were library science, historical linguistics, and business administration. The two software developers who took part in the study had specifically chosen their education pathway with a view to working in their preferred role, while the penetration testers had chosen their discipline after discovering it while studying. In contrast, the software testing professionals entered the field through necessity rather than choice, or else transitioned from a different career path altogether.

The main reasons given for becoming a tester was the need for employment. Other reasons included as a stepping stone to work for a certain company, switching from a financial role due to digitalisation of banking, transitioning from a librarian to testing library software (again due to digitalisation), following a friend who had found a job in testing by chance after graduating in a non IT discipline, being placed on a testing course by the employment office and finally, moving from web development to testing when development work dried up.

4.2 Valuable Skills

When questioned about which skills participants considered crucial for success as a software tester, the answers varied in both volume of detail provided, and also in the approach to answering the question. The first thing to note is that the most common answer given was good communication skills, with nine out of sixteen identifying it as important. One respondent elaborated: “it is important to be able to give sufficient technical information for a developer to triage a problem while also being able to describe findings to business people in terms that they understand”. Another noted that: “showing things didn't work as expected can ruffle feathers when you're not careful. Results don't matter if nobody pays attention to them”.

The following graph shows the number of survey participants who identified certain skills as important for software testing success. Skills are shown along the X axis and the number of participants who chose the skill is shown on the Y axis.

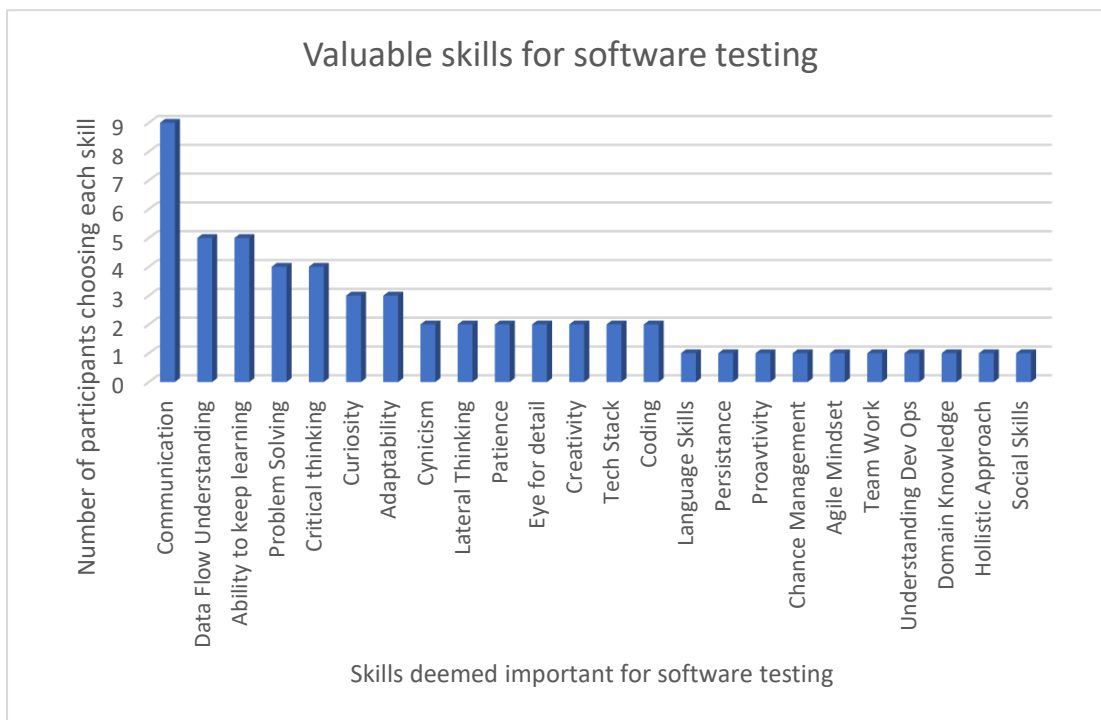


Figure 1. Skills identified as important for software testing

Respondents unanimously agreed on the critical role of technical proficiency. Understanding how information flows through a system and recognising the untrustworthiness of input - whether from users or other systems - were highlighted as foundational aspects. Technical understanding was also deemed essential for effective software testing.

As already indicated however, the role of the tester extends beyond technical expertise alone. The duality of the tester's responsibility to be both a technical expert and an effective

communicator was identified as key. As one respondent aptly noted, "Our job is also to report the findings and communicate them to different audiences." This dual responsibility underscores the significance of not only technical prowess but also strong written and spoken language skills. Other soft skills consistently highlighted as fundamental included proactivity, logical problem-solving, and a continuous willingness to learn. One respondent succinctly captured this sentiment, stating: "You have to start somewhere, be proactive, communicate, have a logical way to solve problems (or like to solve problems, for that matter)."

The dynamic nature of technical skills in software testing was another notable finding. Respondents emphasised the need for adaptability to different technology stacks and methodologies, this need for flexibility reflects the ever-evolving testing landscape. Coding skills, particularly the ability to read and discuss code, were also highlighted as increasingly important. Creativity, attention to detail and effective collaboration were consistently identified as crucial soft skills too. Testers were described as "the glue between different parties in a team," emphasising this need for collaboration and strong interpersonal skills. These findings underscore the diverse nature of skills required for success.

4.3 Education

Perhaps surprisingly, fifteen of the sixteen participants stated that they did not think software testing was taught adequately in IT education, with the sixteenth asserting, "I wouldn't know because I never had any formal IT education but based on what I see in the industry I would guess not". Some of the other participants elaborated on their opinions, with one writing, "There's not enough dedication to testing in education and it's not identified to a level of what criticality it represents in real life." Speaking from personal experience another respondent wrote that in his five-year computer science program, "I don't think we talked about software testing at all. From what I've heard, the situation hasn't really improved a lot since then, unfortunately." This sentiment was echoed in another reply, "We had one testing course in the whole degree. Testing is not considered as an important part of the development process which I think is strange as it is crucial part of the development process. Testing is starting to get more and more attention these days, but it is still not being taken into account as much as it should. In my current project if there is something that has to be cut, it's always testing first." Another response lamented this lack of testing coverage in education, "Software testing is invisible to students as a valid career path. It's just seen as some minor aspect of development."

As well as giving examples of the lack of focus on testing in IT education, some of the participants also offered potential reasons for it: "Up until not long ago, thorough and structured

software testing was more of an afterthought in the software development lifecycle and therefore universities and other education bodies have not adapted quickly enough." Another potential rationale given was: "It is hard to impress the importance of quality assurance in a dry school setting and with the way development projects are structured there." One respondent sympathised, "The variety and depth of topics that can be taught during a degree are limited. If software testing must be prioritised, something else would likely need to be taken out". The potential risks of students not gaining testing experience were also highlighted: "Probably the focus is on programming so that students don't get overwhelmed, but they do [become overwhelmed] when they land their first roles in the field."

4.4 Testing as a Stepping Stone Career

When asked if testing is seen as a stepping stone career, one respondent wrote: "Some of the best IT staff I have met have served their time through different roles. The cross-discipline skills that they can bring to bear is invaluable". This not only highlights the potential of software testing as a stepping stone but also emphasises the broader skill set it can cultivate. Another gave a more complex response to the question indicating that it is a stepping stone, "but having said that, there is still a good chance that the next step still incorporates many QA tasks, whether it is in the direction of DevOps, embedded software testing/automation engineering, or a combo of QA/AI/DevOps/big data." This perspective suggests more of a dynamic nature within the development landscape, with testing and programming being two sides of the same coin.

Despite this, a substantial majority of the participants felt that testing is a distinct and fulfilling career path in itself, and not at all a stepping stone. One respondent noted: "I see testing as a related, but separate career path. The mindset and the people that are good at it are different from IT/Dev" emphasising the qualities that make software testing unique as a profession. Expanding on this, other responses provided more concrete examples of the diverse paths within testing. "A tester can specialise in various types of testing, such as automation, load testing, or security testing. Sometimes, they can continue as a test manager," according to one participant, showcasing the versatility and specialisation opportunities within testing career pathways. On the other hand, another respondent actually lamented that the discipline does not provide a pathway to other roles, "I saw it as a stepping stone, but it was a trap, the QA role is rarely respected and the ceiling on salary, skills, and career progression is very low," challenging the idea that testing is inherently a means to an end.

Overall, while acknowledging its potential as a stepping stone with broad applicability, participants consistently emphasised that in today's landscape software testing stands as a substantial and fulfilling career in its own right.

4.5 Can Anyone Excel in Software Testing?

When the subjects were asked if they viewed software testing as something anyone could learn or is it something that requires particular personality traits in order to succeed, consensus among the responses reflected the belief that while anyone can learn testing to a certain extent excelling in the field requires specific characteristics and mindset. "Anyone can do it at the most basic level but the top 10% roles need a very specific mindset," observed one participant, emphasising the need for a unique approach to truly excel in the field. Another respondent remarked: "I think the basics can be learned by anyone, but to truly excel in the field you need to have an eye for the weak points: the scenario that is not covered, unspecific descriptions, weird user behaviour, etc." This perspective underscores the nuanced and specialised nature of testing expertise. While acknowledging that many can learn testing, participants highlighted the importance of suitability for the role and the value of a diverse quality assurance team. Similarly, one participant said that, "Yes, many can learn it but, as with other skills, not everyone that can learn it is suited for the role. I still would like to emphasise that in my view it is important to have a diverse QA team. Many perspectives on a problem are likely to lead to a better and more durable solution".

4.6 Personality

The respondents were next asked to concentrate solely on which personality traits contribute to success in software testing and how these differ from those deemed as advantageous for other IT roles. Once again, effective communication and teamwork abilities were repeatedly emphasised as pivotal. One participant highlighted this distinction: "Testers need to be more communicative and work well in teams than other IT roles." Overall, respondents expressed a genuine enjoyment of working with people and collaborating in pairs or larger groups. However, it was also noted that testers must represent the interests of end-users, occasionally leading to confrontations with teammates, which emphasises the need for traits like patience and diplomatic skills.

Creativity also emerged as a common thread. Testers have to be imaginative in devising scenarios that developers may not have considered. A "touch of professional pessimism" was acknowledged as beneficial as well, due to the need to scrutinise and challenge assumptions. The

expectation for testers to adapt quickly to new challenges and technologies was stressed, emphasising openness to learning and versatility, as was the importance of a good memory.

Additionally, attention to detail, pattern-spotting and lateral thinking were deemed highly relevant traits, acknowledging the unique focus on finding inconsistencies and unexpected behaviours. Also, an innate interest in exploring systems and learning from real-world product usage, a willingness to question everything and thinking outside the box were seen as valuable assets in testing. In contrast to development, testing was portrayed as requiring more curiosity and interest in understanding how things work, especially in manual testing. Developers, on the other hand, were characterised as requiring a greater aptitude for problem-solving.

4.7 Standard Profile

When asked if there is a standard profile for a successful software tester or if the role is more flexible, one respondent emphasised the value of diversity, stating: "I love people coming from all kinds of different backgrounds and all kinds of different educational routes because all of their life skills and cultural knowledge only makes the team stronger, it helps fight bias and people can spot things that would otherwise be missed". Another participant also emphasised the importance of varied backgrounds: "We have defined requirements and QA standards we all have to live up to, but I think it helps in quality assurance to also have or have had a different background or working history to either provide you with the necessary field knowledge or have a more practical perspective of the software solution in use, QA service quality benefits from the diversity of its team." A third respondent stated: "I think a mix of different people in a test team gives you the best results. Some might be more technical, some more able to act like the user, some specialise in security/performance/accessibility. Each of their findings is valuable feedback resulting in a better overall picture of the software. I think testing is uniquely flexible in that regard. Hopefully companies can see it as well."

Others focused on individual qualities, with one answer emphasising the importance of mindset and attitude, "Whenever I've hired a tester for my team, I've looked for mindset and attitude. It's easy to teach the technical skills, and harder to teach mindset and attitude." Overall, the consensus from the responses was that there is no standard profile for a successful software tester. The role is perceived as flexible, accommodating individuals with diverse backgrounds, experiences, and approaches.

4.8 Communication

The following graph shows the importance that survey participants placed on communication skills for success in software testing along with the percentage of each of the chosen responses. Answers were chosen on a scale of one to ten which is shown along the X axis and the number of participants which chose each number is shown on the Y axis.

In your experience, how important do you think effective communication skills are for a software tester?

16 responses

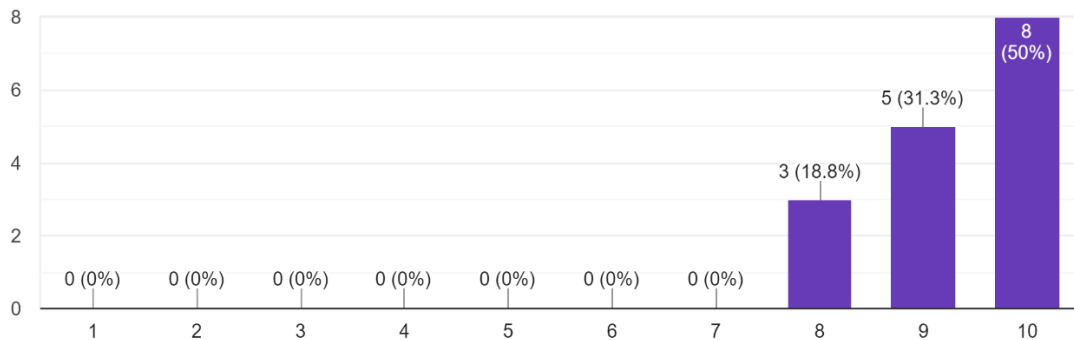


Figure 2. Importance of communication in software testing

Consistently in their answers, the study participants overwhelmingly emphasised the paramount importance of effective communication skills in software testing. In their responses to this question, eight out of the sixteen respondents chose the highest rating of ten out of ten, five chose nine and the final three chose eight (figure 2). One added that a tester, "not only needs to find issues, but they must also to be able to communicate what they find to clients, managers, and the people who need to find them." Thus, highlighting the ability to convey findings to individuals with different backgrounds and different levels of technical knowledge as a key competency for post-test actions.

The importance of communication also extended beyond technical aspects. The nuances of communication become particularly crucial when dealing with intangible results. One participant emphasised the broader impact, stating: "Communication is key. You can step on toes with testing results, have your bug reports ignored or the impact of an issue misunderstood if you do it wrong." Another said: "Testing specialists deliver technical and business-related critical information whether or not the quality or functional standards and requirements are met. Communication is a soft skill that cannot be overvalued but can be horribly undervalued!" This perspective

further highlights the importance of communication skills for both the effective delivery of technical and business-related insights.

Collaboration is another aspect of software testing where communication skills are vital. One participant succinctly put it: "The whole team needs to work together to build quality in. This requires good communication and collaboration." Software testing is not performed in isolation, thus it necessitates strong communication skills.

4.9 Conscientiousness

The following graph shows the importance that survey participants placed on conscientiousness, for success in software testing. Answers were chosen on a scale of one to ten which is shown along the X axis and the number of participants which chose each number is shown on the Y axis. The percentage of each option chosen is also shown.

In your experience, how important do you think conscientiousness is for a software tester? (In this context, conscientiousness refers to the trait of being thorough, careful, and diligent)

16 responses

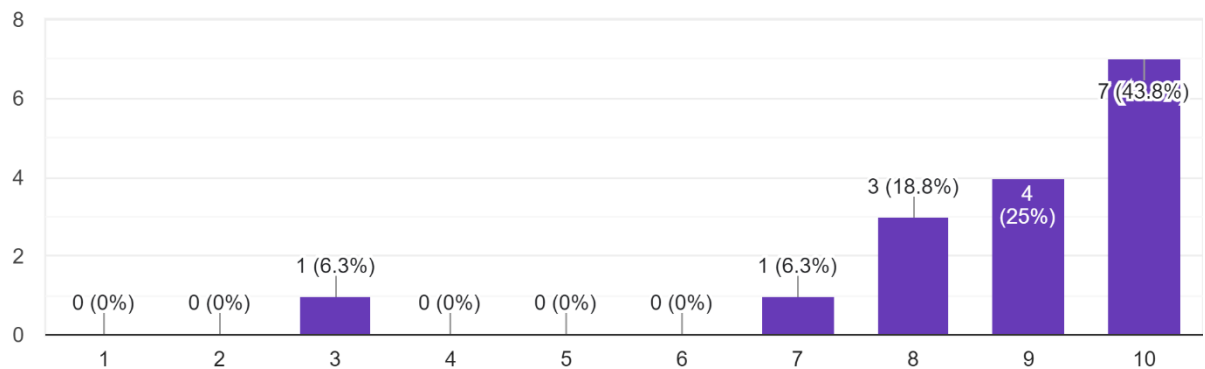


Figure 3. Importance of conscientiousness in software testing

The participants also collectively affirmed the significance of conscientiousness for software testers, emphasising traits such as thoroughness, carefulness, and diligence. Seven of the sixteen respondents ranked the importance of the trait as ten out of ten and four chose nine out of ten, clearly recognising conscientiousness as a vital aspect of the profession (figure 3). One respondent wrote: "Without dedication to and understanding of the testing task, the risk of defects ending up in production rises significantly." Another highlighted the role of conscientiousness in

advocating for improvements, emphasising its importance: "often nobody [cares] and you as a tester have to argue to improve things. If you don't care, nobody else will either." This assertion underscores conscientiousness as a driving force for continuous improvement and quality enhancement.

One respondent noted that conscientiousness is particularly important when dealing with unexpected outcomes: "Being methodical and rigorous is key when looking for unexpected behaviours and edge cases." Another agreed with the importance of conscientiousness, but also noted the delicate balance between thoroughness and efficiency, stating that "being thorough is important, but you can't test it all. Testers need to be able to work within time limits and not get lost in detail. You need to be careful and diligent, but also efficient." This perspective reconciles being pragmatic within the constraints of project timelines.

On the other hand, one participant provided a contrasting perspective and chose a lower rating of just three out of ten, expressing the view that they do not identify the role as detail oriented. In their opinion success as a tester shouldn't rely on having to "save the day as they are so conscientious", and the team as a whole should take responsibility for a successful project. This viewpoint challenges the prevalent opinion among the group, however it was very much an outlier.

4.10 Extroversion

The following graph (figure 4) shows the importance that survey participants placed on extroversion for success in software testing. Answers were chosen on a scale of one to ten which is shown along the X axis and the number of participants which chose each number is shown on the Y axis. Percentage of each of the chosen options is also shown.

In your experience, how important do you think extroversion is for a software tester?

16 responses

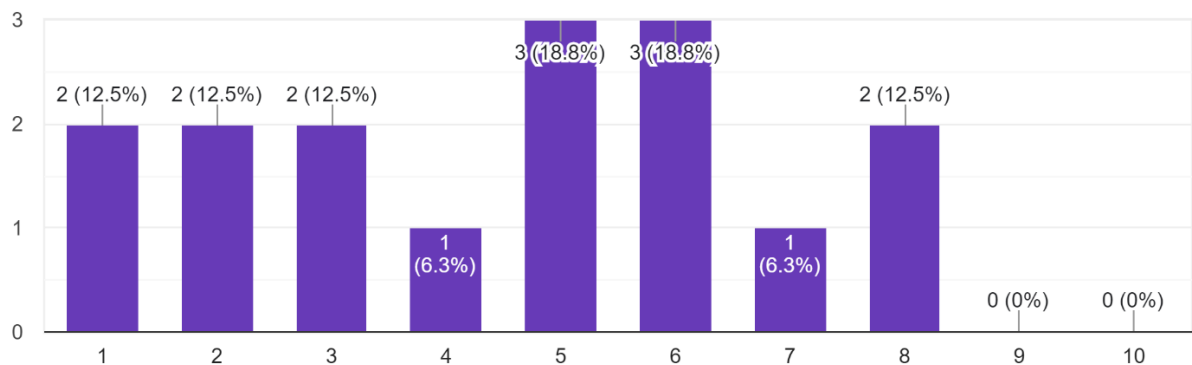


Figure 4. Importance of extroversion in software testing

Unlike communication and conscientiousness, the importance of extroversion for software testing elicited a contrasting range of opinions and diverse perspectives (figure 4). One participant took a neutral stance: "It's not really important for a tester to be introverted or extroverted." Another generally agreed with this but acknowledged that testing differs from other IT roles in regard to sociability "In general in IT, it is not important to be extroverted. However, it is a bit more important in testing due to the need for communication." Other participants also noted the difference between extroversion and communication. "While communication is important, I don't think the type of communication makes a big difference. You can communicate well through emails, reports and by making tickets. Being present in meetings is good but speaking is not always necessary."

Other participants emphasised the importance of effective communication skills over extroversion. One commented: "It's all about communication and reaching out to the right people." Another highlighted the need for diplomatic communication, stating: "You have to know how to tell about unpleasant things like faults and be able to ask questions in problem situations. Diplomacy is the key word." One respondent approached the topic from a personal perspective, "I'm very

shy and introverted. However, I had to learn to build relationships and collaborate continually with other people on my team and other teams. That is essential for success."

4.11 The Future

When asked about how they see the role of software testing evolving and how a tester should adapt to this, the respondents gave a range of insightful responses. A common theme was the importance of adaptability and staying updated with evolving technologies. One participant said that "modern jobs are ever-changing and we need to be mindful of that and be willing to learn new trends and techniques to keep our skillset updated and relevant." Several respondents expressed the belief that testers with advanced and newer skills would be in demand and agreed that continuous learning would be essential. "Newer more advanced skills will be needed. We need to just keep studying unfortunately!"

Some participants highlighted the increasing importance of automation, while others cautioned against relying solely on it. One participant expressed a balanced view, stating: "Automation is great but unfortunately will not solve all testing needs." The idea of testers moving away from manual testing towards more exploratory testing and non-functional testing was emphasised by another respondent. "I see testers being freed from monotone repetitive manual testing. Testing is going to be less about checking lists and more about exploratory testing, non-functional requirements, and quality coaching."

The role of artificial intelligence in testing was also a recurring theme. One of the respondents underlined its increasing significance, stating: "AI is definitely going to come in and aid various parts of software testing, from checking the language presented to users to simulating user interactions in a more realistic manner." Another respondent emphasised the need for testers to embrace AI early and explore ways it can enhance productivity: "Testers need to adapt to this by embracing it early and finding how it can improve their productivity."

Several participants discussed the evolving nature of the responsibilities of the testers themselves, foreseeing a shift towards supervisory or administrative roles due to the increasing impact of AI. One noted, "AI will have more and more of an impact, and thus the role of the tester will be more of an orchestrator of testing services and an editor of solutions."

5 Discussion

Having presented the most pertinent findings from the responses to the questionnaire. The following section looks at how these results, in conjunction with the findings from the literature review, can be interpreted and utilised to provide recommendations for potential recruiters, and hopefully inform the production of a proactive guide for candidate selection, motivation and development.

5.1 Personal Characteristics

The literary review section of this paper has highlighted the severe lack of research into which personal traits are beneficial for successful software testing professionals to possess. It's clear from the responses to the questionnaire, and from the small amount of research done on the subject previously, that effective software testers require unique personality traits, distinctive from those of other IT professionals. By targeting these characteristics, recruiters could significantly increase their chances of successfully locating and selecting the best candidates for quality assurance roles within the industry.

5.1.1 Communication and Interpersonal Skills

Effective communication has consistently been the most proposed personality trait associated with software testing success throughout this study. This consensus on the importance of communication skills emphasises a growing recognition of testers as effective communicators and collaborators. The need to be able to pass technical information in terms that all audiences and stakeholders (both business and technical) can comprehend, and with diplomacy is vital for effective testing. Relaying the sometimes-intangible results produced from testing is when the nuances of effective communication become particularly crucial. This is true of both written and spoken language skills, which therefore should be strong in potential job candidates.

The importance of these skills for software testing was also strongly supported in the literature review. In "What Characterizes a Good Software Tester? A Survey in Four Norwegian Companies" (Deak, 2014), communication skills were once again identified as the most valued characteristic in the study. The research notes that "Testers must be able to know how to provide the right information and how to communicate it properly to the parties involved" and that "Testers often have to report problems and they have to be comfortable with conflict, which lead to a vast amount of communication on daily basis". Merkel and Kanij (2010) also echo the importance of

communication and interpersonal skills “to accurately describe faults, persuade developers as to their existence and importance, and to teach them how to avoid such faults in future”. Therefore, communication skills need to be high on the list of requirements when selecting testing candidates.

As well as gauging candidates’ communication skills organically in an interview scenario, recruiters should also aim to assess their ability to articulate technical concepts. Behavioural questions targeting past communication challenges and collaboration assessments may also help to contribute to a comprehensive evaluation. Furthermore, written communication could be assessed through applications and résumés. References and recommendations from previous employers should also be sought to provide real-world perspectives.

5.1.2 Continuous Learning

The next most frequently repeated, non-technical skill highlighted in the study was the capacity for continuous learning. The expectation for testers to adapt quickly to different technology stacks and methodologies reflects the continually evolving nature of software testing. This also aligns with the literature review and the broader industry discourse on the importance of continuous learning and adaptability to keep up with the ever-evolving nature of software testing.

Recruiters should aim to gauge potential recruit’s attitude to continuous learning by enquiring about their familiarity with emerging technologies, discussing learning approaches, and posing behavioural questions. Through examining résumés for participation in learning initiatives and by assessing problem-solving abilities through scenarios and case studies, candidates committed to staying updated can be identified. Recruiters should also look for proactive learners who actively seek out new information, engage with the testing community and demonstrate adaptability to evolving industry trends.

5.1.3 Problem Solving and Critical Thinking

After communication and continuous learning, problem-solving and critical thinking emerged as the next two most important aptitudes, with four of the sixteen participants underscoring their significance. Critical thinking involves assessing and evaluating information or situations while problem-solving concerns actively addressing and resolving specific problems. In practice, these skills intersect, effective problem-solving benefits from a foundation of critical thinking. Critical thinkers analyse problems thoroughly, consider various options and make informed decisions during the problem-solving process.

Targeting these abilities should therefore constitute a fundamental part of the recruitment processes for potential testers. Implementing practical problem-solving scenarios during interviews would allow candidates to demonstrate their analytical abilities in real-world testing situations. Additionally, presenting candidates with hypothetical testing challenges and evaluating their approach, methodical reasoning and decision-making process, would provide an insight into their critical thinking skills. Finally, by asking about past experiences where candidates have successfully identified and resolved complex issues a measure of their problem-solving capabilities can be gained.

5.1.4 Curiosity and Adaptability

With both being highlighted as important by three of the study participants, the significance of curiosity and of adaptability in software testing cannot be overstated. While distinct, these qualities complement each other in fostering a mindset that is open to new experiences, learning and change. Both contribute to an individual's ability to navigate and thrive in dynamic environments and so are integral for software testing professionals.

Curiosity is the desire to understand, question and explore. In software testing where technologies evolve rapidly, a curious tester is more likely to delve deeper into and uncover potential problems, and proactively seek innovative solutions. This inquisitive mindset is also a catalyst for the afore-mentioned continuous learning, allowing testers to stay abreast of emerging technologies and methodologies. Adaptability ensures testers can seamlessly adjust to the dynamic nature of the industry. Technological advancements and shifts in requirements necessitate professionals who can adapt swiftly and embrace change. An adaptable tester not only copes but thrives in diverse testing environments.

To help identify these traits, recruiters should try to incorporate them into their selection criteria. As with continuous learning, interview questions should assess a candidate's past experiences of exploring new technologies or adapting to changes. Scenarios or case studies that require creative problem-solving and showcase an inquisitive approach can also be used to help evaluate a candidate's curiosity. Recruiters can ask about past experiences demonstrating a candidate's ability to learn quickly and adapt to different testing methodologies. Assessing how candidates have navigated challenging scenarios, embraced unfamiliar technologies, or led initiatives that required flexibility can also help to gauge their adaptability.

5.1.5 Conscientiousness

The main finding of the paper "An Empirical Investigation of Personality Traits of Software Testers," (Kanij, Merkel and Grundy, 2015) was the significant difference in conscientiousness between software testers and other software development professionals. Software testers displayed a significantly higher prevalence of this trait than software developers. Therefore, the characteristic was singled out in our study for special attention. Participants were asked how important they thought it was for software testers to be conscientious. The results show that overall they agreed strongly with the findings of the paper, with a majority scoring the trait as very important. A conscientious tester is more likely to adhere to rigorous testing procedures, leaving no stone unturned in their quest to uncover even the most subtle issues. Furthermore, a conscientious tester can be trusted to execute test cases meticulously and consistently produce reliable results. This reliability is especially critical in ensuring the accuracy of testing outcomes and contributing to the overall reliability of the software being tested.

Recruiters should therefore endeavour to flag this trait in their criteria for candidate evaluation. During the interview process, asking candidates about their approach to organising testing processes and executing testing tasks themselves, can provide insights into their conscientiousness. Inquiring about how they prioritise and manage their workload, especially when faced with tight deadlines, can help gauge diligence and thoroughness. Their methods for record keeping of test cases and results, can help assess their attention to detail. Additionally, scenario-based questions that assess how candidates handle complex scenarios or adhere to established protocols can offer insights into their conscientious approach to work. Seeking examples of how conscientiousness contributed to successful outcomes in a candidate's professional or personal history can further test their suitability for the role. References from previous employers or colleagues will also offer valuable perspectives on a candidate's work ethic and reliability.

5.1.6 Other Personal Characteristics

Other notable answers produced by the questionnaire included traits such as cynicism, lateral thinking, patience, an eye for detail, creativity, proactivity and teamwork. Cynicism serves as a valuable attribute, prompting testers to scrutinise assumptions, question results and approach testing scenarios with discernment, enhancing examination of software. Lateral thinking, characterised by creativity and unconventional problem-solving, enables testers to devise innovative scenarios and address unforeseen challenges. Patience ensures meticulous examination and persistence in navigating complex scenarios, contributing to comprehensive testing coverage. An acute eye for detail helps ensure precision, identifying subtle defects and maintaining overall

software quality. Creativity acts as a catalyst for devising testing strategies and contributing to the quality assurance process. Proactivity helps testers take initiative, anticipate challenges, and allows them to actively contribute to the team's success.

Recruiters should aim to strategically integrate these traits into their assessment criteria by posing scenario-based questions during interviews, assessing candidates' contributions to team projects, problem-solving, creativity and patience in dealing with complex scenarios. During interviews, posing questions that require candidates to navigate ambiguous situations can reveal their cynicism and their lateral thinking abilities. While asking about past experiences, where candidates demonstrated patience in dealing with complex testing challenges, may provide insights into their persistence and attention to detail.

To evaluate creativity and proactivity, recruiters can request candidates to share examples of innovative testing approaches or other circumstances where they have innovatively dealt with problems in the past, or how they have proactively identified and addressed potential issues. Additionally, behavioural interview questions focused on teamwork can unveil a candidate's collaborative skills and ability to contribute effectively to a team.

5.2 Background

Participants in the study came from a diverse range of backgrounds, with varying levels of experience in software testing. Notably, their educational trajectories were quite varied, challenging the conventional notion that a computer science degree is the sole gateway to software testing as a profession. Furthermore, the acknowledgment among the participants themselves that there is no standard profile for a successful software tester underscores the diversity in work and educational backgrounds within the testing profession. This diversity can be viewed as a significant asset, offering numerous advantages to both individual testers and the organisations they serve.

Having software testers with diverse backgrounds offers the potential for cross-disciplinary skills and insights. Individuals who have served their time through different roles bring a unique set of skills and perspectives to the testing realm. This cross-disciplinary exposure allows testers to draw from various experiences, enriching problem-solving approaches and fostering a more holistic understanding of software quality.

Recruiters should actively encourage this diversity by seeking candidates with diverse educational backgrounds and work histories. A mix of individuals with technical, non-technical, or even non-IT backgrounds can contribute to a well-rounded testing team. For instance, someone with a background in business administration may bring valuable insights into user experience and

business requirements, complementing the technical expertise of individuals with IT degrees. The recognition that diverse teams lead to stronger collaboration and innovation is a well-established concept in organisational psychology. A mix of backgrounds fosters a collaborative environment where team members learn from each other, leading to more creative problem-solving and improved decision-making.

Recruiters should strive to strategically tap into this diversity by prioritising inclusive hiring practices. Instead of rigidly adhering to predefined educational or career paths, recruiters can look for candidates who bring unique perspectives, soft skills and problem-solving approaches. This approach will not only enhance team dynamics but also contributes to a more adaptable and resilient testing team.

5.3 Extraversion vs Introversion

Shoib et al. (2009) found that within the realm of software testing, exploratory testing requires a unique set of skills. The main conclusion of their paper was that extrovert personality types are more likely to be successful exploratory testers. With this in mind, the participants in our study were asked how important they thought extraversion was to the role of software testing in general. Analysis of the results revealed a wide range of responses, with the majority leaning towards lower ratings (figure 4). Out of sixteen respondents, ten chose ratings between one and five out of ten.

Candidates tended to feel that extraversion is not as an essential skill to succeed in the industry. Therefore, it should not be necessary for recruiters to look for this trait when conducting interviews. Moreover, extraversion and communication skills should not be collated together. The fact that an individual is introverted doesn't mean they lack the capacity for strong communication. Introverts often excel in one-on-one or small group interactions, they tend to be good listeners and thoughtful in their responses. They also exhibit strong observational skills which can contribute to clear and detailed communication.

In a professional context, introverts can excel in tasks that require concentration, analysis, and strategic thinking, attributes that actually align with certain aspects of software testing. Their ability to communicate thoughtfully and diplomatically can be particularly valuable when conveying complex technical information or reporting testing results to various stakeholders. While extroverts may thrive in more dynamic and social settings, introverts bring unique strengths to communication making them well-suited for roles that demand thoughtful and precise interactions. Recruiters should recognise that introversion does not inherently impede one's ability to

communicate effectively in a professional setting, and neither introversion nor extroversion should be considered as factors when recruiting software testers, unless for specific exploratory testing roles.

5.4 Domain Knowledge

Clearly, prior experience and knowledge of a specific competency area is very useful in any field of work. In fact, Beer and Ramler (2008) found that substantial domain knowledge was essential for effective testing and tools fell well short in compensating for a lack of experience. The data gathered from our own study also concurs with this, with participants acknowledging the value of domain expertise in enhancing testing practices, identifying nuanced issues, understanding user perspectives and ensuring comprehensive test coverage.

On the other hand, while domain knowledge enriches the testing process, an overemphasis on it during recruitment may pose challenges. This could potentially narrow the pool of candidates, limiting diversity and preventing the inclusion of varied perspectives in testing teams. As has already been covered in section 5.2, a diverse team with a mix of backgrounds is a great asset in quality assurance and software testing. Therefore, recruiters must weigh the benefits of domain knowledge against the advantages of a diverse team composition. A team comprising individuals from various educational and professional backgrounds brings different perspectives, fostering creativity and innovation.

To optimise recruitment processes, organisations should aim to strategically blend domain experts with individuals from diverse backgrounds. This approach combines the depth of domain knowledge with the breadth of diverse experiences. This also aligns with the empirical findings, where respondents emphasised the importance of collaboration and communication within testing teams, underlining the relationship between technical expertise and soft skills. While domain knowledge remains a valuable asset in software testing, a nuanced approach to recruitment is essential.

5.5 Skill Acquisition

Both the literature review and the responses gathered from this study emphasise the fact that software testing is acutely underrepresented in formal education. Questionnaire participants uniformly expressed concerns about the inadequacy of testing in IT curriculums. However, as mentioned previously, there are numerous positive aspects of recruiting from diverse backgrounds. It is crucial for recruiters to recognise that a lack of formal testing education is not necessarily a drawback, but rather an opportunity to incorporate diverse skill sets and innovative problem-solving approaches into their teams.

The participants in our study also reiterated the findings of Florea and Stray (2020) that hands-on experience in the job is considered the most efficient method of learning software testing. The preference for continuous informal learning rather than formal courses reflects the dynamic nature of the field, casting further doubt on the importance of formal testing education when recruiting software testers.

As highlighted in our discussion on conscientiousness (Section 5.1.5) and continuous learning (Section 5.1.2), it is more important to create a work environment that values and supports professional growth and contributes to overall job satisfaction. Organisations can implement targeted strategies that provide access for employees to resources that help them to gain new skills and experiences within the testing domain. Some examples might include, investing in training programs, providing learning resources, encouraging mentorship and recognising and rewarding growth.

Clearly more focus on testing during higher education would be preferable, not only for testing roles but also for roles in software development and IT in general. However, rather than fixating on formal testing qualifications during recruitment, organisations should instead focus on providing opportunities for testing professionals to acquire new skills while on the job. By doing so recruiters can contribute to the growth and adaptability of their teams, as well as creating an environment that attracts, motivates and retains the best candidates for the job.

5.6 Motivation

As well as investigating factors that may be useful when selecting candidates for software testing roles, as was touched upon in the previous section another goal of this study is to look at what motivates testers and explore how this information could be used to enhance long-term commitment and job satisfaction. Participants in the study were not only questioned about their views on software testing as a career but also their motivation to perform effectively, remain in their current position and in the industry in general.

The results revealed that the majority of participants did not perceive software testing as merely a stepping stone into other roles within the software development industry. This contrasts with a common misconception that testing roles are transient. The participants emphasised that testing constitutes a distinct career path with its own set of challenges which requiring a unique mindset. The diverse nature of testing offers many opportunities for growth and innovation and so can offer a very fulfilling career.

Even those who did view testing as a stepping stone acknowledged that the cross-disciplinary nature of testing skills made them invaluable across the sector. The participants also noted that quality assurance tasks are now performed by individuals in various IT roles, suggesting that moving from testing to another role may not necessarily be a forward step in career progression but rather a lateral shift. Moreover, within the testing field, there are more senior roles, such as testing managers, which can offer opportunities for career advancement without leaving the field.

Building upon insights from Deak et al. (2016), who explored the motivation and job satisfaction of software testers, our research also recognises the challenges of motivating testing teams. Testing is often perceived as less exciting than other areas of software development. Some participants of our questionnaire raised concerns, highlighting perceived issues such as a lack of respect, inadequate monetary rewards and limited career opportunities. These factors could potentially demotivate professionals and impact their commitment. It is imperative for prospective employers to address these issues, ensuring that software testing roles are recognised and rewarded and clear career progression pathways are offered to enhance motivation and commitment within testing teams. Strategies should be considered such as showcasing success stories, integration of testing with development tasks, acknowledgement and reward of individuals who actively seek to acquire new skills, as well as providing structured career development opportunities, highlighting the potential for upward career progression without leaving the QA domain.

6 Recommendations

Based on the extensive research, examination of results and discussion carried out so far in this study, the following section comprises a set of comprehensive recommendations to help direct companies when recruiting software testing specialists. The ultimate aim is to guide recruitment processes and foster a thriving testing environment within organisations to empower recruiters to build well-rounded, diverse and motivated software testing teams equipped to meet the diverse challenges of the industry. Furthermore, recommendations are provided to promote employee satisfaction and ongoing skill development within the testing teams.

6.1 General Software Tester Recruitment Strategies

6.1.1 Behavioural Interviews:

Behavioural Questions: Use structured behavioural interview questions to elicit responses that demonstrate candidates' soft skills and past experiences. Tailor questions to each trait, focusing on scenarios where candidates faced challenges relevant to testing roles and showcasing the desired traits.

Practical Exercises: Incorporate hands-on practical exercises or simulations to evaluate candidates' technical proficiency and problem-solving abilities. Design exercises that mirror real-world testing scenarios, allowing candidates to demonstrate their skills in a simulated environment. Provide opportunities for candidates to showcase their ability to apply theoretical knowledge to practical testing tasks.

6.1.2 Integration of Key Traits:

Curiosity: Evaluate candidates' inquisitiveness by posing open-ended questions that assess their eagerness to explore new technologies, methodologies and testing approaches assessing their inclination towards continuous learning and innovation. Request examples from their past experiences where they demonstrated a thirst for knowledge and a proactive approach to learning.

Adaptability: Engage candidates in discussions about actual experiences of adopting new technologies and methodologies. Present hypothetical scenarios reflecting emerging trends or disruptive technologies and gauge candidates' responses to assess their adaptability and forward-thinking approach.

Conscientiousness: Assess candidates' diligence, reliability and attention to detail. Inquire about their methods for organising and executing testing processes, managing workload, prioritisation of tasks and adhering to established protocols probing for evidence of conscientiousness in their work habits. Request specific instances where their conscientiousness contributed to successful testing outcomes, demonstrating their reliability and commitment to quality assurance.

Lateral Thinking: Gauge candidates' ability to think creatively and approach problems from unconventional angles. Present hypothetical testing scenarios or challenges that require innovative solutions. Evaluate their thought processes, adaptability and capacity to devise creative testing strategies.

Teamwork: Explore candidates' collaborative skills and their ability to work effectively within a team. Pose questions that assess their experiences in contributing to team projects, resolving conflicts and fostering a positive team dynamic. Look for examples of how they have supported and collaborated with colleagues to achieve common goals.

6.2 Desirable Character Selection in Interview Scenarios

6.2.1 Communication and Interpersonal Skills

Structured Interviews: Conduct structured interviews with a focus on candidates' ability to communicate technical concepts to both technical and non-technical stakeholders, assessing their clarity, coherence and effectiveness in conveying information.

Evaluate candidates' active listening skills and empathy through role-playing exercises or scenario-based questions involving stakeholder interactions.

Technical Writing Assessment: Introduce a technical writing assessment where candidates are tasked with documenting test plans, bug reports, or technical documentation, evaluating their written communication skills and attention to detail.

Review writing samples from candidates' previous work or academic projects to assess their ability to articulate complex ideas in a clear and concise manner.

Reference Checks: Request references from previous employers or colleagues specifically addressing candidates' communication abilities, professionalism and collaborative nature, providing additional insights into their interpersonal skills and work ethic.

6.2.2 Continuous Learning Abilities

Discussion Forums: Create discussion forums during interviews to explore candidates' learning approaches and strategies for staying current in the field, encouraging them to share experiences and insights from their ongoing professional development efforts. Engage candidates in conversations about their participation in online communities, forums, or professional networks, assessing their engagement with industry trends and emerging technologies.

Résumé Review: Review candidates' résumés for evidence of continuous learning initiatives, such as certifications, courses, workshops, or conference attendance, indicating their commitment to professional growth and development. Assess the relevance and currency of candidates' technical skills based on their education, training and certifications, ensuring alignment with the evolving demands of the testing industry.

6.2.3 Problem Solving and Critical Thinking

Practical Scenarios: Implement practical problem-solving scenarios during interviews, presenting candidates with real-world testing challenges and evaluating their ability to analyse, strategise and execute effective solutions. Encourage them to walk through their problem-solving approach step-by-step, providing insights into their critical thinking abilities, resourcefulness and decision-making processes.

Hypothetical Testing Challenges: Present hypothetical testing challenges or case studies that require candidates to assess risks, identify priorities and devise testing strategies, gauging their analytical skills and creativity. Evaluate their ability to think outside the box and propose innovative solutions to complex testing problems, assessing their capacity for lateral thinking and adaptability.

6.3 Conscientiousness

Structured Interview Questions: Structure interview questions around candidates' approach to organising and executing testing processes, probing for evidence of diligence, thoroughness and reliability in their work habits. Inquire about candidates' methods for prioritising tasks, managing deadlines and maintaining attention to detail, assessing their conscientiousness in handling testing assignments.

Scenario-Based Assessments: Utilise scenario-based questions or practical exercises to simulate challenging testing scenarios and evaluate candidates' response strategies, providing insights into their conscientious approach to work, as well as their problem-solving abilities. Present candidates with scenarios involving conflicting priorities, ambiguous requirements, or tight deadlines, observing their ability to remain composed, focused and methodical in their approach.

6.4 Diversity and Collaboration

Diversity and Inclusion Training: Embed diversity and inclusion training into the organisational culture by providing comprehensive education and awareness programs for hiring managers and interviewers. These initiatives ensure that recruitment practices are fair, unbiased, and inclusive, promoting equal opportunities for all candidates. Organisations benefit from a broader range of perspectives, experiences, and ideas, leading to enhanced innovation, creativity, and performance.

Cross-Disciplinary Collaboration: Nurture collaboration between individuals with diverse technical and non-technical backgrounds, recognising the value of interdisciplinary perspectives in enhancing problem-solving approaches and driving innovation. Encourage knowledge sharing and cross-training initiatives within testing teams, empowering individuals to leverage their unique skills and experiences to address complex testing challenges effectively.

6.5 Development and Motivation

Onboarding and Training Initiatives: Establish comprehensive onboarding programs that provide new hires with the necessary tools, resources and support to integrate smoothly into the testing team and organisation. Offer a range of training opportunities tailored to the specific needs and career goals of testing professionals.

Access to Learning Resources: Ensure employees have comprehensive access to a diverse range of learning resources to facilitate continuous skill development and knowledge enhancement among testing professionals. Empower individuals to stay abreast of the latest trends, tools and methodologies in software testing, thereby fostering a culture of lifelong learning within the organisation.

Networking Opportunities: Organise networking events, industry conferences and community meetups to facilitate knowledge exchange, collaboration and professional growth. Provide

platforms for testers to showcase their work, share best practices and connect with peers and industry experts, implementing a sense of community and camaraderie within the testing community.

Mentorship Programs: Establish robust mentorship programs designed to provide guidance, support, and insights to junior members, accelerating their growth and integration into the team. By nurturing a culture of mentorship, the organisation encourages collaborative learning, skill acquisition and career advancement opportunities for all team members.

Integration of Testing Tasks with Development: Recognise the integral role of testing in software development by integrating testing tasks into the development process. Collaboration between testing and development teams ensure that quality assurance is prioritised throughout the software development lifecycle. Enhancing product quality and delivery timelines while minimising rework, ultimately resulting in more robust and reliable software products.

Showcasing Success Stories: Actively promote and showcase success stories that exemplify exceptional achievements and contributions to inspire and motivate professionals and to reinforce the value of their work and the impact it has on the organisation's success. This recognition also serves to instil pride and a sense of purpose among team members.

Recognition and Reward: Implement a formal recognition and reward system to acknowledge individuals who actively pursue new skills, demonstrate exemplary performance and contribute to the organisation's success. Celebrating achievements and efforts helps the organisation reinforces a culture of continuous learning, professional development and excellence. Recognition could include monetary rewards, public acknowledgment, career advancement opportunities and participation in special projects or initiatives.

Addressing Concerns: Proactively address concerns related to respect, wages and career opportunities through transparent communication channels and structured feedback mechanisms. Regular salary reviews ensure that compensation remains competitive and aligned with industry standards. Transparent career progression frameworks provide clear guidelines and pathways for professional growth and advancement. Open communication channels allow employees to voice concerns, aspirations, and expectations, facilitating a supportive and inclusive work environment where every individual feels valued and respected.

7 Conclusion

It's clear from the findings of both the prior research on the subject and from the investigation carried out in this study that software testing specialists are a unique subset within the IT profession. They require different skills, personalities, attitudes and mentalities from their colleagues working in other roles within the industry. These include effective communication, continuous learning abilities, problem-solving skills and conscientiousness, among many others.

The recommendations offered in this paper leverage this research to provide actionable strategies to enhance recruitment processes, foster collaboration and diversity and promote employee satisfaction and development. By implementing these recommendations, OP Financial Group can streamline their recruitment efforts ensuring they attract and retain top-tier talent in the software testing domain. Similarly, these insights offer valuable guidance for the broader software testing industry, influencing recruitment and training practices across organisations and contributing to the advancement of the field. For academia, our study provides empirical insights into the personal characteristics and motivations of software testing professionals, enriching the existing literature on the subject.

However, much more research still needs to be done to further deepen understanding of the intricacies of software testing and the unique attributes required for success. While this study sheds light on some key aspects, there are still many areas left unexplored. Future research could delve much deeper into the specific personality traits, motivations and skill sets explored in this thesis. Additionally, examining the impact of organisational culture, leadership styles and team dynamics on testing outcomes, could provide further valuable insights for enhancing testing practices and team performance. These unexplored areas within software testing present a multitude of potential opportunities for further research and advancement in the field.

As a final step, this thesis has also now been submitted to recruitment personnel at OP Financial Group and will be disseminated among relevant individuals. They will then have the opportunity to review and analyse the recommendations outlined in the paper. Subsequently, meetings will be organised to discuss the implications of the research findings and how they can be integrated into OP's recruitment practices effectively. Personnel will have the chance to ask questions, share insights and provide feedback on the feasibility and applicability of the proposals. This collaborative approach ensures that the recommendations are not only understood but also embraced by those directly involved in the recruitment processes.

To close, I would like to extend sincere gratitude to all individuals, organisations and sources that supported my research. Special thanks to OP Financial Group for their collaboration and valuable insights, as well as to the research participants who generously shared their time,

experiences and perspectives. I would also like to thank my advisor Teemu Havulinna for his support and patience throughout the process of writing this thesis. Additionally, I would like to acknowledge the contributions of previous research studies and academic literature that informed and enriched this work.

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Appendix 1. Questionnaire Form

Thank you so much for completing this survey! Your experiences and perspectives are crucial for shaping understanding of the dynamic field of software testing. This survey aims to explore various aspects of software testing, including skills, career trajectories and the diverse perspectives within the testing community. Your candid responses will not only contribute to valuable insights for the industry but will also play a key role in shaping my thesis and helping me to graduate. Your time and input are greatly appreciated. Thank you, thank you, thank you!

- 1. Can you briefly describe your educational and professional background? (If you are a software tester, how did you enter the field?)**

- 2. What is your current role and how long have you been working in it?**

- 3. From your point of view, in IT education do you think software testing is adequately taught and recognised in comparison to other IT roles (e.g. development)? Why or why not?**

- 4. How do you view software testing as a career path? Do you see it as a stepping stone to other IT roles, and if so, why?**

- 5. In your opinion, is software testing a role that anyone can learn, or do you believe only individuals with a specific characteristic set can succeed in the field? (Please explain)**

-
-
6. Without considering technical skills, are there specific personality traits that you believe contribute to success in software testing? How do these traits differ from other IT roles?

-
-
7. Reflecting on your experiences, do you believe there is a standard "profile" for a successful software tester, or is the role more flexible, accommodating different backgrounds and approaches?

-
-
8. In your experience, how important do you think effective communication skills are for a software tester?

Mark only one oval.

1 2 3 4 5 6 7 8 9 10

9. Please briefly explain your choice of importance

-
-
10. In your experience, how important do you think conscientiousness is for a software tester? (In this context, conscientiousness refers to the trait of being thorough, careful, and diligent)

Mark only one oval.

1 2 3 4 5 6 7 8 9 10

11. Please briefly explain your choice of importance

12. In your experience, how important do you think extroversion is for a software tester?

Mark only one oval.

1 2 3 4 5 6 7 8 9 10

13. Please briefly explain your choice of importance

14. How do you see the role of software testing evolving going forward, and how should the tester adapt to this?
