Career Mapping in Software Testing: insights into the professional profile

José W. R. A. Filho
Universidade Federal Rural do Semi-Árido (UFERSA)
Angicos, Rio Grande do Norte, Brazil
jose.filho44493@alunos.ufersa.edu.br

Francisco A. Andrade
Universidade Federal Rural do Semi-Árido (UFERSA)
Mossoró, Rio Grande do Norte, Brazil
francisco.andrade53954@alunos.ufersa.edu.br

Jarbele C. S. Coutinho
Universidade Federal Rural do Semi-Árido (UFERSA)
Angicos, Rio Grande do Norte, Brazil
jarbele.coutinho@ufersa.edu.br

Wilkerson L. Andrade
Universidade Federal de Campina Grande (UFCG)
Campina Grande, Paraíba, Brazil
wilkerson@computacao.ufcg.edu.br

ABSTRACT

Due to the inconsistency between the professional qualifications offered in academic training and the actual demands of the software industry, entering or qualifying for a career in Software Testing can be challenging for entry-level professionals. Combined with a lack of clarity regarding the desired requirements at different career levels in this field, the industry presents a lengthy list of hard skills that are essential for a career. It emphasizes the search for mid-level or senior-level professionals, which limits the hiring process. Therefore, this study goal to identify the professional requirements expected by the industry in the field of Software Testing. Thus were conducted: (i) a qualitative and quantitative study, based on the analysis of national and international job openings posted on professional social media; and (ii) a survey of professionals with technical experience in the Software Testing sector, to validate the results obtained in the previous study. The results were organized into Junior, Intermediate, and Senior levels, and categorized according to hard skills, soft skills, academic background, and certifications. Regarding technical skills, automation tools and agile methodologies, and interpersonal skills, communication, teamwork, and leadership stand out. Finally, this study contributes to a career path mapping in Software Testing, based on insights into the actual professional qualifications required for a professional in this field.

KEYWORDS

Software Testing, Professional Qualification, Software Industry

1 Introduction

Software Testing (ST) professionals, such as Test Analysts, Software Testers, and Quality Engineers, are responsible for planning, executing, and documenting tests that ensure system reliability [14]. However, despite the field's relevance and the high demand for these professionals, recent graduates face challenges entering the job market in this sector. This is largely due to the mismatch between academic training and industry demands, particularly regarding professional practice, mastery of specific tools, and the development of soft skills such as communication, teamwork, and problem-solving [17].

The lack of specific Software Testing courses in undergraduate programs, coupled with a lack of clarity regarding the desired requirements at different career levels, contributes to this difficulty

[9]. Although some studies investigate the professional profile in Software Engineering in general, research focused exclusively on careers in Software Testing is still limited [9].

For entry-level professionals, another challenge is perceived as related to a lack of experience. Companies and recruiters tend to seek mid-level or senior-level professionals, limiting the entry of entry-level professionals. Moreover, for experienced professionals, there is a perceived need to understand the knowledge required for career advancement, which is not yet clearly defined according to the company's organizational policies.

Another notable factor is the teaching of Software Testing in academic settings, which remains predominantly theoretical and compromises the practical and technical training of future professionals in the field [15]. Although strategies to align real industry demands with the academic context have been tested in the classroom, in a more practical way [12], significant gaps remain in the Software Testing context.

Given this context, this study investigates the following research question: "*What professional requirements does the software industry demand for a Software Testing career?*". Thus, the goal is to identify a set of skills and competencies expected by the software industry in the Software Testing field, considering professional seniority in the field, to provide relevant information for beginners or those seeking to expand their professional qualifications in this sector.

To support the investigation of the research question, a qualitative and quantitative study was conducted based on the analysis of job advertisements for Software Testing careers, both nationally and internationally, published on professional social networks and job posting platforms, such *LinkedIn*[1], *Indeed*[2] and *Glassdoor*[3]. The results were synthesized and validated with professionals working in the software industry, in the Software Testing sector, through an opinion survey. For this purpose, professionals with Junior, Mid-Level, or Senior seniority levels were considered.

The results obtained are expected to contribute to guiding Software Testing professionals in training or in career transition, in addition to providing indicators for structuring specific training and curricular adaptations relevant to the real demands of the sector.

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[1] *LinkedIn*: br.linkedin.com

[2] *Indeed*: br.indeed.com

[3] *Glassdoor*: www.glassdoor.com.br

Therefore, this paper is organized as follows: Section 2 presents the theoretical foundation; Section 3 discusses related work; Section 4 presents the research method adopted; Section 5 presents the results; Section 6 discusses the results more specifically; Section 7 highlights some of the main threats to validity and the strategies adopted to mitigate them; and, finally, Section 8 presents the conclusions of the study.

2 Professional qualification in software testing

The demand for qualified Information Technology (IT) professionals has grown considerably, driven by the sector's steady advancement and the digitalization of services in various fields, such as healthcare, finance, and education [8]. Companies across various sectors seek talent capable of developing and maintaining technological solutions aligned with their operational and strategic needs. According to the Association of Information and Communication Technology and Digital Technologies Companies [2], Brazil will need more than 797.000 professionals in the next five years, with an average of 200.000 new positions created per year [4].

According to Souza et al. [17], the qualification of Software Testing professionals is essential for developing high-quality systems aligned with customer needs. This qualification requires professionals to have mastery of theoretical concepts, verification and validation techniques, the use of automated tools, critical analysis skills, and an understanding of the various types and techniques of software testing.

Despite its importance in a software development project, the field of Software Testing still suffers from a shortage of qualified professionals [5]. According to Nascimento et al. [15], many educational institutions present this field superficially through a curricular component or include it as supplementary content in other components, without adequate depth or practical knowledge. As a result, professionals enter the job market with limited skills, resulting in them not being hired or hiring someone who may compromise the quality of the systems being tested.

Professional qualifications in Software Testing must combine theoretical knowledge, practical experience, and constant updating [7], considering the continuous emergence of tools, methodologies, and approaches that tend to support the testing strategies used in software projects.

To ensure the quality of a software project, it's important to consider testing. By detecting and correcting flaws in the early stages of development, the testing process helps save resources and avoid constant updates that could be prevented with good planning and validation [16]. Therefore, to ensure the effectiveness of testing, it's important to consider the qualifications of the professionals who perform it.

3 Related work

Some studies have investigated the competencies required for professionals working in Software Engineering, focusing on technical and interpersonal skills [6, 10], while other studies present results more focused on the professional profile in Software Testing [1, 11, 13].

Souza et al. [6] explored the discrepancy between the competencies provided by Software Engineering education and those required by the industry, highlighting gaps in academic training and the need for socio-emotional skills. Galster et al. [10] analyzed the soft skills most in demand by the software industry in New Zealand. They analyzed 530 job advertisements and mapped 17 interpersonal competencies. Soft skills such as communication, collaboration, and adaptation were identified. These results highlight the importance of interpersonal skills, which are also fundamental in various areas of Software Engineering, including Software Testing.

Lagogrande and Marcolin [13] analyze the growing demand for Software Test Analysts, highlighting the need for qualified professionals capable of combining technical and behavioral skills with market demands. They identified that knowledge of test automation, combined with agile methodologies, is a strategic differentiator, while skills such as communication, proactivity, and critical thinking are essential for career advancement.

Aludhilu et al. [1] investigate the main challenges faced by Namibian startups in the Software Testing field, such as the shortage of qualified professionals, the lack of structured practices, and limited access to specific training. To address these gaps, the authors conducted customized training, focusing on practical methodologies, accessible tools, and continuous skills development. The results indicate that, after implementing the training program, there was an improvement in the understanding of testing concepts, the application of best practices, and the overall quality of verification processes in the participating startups. Furthermore, it highlights the importance of aligning testing training with the real demands of the sector, promoting concrete improvements in the quality of software products and the competitiveness of local companies.

Garousi et al. [11] describe differences between academic training in Software Testing and training offered by industry. The authors highlight that university education tends to be theoretical and poorly standardized, while industrial training prioritizes practical tools but neglects conceptual foundations. To bridge this gap, they propose adopting a teaching approach that combines theory and practice, the use of real industry projects in the courses, and the creation of laboratories with applied exercises using tools widely used in the market. The study emphasizes the need for closer and continuous collaboration between academia and industry as key to developing more well-rounded professionals aligned with the sector's demands.

In this sense, this study stands out by mapping competencies required for a career in Software Testing at the Junior, Mid-Level, and Senior levels, with a sample of vacancies in the national and international context, combining job vacancy analysis and validation with professionals in the field, through quantitative and qualitative analyses.

4 Research method

This study used an exploratory qualitative and quantitative approach to analyze the competencies and skills required of Software Testing professionals. It collected data from job openings posted on professional social media platforms and job posting platforms, including *LinkedIn*, *Indeed*, and *Glassdoor*. The research method was organized in two stages: *(i) Stage 1* - a survey of job openings on job posting platforms and thematic analysis of the collected data;

(ii) Stage 2 - validation with industry professionals in the Software Testing field through a survey and data analysis.

4.1 Step 1 - Research and analysis of software testing job openings

Considering the professional social networks and job posting platforms used in this study (*LinkedIn*, *Indeed*, e *Glassdoor*), a search was conducted for job postings in the Software Testing field, both nationally and internationally, published between April and June 2024 and January and March 2025. The search terms "*QA Engineer*", "*Software Tester*" e "*Quality Analyst*" were used.

In the end, 63 jobs were found from the professional social network *LinkedIn*, 36 from the job posting platform *Indeed*, and 18 from the job posting platform *Glassdoor*. A total of 117 jobs were returned. The vacancy analysis took into account the following criteria:

(1) Duplication elimination.
(2) Collection of key job information (position, company, seniority, and *view access link*).
(3) Classification of jobs by level (Junior, Mid-Level, or Senior).
(4) Categorization and grouping of competencies into *Soft Skills*, *Hard Skills*, and general qualifications, according to the Thematic Analysis (as described in the section 4.1.1 .

4.1.1 Thematic Analysis. The analysis of the data obtained from the 117 vacancies identified was conducted using Thematic Analysis, proposed by Braun and Clarke [3]. Thematic Analysis is a qualitative research method used to identify recurring patterns or "themes" in a data set.

Thus, the Thematic Analysis process was organized according to the following activities:

(1) Familiarization with the data: reading and initial organization of the collected information.
(2) Definition of themes: grouping skills and competencies into meaningful categories.
(3) Production of the report: systematization of the findings into clear and coherent descriptions.

4.2 Step 2 - Survey with software testing professionals

To validate the data obtained through Stage 1 and improve understanding of the competencies required for a Software Testing position, a survey was planned and conducted with professionals working in Software Testing, covering the different seniority levels for this professional category, namely Junior, Mid-Level, and Senior.

The survey was conducted through the Google Forms platform *Google Forms*[4] between February 20th and May 27th, 2025. The survey was distributed on various online platforms and communities frequented by technology professionals, such as *LinkedIn*, *DevMedia* forums, and the *Scriptcase* community. A total of 27 responses were collected.

The questionnaire was structured into four sections. The first was dedicated to assessing the professional profile of the participants, aiming to collect data such as age, gender, degree level, and seniority. The subsequent sections presented specific questions for

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[4]*Google Forms*: docs.google.com

Table 1: Summary of the questionnaire

Section I: Participant Profile	
01	What is your current job position?
02	How long have you been working in the Software Testing field?
03	What is your level of academic education?
04	What is your main area of study?
05	Do you hold any certifications in the Software Testing field?
06	How do you identify your gender?
07	What is your age group?
Section II: Skills and Qualifications	
08	Evaluate how important or present the listed Soft Skills are in your work environment.
09	Which Agile methodologies are used in your daily work routine?
10	Was higher education a requirement for your current position?
11	Which test automation tools are frequently used in your professional environment?
12	Regarding methodologies, tools, and practices, evaluate how much each statement applies to your work environment.
13	Evaluate how much each responsibility is part of your professional activities.
Section III: Responsibilities and Differentials	
14	Evaluate how much each listed item is considered a differential in your work environment or career.
15	Evaluate how much each listed item is considered a differential in your work environment or career.

each seniority level (Junior, Mid-Level, and Senior), as indicated by the participant in the initial section of the questionnaire. The questionnaire questions were developed based on the most frequently required skills and competencies, identified in the initial analysis of the job advertisements (Stage 1), as presented in Section 5. The Table 1 presents a summary of the statements of each question addressed in the questionnaire.

The Survey data analysis process was conducted in a structured manner: responses were grouped and analyzed separately by seniority level, allowing for a detailed understanding of the competencies for each segment. For each question, the responses were tallied to generate percentages (%), reflecting the perception and frequency of the competencies mentioned by professionals at their respective seniority levels.

5 Results

In the IT sector, seniority levels reflect a professional's experience and responsibility and are currently categorized as Junior, Mid-Level, and Senior. The Junior level refers to professionals who are at the beginning of their careers, developing practical skills. The Mid-Level level refers to professionals who have greater autonomy and technical knowledge, but are still seeking improvement. And the Senior level refers to professionals with extensive experience, leading projects, and making strategic decisions within the team.

Table 2: Summary of thematic analysis for Junior level vacancies.

Theme	Quantitative	(%)
Theme 1 - Hard Skills	34	100%
Theme 2 - Soft Skills	34	100%
Theme 3 - Certifications	21	64%
Theme 4 - Differential	15	45%

Source: Own authorship

5.1 Results of step 1 - Research and analysis of job openings in ST

In Step 1 (described in section 4.1), 117 job advertisements in the Software Testing field were analyzed, distributed among *LinkedIn* (63 vacancies), *Indeed* (36 vacancies), and *Glassdoor* (18 vacancies).

Initially, key information about the vacancies was collected, such as the position offered, company, seniority level, and a link to view the advertisement for each vacancy. The vacancies were then categorized according to the seniority level indicated in the advertisement description. 34 vacancies were identified for the Junior level, 46 for the Mid-Level level, and 37 for the Senior level. This analysis contributed to mapping market demands and preferences, according to the technical and behavioral competencies for each seniority level.

Thematic analysis was adopted to examine the Hard Skills, soft skills, qualifications, responsibilities, and expected differences in Software Testing professional profiles, at Junior, Mid-Level, and Senior levels. Thus, a practical theory was formulated that identifies the essential competencies for this professional profile. Overall, 20 skills and competencies were identified for Junior-level professionals, and 31 skills and competencies for Mid-Level and Senior levels. These characteristics were categorized according to the coding proposed by the Thematic Analysis. The complete data from this analysis can be viewed in the Supplementary Material.

During the Thematic Analysis, four distinct themes were used to help structure and understand industry demands. The themes used in the skills and competency assessment were:

(1) Theme 1 - *Hard Skills*: Technical knowledge such as methodologies, tools, programming languages, planning, test execution, bug management, and documentation.
(2) Theme 2 - *Soft Skills*: Essential interpersonal skills, such as communication, leadership, and teamwork.
(3) Theme 3 - *Academic Background and Certifications*: Required qualifications, including IT degrees and specific certifications.
(4) Theme 4 - *Differential*: Unique skills and competencies that offer a competitive advantage, especially for juniors.

In the Junior seniority professional profile category, the analysis of the 34 vacancies revealed that 100% of them required Hard Skills (Theme 1) and 100% also highlighted the need for Soft Skills (Theme 2). Furthermore, 64% of the vacancies indicated the importance of Academic Training and Certifications (Theme 3), while 45% indicated some specific Differential (Theme 4), as detailed in Table 2.

It is worth noting that, during the data collection on the *LinkedIn*, *Indeed*, and *Glassdoor* platforms, it was observed that vacancies for

Table 3: Summary of thematic analysis for Full and Senior level vacancies.

Theme	Quantitative	(%)
Theme 1 - Hard Skills	76	92%
Theme 2 - Soft Skills	62	75%
Theme 3 - Certifications	46	56%

Source: Own authorship

Table 4: Hard skills expected for the Junior level

Hard Skills	Quantitative	%
Methodologies (Agile, Waterfall, Kanban, Scrum)	34	100%
Testing tools: Postman, Selenium	22	64%
Management tools: Jira	25	73%
Programming languages: Java, JS, Python, C#	22	64%
Repositories: GitHub, GitLab	12	36%
CI/CD	34	100%
Bug management: reporting, documenting, resolving	34	100%
Test planning (plans and cases)	34	100%
Manual and automated testing	16	46%
Regression/Integration Testing	34	100%
Detailed test documentation	34	100%

Source: Own authorship

mid-level and senior professionals were often grouped under the same filter or presented together, especially on *LinkedIn*. Therefore, the data related to these two seniority levels were analyzed as a unified process. Considering this approach, the adopted Themes indicated that, of the 83 vacancies analyzed, 92% indicated the need for Hard Skills (Theme 1), 75% reported the need for Soft Skills (Theme 2), and 56% indicated the need for Academic Training and Certifications (Theme 3). None of the vacancies analyzed indicated the requirement of any specific Differential (Theme 4) in the career, as shown in Table 3.

To understand in more detail the information extracted from the analyzed vacancies, the following results are presented according to seniority levels, for each Theme.

Theme 1 - Hard Skills. The most wanted hard skills in the job market for software testing professionals vary significantly with seniority. For junior professionals, the focus is on fundamental skills such as basic functional testing knowledge, familiarity with tools like Postman, JIRA, and TestRail, and SQL proficiency. Agile methodologies (Scrum, Kanban) and Waterfall are also required in 100% of positions. Testing tools (such as Postman and Selenium) are valued in 64%, and knowledge of management tools like JIRA is required in 73% of advertised positions. Programming languages (such as Java, JavaScript, Python, C#) are required in 64% of the positions, and experience with repositories (GitHub, GitLab, Continuous Integration (CI)/Continuous Delivery (CD)) in 36% of the advertised positions. Bug management, planning, and execution of manual and automated tests are required in 100% of the positions offered, and regression and integration testing in 46%. Test documentation and reporting are also essential, required in 100% of the positions. The Table 4 presents Hard skills expected for the Junior level.

For mid-level and senior professionals, in the 83 positions offered for this seniority, in addition to a minimum of 3 years of experience

Table 5: Hard Skills expected for the Mid-Level and Senior Level

Hard Skills	Quantitative	%
Methodologies (Agile, Waterfall, Kanban, Scrum)	67	81%
Experience with tools: Postman, Selenium, Zephyr	69	83%
Management tools: Jira	45	54%
Languages: Java, JS, Python, C#	64	77%
Repositories: Github, Gitlab	57	69%
CI/CD	57	69%
Management Bug reporting: reporting, documenting, resolving	83	100%
Test planning: plans and cases	40	–
Framework creation, automation, and maintenance	21	25%
Manual and automated testing	78	94%
Regression/integration testing	38	46%
Detailed report documentation	8	10%
Mentoring junior members	36	44%
AWS cloud environment testing	16	19%
Backend/frontend automation, Web/Mobile API	27	33%
REST APIs	17	21%
SQL and NoSQL databases (MongoDB, Oracle)	50	60%
Tools: Kafka, DevOps, Azure	24	29%
E2E Testing and Defect Management	11	13%

Source: Own authorship

Table 6: Soft Skills expected for Junior-Level Professionals

Soft Skills	Quantitative	%
Communication	34	100%
Organizational Skills	22	64%
English Level	28	82%
Teamwork	34	100%
Analytical Skills	22	64%

Source: Own authorship

Table 7: Soft Skills expected for the Mid-Senior level

Soft Skills	Quantitative	%
Communication	83	100%
Organizational Skills	34	41%
Advanced English Level	61	74%
Teamwork	66	79%
Analytical Skills	51	62%
Leadership	57	69%

Source: Own authorship

in the TS area for mid-level professionals, and 5 years of experience in the TS area for senior professionals, the main hard skills include agile methodologies such as Kanban, Scrum, and Waterfall, presented in 81% of the advertisements. Experience with testing tools, such as Selenium and Postman, is required in 83% of the analyzed positions. Management tools, such as Jira, are required in 54% of cases. Understanding of programming languages such as Java, JavaScript, Python, and C# is requested in 77% of the positions; while experience with GitHub and GitLab repositories and CI/CD appears in 69% of the advertisements. Bug management is required in 69% of the advertised opportunities; Planning, developing test plans, and developing test cases is required in 100% of job openings. Executing manual and automated tests is required in 94% of cases, while regression and integration testing are mentioned in 46% of job openings. Test documentation and reporting are required in only 10% of opportunities.

In addition to these skills, new competencies are added in these senior positions. Mentoring junior team members, for example, is required in 44% of the analyzed positions, while experience with testing in an AWS cloud environment is required in 19% of positions. The creation, automation, and maintenance of frameworks is important in 25% of cases. Automation testing, both back-end and front-end, as well as API, web, and mobile, is required in 33% of the offered positions. Knowledge of SQL and NoSQL databases is essential in 60% of cases, and an understanding of REST APIs is relevant in 21%. Additionally, integration tools, such as Kafka and Azure DevOps, are required in 29% of situations, and end-to-end testing is important in 13% of cases. It is important to note that, for Mid-Level and Senior professionals, some essential skills may not be explicitly mentioned in job advertisements, possibly because it is assumed that these professionals already possess these basic competencies, resulting in a lower frequency of requirements for fundamental tasks compared to Junior professionals. Furthermore, some skills that are considered differentiating for Junior-Level professionals become mandatory at more advanced levels, reflecting the greater expectation of technical mastery and experience in these positions. The Table 5 presents Hard skills expected for the Mid-Level and Senior Level.

Theme 2 - Soft Skills. Regarding the soft skills analyzed in the 34 advertised positions, communication was found to be a relevant skill for junior-level professionals, as it was mentioned in 100% of the advertisements. Organizational skills are mentioned in 64% of the positions, and a basic or intermediate level of English is required in 84% of the opportunities offered. Furthermore, teamwork is required in 100% of cases, and analytical skills appear in 64% of the positions analyzed. The Table 6 presents Soft Skills expected for Junior-Level Professionals.

Regarding the soft skills analyzed in the 83 advertised positions for mid-level and senior professionals, communication also remains essential, having been identified in 100% of the positions advertised. However, organizational skills appear in 41% of the positions, indicating that organization is perhaps more implicit or less explicitly required at these levels. An advanced level of English is required in 74% of the positions, and teamwork is mentioned in 79% of the positions. Furthermore, 62% of the positions value analytical skills, and leadership emerges as a new competency, being required in 69% of the positions offered. The Table 7 presents Soft Skills expected for the Mid-Senior level.

Theme 3 - Academic Background and Certifications. Most of the positions require a completed or ongoing degree in Computer Science, Information Systems, or related fields. At more advanced levels, some companies consider practical experience as a partial substitute for academic training. For junior-level professionals, an analysis of the 34 job postings revealed that 64% of the positions require a bachelor's degree in an IT-related field. Furthermore, certifications in Software Testing are mentioned in 18% of the opportunities analyzed. The Table 8 presents a description of the academic background and certifications indicated in the analyzed vacancies.

For mid-level and senior-level professionals, based on the 83 job openings analyzed, it was found that 56% of them require a bachelor's degree in an IT-related field. Certifications such as the ISTQB[5] and certifications offered by the QAI[6], for example, are required in 21% of opportunities. The ISTQB certification is widely

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[5] *International Software Testing Qualifications Board*
[6] *Quality Assurance Institute*

Table 8: Description of academic background and certifications indicated in the analyzed vacancies

Expected for the Junior level	Quantitative	%
Bachelor's degree in IT-related fields	22	64%
Software testing certifications	6	18%
Expected for the Mid-Senior level	**Quantitative**	**%**
Bachelor's degree in IT-related fields	47	56%
Certifications (ISTQB, QAI)	17	21%

Source: Own authorship

cited as a competitive advantage, especially in mid-level and senior positions.

Theme 4 - Differentiators. Differentials are crucial for junior-level candidates, helping them stand out in competitive selection processes. In the junior positions analyzed, 45% of companies consider knowledge of SQL and NoSQL databases an important differentiator. For mid-level and senior-level professionals, these skills, which were previously a differentiator, have in some cases become essential competencies. For example, knowledge of SQL and NoSQL databases, which was a differentiator for Juniors, becomes a Hard Skill required for Mid-level and Seniors.

5.1.1 Career Map for Software Testers. To better represent the categorization based on the thematic analysis applied to the collected data, a career map was created for Software Testing professionals, covering Junior, Mid-Level, and Senior levels. The career map demonstrates the competencies, responsibilities, and skills required at each seniority level, organized into career objectives, professional requirements (education, experience, hard and soft skills), and personal development. Personal development is addressed based on critical analysis and should be validated in the future with qualitative studies. Personas are also presented that exemplify the ideal profiles for each seniority level for Software Testing professionals, helping professionals use them as a career guide.

Career Map for a Junior-Level TS Professional. Junior-level ST professionals are in the learning phase, focusing on developing core competencies. They should demonstrate good communication skills, teamwork, and basic knowledge of testing, programming, and specific tools. Training typically comes from courses such as Computer Science or Software Engineering. While experience is not required, internships and academic projects are recommended. Figure 1 summarizes a career map for those aspiring to become a Junior Test Analyst, highlighting the skills and competencies required by the industry for this seniority level.

Based on the data categorized in Section 5, a persona was created that represents the ideal profile of a Junior Test Analyst/QA, as seen in Figure 2. This professional must develop skills such as basic knowledge of agile methodologies, programming languages, communication, and analysis. A degree in IT and basic certifications in Software Testing are recommended. While professional experience is not required, participation in internships and academic projects is highly valued.

Career Map for a ST Professional at the Mid-Level and Senior Level. Figure 3 shows the career map for ST professionals seeking to advance to the Mid-Level and Senior levels. The main difference

Figure 1: Career Map for a Junior-Level ST Professional
Source: Own authorship
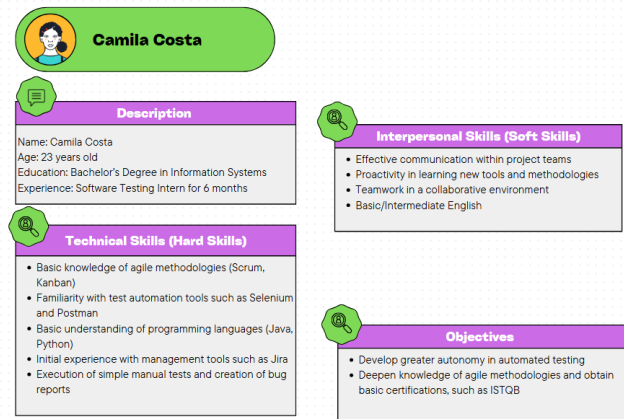
Figure 2: Persona of a Junior-Level ST Professional
Source: Own authorship

between these levels is the length of experience (3 to 5 years for Mid-Level and 5 to 6 years for Senior) and the responsibilities, especially in leadership and decision-making. For this progression, mastery of manual and automated testing, experience with databases and SQL, as well as leadership and communication skills, are essential. Training in IT areas and continuous development, such as participation in events and content production, are also important.

Figure 4 presents a persona that represents the profile of ST professionals at the Mid-Level and Senior levels. In summary, these professionals must primarily possess mastery of methodologies such as Agile, Scrum, and Kanban, experience with automation tools (Postman, Selenium), languages such as Java and Python, as well

Figure 3: Career Map for a ST Professional at Mid-Level and Senior Level

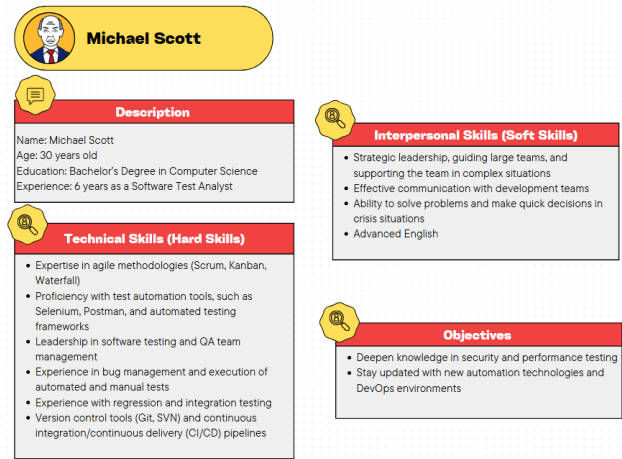*Source: Own authorship*

Figure 4: Persona of a ST professional at the Mid-Level and Senior levels

Source: Own authorship

as SQL/NoSQL databases and continuous integration with GitLab CI/CD. Leadership, decision-making, and effective communication skills are also expected. They typically have a background in IT and certifications such as ISTQB or QAI. The required experience is 3 to 5 years for mid-level and 5 to 6 years for seniors, with active involvement in test planning, automation, and execution.

5.2 Results of step 2 - Survey results

To validate the characteristics found from the analysis of job vacancies for ST professionals (described in section 5.1), and verify that the soft skills, hard skills, certifications and differentials identified match the current work scenario of these professionals, a Survey was conducted with professionals in the software test career. Initially, characterization information of the participants was collected. Then, the information request was presented in the questionnaire, according to the level of seniority of each participant, to validate the results obtained in step 1 of this research (see section 5.1).

Characterization of participants. To characterize the participants' profile and ensure that the Data collected reflects the diversity of experiences and perspectives in the area of software testing. Data regarding professional position, experience time, academic training, main training area, information on certifications, gender, and age group were collected.

Regarding the professional position of the participants, 25.9% were Junior test analysts, 33.3% full test analysts, and 40.7% senior test analysts. About the time of experience of participants was identified that 29.63% of professionals have 1 to 3 years of experience in the ST area; 7.5% have 3 to 5 years of experience; 25.93% have 5 to 10 years of experience; and 25.93% have more than 10 years of experience. Those under 1 year correspond to 11.11%.

About 33.33% of participants have a completed degree. Other levels of training include postgraduate (22.22%), specialization (18.52%), master's degree (14.81%), and doctorate (7.41%). Some participants (3.7%) reported that they were studying a degree. Computer science (48.15%) stands out as the main training area, following the area of information systems (25.93%). Software engineering and other IT areas were cited by 11.11% of participants each. Another 3.70% reported an area of training outside the IT context.

Regarding certifications in the software test area, 74.07% of participants do not have certifications in the ST area; while 25.93% has ISTQB CTFL certification. Regarding the genre of participants, 55.56% identify themselves as male and 44.44% as female. The predominant age group is 25 to 34 years (51.85%), followed by 35 to 44 years (44.44%). The 45-54 range represents 3.70% of participants.

5.2.1 Relevance and use of soft skills. Effective communication is considered essential for the success of software testing activities by 40.74%. The organization and prioritization of tasks are skills considered indispensable in the daily life of labor, by 33.33% (fully agree) and 7.41% (partially agree) of participants. Regarding the use of the English language during work activities, 22.22% fully agree and another 22.22% partially agree that its use is continuous. Team collaboration is a skill often used by 29.63%, which totally agree with this statement, and 11.11% partially agree. The ability to solve problems analytically is a regular task for 33.33% of participants (fully agree) and 7.41% (partially agree). Leading or guiding junior members is part of the professional routine of 29.63% of participants (who fully agree) and 18.52% of participants (who partially agree).

5.2.2 Methodologies, Tools, and Practices Adopted. Regarding the agile methodologies used in their work routine, the combination of Scrum and Kanban was indicated by 88.89% of participants.

A higher education degree was a mandatory requirement for 51.85% of participants; while 14.81% of participants indicated it as a

Table 9: Main methodologies, tools, and practices

Category	Item	Responses	%
Methodologies	Scrum	24	88.89%
	Kanban	24	88.89%
Tools	Jira	11	62.96%
	Postman	17	74.07%
	Cypress	20	74.07%
	Selenium	12	44.44%
	GitHub & GitLab CI/CD	9	33.33%
	MongoDB & Oracle	8	29.62%
	TestLink	2	7.41%
Practices	Linguagens (Java, Java Script, C#, Python)	11	40.74%
	Frameworks (React, TS)	8	29.63%
	REST API Tests	10	37.03%
	BDD Tests (Gherkin)	7	25.92%

Source: own authorship

desirable requirement, and the remaining 7.41% indicated it as not required for the profession.

Test automation tools show a diverse scenario, with Cypress and Postman representing 74.07% of responses. Next, Selenium (44.44%) is indicated, with other combinations and specific tools presenting lower percentages. Regarding management practices and tools: the use of management tools, such as Jira, to track projects and activities is a practice with which 62.96% fully agree, and 11.11% partially agree. The use of programming languages (Java, JavaScript, C#, Python) in daily tasks is a reality for 25.93% (who fully agree) and 14.81% (who partially agree). Knowledge of frameworks such as React and TypeScript is used by 18.52% (who fully agree) and 11.11% (who partially agree) of the participants. Testing REST APIs is a relevant activity among professional responsibilities for 22.22% (who fully agree) and 14.81% (who partially agree) of the participants. BDD testing using Gherkin is a common practice for 14.81% (partially agree) and 11.11% (fully agree).

The use of repositories like GitHub and CI/CD tools like GitLab is a practice with which 33.33% of participants strongly agree. The use of SQL or NoSQL databases (MongoDB, Oracle) in testing activities is relevant for 14.81% (partially agree) and 14.81% (fully agree) of participants. The most cited test management tool for tracking test cases is TestLink (7.41%), although several other custom tools and methods are also employed. The Table 9 presents the main methodologies, tools, and practices.

5.2.3 Main Responsibilities in the Day-to-Day of a Testing Professional. Among the most frequent responsibilities in the day-to-day of professionals, the following are highlighted: those indicated in the "I totally agree" section in each category surveyed. Thus, the main responsibilities include: managing bugs, from identification, documentation, and monitoring of bug resolution (40.74%); planning tests, from creating test cases and scripts based on specifications and requirements (37.04%); executing manual and automated tests (33.33%); performing regression tests to ensure the stability of functionalities after updates (33.33%); performing automated and manual tests on Web or Mobile APIs (25.93%); generating detailed test reports (25.93%), and 14.81% partially agree; E2E testing and defect management (37.04%); and mentoring junior team members (25.93%), with 7.41% stating they partially agree.

5.2.4 Differentials Valued in the Workplace. Regarding differentiators in the professional environment, the survey indicates that familiarity with CI/CD tools (Azure DevOps, Docker) is considered

a differentiator by 14.81% (who strongly agree) and 11.11% (who partially agree). Certifications such as ISTQB CTFL are valued and used by 11.11% (who strongly agree) and 11.11% (who partially agree). Knowledge of SQL or NoSQL databases (MongoDB, JSON) is considered a differentiator by 14.81% (who strongly agree) and 14.81% (who partially agree). The use of integration tools (Kafka) and container solutions (Docker) in the company is mentioned by 11.11% (who strongly agree) and 7.41% (who partially agree). Finally, DevOps-related practices are widely applied by 25.93% who strongly agree.

6 Discussion

According to the results obtained, it is clear that junior professionals are seen as beginners, with an emphasis on activities that promote the improvement of learning and the execution of basic tasks, while mid-level and senior professionals stand out for their technical mastery, leadership, and communication within teams.

The analysis of the vacancies revealed different skill categories by seniority level. For junior professionals, skills are divided into Soft Skills, Hard Skills, Education and Certifications, and Differentiators. For mid-level and senior professionals, the division is made into Soft Skills, Hard Skills, and Education and Certifications.

Regarding Hard Skills, junior professionals must be familiar with agile methodologies, tools such as Selenium and Postman, and programming languages. More experienced professionals must master manual and automated testing, data analytics, and cloud environments. Regarding Soft Skills, junior professionals require good communication, teamwork, and basic or intermediate English. Mid-level and senior professionals, in addition to these skills, require advanced English and leadership skills.

When it comes to Education and Certifications, testing professionals are expected to have a degree in IT. And the highest levels, mid-level and senior, value certifications such as ISTQB and QAI. Finally, regarding Differentiators in the ST area, knowledge in SQL and NoSQL is are differentiator for juniors, but mandatory for mid-level and seniors.

Early-career professionals (junior level) stand out for their interpersonal skills: 71.4% consider communication essential, while 57.1% mention the importance of organization and teamwork. The ability to solve problems with attention to detail was also mentioned by 57.1%. Regarding technical skills, 85.7% of those involved use Postman, while agile methods such as Scrum (53.8%) and Kanban (46.1%) are already part of their routine. However, the use of programming languages is still limited (14.2%), and English is used partially in 42.8% of situations. The most significant activities include test planning (71.4%) and test execution, whether manual or automated (42.8%).

Professional experience in Software Testing provides greater technical expertise and responsibility in developed projects. Mid-level and senior professionals practice Scrum (Mid-level: 66.7%; Senior: 100%) and use tools such as Postman (Mid-level: 66.8%; Senior: 72.7%) and GitHub/CI-CD (up to 81.8%).

Regarding soft skills, communication is universal (100%), while leadership is more prevalent among seniors (72.7%). Automated testing (Mid-level: 55.5%; Senior: 81.8%) and requirements-based planning (Senior: 90.9%) are common practices. Certifications and

practical experience are more prevalent, with English being used frequently (Senior: 54.5%).

Finally, when analyzing the requirements listed in job descriptions offered on job posting platforms, compared to the perceptions of professionals working in the IT field, it was possible to observe different levels of alignment, depending on seniority.

(1) *Junior Seniority Level*: For professionals at the beginning of their careers, a disconnect was observed between the requirements demanded in IT job openings and the activities performed in daily work. Many opportunities require advanced knowledge, such as mastery of automation tools, CI/CD, and multiple programming languages—skills that are still being developed at this stage of a career. On the other hand, survey participants indicate that their activities focus on more basic tasks, such as manual testing, use of Postman, and test planning, in addition to the gradual development of soft skills such as communication and organization.

(2) *Mid-Level and Senior Level*: At the mid-level, the alignment between the results obtained in this survey is more evident. The positions analyzed require experience with test automation, knowledge of agile methodologies, and the use of tools such as GitHub, Selenium, and Jira, which, in fact, is in line with the practices reported by the professionals participating in the survey. Communication remains an essential skill, and leadership is beginning to emerge as a valued competency—a fact also reflected in the survey responses. Among senior professionals, there is a strong convergence between the requirements of the positions and the reality of the job. Companies seek technical mastery, leadership, decision-making, and experience with practices such as automated testing, continuous integration, and team management. Survey participants, both mid-level and senior, reported strategic performance, involvement in process definition, mentoring juniors, and frequent use of advanced tools, confirming consistency with the profile sought by the market.

Finally, it is observed that many of this study's findings reinforce widely recognized patterns in the sector, such as the importance of agility and communication, which can be considered a positive result, as it confirms trends already established in the literature and professional practice. However, it was not possible to identify, based on the data collected, whether these competencies are effectively encouraged and how this occurs in the academic environment, which represents both a challenge and an opportunity for future research.

7 Threats to validity

Although this study adopts methodological rigor, some threats to validity should be considered. Regarding **external validity**, the exclusive use of three platforms (LinkedIn, Indeed, and Glassdoor) may not fully represent hiring trends, as other recruitment channels were not considered. This factor is compounded by a possible geographic bias, as most of the advertisements analyzed refer to the Brazilian context, which may reduce the generalizability of the results to international contexts. Varied terminology used by companies—for example, different titles for similar roles, such as

QA Engineer, Software Test Engineer, or SDET — may also have impacted recall, even with the use of multiple key terms.

Regarding **internal validity**, it is acknowledged that job descriptions may not fully reflect the competencies actually required in daily professional practice. To address this limitation, a survey of professionals working in the field was conducted. However, despite widespread dissemination on professional networks and online communities, only 27 responses were obtained, a small number compared to the total number of submissions and interactions.

Finally, regarding **construct validity**, the categorization of competencies involves a degree of subjectivity inherent in the application of Thematic Analysis. This risk was minimized through a systematic procedure, based on the literature and with detailed records of all stages, ensuring traceability and consistency in data interpretation.

8 Conclusion

Aiming to provide relevant information for professionals new to Software Testing or seeking to expand their professional qualifications in this sector, this study investigated the software industry's main requirements for Software Testing professionals by analyzing job openings posted on job boards and then validating the results with professionals working in the sector.

Based on the qualitative and quantitative analysis of the vacancies and the survey results, it was possible to conduct a detailed investigation into industry expectations. The survey revealed that the most in-demand skills vary according to seniority level, but converge in some key aspects. The results indicate that, in addition to mastery of specific tools and methodologies, interpersonal skills are highly valued at all levels of employability: junior, mid-level, and senior.

Therefore, it is possible to conclude that initiatives that promote technical training and the development of soft skills, such as the appreciation of certifications and practical experience, are essential to preparing more qualified professionals aligned with current market demands. It is also hoped that this work will contribute not only with guidance for those wishing to pursue a career in Software Testing but also with support for the development of educational programs and more effective recruitment strategies.

Future work aims to (1) expand the number of survey participants, including professionals from different regions and contexts, to increase the sample size and data diversity. Another possibility to be investigated is (2) exploring aspects of the Software Testing curriculum in academia to identify the alignment between practices and challenges in Software Testing education and what is expected in the software industry. In addition, (3) improving the analysis of results through statistical methods such as measures of dispersion, significance tests, reliability indicators, and nonparametric tests.

ARTIFACT AVAILABILITY

The artifacts used and generated in this research are available at the electronic address: https://zenodo.org/records/15742986.

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