UNIVERSIDADE
FEDERAL RURAL
DE PERNAMBUCO

Thiago Alves Bastos

A Diagnoses Instrument for Software Engineers' Soft Skills

Recife

2019

Thiago Alves Bastos

A Diagnoses Instrument for Software Engineers' Soft Skills

Monograph presented to the Bachelor of Computer Science Course of the Federal Rural University of Pernambuco as a partial requirement to obtain the Bachelor of Computer Scientist title.

Federal Rural University of Pernambuco – UFRPE

Computing Department

Bachelor of Computer Science Course

Advisor: Suzana Cândido de Barros Sampaio

Recife

2019

Dados Internacionais de Catalogação na Publicação
Universidade Federal Rural de Pernambuco
Sistema Integrado de Bibliotecas
Gerada automaticamente, mediante os dados fornecidos pelo(a) autor(a)

B327d Bastos, Thiago Alves
A Diagnoses Instrument for Software Engineers' Soft Skills / Thiago Alves Bastos. - 2019.
80 f.

Orientadora: Suzana Cândido de Barros Sampaio.
Inclui referências e apêndice(s).

Trabalho de Conclusão de Curso (Graduação) - Universidade Federal Rural de Pernambuco, Bacharelado em Ciência da Computação, Recife, 2019.

1. Soft Skills. 2. People Factors. 3. Agile Methodologies. 4. Soft Skills for Software Engineers. I. Sampaio, Suzana Cândido de Barros, orient. II. Título

CDD 004

MINISTÉRIO DA EDUCAÇÃO E DO DESPORTO
UNIVERSIDADE FEDERAL RURAL DE PERNAMBUCO (UFRPE)
BACHARELADO EM CIÊNCIA DA COMPUTAÇÃO

http://www.bcc.ufrpe.br

Ficha de Aprovação do Trabalho de Conclusão de Curso

Trabalho defendido por THIAGO ALVES BASTOS às 13:30 do dia 03 de dezembro de 2019, na Sala 42 do CEAGRI II, como requisito para conclusão do curso de Bacharelado em Ciência da Computação da Universidade Federal Rural de Pernambuco, intitulado " **A Diagnoses Instrument for Software Engineers' Soft Skills** ", orientado por Suzana Cândido de Barros Sampaio e aprovado pela seguinte banca examinadora:

Suzana Cândido de Barros Sampaio
DC/UFRPE

Marcelo Luiz Monteiro Marinho
DC/UFRPE

To my parents and to my grandmother, Maria, for the endless love and support in my entire life...

Acknowledgements

First I am thankful to God, for giving me body and mental health during all this years, if weren't for Him and His mercy in my life I wouldn't have made this far.

I am also grateful for my family, mainly parents, Fátima e Moisés. They always gave their best for me and my education, investing in my future. They definitely are the models I want to follow in everything.

I also would like to thank all the Professors of the Computing Department of the Federal Rural University of Pernambuco, in special Professor João Paulo, who believed in me since the first semester of my graduation and gave me the opportunity of participating in a research project, which helped me during the entire course.

To Professor Suzana Sampaio, my advisor. Thanks for always be present to help me, since the beginning of this work. She is so dedicated and committed to what she does that she is an inspiration of who I want to became as a person and as a professional.

To all my friends, the ones that I already knew, before the University, and those that I made in the University. You were very important to my personal growth, thank you all so much. I also would like to thank all of you for the support and patience, listening to me and helping me in difficult times during all these years.

I am thankful for all of those that somehow helped me to fish this work, specially in this final stretch. Specially my Manager, José Henrique, and my teammates from CESAR who allowed me to have my vacations to focus on the writing of this document. To my girlfriend, Cinthia Nery, for believing in me, during this difficult period, and also for helping me with her English language skills.

Finally, I am thankful to me, because even though it was a difficult time, I didn't give up and I overcame it.

“O que põe o mundo em movimento é a interação das diferenças, suas atrações e repulsões; a vida é pluralidade, morte é uniformidade.”

(Octavio Paz)

Resumo

O uso de Metodologias Ágeis em meio aos Projetos de Desenvolvimento de Software têm crescido nos últimos anos. Essas metodologias tem um conjunto de valores e princípios que são centrado nas pessoas, aumentando a importância dos fatores humanos para o sucesso dos projetos que utilizam Metodologias Ágeis. Entretanto, esses fatores nem sempre são completamente entendidos pelos profissionais que trabalham dentro de times ágeis. Essa realidade levou ao surgimento de um ”*gap*” entre o que as empresas esperam dos Engenheiros de Software e o que eles realmente têm, em termos de *Soft Skills*, especialmente em seus primeiros empregos. Por isso, baseado em uma Revisão da Literatura e na opinião dos Engenheiros de Software que trabalham em times ágeis dentro do Porto Digital de Recife, esse trabalho desenvolveu um *MVP* de um instrumento capaz de fazer uma auto avaliação das 8 *Soft Skills* mais importantes para um Engenheiro de Software que trabalha em um ambiente Ágil. Elevando a atenção para a relevância das *Soft Skills* para carreira de um Engenheiro de Software, destacando quais são as *Soft Skills* mais importantes para eles e também reduzindo o ”*gap*” existente no mercado de TI. Além disso, durante esse estudo foi criado um Catálogo de *Soft Skills* contendo os seus sinôimos e suas definições encontradas na Literatura. Por fim, pode-se perceber que as *Soft Skills* são muito importantes para os Engenheiros de Software, sendo Liderança e Negociação as menos relevantes e Comunicação a mais relevante, e o MVP do instrumento desenvolvido se mostrou de extrema relevância, principalmente para engenheiros de Software no começo da carreira. Além disso, também foi possível perceber que não existem atividades suficientes dentro das empresas para melhorar as *Soft Skills* dos Engenheiros de Softwaer e as atividades existentes não estão alinhadas com as expectativas deles.

Palavras-chave: *Soft Skill*, Fatores Humanos, Metodologias Ágeis, *Soft SKills* para Engenheiros de Software.

Abstract

The use of Agile Methodologies among the Software Development Projects have being increasing in recent years. These methodologies have a set of values and principles which are people-centered, increasing the importance of the people factors for the success of projects using Agile methodologies. However, these factors are not fully understood by practitioners who work within Agile teams. This reality created a gap between what the companies are expecting from their Software Engineers and what they really know, in terms of Soft Skills, especially in their first-time job. Therefore, based on a Literature Review and on the opinion of the Software Engineers working within Agile Teams in the Digital Port of Recife, this work developed the MVP of an instrument capable of making a self evaluation of the 8 most important Soft Skills for a Software Engineer working in an Agile environment. Raising awareness about the relevance of the Soft Skills for the career of a Software Engineer, highlighting what are the most relevant Soft Skills for them and also reducing the existent gap in the IT job market. Moreover, during this study it was created a Soft Skill Catalog, containing the synonyms and the definitions of these Soft Skills found in the Literature. Finally, it was possible to realize the relevance of the Soft Skills for the Software Engineers where Leadership and Negotiation were the two less important and Communication was the most important and the developed instrument came out as an extremely important instrument, specially for the Software Engineers in the beginning of the career. Moreover, it was also possible to realize that there aren't enough activities inside the companies to improve the Soft Skills of their Software Engineers and the existent activities are not aligned with their expectations.

Keywords: Soft Skills, People Factors, Agile Methodologies, Soft Skills for Software Engineers.

List of Figures

List of Tables

List of Abbreviations

MVP	Minimum Viable Product
SE	Software Engineer
XP	eXtreme Programming
DSDM	Dynamic Systems Development Method
ASD	Adaptative Software Development
FDD	Feature Driven Development
IC	Individual Competence
SK	Soft Skill
DP	Digital Port of Recife
HR	Human Resources
FR	Functional Requirement

Contents

1 Introduction

Back to the end of the 60s the term ”Software Crisis” was adopted to indicate the difficulty of developing useful and efficient software. During that time there were a lot of problems which led the world of software development to face this difficult period (FITZGERALD, 2012).

According to Fitzgerald (2012), it happened mainly because of the transformation that was happening with the computer industry, making the computer became increasingly accessible to all. Implying a transformation not only in the way people were using the computers, but also on the projects complexity and problems.

Some of the problems occurring during this period were: late delivery (68 percent of all software overruns their schedules, according to an IBM study in 1994), exceed the overall budget (65 percent according to the same IBM study) and, one of the worst characteristics of that period, a lot of software were useless because the likelihood of the developed software match the expectations of the client were very low, wasting almost all efforts used during the development process (FITZGERALD, 2012).

Therefore, during more than 30 years of studies, some alternatives to the Traditional mindset were appearing, such as the V-Model, the Spiral model and then the Rational Unified Process (RUP). However, during this years many sources would still recommend the Traditional approach, which is a single pass software development lifecycle (ABBAS; GRAVELL; WILLS, 2008).

Even though these approaches tried to fix the Traditional approach problems, they were still heavyweight, document and plan drive. But to build software successfully, it was necessary a mindset change. This change finally came through the advent of the Agile Manifesto, in 2001 (ABBAS; GRAVELL; WILLS, 2008).

The Manifesto gathered values and principles that were somehow inside of some Agile practices that were around since the 70s or even before, but these practices were being taken for granted by most of the traditional methodologies. Hence, the Agile Methodologies became the most noticeable change in the world of software development and is the most used methodologies among the Software Projects worldwide (ABBAS; GRAVELL; WILLS, 2008; COLLABNET, 2019).

The change of mindset brought by the Agile Manifesto was to show that the most important part in a software development project are the people involved in the project and not the processes and its heavy documentations (COCKBURN; HIGHSMITH, 2001). Fitting much better in the dynamic environments that were emerging (PALMQUIST et

al., 2013). Which cause a decreasing on the usage of the Traditional Methodologies among the software development projects, according to Standish (Accessed in 2019).

However, even though agile development processes work better in a people-centered culture (COCKBURN; HIGHSMITH, 2001) and the fact that Agile Methodologies have its value and principles human-oriented when it says that ”Individuals and interactions over processes and tools”, ”Customer collaboration over contract negotiation” and ”Responding to change over following a plan” (FOWLER; HIGHSMITH, 2001), human factors are not fully understood by practitioners who work within an agile software project and, consequently, it is not completely explored (PAPATHEOCHAROUS et al., 2014).

Consequently, the present project aims to understand the actual relevance of the human or people factors (also known as Soft Skills, according to the definition of Gardiner (2005)) for SE working in Agile teams of companies placed in the Digital Port of Recife (DP), in the northeastern state of Pernambuco, Brazil.

In order to do it, this study brings a Literature Review, with the objective of gathering relevant Soft Skills for a Software Engineer working inside of Agile environments. A Survey was also applied in the companies of the DP to filter the Soft Skills gathered in the Literature Review.

Finally, during this study was also developed a Minimum Viable Product (MVP) of an instrument, which is a software product with the objective of highlighting important Soft Skills for a Software Engineer (SE), diagnose how good a SE is at these skills and also indicate some improvement points. This instrument was made specially for these SEs about to graduate and looking for their first job and also these already working, but for about five years.

1.1 Justification

As introduced, there is a rising importance of the human factor inside of Software Development Projects using Agile Methodologies. However, Papatheocharous et al. (2014) realised that the Soft Skills are not fully understood by practitioners who work within an agile software project. Which led to a gap between what the companies are expecting from their Software Engineers and what they really know, in terms of Soft Skills, especially in their first-time job and it has being a reality in Brazil and also abroad (FAGERHOLM; VIHAVAINEN, 2013; VALENTIN; CARVALHO; BARRETO, 2015).

Moreover, Fagerholm e Vihavainen (2013) also showed that the gap is caused mainly because of behavioral competencies and not because of the technical knowledge of the Software Engineers.

The presented context leads to the following Research Question: how to diagnose

the relevant Soft Skills of Software Engineers currently working (or planning to work) on Agile Teams? Being more specific, what are the most relevant Soft Skills Software Engineers working within Agile Teams in the Digital Port of Recife (DP), how to identify theses skills on a Software Engineers and how to help them to improve these Soft Skills?

Gathering the most important non-technical skills for a SE, according to the Literature, asking which one of those are the most important for the SEs working within Agile Teams inside the Digital Port of Recife. It is also developing an MVP of an instrument, which is a version of a product developed with a ”minimum amount of effort and the least amount of development time” (RIES, 2011), that will allow the Software Engineers to make a self evaluation with the objective of diagnosing these Soft Skills.

By doing that, it will make the SE understand at which Soft Skills they are good at, which ones they need to improve, and also help on how to improve, reducing the existent gap and making people aware of the importance of the human factors for their careers as Software Engineers.

1.2 Goals

This section brings the general and specifics goals of this study.

1.2.1 General Goal

Proposing an instrument for the diagnoses of the Software Engineers' Soft Skills within Agile Teams in the Digital Port of Recife. By doing that, it fosters the discussion about what are the relevant soft skills in Agile environments for Software Engineers (SE) and also on how to help the SE to improve their behavioral competencies.

1.2.2 Specifics Goals

1. Raise awareness of the relevant Soft Skills for Software Engineers working within Agile Teams in the Digital Port of Recife.
2. Highlight the most relevant Soft Skills and the improvement points.
3. Reduce the gap between what is expected from the Software Engineers in the labor market and their actual experience in terms of behavioral competencies, especially in their first-time job.

1.3 Document Structure

Besides this chapter, there are more 5 chapters composing this document.

Chapter 2 shows the background about the subjects covered in this study.

Chapter 3 shows the methodology applied in this work, and also gives specific details about every research step.

Chapter 4 shows the results obtained during this research. This chapter will present the Soft Skills gathered in the Literature Review and show the development and the results of the Survey.

Chapter 5 presents the development process and the results of the MVP of an instrument, explaining how it works and showing all feedback received by the SEs that tested it.

Finally, chapter 6 points to the main contributions of this work, the final considerations of the author, suggestions of future works and the difficulties encountered.

2 Background

The present chapter shows a brief theoretical foundation with the goal of giving to the reader a better understanding about all the subjects covered in this study.

2.1 Agile Methodologies

As it was introduced in the last chapter, there were a lot of problems happening in the world of Software Development during the Software Crises. So it was necessary a change of mindset and it came in 2001 with the creation of the Agile Manifesto.

Martin Fowler, Jim Highsmith and others 15 practitioners published a work called “The Agile Manifesto” with the objective of revealing better ways of developing software (FOWLER; HIGHSMITH, 2001), working as an alternative to the traditional mindset, which is a single pass software development lifecycle (ABBAS; GRAVELL; WILLS, 2008). Their work gathered a set of values and principles, which are followed by the Agile Methodologies.

Table 1 – Agile Manifesto Values.

Agile Manifesto Values
Individuals and interactions over processes and tools.
Working software over comprehensive documentation.
Customer collaboration over contract negotiation.
Responding to change over following a plan.

Source: Fowler e Highsmith (2001)

Looking at Values and Principles shown by Table 1 and Table 2, there is a clear characteristic of the Agile mindset, which is the relevance that is placed in the people involved in the project. This means that the Agile Methodologies are human-oriented and, therefore, the individual factors are crucial for the success of the project (COCKBURN; HIGHSMITH, 2001).

Also, in opposition to the Traditional mindset, Agile environments are not completely concerned about heavy documentation. There are also a lot of interactions with the client, to make sure it is going to deliver what is expected, and the software is not developed sequentially, it is developed in an iterative and incremental way (PALMQUIST et al., 2013).

Table 2 – Agile Manifesto Principles.

Agile Manifesto Priciples
Certify the satisfaction of the client through early and continuous delivery of valuable software.
Welcome changing requirements, even late in development. To guarantee competitive advantages for the client.
Deliver working software frequently to the client.
Business people and developers work together daily throughout the project.
Build projects around motivated individuals, give them the environment and support they need and trust them to get the job done.
The most efficient and effective method of conveying information with and within a development team is face-to-face conversation.
Working software is the primary measure of progress.
Agile processes promote sustainable development. The sponsors, developers and users should be able to maintain a constant pace indefinitely
Continuous attention to technical excellence and good design enhances agility.
Simplicity is essential.
The best architectures, requirements and designs emerge from self-organizing teams.
At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

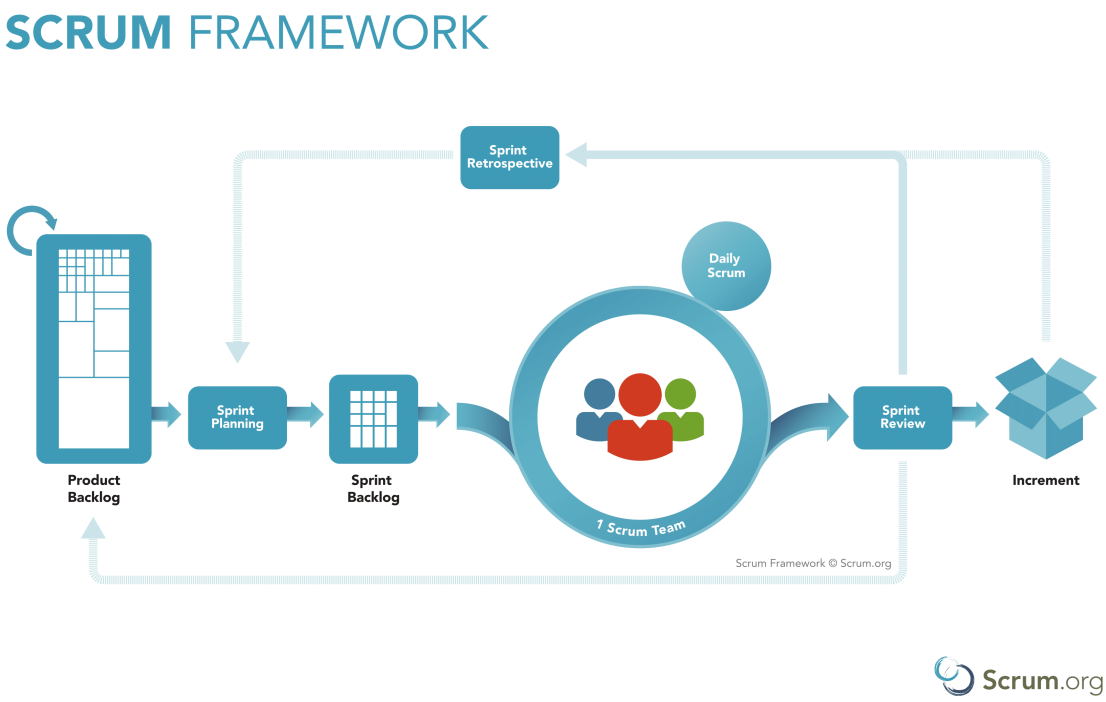
Source: Fowler e Highsmith (2001)

Therefore the results of The Chaos Report 2015 is a proof of the success of the Agile Methodologies over the Traditional Methodologies for software development. The report showed that 39 percent of the projects using Agile Methodologies succeeded and just 11 percent succeeded with the *Waterfall* Methodology (STANDISH, Accessed in 2019). Confirming that Agile Methodologies fit better in dynamics environments, according to Palmquist et al. (2013).

There are many Agile Methodologies like: XP (BECK; GAMMA, 2000), Scrum (SCHWABER; SUTHERLAND, 2013), DSDM (STAPLETON, 1997), ASD (HIGHSMITH, 2013), Crystal (COCKBURN, 2006), FDD (PALMER; FELSING, 2001), Kanban (AHMAD; MARKKULA; OIVO, 2013) e o Lean (POPPENDIECK; POPPENDIECK, 2003). However, the most used one is SCRUM (COLLABNET, 2019), therefore it will be used to explain the Agile mindset. The SCRUM structure is shown by Figure 1.

SCRUM is a framework very simple to understand that helps to manage complex projects. It is called a framework because it can be adapted to the context of the project,

Figure 1 – SCRUM General Structure



Source: Scrum.org (2009)

as long as it is used its events and roles (SCHWABER; SUTHERLAND, 2013).

There are just 3 roles: the Development Team, the Product Owner, which is responsible for defending the interests of the client inside of the project, and the SCRUM Master, responsible for resolving possible conflicts and to make sure the project will work according to the rules of SCRUM (SCHWABER; SUTHERLAND, 2013).

Once we have understood the roles of SCRUM, it is easier to understand the development process, showed in Figure 1. It has iterations, called Sprints, that will be executed during the whole project and it is incremental, meaning that the Product Backlog, which has all the elements that represent the project, will be delivered in small pieces at the end of every Sprint and, in the end of the last Sprint, it will be derived the final product, according to the demands of the client (SCHWABER; SUTHERLAND, 2013).

So the characteristics of the SCRUM matches perfectly with the values and principles of the Agile Manifesto. It values for continues delivery, changes are always welcome and it also values for self-organized teams, meaning that people within the project must be able to manage their tasks and know their responsibilities. So a key factor for the success of a project using SCRUM is the people factors, like communication, for example (BOOTLA; ROJANAPORNPUN; MONGKOLNAM, 2015; COCKBURN; HIGHSMITH, 2001; SCHWABER; SUTHERLAND, 2013).

Therefore domain the people factor inside of an Agile environment is very important and, according to Papatheocharous et al. (2014), it will lead to a more productive and satisfied team, which makes SCRUM hard to dominate (BOOTLA; ROJANAPORNPUN; MONGKOLNAM, 2015).

The People Factors can be divided into, Hard and Soft dimensions (GARDINER, 2005). Both of them will be fully explained in the next section.

2.2 Soft Skills

As introduced in the last section, mastering the individual competencies inside of an Agile environment is very important. Comprehending those factors will allow an understanding of the technical characteristics and also the behavioral aspects, such as communication, teamwork, leadership, and others, of all people involved in the process (COCKBURN; HIGHSMITH, 2001; BOOTLA; ROJANAPORNPUN; MONGKOLNAM, 2015; BUSHUYEVA et al., 2018).

The focus of this work is the Behavioral aspects of a SE. Because, according to Papatheocharous et al. (2014), the lack of control of these characteristics is the the main cause of failure in software projects and also because these characteristics are harder to develop or learn (GARDINER, 2005).

However, to understand what is the behavioral aspects, first it is necessary to understand what is an individual competence. Table 3 brings a set of definitions of Individual Competence found in the Literature.

To clarify even more the definition of Individual Competence, it is necessary to explain a fill terms used in its definition, such as: **knowledge**, **skill**, and **ability**.

- **Knowledge:**
  - ”the collection of information and experience that an individual possesses.” (International Project Management Association (IPMA), 2015);
  - ”includes theoretical knowledge (e.g. knowing the second law of thermodynamics) and procedural knowledge (e.g. knowing the procedure for assembling a particular electronic card)” (TRICHET; LECLÈRE, 2003).
- **Skill:**
  - ”specific technical capabilities that enable an individual to perform a task.” (International Project Management Association (IPMA), 2015);

  - ”include formalized know-how (e.g. the application of working procedures) and empirical know-how (e.g. tricks, abilities or talents)” (TRICHET; LECLÈRE, 2003).

- **Ability:**

  - ”is the effective delivery of knowledge and skills in a given context” (International Project Management Association (IPMA), 2015).

As shown in Table 3, there isn’t a consensus about the definitions of Individual Competence in the Literature (WINTERTON; DEIST; STRINGFELLOW, 2006). Therefore the author had to choose one of the definitions to follow. The chosen definition was the IPMA ICB 4.0 definition, which is the last definition of the table. The author choose this definition because it is the newer among the others and mostly important because IPMA ICB 4.0 is a competence model which is already used in the Literature as a standard (BUSHUYEVA et al., 2018).

Now that it was chosen the definition of IC that will be used in this work and it is clearly explained, it’s possible to understand the behavioural area of the IC. Just as its definition, there isn’t a consensus of how to divide the Individual Competences into areas. Therefore it will be presented two ways of divide the IC, one of them according to International Project Management Association (IPMA) (2015) and the other according to Gardiner (2005).

Table 3 – Individual Competencies Definitions

Individual Competence	
Definition	**References**
The combined usage of knowledge, skill and experience required to fulfil a specific task.	(JONES; VOORHEES, 2002; VOORHEES, 2001)
Measurable human capabilities that are required for effective work performance demands.	(MARRELLI, 1998)
“a standardized requirement for an individual to properly perform a specific job and it encompasses a combination of skills, knowledge, and behaviour utilized to improve performance”.	(BROZOVA; SUBRT, 2008)
“way to put in practice some knowledge, know-how and also attitudes, inside a specific context”.	(BERIO; HARZALLAH, 2005)
The combined use of knowledge, skills and abilities to accomplish the desired result.	(International Project Management Association (IPMA), 2015)

Source: the author

The International Project Management Association (IPMA) (2015) divides the Individual Competencies into three areas: **Perspective, People and Practice**.

- **The Perspective area:** ”is the set of methods, tools and techniques through which individuals interact with the environment and the reason that leads people, organisations and societies to support a project.”
- **The People area:** ”is the collection of required personal and interpersonal competencies to successfully participate in or lead a project.”
- **The Practice area:** ”is a set of methods, tools and techniques used in projects to realise its success.”

The other classification, according to (GARDINER, 2005), can be into the hard and soft dimensions. The Soft dimension, also known as Soft Skills, are related to personal and interpersonal competencies, such as communication, leadership, and others. On the other hand, the Hard dimension, also known as Hard Skills, are related to mechanical and technical activities (e.g. planning, estimation and controlling).

The present project focus on the behavioral aspects of a Software Engineer, so it will follow the definition of Gardiner (2005) of Soft Skills, which is equivalent to the People area of the International Project Management Association (IPMA) (2015). There are other terms used in the Literature that can be used as synonyms to Soft Skills, such as non-technical skills, social skills and others (GARDINER, 2005; PAPATHEOCHAROUS et al., 2014). But in this project for now on it will be used the terms Soft Skills and non-technical skills.

Lastly, with the rising importance of the Soft Skills inside of Agile environments, as showed during all the sections above, it is necessary to look into what is being made in the Literature, in terms of studies to understanding this relevance for SEs with not much experience and, more importantly, find out which non-technical skills are the most important among all and how to improve them.

2.3 Related Works

The value of agile methodologies as SCRUM, have increased the human factors importance when it says: ”*individuals and interactions over process and tools*” (FOWLER; HIGHSMITH, 2001).

Bootla, Rojanapornpun e Mongkolnam (2015) collected a set of skills and attributes for SCRUM development teams and validate them with experts and practitioners. The skills and attributes were categorized in 3 types: technical skills, people or soft skills, and attitudes. They were able to select 38 important skills/attributes from all the

material they worked with, among which 16 are Soft Skills, and the majority of the experts and practitioners have agreed with all the proposed skills/attributes. Even though they have already selected relevant soft skills, it was validated with Thai expects, which is a very specific context, so these Soft Skills may change in a different culture. Even more important, it does not show manners of identifying and improving these Soft Skills in a Software Engineer.

Stevens e Norman (2016) also selected a set of key Soft Skills, due to the strong demand for those skills in the job market of New Zealand's capital. They did it through the analyses of job advertisements, interviews, focus groups and also a Survey. However, just like the study of Bootla, Rojanapornpun e Mongkolnam (2015), it was made in a very specific context. There is also a study which was able to select relevant Soft Skills for Software Engineers and, even though it was made in Uruguay, the focus of their project wasn't in Software Engineers working on Agile environments Matturro, Raschetti e Fontán (2015).

Due to the importance of the non-technical skills, Fagerholm e Vihavainen (2013), Valentin, Carvalho e Barreto (2015) realised that there is a gap between what the companies are expecting from their Software Engineers and what they really know, in terms of Soft Skills, especially in their first-time job, and it is a reality in Brazil and also abroad.

Moreover, according to Fagerholm e Vihavainen (2013), the gap is caused mainly because of behavioral competencies and not because of the technical knowledge of the Software Engineers.

Because of the existence of such gap, there are already some universities and colleges working on different pedagogical approaches with the objective of reducing this gap. Heggen e Cody (2018) said that the current Software Engineering courses are not aligned with the needs of the industry. So they explained a work-program for students in the Berea College. In which the students are employed by the Computer Science Department to develop software during a whole year. The students are trained by a supervisor and develop the project for the college. The students are involved in development, bug fixing and also support tasks. However, it does not encompasses a SE with not much experience and those at the end of the graduation.

Consequently, after an overview of the Literature in terms of the relevance Soft Skills for Software Engineers and due to the increasing importance of the non-technical skills inside of an agile environments, Papatheocharous et al. (2014) realized that knowing the human factors of a team is generally going to lead to a more productive and satisfied one. Moreover, they also said that the most frequent cause of failure in a software project does not have a technical nature but a social one.

Therefore Bushuyeva et al. (2018) proposed a model capable of identifying Soft Skills. The authors use the IPMA ICB 4.0 to create a pattern and then their model gets the information about non-technical skills and generate a graph comparing the created pattern with the actual score of each Soft Skills. However, its focus is on the IT project management instead of the Software Engineers themselves. Purao e Suen (2010) have developed a multi-faceted metric which is also a way of assessing Soft Skills of Software Engineers, but it just a assessment method, it doesn't show improvement points for each one of the soft skills assessed or even how to improve them.

Finally, it is possible to conclude that getting to know the human factors of a team affects not only the Software Engineers themselves but also the companies that they work for. So it is important to promote the discussion about Soft Skills and help the Software Engineers to improve their non-technical skills as a manner of having better teams inside of a company and also reduce the existing gap.

2.4 Chapter Conclusion

This chapter presented the main subjects of this work, giving to the reader a basic understand of what is necessary to understand this study.

After a contextualization section, it was explained the Agile mindset through the explanation of the most used Agile Framework (SCRUM) and showing the values and principles of the Agile Manifesto. It was also explained the change of perspective that this methodologies brought, showing that the most important thing inside of an Agile project are the People Factors and not the processes and tools.

Besides, the concepts of People Factor for the world of software development was presented, showing the definition of Hard Skills and Soft Skills.

Finally, it was discussed the reason of studying the Soft Skill for SEs working an Agile environments. It was shown that knowing the People Factors can increase the productivity and the satisfaction of the team, that the main cause of failure in software projects is related to the Soft Skills and not to their technical knowledge and also that there is a existing gap between what a SE knows and what the companies are expecting of them to know, in terms of non-technical skills, and it needs to be fulfilled.

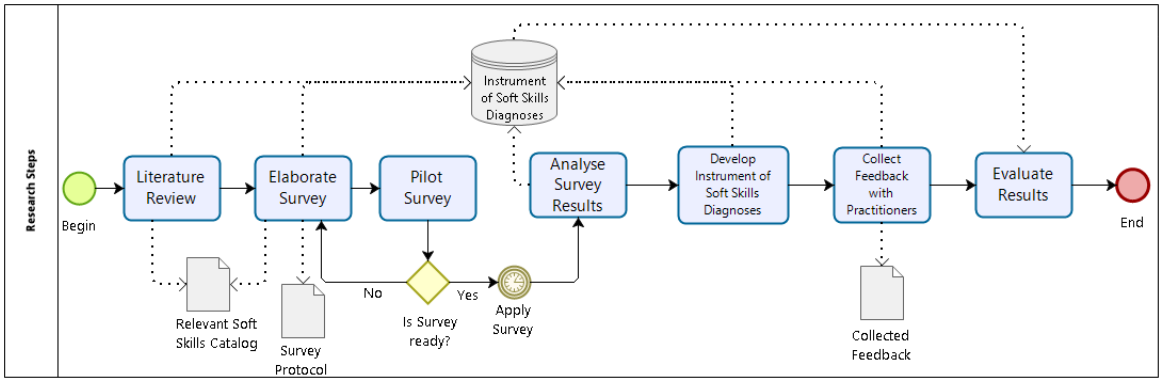
3 Methodology

The present work aims to foster the discussion about relevant Soft Skills for Software Engineers currently working (or planning to work) on Agile environments, through the development and assessment of an instrument capable of diagnosing these skills in a SE. So, this chapter will explain the research steps that was taken to reach the goal of this work.

This research can be seen as an approach using qualitative method, as explained by Rosa, Oliveira e Orey (2015). First it was used an approach to support the qualitative method, gathering relevant data for the development of the Soft Skill diagnoses instrument. Then the qualitative approach was used to gather relevant information about the developed instrument, analysing the practitioners' opinions.

For a better understanding of the Research Steps of this work, Figure 2 is going to show its overview. It presents all the phases of this research.

Figure 2 – Research Steps



Source: the author

The following sections will explain each Research Step showed in Figure 2.

3.1 Literature Review

It was made a Literature Review for a better understanding of the Research Problem, gathering the relevant non-technical skills for Software Engineers inside of an agile environment and looking into the different ways of how to identify these skills in a SE. It was made based in a Systematic Literature Review, as explained by Kitchenham e Charters (2007), but not following every steps.

The Literature Review was made using a search string in the research sources showed in Table 4. The collected papers were analysed, first by its title, then by its

abstracts and then, the last papers were read entirely.

Table 4 – Used Research Sources

Search Source	URL
IEEE Xplore Digital Library	http://ieeexplore.ieee.org/
Springer Lin	http://link.springer.com/
Science Direct	http://www.sciencedirect.com/
ACM Digital Library	http://dl.acm.org/
Google Scholar	http://scholar.google.com

Source: the author

Initially, it was used a search string just with the two main areas involved in this research (Agile Methodologies and Soft Skills). As expected, this string didn't bring as many results as needed for the research, so the author started to add some synonyms separately for each research area. In other words, first it was added synonyms for Soft Skills and the search string was tested, after that, the same thing was made for the Agile Methodologies, then the author had two search strings tested. The next step was to put both of them together in a single string, resulting in the following Search String: "*((Soft Skill) OR (Behavioral Characteristics) OR (Behavioural Characteristics) OR (Behavioral Competencies) OR (Behaviour Competences)) AND ((Agile) OR (Scrum) OR (Extreme Programming) OR (LEAN))*". However, it was necessary to add the term "Software Engineer" to get other results that were more aligned with my research problem.

Besides the importance of a good search string and its continuous improvement, it was also necessary to use Snowballing, a technique used to collect papers about specific subjects that were not easily found with the search string and to better understand the results of some papers, looking into there references (WOHLIN, 2014).

Moreover, there was defined some rules to be used to select the best papers for this study. The rules are following ones:

- The publication year of the paper must be equal or higher to 2001, which is publication year of the Agile Manifesto;
- The paper must be written in English;
- Must be published in journals and peer-reviewed conferences;
- Must be directly related to the research questions;
- Must approach the research topics, such as Soft Skills for Software Engineers;

Based on these rules, it was selected the papers presented on Table 5. However, it was necessary to add a few more papers, using Snowballing, in order to find the definition of a fill Soft Skills that wasn't found among these papers. So it was also used: International Project Management Association (IPMA) (2015) (E1), International Project Management Association (IPMA) (2006) (E2) and Nijhuis, Vrijhoef e Kessels (2018) (E3).

Table 5 – Selected Papers

ID	Paper Title	Publication Year	Reference
[1]	Necessary skills and attitudes for development team members in scrum: Thai experts' and practitioners's perspectives.	2015	(BOOTLA; ROJANAPORNPUN; MONGKOLNAM, 2015)
[2]	Rapid improvement of students' soft-skills based on an agile-process approach.	2015	(VALENTIN; CARVALHO; BARRETO, 2015)
[3]	Hiring millennial students as software engineers: a study in developing self-confidence and marketable skills	2018	(HEGGEN; CODY, 2018)
[4]	Soft skills in software engineering: A study of its demand by software companies in Uruguay.	2013	(MATTURRO, 2013)
[5]	Teaching Agile Software Development at University Level: Values,Management, and Craftsmanship,	2013	(KROPP; MEIER, 2013)
[6]	Skills for the agile designer: seeing, shaping and discussing design ideas	2010	(WIRFS-BROCK, 2010)
[7]	Designing with an Agile Attitude	2009	(WIRFS-BROCK, 2009)
[8]	Industry expectations of soft skills in IT graduates: a regional survey.	2016	(STEVENS; NORMAN, 2016)
[9]	Personalised continuous software engineering.	2014	(PAPATHEOCHAROUS et al., 2014)
[10]	Designing a multi-faceted metric to evaluate soft skills.	2010	(PURAO; SUEN, 2010)
[11]	Scrum and team effectiveness: theory and practice.	2008	(MOE; DINGSØYR, 2008)
[12]	A Starting Point for Negotiations - Delivering with a Heterogeneous Team.	2012	(LORBER; TIESZEN, 2012)
[13]	Hidden Skills that Support Phased and Agile Requirements Engineering.	2003	(KOVITZ, 2003)
[14]	Training Future Software Developers to Acquire Agile Development Skills.	2007	(TAN; TEO, 2007)

Source: the author

3.2 Elaborate Survey

It was elaborated a Survey, according to Mello e Travassos (2016), with the objective of:

- Raise awareness about the relevance of the non-thechnical skills for SE.
- Understanding the actual relevance that the companies of the Digital Port in Recife are giving to the Soft Skills;
- Filtering 8 out of the 10 important non-technical Skills gathered during the Literature Review.

In order to do it, it was necessary to analyse the papers selected during the Literature Review (Table 5) to find all non-technical skills brought in every paper and also for the definition of these Soft Skills.

After analysing all papers, it was selected the 10 most mentioned SK among those papers to put them on Survey.

The Survey has 3 parts:

- its first part has 4 demographic questions;
- the second part there are 20 statements related to the 10 SK (2 statements for each SK), selected during the Analyses phase, with the objective of selecting the 8 most important SK , according to the context of the Software Engineers working in the Digital Port.
- the last part has 2 more questions with the objective of getting information about how the companies are investing in the Soft Skills of their Software Engineers and also about what the Software Engineers are expecting from the companies that they're working, in terms of what activities are offered by the company to improve their non-technical Skills.

Moreover, to evaluate these statements, it was used the Likert Scale, which is a scale from 1 to 5, where 1 means strongly disagree and 5 means strongly agree with the statement.

Finally, the Survey Protocol (Appendix A) was ready, but it was still necessary to go through the test phase.

3.3 Pilot Survey

With everything done in the elaboration of the Survey Protocol, it was necessary to test it before it goes live and collect the final answers. This phase was important to get some feedback about improvement points and reduce the risk of committing a mistake during application phase.

During this phase, it was collected the feedback of 5 Software Engineers with ages between 20 and 25 years. However, their answers were deleted by the end of this phase and it was necessary to go back for the last phase and reevaluate the Survey Protocol, to check whether it was still aligned with the research goals.

It was made during a whole week and, after changing what was necessary, taking into account every feedback received, and going back to the last phase to reevaluate the Survey Protocol (Appendix A), it was time to go live with the final version of the Survey.

3.4 Apply Survey

Having finished the test phase of the Survey Protocol, it was stared the Survey Application phase. The phase responsible of getting the real answers.

The goal of this phase was to get the maximum of answers in the shortest time possible, to have enough time to execute the next research steps. So it was created a rule saying what was the least expected results for the Survey and what was maximum time it could be left live, receiving answers. The created rules for the Survey are the following ones:

- The Survey must have at least 30 answers;
- The Survey should be left open for answers for a maximum period of two weeks.

In order to reach the goal explained above, it was necessary to share the Survey to the higher number of Software Engineers working in the Digital Port of Recife possible. So it was initially sent to a group of people known by the author and it was also sent to the email groups of at least 4 different companies of the Digital Port. When the Survey was sent to the email groups, it was sent with a message briefly explaining the research and explaining that it must be answered just by Software Engineers.

Finally, after reaching the goals of this phase it was started the analyses of the Survey results, which will be explained in the next subsection.

3.5 Analyse Survey Results

After receiving all the answers, it was necessary to analyse them in order to get relevant information for the development of the instrument and also for getting the results of the quantitative part of this research.

During the analyses the author was looking for the following aspects:

- understand what is the final public that the instrument would be developed for;
- highlight the 8 most relevant SK according to the practitioners of the Digital Port of Recife;
- evaluate the actual relevance of the Soft Skills for the companies of the Digital Port of Recife;
- understand if the actual relevance given by the companies to the non-technical skills of their Software Engineers is enough, according to them;
- put in perspective what the companies are doing to improve the Soft Skills of their Software Engineers;
- make a relation between what the companies are doing and what the SE are expecting from their companies to do to improve their SK.

With at least the first two topics of the aspects that the author was looking for, listed above, it was possible to begin the next phase of this study. It is responsible for the development of the Soft Skill diagnoses instrument.

3.6 Develop Instrument of Soft Skill Diagnoses

The goal of this phase is to develop the MVP of an instrument capable of scoring 8 relevant SK of a SE and, based on the literature, pointing to improvements inside of each non-technical skills. Emphasize what are the most important Soft Skills for the job market. Moreover, starting to reduce the existent gap of what is expected from the Software Engineers in terms of non-technical skills, specially in their first-time job, and also raise awareness about the relevance of the SK.

So, after analysing the results of the Survey it was possible to start the development of the MVP. The development phase is composed by: the elaboration of the instrument, listing its requirements, the development itself and a test period, to make sure that important improvements would me made in the MVP before its deploy.

First it was listed the requirements for the MVP, such as: being capable of scoring the 8 most relevant SK of a SE and also pointing to improvements inside of each non-technical skills. It was also necessary to decided which technology would be used for the development the instrument.

After understanding what composes the instrument, who is going to use it and what is the technology to be used in its development, it was started the developed phase, which last for two weeks. The instrument was developed making continuous delivery, it means that at least once in a week it was evaluated what was developed and it was always delivered a functional and important part of the MVP.

For the test phase, which is responsible for evaluating what was made during the development iteration, 6 Software Engineers, with ages between 20 and 25 years, used the instrument and listed improvements that should be done. After implementing all improvements, it was possible to start the next phase, which is going to make people use and evaluate the relevance of such instrument and also give more feedback, which will lead to future works.

3.7 Collect Feedback with Practitioners

The goal of this phase is to collect the opinion of the practitioners about the developed instrument, indicating its relevance and what they would like to see in a future version of this instrument.

After the development phase, it was necessary to elaborate a fill questions to ask the practitioners who were about to use the instrument, in order to collect feedback aligned with the objectives of this phase.

Having elaborated the questions, the instrument went live and it was used by the practitioners. Among the people that used it, 4 SE answered the questions and their feedback were collected and analysed. These SE were all inside of the profile that were supposed to use the instrument, according to the results of the Survey.

After analysing the feedback, it was presented the future works related to the instrument and the results related to its actual relevance, according to the feedback of these SE.

3.8 Evaluate Results

This was the last phase of this study, its objective is to present the final considerations of this research, based on what was derived from the results of all previous phases of this work.

So it will contribute for the understanding of the relevance of Soft Skills in the job market of Software Engineering working within Agile environments, specially in the Digital Port of Recife. Moreover, it will also contribute for a better understanding of what is the definition of the 8 most important Soft Skills, since there isn't an agreement of their definition.

3.9 Chapter Conclusion

The present chapter explained the entire methodology used in this study. Started explaining what was the methodology approach used and explained it. Then it showed an overview of the Research Steps, using Figure 2. Finally it detailed every Research steps, saying what was done in each one of them.

4 Research Development

The present chapter contains the development and the results of the Literature Review and the application of the Survey with the Software Engineers working in Agile environments in the Digital Port of Recife.

The results generally illustrate what are the most important non-technical skills for a Software Engineer according to the Literature and with the practitioners inside the DP. It also presents the actual relevance given by the companies of the DP to the SK, revealing whether the companies evaluate and follow up these skills in their Software Engineers, providing activities for them to improve their Soft Skills.

4.1 Soft Skills Catalog

During the Literature review, it was found 31 SK. Which were too many to be used in the Survey and in the instrument. So it was necessary to go back to the papers and look for the definition of every SK, in order to group them according to their definition, as an approach to reduce the number of Soft Skills.

After collecting the definitions, it was possible to group the SK and also collected some synonyms of these SK, but it was still too many to be used. Therefore, it was selected the 10 SK showed in the list below, which are the most mentioned Soft Skills in the Literature Review. The list contains just a short vision of the table of Soft Skills Mapped per Paper, go to Appendix C.

- Communication;
- Leadership;
- Teamwork;
- Self-management;
- Dealing with Change;
- Eagerness to learn;
- Negotiation;
- Conflict Management;
- Problem Solving;
- Ethics.

Exemplifying the difficulty of finding the definition of each one of the the Soft Skills in the Literature, it was created a Soft Skill Catalog, containing the name of these skills, its synonyms and also the found definitions. This Catalog can be found in the Appendix B.

4.2 Survey Protocol

Having created the Soft Skill Catalog, it was possible to started the creation of the Survey Protocol.

First it was created the statements for the SK. These statements were created based on the definition of the SK, with the objective of identifying what are the 8 most important SK according to the SE of the DP among the 10 most important according to the Literature.

Table 6 – Statements per Soft Skill

Soft Skill	Statement
Communication	- Be able to make yourself clear inside the project [8]. - Be able to accurately deliver information to all relevant parties inside the project [E1].
Leadership	- Be able to provide guidance/be a mentor to individuals of the project [E1, E2]. - Be able to motivate the others in the project to fulfill the project's objectives [E2].
Teamwork	- It is important to respect the others in the project for what they can contribute [8]. - The team relationship is an important aspect for the success of the project [E1].
Self-management	- It is important to be able to complete a task in the time meantime [8]. - It is important to have timeliness for the projects activities, like meetings [8].
Dealing with Change	- Be able to adapt easily to changes [E2]. - Be able to keep in mind the interests of the project [E2].
Eagerness to learn	- Be proactive inside the project [8]. - Be curious to learn new things inside the project [8].
Negotiation	- Be able to balance different interests, aiming to keep a positive working relationship [E1]. - Be able of hiring new people for the project [E1].
Conflict Management	- Be able to be a remedy for disagreements inside the project [E1]. - Capable of working with people that have distinct aims [E2].
Problem Solving	- Be able to interpret requirements [8]. - Be able of applying ways of thinking to solve challenges [E1].
Ethics	- Treat everybody equally regardless of their seniority [8]. - Must know their personal and professional freedoms and limits inside the project [E2].

Source: the author

After the creation of all statements, it was possible to complete the Survey Protocol, adding just a fill more questions, some with the objective of understanding the actual relevance that the companies are giving to the SK and also others for collecting demographic answers. Then it was started the test phase of the Survey Protocol.

During the test phase of the Survey, it was collected some feedback related to the Survey Protocol. The list below shows the feedback that were used to improve the Survey Protocol, even though all of them were taken into account.

- Improve the introduction text, it is too long, the people answering your Survey

shouldn't be spending their time reading the initial text;

- In the second sections, before putting the statements, add some text explaining the used scale in the context of the Survey;
- Do not repeat the term "Software Engineer" in every statement, put it in the introduction text of the section, it will make the Survey less weary.

After improving the Protocol according to the feedback in the list above, specially the SK statements, it was finished the creation of the Survey Protocol. The form resulting from the Survey Protocol can be found in the Appendix A. The statements presented on Table 6 are the ones resulted from the the improvements of the test phase.

4.3 Survey Results - First Analyse

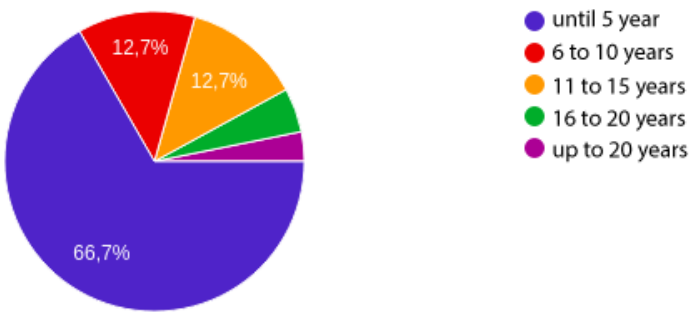
This section will show the results arising from the 63 answers collected in the application phase of the Survey. In order to get these answers, the Survey was shared in at least 4 different companies and during a entire week the SE of the DP had access to the Survey.

4.3.1 Analyses of the Demographic Questions

Initially, the first set of information collected from the Survey Results were related to the demographic questions, indicating what are the characteristics of the public that would be using the instrument.

First it was realised that **66,7%** of the SE who answered the Survey are already graduated and they were also in the beginning of their careers, having a maximum of 5 years of experience, as shown by Figure 3.

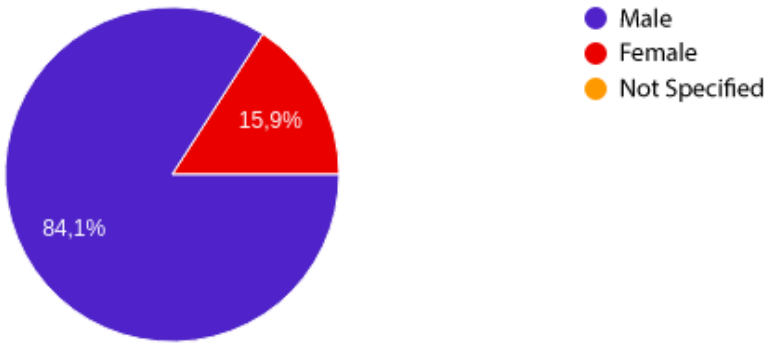
Figure 3 – Software Engineers Professional Experience



Source: the author

Another relevant fact is that most of the SE who answered the Survey are Male. There was only **15.9%** Female people who answered it, as can be seen on Figure 4. It indicates that there are much more Male SE than Female.

Figure 4 – Gender of the Software Engineers



Source: the author

The interesting fact of this first analyses is that the profile of the SE who will possibly use the developed instrument are practically the same SE inside of the existing gap, pointed by Fagerholm e Vihavainen (2013) and Valentin, Carvalho e Barreto (2015), already explained in the Theoretical Background Chapter in the Related Works Section. The SE have the following profile: male, graduated and in his/her first 5 years of experience.

Having in mind this profile, it was possible to analyse the statements about the SK, with the objective of getting the 8 most important SK according to the opinion the SE of the DP. In order to do it, it was necessary to analyse the given mark to the statements separately. First looking for the group of SE with a maximum of 5 years of experience and then looking for the group of SE with more than 5 years of experience.

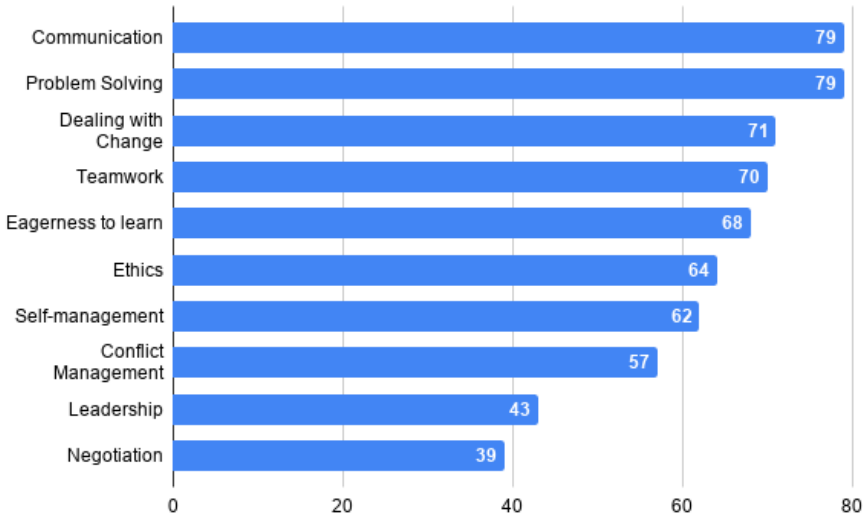
4.3.2 Analyses of the 10 Soft Skills - First Approach

The first analyses of the statements, related to the first group, it was created a table with the answers of this group and it was analysed the given marks for every statement. It was made a sum of the number of 4's and 5's given to each statements of all SK. The 8 SK with more 4's and 5's would be selected to be used in the instrument. The equation can be seen bellow.

$$SoftSkillMark = \sum FirstStatementWith4Or5 + \sum SecondStatementWith4Or5 \tag{4.1}$$

The selection of the 8 most important SK was made as explained above because, according to the Likert Scale used in the Survey, the marks 4 and 5 indicate that the given statement was an important characteristic for a SE. Therefore, after performing the analyses of the statements of every SK, the result was the first 8 of the SK presented in Figure 5.

Figure 5 – Soft Skill Statements Result - Total Number of 4'S and 5's



Source: the author

The same analyses was made for the second group of SE, those with more than 5 years of experience. It indicated that the same SK should be removed from the group of 10 SK.

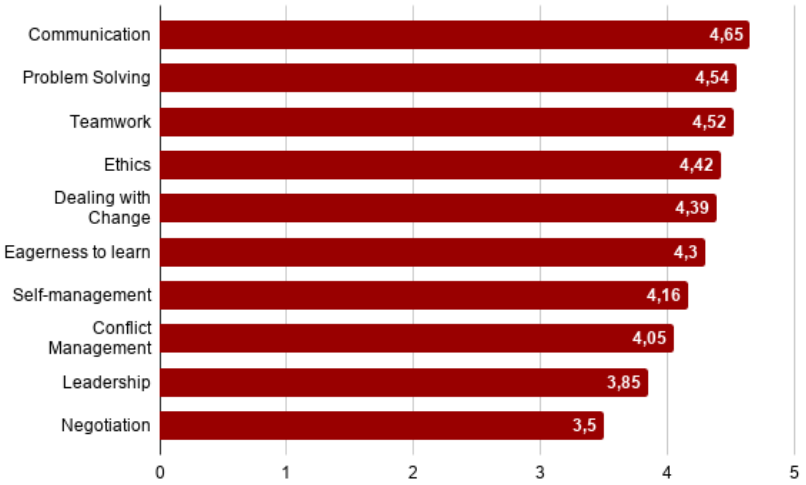
4.3.3 Analyses of the 10 Soft Skills - Second Approach

Another approach was used to decide which SK should be removed. It was made an average of all marks given to the statements of the SK and after that it was calculated the average mark of the SK. The results of this analyses is shown on Figure 6. The equation for this analyses can be seen bellow.

$$AverageMarkOfSoftSkill = \frac{\sum FirstStatementMark + \sum SecondStatementMark}{2} \tag{4.2}$$

Having analysed the results of the second approach, it confirmed that, according to the marks of the SK presented on Figure 6, the SK that must be removed are the same SK removed in the first approach.

Figure 6 – Soft Skill Statements Result - An average of its Mark



Source: the author

4.3.4 Conclusion of the First Analyses of the Survey Result

Confirming the removal of **Negotiation** and **Leadership** from the list of 10 SK, now the study has the 8 most important SK, according to the SE of the DP, that will be used in the instrument. These SK are listed below.

- Communication;
- Problem Solving;
- Dealing with Change;
- Teamwork;
- Eagerness to learn;
- Ethics.
- Self-management;
- Conflict Management;

Nevertheless, it can be analysed the reason Leadership and Negotiation had been removed. The reason can be related to the possibility of these SK are related to the seniority of the SE, i.e., the higher the experience, the most the SE will be seen as a leader in the project. However, this analyses will be made in a future work.

Finally, after this analyses it was possible to have two primordial information to start the development phase of the instrument. The first information was the profile of the SE that will use the instrument, as it was explained in the beginning of this section. The second information was the list of 8 SK that will be assessed by the instrument.

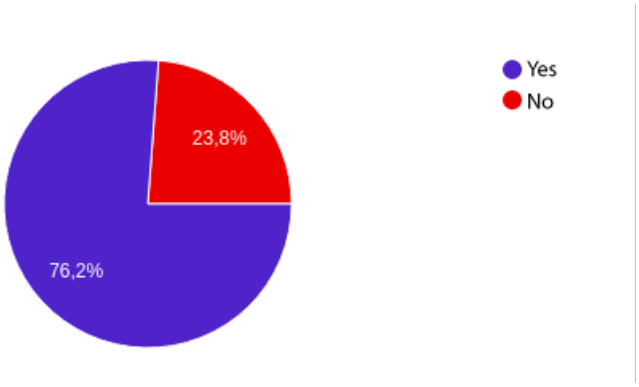
Therefore it was started the development of the instrument, that will be explained in the next chapter. While the instrument was developed, it was also start the second phase of analyses of the Survey.

4.4 Survey Results - Second Analyse

During this phase it was analysed the other part of the questions of the Survey, responsible for understanding the actual relevance of the SK for the companies in the DP. It was also made a correlated analyses with the results of the First Analyse.

Firstly, most of the SE said that they noted that their SK were evaluated during their job interview, as can be seen in Figure 7. This is probably related to the phase of the job interview that happens with the HR people.

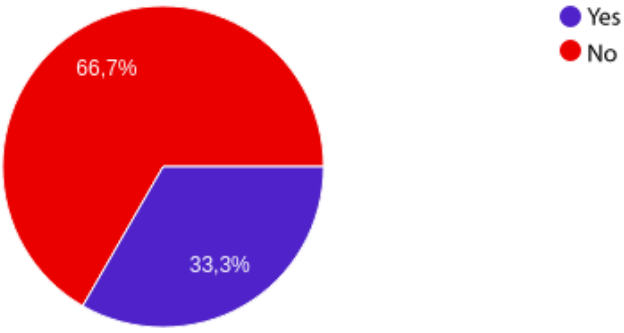
Figure 7 – Soft Skills were Evaluated During the Job Interview



Source: the author

Even though the the SK of the SE in the DP were evaluated during their job interview, the majority of the SE said that there aren't any activities with the objective of improving their non-technical skills inside the company. It is shown by Figure 8.

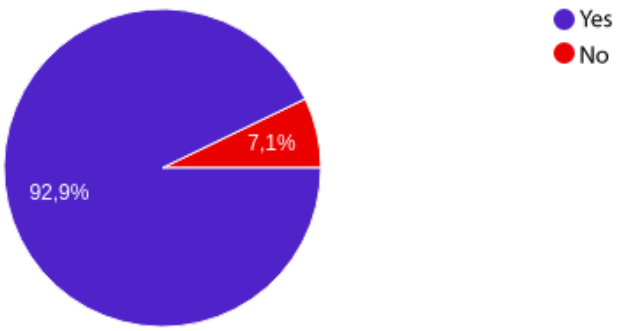
Figure 8 – Existence of Activities to Improve the Soft Skills



Source: the author

The interesting fact about the reality shown above is that the graph showing the non existence of improvement activities is almost the opposite of the graph showed by Figure 7. However, more than **90%** of these SE, who said "No" in the graph above, said that they would like to have activities to improve their SK. This is shown by Figure 9.

Figure 9 – Software Engineers would like to have Activities to Improve their Soft Skills



Source: the author

The reality presented above seams to indicate that generally the companies in the DP are not providing the right activities or enough activities for their SE to improve their SK, even though it is desired.

Therefore, for a better understanding of this reality, it was asked examples of activities for the SE who said that there are improvement activities inside their companies. Table 7 shows a list of these activities, brought by the SE, along with its characteristics.

Table 7 – There are Activities to Improve the Soft Skills

Activities	Characteristics
Assessments with Feedback	- Focused on improving SK, such as communication. - Continous. - Formal and spontaneous.
Workshops/Events	- Focused on improving SK, such as interpersonal relationships. - Every month. - The team encourages the SE to create a material and present to the others. - Support the SE to participate on events of their interest. - Presence of the HR people.
Mentorship	- Prepare the SE to do the job interview. - For new employees (SE) and interns.

Source: the author

Moreover, to the group of SE who said that there aren't activities to improve their SK, it was made a question to understand what activities they would like to have in their companies.

However, even thought the answers of the SE were different when it was asked if there were any activities to improve their non-technical skills, the answers of the SE about what activities they would like to have were pretty much the same, when asked about what are the activities they already have. They said that they would like to have: Assessments with Feedback, Workshops/Events and Mentorship.

Besides the similarities of the activities, there were some differences on its characteristics, such as: the SE who said that there aren't any activities, said that they would like to have feedback anonymously and also, when talking about Mentorship, they didn't mention any characteristic. Another difference is that they talked much more about SK then the group of SE who said that there were activities inside their companies, listing SK like: emotional intelligence, self-management and conflict management, that weren't mentioned on Table 7

Therefore, even if the companies are listening the necessity of their SE to improve their SK and are starting to know the relevance of these skills for their SE and for themselves, it is an indication that maybe these activities are not happening aligned with the expectations of the SE.

So it is necessary to have a closer look at the characteristics of these activities, to understand how they are happening and whether they are according to the expectations of the SE. However it will be made in a future work.

Moreover, most of these activities brought by the SE are directly related to Agile teams. Besides that, the SE also brought some characteristics that a team must have to help to improve the SK of their SE. The relation of these activities and these characteristics with Agile teams are shown by Table 8.

Table 8 – Relation of the Activities and Characteristics of a Team with Agile Teams

Activities	**Relation to Agile Teams**
Feedback	The SCRUM Team should increase the opportunity for Feedback (SCHWABER; SUTHERLAND, 2013).
Mentoring and Workshop	They are techniques used by Agile teams to share knowledge (REJAB; NOBLE; ALLAN, 2014; RAZZAK; MITE, 2015).
Characteristics	**Relation to Agile Teams**
Transparency.	It is one of the pillars of SCRUM (SCHWABER; SUTHERLAND, 2013).
Delivery-Driven.	It is related to the first principle of Fowler e Highsmith (2001).
Encourage the SE to assume different positions inside the team.	It is related to one of the characteristics of the SCRUM Team, which is be cross-functional (SCHWABER; SUTHERLAND, 2013).

Source: the author

Finally, according to results presented on Table 8, it is confirmed that the char-

acteristics, activities and principles of an Agile Team helps the improvement of the non-technical skills of the Software Engineers. Moreover, it can be seen that the companies in the DP probably have started to understand the relevance of improving the SK of their SE, but it still needs to be improve.

4.5 Chapter Conclusion

The present chapter expatiate on the development and the results of the Literature Review and the application of the Survey.

First it explained how it was made the Soft Skill Catalog, found on Appendix B, and explained how it was selected the first 10 SK that would be assessed by the Survey, in order to find out the 8 most important ones.

After selecting the 10 SK, it was created the statements for each one of the SK and these statements were added to the Survey, that can be found on Appendix A. After creating it, it had to be tested and improved, based on the feedback received during the test phase. Having the final version of the Protocol, it was possible to go live with it to get the answers of the SE.

Finally, with the answers of the Survey, it was possible to analyse its results. The analyses indicated: the profile of the SE who will used the instrument, the 8 most important SK, that will be assessed by the instrument and also it was possible to understand the actual relevance given by the companies of the DP to the SK of their Software Engineers.

5 Instrument Development

The present chapter will explain the process of developing a MVP of an instrument capable of assessing the SK of Software Engineers and also point to improvements in every SK. Moreover, the idea of the instrument is that the SE will be doing a self evaluation and in the end the SE will receive a report, containing information about the assessed SK.

After the explanation of the development process, it will be shown the relevance of this instrument for the career of a SE, based on the feedback of the SE that used the instrument. It will also show that it will help to to reduce the existent gap of what is expected from the SE and what they really have, in terms of SK.

5.1 Development Process

The development of the MVP started after the first analyses of the Survey, as explained in the last chapter. Because to develop the instrument was necessary to understand the public that would use it, the list with the 8 most important SK and also the definition of these SK, that can be found on the Soft Skill Catalog.

Initially, it was created the list with the Functional Requirements (FR) for the MVP. These requirements can be seen on the list below.

- **FR001:** The instrument must have a welcome screen.

Description: The instrument must have a welcome screen containing a text and a button. The text has a brief text about the instrument and how it work and the button send the user to the evaluation form.

- **FR002:** The Software Engineer must be able to answer the evaluation form.

Description: The instrument must have an evaluation form containing the statements for self evaluation. Each statement must have a mark associated, which will be given by the Software Engineer.

- **FR003:** The instrument must generate an evaluation report.

Description: At the end of the evaluation form, the instrument must generate an Evaluation Report. The generated report must have a graph radar containing the marks of each statement and also a list of improvement points for every Soft Skill which has a statement with a mark smaller than 4.

- **FR004:** The Software Engineer must be able download the evaluation report.

Description: The Software Engineer must be able to download the Evaluation Report generated at the end of the evaluation form. The report must be downloaded as a pdf file.

- **FR005:** The Software Engineer must be able to download the radar graph.

Description: The Software Engineer must be able to download the radar graph of the Evaluation Report as an image.

After the definition of the FR of the MVP, it was necessary to define the data structure to be used in the instrument. It was chosen to create a list of JSON (*Java Script Object Notation*) objects. Because JSON is a popular format for data (SEVERANCE, 2012).

These objects contains: the name of the Soft Skill, an ID, the mark of the Soft Skill and a list of statement. The list of statements is also a list of JSON objects, which contains: an ID for the statement, the description of the statement, the improvement statement and the mark of the statement. For a better understanding, Figure 10 shows an example of the JSON object explained above.

Figure 10 – Example of JSON Object Used in the Instrument

```
{
  id: 7,
  name: 'Ethics',
  points: 0,
  statements: [
    {
      id_st: 0,
      description: 'I know how to fit socially in work.',
      improvement: 'Fit socially in work is a must have for you.',
      points_statement: 0,
    },
    {
      id_st: 1,
      description: 'I treat everybody equally regardless of their seniority.',
      improvement: 'Regardless of the seniority of your team members, you should treat them equally.',
      points_statement: 0,
    },
    {
      id_st: 2,
      description: 'I always demostrate personal integrity and reliability for everyone involved in the project.',
      improvement: 'Be reliable and have integrity with everyone involved in the project.',
      points_statement: 0,
    },
    {
      id_st: 3,
      description: 'I know my personal and professional freedoms and limits inside the project.',
      improvement: 'Try to understand your personal and professional freedoms and limits inside the project.',
      points_statement: 0,
    },
    {
      id_st: 4,
      description: 'I recognize that everyone is there to help in the project.',
      improvement: 'You should recognize that everyone is there to help in the project.',
      points_statement: 0,
    },
  ],
},
```

Source: the author

Along with the definition of the data structure, it was decided what the technology would be used and template.

In order to help the SE to have an easier access to the instrument, it was decided that it would be a web application instead of an App to be install on the mobile phone. Because it would help to share the instrument with the practitioners, just by sending the access link to them.

As it would be a web application, it was chosen a technology that would help the author to develop an application that must be: responsive (adaptable to different sizes of screens), with an attractive design, to stimulate the SE to use the instrument, and that could be developed in the shortest period of time possible. So it was necessary to be chosen a technology that the author already had familiarity.

Therefore it was chosen the **Vue.js**[1], which is a JavaScript Framework, to develop the instrument. Knowing the technology that would be used, it was necessary to choose the template.

The author chose the Vuestic Template[2], which already has a lot of components, that could be reused in the instrument, and because the author wouldn't have to worry about the design and the responsiveness of the page. Another important information about this template is that it has the MIT Licence, which allowed the author to use it and change whatever was necessary for the instrument.

With the structure of the instrument defined, it was necessary to use the Soft Skill Catalog to check the definition of the 8 SK, with the objective of creating statements. These Statements will be used to assess the SK, the ones presented on the list below, and others to indicate the improvement points, which a couple examples can be found on Table 9. These statements are what is going to fulfill the JSON object previously explained.

- **Communication:**
  - I am able to make myself clear inside the project [8].
  - I can accurately deliver information to all relevant parties inside the project [E1].
  - I see myself as an inclusive person, making sure that everyone understands information, regardless of the level of knowledge of my team [8].
  - I am able to exchange information consistently inside my project [E1].
  - I can clearly express myself inside the project with my written language [8].

[1] https://vuejs.org/
[2] https://github.com/epicmaxco/vuestic-admin

- **Teamwork:**
  - I respect the others in my project for what they can contribute [8].
  - I am able to contribute to the success of my team without degrading relationships [8].
  - I am capable of working in a multi-disciplinary environment [E1].
  - I think that the relationship is an important aspect for the success of the project [E1].
  - I always adopt a sense of responsibility for the team and the project [8].
- **Self-management:**
  - I am capable of completing a task in the meantime [8].
  - I am never late in my schedule inside the project [8].
  - I am good at dealing with stressful situations [E2].
  - I am always ready to participate and offer my opinions while acknowledging there is more to learn [8].
  - am able of setting my personal goals [E1].
- **Dealing with Change:**
  - Adapt to changes is an easy thing for me [E2].
  - I always keep in mind the interests of my project [E2].
  - I can easily change context inside my project [E2].
  - I always make the others feel welcome to express themselves [E2].
  - I believe that the others inputs in the project will bring benefits for the project [E2].
- **Eagerness to learn:**
  - I am pro-active inside my project [8].
  - I am always curious about learning new things inside the project [8].
  - I can easily take feedback inside the project [8].
  - I am always positive and optimist [8].
  - I always feel confident about my attitudes and my opinions inside the project [8].
- **Conflict Management:**
  - I am always a remedy for disagreements inside the project [E1].

  - I am always trying to stimulate a learning process for future conflicts [E1].
  - I am capable of working with people that have distinct aims [E2].
  - I know everyone in the project [E2].
  - I am always observable to notice and help with any possible disagreement or conflict [E1].

- **Problem Solving:**

  - I am always applying existing technical skills to seek out new skills [8].
  - I am good at interpreting requirements [8].
  - I am always trying to apply different ways of thinking to solve challenges [E1].
  - I stimulate the collective creativity of my team [E1].
  - I always prioritize my activities [E1].

- **Ethics:**

  - I know how to fit socially at work [8].
  - I treat everybody equally regardless of their seniority [8].
  - I always demonstrate personal integrity and reliability for everyone involved in the project [E1].
  - I know my personal and professional freedoms and limits inside the project [E2].
  - I recognize that everyone is there to help in the project [8].

Finally, it was possible to started the implementation it self. The instrument was developed with an Agile mindset, being delivered-driven. It means that during this process, the FR were being developed and being tested, which took about 2 weeks.

During the tests there were some feedback. These changes were always welcomed, because they were to improve the instrument before going to the Feedback round with the practitioners. The Table 10 shows a list with the feedback that were analysed and implemented in the instrument.

After the implementation process, the instrument was working according to its FR. Allowing show how it works and the path until the Evaluation Report, which will be shown by the following screen shots of the instrument.

First is the Welcome screen, which containing a brief text about the instrument and how it works. It is shown by Figure 11.

Table 9 – A fill Improvement Statements per Soft Skill

Soft Skill	Statement
Communication	- Try to be more clear inside the project [8]. - You should manage to deliver an information to all relevant parties inside the project [E1].
Teamwork	- You should always respect the others in the project for what they can contribute [8]. - Do not degrade relationships in order to contribute to the project. It won't help to the success of the project [8].
Self-management	- Work hard to always complete a task in the meantime [8]. - Make sure that you will be always on point for every event schedule inside your project [8].
Dealing with Change	- You must adapt yourself easily to changes [E2]. - Always keep in mind the interests of your project [E2].
Eagerness to learn	- Be pro-active inside your project [8]. - Be curious about learning new things inside the project [8].
Conflict Management	- In case of disagreements inside the project, try to be always a remedy [E1]. - Try to stimulate a learning process for future conflicts [E1].
Problem Solving	- Always use your technical skills to seek out new ones [8]. - You should be good at interpreting requirements [8].
Ethics	- Regardless of the seniority of your team members, you should treat them equally [8]. - Try to understand your personal and professional freedoms and limits inside the project [E2].

Source: the author

Table 10 – Feedback Received in the Test of the Instrument

Feedback
Improve the text of the welcome screen.
Add a progress bar to give an idea of how much of the evaluation form was covered.
Reduce the width of the dropdown, because it is looking much more like a text box then a dropdown.
Change the color of the radar graph to red, it will help to make the people understand that it is important

Source: the author

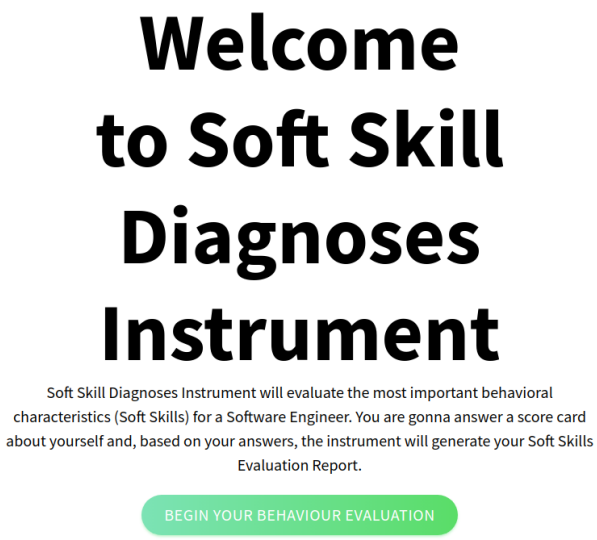
Clicking on the button ”BEGIN YOUR BEHAVIOR EVALUATION”, the SE is taken to the next part of the instrument, which is the evaluation form. It contains a from with 8 parts, one for each SK, and each part contains 5 statements.

Moreover, as it was developed as a responsive Web page, it will work on different screen sizes, Figure 12 shows the last part of the Evaluation Form on a mobile screen and Figure 13 shows the same page, but on a computer screen.

For each one of the statements the SE must select one of the options as an answer: Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree. This options came from the same scale used in the Survey, the Likert Scale.

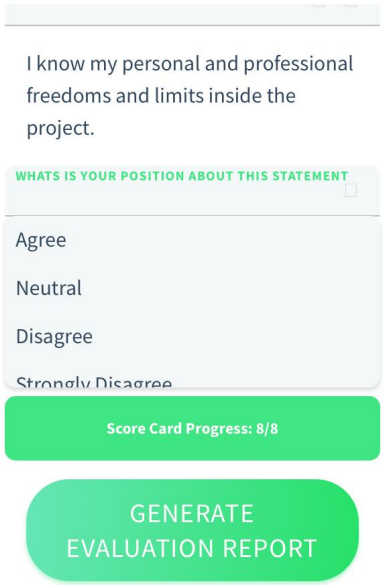
So when the SE chose Strongly Disagree, the instrument will give mark 1 to the

Figure 11 – The Welcome Screen of the Instrument



Source: the author

Figure 12 – The Evaluation Form of the Instrument on a Mobile Screen



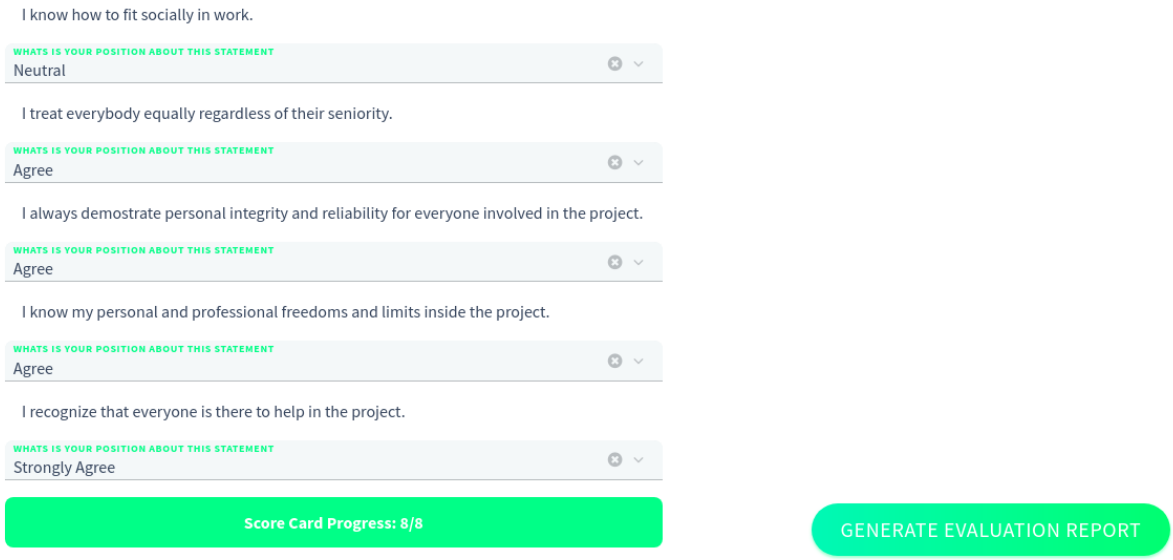
Source: the author

statement, if the SE chose Disagree, it would give mark 2 and so on until the SE chose Strongly Agree, which would give mark 5 to the statement.

Completing the evaluation form, the SE is able to generate the Evaluation Report by clicking on the button ”GENERATE EVALUATION REPORT”. A piece of this report is shown by Figure 14.

In the report page there is a radar graph containing the marks of every Soft Skills

Figure 13 – The Evaluation Form of the Instrument on a Computer Screen



Source: the author

and a list of improvement points for each statement of every SK.

The mark of the Soft Skill is given by the number of statements with a mark equals to 4 or 5, which means that the SE has the characteristics brought by the statement. As there are 8 SK with 5 statements each, the radar graph will show the marks of the 8 SK in an octagon and its rage goes from 0 to 5.

The improvement points, on the other hand, shows the improvement statements of every Soft Skill. However, it is sorted by the SK with the lowest mark to the one with the best mark, but it won't show improvement statements for he SK with mark 5, because it means that the SE already has all the characteristics of that SK. Moreover, the improvement points are related to the statements with a mark lower than 5, which means that is still something to be improved.

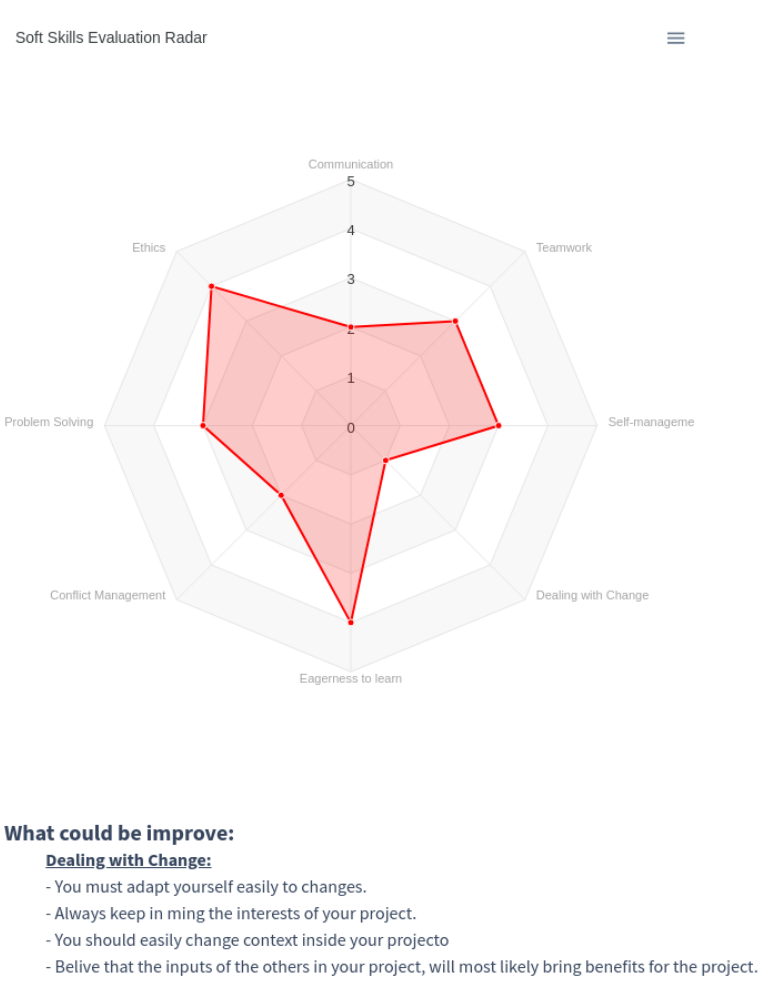
Moreover, the radar graph has a menu, where the SE can click and choose to download the image of the graph with. Besides that, on the end of the page, there is also a button called ”DOWNLOAD REPORT AS PDF” where the SE can click to download the whole report as a PDF file.

Finally the MVP was ready to be used and receive the real feedback from the Software Engineers of the DP. This will be explained in the next section

5.2 Feedback of Practitioners

With the instrument ready to be used, it was possible to ask for SE to use it and send feedback about its usage and its relevance.

Figure 14 – The Evaluation Report of the Instrument



Source: the author

Therefore, it was necessary to define some questions to receive feedback from the SE, these questions are listed on the Table 11. After receiving the feedback it was necessary to analyse the answers to understand the relevance of such instrument for the career of a SE and check whether it would help to reduce the existing gap.

The link for the instrument and the questions from Table 11 were shared with some SE. The SE who answered the questions and sent feedback were exactly the ones belonging to the profile that was formed in the Survey, i.e., they were all SE with less than 5 years of experience and male.

There were 4 SE who sent their feedback about the instrument. Moreover, they also sent their Evaluation Reports, but it will be shown just a piece of the report from 2 of them. Further on there will be a Table with the answers of all of them for the questions of Table 11.

The Evaluation Report of the SE1 had generated the graph presented on Figure 15.

Table 11 – Questions to Evaluate the Instrument

ID	Question
Q1	How can I improve this instrument, so that it will help the SE to better understand their SK?
Q2	What the relevance of this instrument for a SE in the beginning of his/her career?
Q3	How do you see the relevance of the SK assessed by the instrument for SE in the beginning of career?
Q4	Would you use or recommend this kind of instrument for SE in the beginning of career?

Source: the author

Figure 15 – Radar Graph of the SE1

Source: the author

Still on the SE1, Figure 16 shows a fill improvements pointed by the instrument:

The radar graph generated by the Evaluation Report of the SE2 is shown on Figure 17. The Figure 18 shows a fill improvement points for the SE2.

The answers of the 4 SE for the questions of the Table 11 are shown on the list below.

- **SE1:**
  - **Q1:** Before the test, put the definition of the Soft Skills that will be assessed.
  - **Q2:** It is very important because it shows improvement points. It is missing just the information about how to improve these Soft Skills.

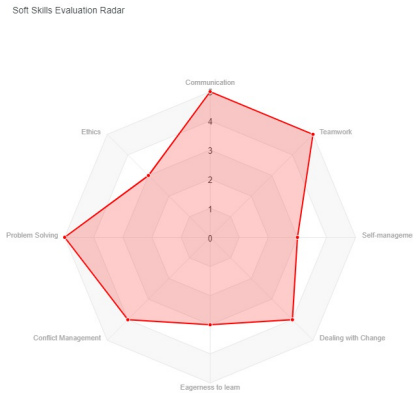
Figure 16 – A Fill improvements of the SE1

Self-management:
- Work hard to always complete a task in the meantime.
- Make sure that you will be always on point for every event schedule inside your project
- You should be good at dealing with stressful situations
- Always participate and offer your opinions, but never forget to acknowledge that there is always more to learn.
- You should be able to set your personal goals.

Dealing with Change:
- You must adapt yourself easily to changes.
- Always keep in ming the interests of your project.
- You should easily change context inside your projecto
- Always try to make the others feel welcome to express themselves.
- Belive that the inputs of the others in your project, will most likely bring benefits for the project.

Source: the author

Figure 17 – Radar Graph of the SE2

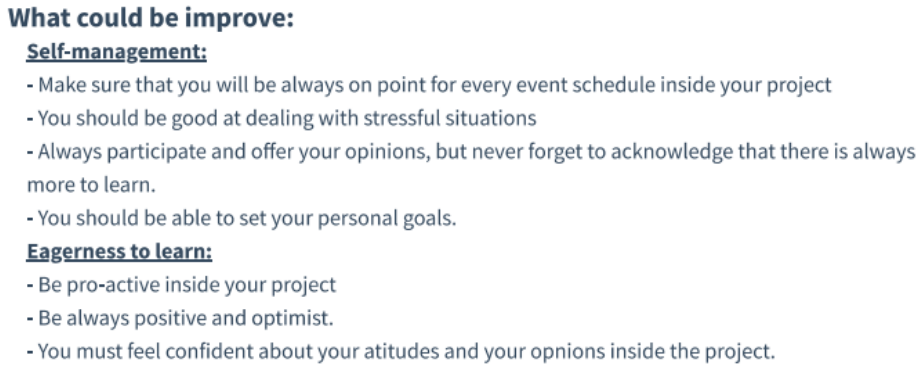


Source: the author

  - **Q3:** Extremely important. It is very important that the SE doesn't focus just on Hard Skills but they should also try to improve the behavioral aspects. No Software is developed just by a single person in the job market, so interact and know how to deal with the most different people is a very important skill for the future.
  - **Q4:** Absolutely. I believe that this kind of instrument should be used inside the companies during the performance assessment process.

- **SE2:**
  - **Q1:** I don't really see any necessary improvement. The instrument is capable of doing what was proposed.
  - **Q2:** This instrument is extremely important for SE in the beginning of the career, because it will help them to understand what is their professional profile, learning their weakness and strengths and the most important soft

Figure 18 – A Fill improvements of the SE2



Source: the author

skills. Therefore, it will have better behavior inside of a company, as well as find jobs that suit them better.

- **Q3:** Extremely relevant because all mentioned Soft Skills are essential for a Software Engineer.
- **Q4:** I would, for sure, used and recommend it. Because it is extremely necessary to know your main skills since the beginning of the career.

- **SE3:**
  - **Q1:** For a Software Engineer would be easier to answers the questions if they were more related to their daily routine.
  - **Q2:** It is very important. The job market is no longer looking for a technically perfect person, but a person who has good Soft Skill, like leadership, proactive, etc.
  - **Q3:** The list is in accordance with the daily routine of a Software Engineer, giving an overview of what could be improved.
  - **Q4:** Yes, because the majority of the other existing instruments are paid and the free ones don't show many details. It is a great MVP to understand the behavioral profile of who is answering the test.
- **SE4:**
  - **Q1:** Improve usability and also make a more deep analyses on the Soft Skills, showing the priority of which Soft Skill should be improved first, if exists.
  - **Q2:** I believe that the instrument can help the SE on personal development, especially those who just graduated or those who are inexperienced.
  - **Q3:** I believe that the Soft Skills already are and will continue being a requirement for the most opportunities in the job market, because there are a lot

of problems in the execution of the project when the people involved don't develop some Soft Skills, like communication and problem-solving.

- **Q4:** I would use and would recommend as a supporting tool for interns who had just entered the IT job market.

The feedback received on the first question, points to improvement points, such as: improve usability and improve the statements to fit better on the daily routing of the SE. However it will be made in a future work.

The answers on the second question, shows that the instrument is relevant for the career of a SE, specially those starting the career, exactly the public pointed by the Survey results.

Checking the answers on the third question, all the practitioners agreed with the 8 SK assessed on the instrument. They said that these SK are important for a SE in the beginning of career and also said that they are in accordance with the daily routing of a SE.

Finally, all practitioners said that would use and recommend the instrument. Showing the necessity of the SE to understand their SK since the beginning of the career.

In conclusion, it was possible to see the necessity that the practitioners have of understanding their SK and it is so important that they said that they would recommend it, specially for the SE that just entered the IT job market. Therefore, the instrument developed is a great MVP to help the SE and it is also important to help reducing the existent gap in the IT job market, previously explained.

5.3 Chapter Conclusion

During this chapter it was explained the development process of the MVP of an instrument capable of diagnosing the SK of the SE, showing the actual behavioural profile of the SE and also pointing to improvements in each one of the SK. Moreover, this chapter showed the evaluation of the instrument, based on the feedback received from the practitioners who work in the DP.

Therefore, first, it was explained the usage of the Soft Skills Catalog to create the statements that would be used in the instrument.

After the creation of the statements, it was explained how it was developed, showing its requirements, the data structure and the used technology used. Moreover, it explained the development it self, how it happened.

Having explained the development, it was shown how the instrument works, showing the main flow thought the images.

Finally, it was presented how the practitioners were able to send feedback about the instrument and it also showed the analyses of these feedback.

6 Final Considerations

The present work had the objective of proposing an instrument for the diagnose of Software Engineers' Soft Skills within Agile Teams, in the Digital Port of Recife. Reaching this goal, this project also raised awareness about the relevance of the SK for SE, highlighted important SK for SE of the DP and also reduced the existent gap on the IT job market.

In this context, during the research it was created a Soft Skill Catalog, containing the 10 most mentioned SK for SE in the Literature, its synonyms and also the definition of each one of the SK. It was also possible to have an overview of the actual scenario of the companies in the DP, understanding the relevance of the SK for these companies and for their SE. Moreover, it was developed and evaluate the MVP of the instrument for the diagnose of SK.

Based on the results of this work, it was possible to see the relevance of the SK for the SE, being one of the most important aspects within Agile Teams for the success of the project. Among the 10 Soft Skills Leadership and Negotiation turned out to be the 2 less important and Communication the most important, according to the SE of the DP.

Moreover, it was possible to see that, the developed instrument is crucial for SE in the beginning of career, knowing their behavioral profile inside of the area that he/she is about to start work can help prevent a lot of misbehavior problems and will also help on understand exactly what needs to be improve.

However, even thought the companies of the DP are starting to understand the relevance of the SK, there aren't still enough activities to improve the SK of the SE and the existent ones are not aligned with the expectations of their SE.

6.1 Limitations and Future Works

The results obtained by this study are mainly limited by the regional perspective where the research was conducted. Moreover, the sample size of SE who participated and the number of companies represented in the research are not enough to allow generalisations about the real scenario of Relevant Soft Skills for Software Engineers in Agile Teams. Another limitation is the completeness of Soft Skill Catalog, it was necessary to stay with the 10 SK most mentioned in the Literature Review, but there may be others.

In this context, it is possible to highlight the following possibilities of future work:

- Turn the MVP of the instrument into a product, adding what the practitioners proposed as improvements and implementing a complete version of the instrument;
- Develop a study focused on the activities to improve SK of the SE, in the DP. Checking whether they are aligned with the expectations of the SE and how to improve these activities;
- Increase the current scope of the present research. Reaching SE working on other parties of the country/world. Facilitating to understand whether the SK change according to the regional characteristics, the culture for example;
- Making a study to understand whether the SK of a SE working on local Agile teams are the same for SE working on Global Agile Teams.

6.2 Difficulties Encountered

Some of the Research Steps presented significant difficulties during its execution, causing a delay on the schedule of this research. One of these Research Steps was the Elaboration of the Survey, because it was necessary to finish the Soft Skill Catalog. However, the author found it very difficult to find the definitions of the Soft Skills in the Literature. Another critical moment was the evaluation of the Survey, because it had to be fished before the development phase of the instrument.

Besides that, there were activities inside of others Research Steps that the author found very exhausting and sometimes disheartening. One of these activities is in the beginning of the research, during the Literature Review, which is the pursuit for a good Research String.

Bibliography

ABBAS, N.; GRAVELL, A. M.; WILLS, G. B. Historical roots of agile methods: Where did “agile thinking” come from? In: SPRINGER. *International conference on agile processes and extreme programming in software engineering*. [S.l.], 2008. p. 94–103. Referenced 2 times on pages 14 and 18.

AHMAD, M. O.; MARKKULA, J.; OIVO, M. Kanban in software development: A systematic literature review. In: IEEE. *2013 39th Euromicro conference on software engineering and advanced applications*. [S.l.], 2013. p. 9–16. Referenced on page 19.

BECK, K.; GAMMA, E. *Extreme programming explained: embrace change*. [S.l.]: addison-wesley professional, 2000. Referenced on page 19.

BERIO, G.; HARZALLAH, M. Knowledge management for competence management. *Journal of Universal Knowledge Management*, v. 1, p. 21–28, 2005. Referenced on page 22.

BOOTLA, P.; ROJANAPORNPUN, O.; MONGKOLNAM, P. Necessary skills and attitudes for development team members in scrum: Thai experts’ and practitioners’s perspectives. In: IEEE. *2015 12th International Joint Conference on Computer Science and Software Engineering (JCSSE)*. [S.l.], 2015. p. 184–189. Referenced 5 times on pages 20, 21, 23, 24, and 28.

BROZOVA, H.; SUBRT, T. Competency mapping and modelling in system design. *Scientia Agriculturae Bohemica*, v. 39, n. 2, p. 125–131, 2008. Referenced on page 22.

BUSHUYEVA, N.; BUSHUIEV, D.; BUSUIEVA, V.; ACHKASOV, I. It projects management driving by competence. In: IEEE. *2018 IEEE 13th International Scientific and Technical Conference on Computer Sciences and Information Technologies (CSIT)*. [S.l.], 2018. v. 2, p. 226–229. Referenced 3 times on pages 21, 22, and 25.

COCKBURN, A. *Agile software development: the cooperative game*. [S.l.]: Pearson Education, 2006. Referenced on page 19.

COCKBURN, A.; HIGHSMITH, J. Agile software development: The people factor. *Computer*, IEEE, n. 11, p. 131–133, 2001. Referenced 5 times on pages 14, 15, 18, 20, and 21.

COLLABNET. *State of Agile Survey 13th Annual State Of Agile Report*. 2019. Disponível em: <https://www.stateofagile.com/#ufh-i-521251909-13th-annual-state-of-agile-report/473508>. Referenced 2 times on pages 14 and 19.

FAGERHOLM, F.; VIHAVAINEN, A. Peer assessment in experiential learning assessing tacit and explicit skills in agile software engineering capstone projects. In: IEEE. *2013 IEEE Frontiers in Education Conference (FIE)*. [S.l.], 2013. p. 1723–1729. Referenced 3 times on pages 15, 24, and 36.

FITZGERALD, B. Software crisis 2.0. *Computer*, IEEE, v. 45, n. 4, p. 89–91, 2012. Referenced on page 14.

FOWLER, M.; HIGHSMITH, J. The agile manifesto. *Software Development*, [San Francisco, CA: Miller Freeman, Inc., 1993-, v. 9, n. 8, p. 28–35, 2001. Referenced 5 times on pages 15, 18, 19, 23, and 41.

GARDINER, P. D. *Project management: A strategic planning approach*. [S.l.]: Macmillan International Higher Education, 2005. Referenced 4 times on pages 15, 21, 22, and 23.

HEGGEN, S.; CODY, M. Hiring millennial students as software engineers: a study in developing self-confidence and marketable skills. In: IEEE. *2018 IEEE/ACM International Workshop on Software Engineering Education for Millennials (SEEM)*. [S.l.], 2018. p. 32–39. Referenced 2 times on pages 24 and 28.

HIGHSMITH, J. *Adaptive software development: a collaborative approach to managing complex systems*. [S.l.]: Addison-Wesley, 2013. Referenced on page 19.

International Project Management Association (IPMA). Individual competence baseline (icb 3.0). In: . [S.l.: s.n.], 2006. p. 213. Referenced on page 28.

International Project Management Association (IPMA). Individual competence baseline (icb 4.0). In: . [S.l.: s.n.], 2015. p. 415. Referenced 4 times on pages 21, 22, 23, and 28.

JONES, E. A.; VOORHEES, R. A. Defining and assessing learning: Exploring competency-based initiatives. report of the national postsecondary education cooperative working group on competency-based initiatives in postsecondary education. brochure [and] report. ERIC, 2002. Referenced on page 22.

KITCHENHAM, B.; CHARTERS, S. *Guidelines for performing Systematic Literature Reviews in Software Engineering*. 2007. Referenced on page 26.

KOVITZ, B. Hidden skills that support phased and agile requirements engineering. *Requirements Engineering*, Springer, v. 8, n. 2, p. 135–141, 2003. Referenced on page 28.

KROPP, M.; MEIER, A. Teaching agile software development at university level: Values, management, and craftsmanship. In: IEEE. *2013 26th International Conference on Software Engineering Education and Training (CSEE&T)*. [S.l.], 2013. p. 179–188. Referenced on page 28.

LORBER, A. A.; TIESZEN, S. R. A starting point for negotiations–delivering with a heterogeneous team. In: IEEE. *2012 Agile Conference*. [S.l.], 2012. p. 148–155. Referenced on page 28.

MARRELLI, A. F. An introduction to competency analysis and modeling. *Performance Improvement*, Wiley Online Library, v. 37, n. 5, p. 8–17, 1998. Referenced on page 22.

MATTURRO, G. Soft skills in software engineering: A study of its demand by software companies in uruguay. In: IEEE. *2013 6th international workshop on cooperative and human aspects of software engineering (CHASE)*. [S.l.], 2013. p. 133–136. Referenced on page 28.

MATTURRO, G.; RASCHETTI, F.; FONTÁN, C. Soft skills in software development teams: A survey of the points of view of team leaders and team members. In: IEEE PRESS. *Proceedings of the Eighth International Workshop on Cooperative and Human Aspects of Software Engineering*. [S.l.], 2015. p. 101–104. Referenced on page 24.

MELLO, R. M. de; TRAVASSOS, G. H. Surveys in software engineering: Identifying representative samples. In: ACM. *Proceedings of the 10th ACM/IEEE International Symposium on Empirical Software Engineering and Measurement*. [S.l.], 2016. p. 55. Referenced on page 28.

MOE, N. B.; DINGSØYR, T. Scrum and team effectiveness: Theory and practice. In: SPRINGER. *International Conference on Agile Processes and Extreme Programming in Software Engineering*. [S.l.], 2008. p. 11–20. Referenced on page 28.

NIJHUIS, S.; VRIJHOEF, R.; KESSELS, J. Tackling project management competence research. *Project Management Journal*, SAGE Publications Sage CA: Los Angeles, CA, v. 49, n. 3, p. 62–81, 2018. Referenced on page 28.

PALMER, S. R.; FELSING, M. *A practical guide to feature-driven development*. [S.l.]: Pearson Education, 2001. Referenced on page 19.

PALMQUIST, M. S.; LAPHAM, M. A.; MILLER, S.; CHICK, T.; OZKAYA, I. *Parallel worlds: agile and waterfall differences and similarities*. [S.l.], 2013. Referenced 3 times on pages 15, 18, and 19.

PAPATHEOCHAROUS, E.; BELK, M.; NYFJORD, J.; GERMANAKOS, P.; SAMARAS, G. Personalised continuous software engineering. In: ACM. *Proceedings of the 1st International Workshop on Rapid Continuous Software Engineering*. [S.l.], 2014. p. 57–62. Referenced 5 times on pages 15, 21, 23, 24, and 28.

POPPENDIECK, M.; POPPENDIECK, T. *Lean Software Development: An Agile Toolkit: An Agile Toolkit*. [S.l.]: Addison-Wesley, 2003. Referenced on page 19.

PURAO, S.; SUEN, H. Designing a multi-faceted metric to evaluate soft skills. In: ACM. *Proceedings of the 2010 Special Interest Group on Management Information System's 48th annual conference on Computer personnel research on Computer personnel research*. [S.l.], 2010. p. 88–91. Referenced 2 times on pages 25 and 28.

RAZZAK, M. A.; MITE, D. Knowledge management in globally distributed agile projects–lesson learned. In: IEEE. *2015 IEEE 10th International Conference on Global Software Engineering*. [S.l.], 2015. p. 81–89. Referenced on page 41.

REJAB, M. M.; NOBLE, J.; ALLAN, G. Distributing expertise in agile software development projects. In: IEEE. *2014 Agile Conference*. [S.l.], 2014. p. 33–36. Referenced on page 41.

RIES, E. *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. [S.l.]: Crown Books, 2011. Referenced on page 16.

ROSA, M.; OLIVEIRA, D. P. A.; OREY, D. C. Delineando e conduzindo o método misto de pesquisa em investigações em educação matemática. 2015. Referenced on page 26.

SCHWABER, K.; SUTHERLAND, J. The scrum guide-the definitive guide to scrum: The rules of the game. *SCRUM. org, Jul-2013*, 2013. Referenced 3 times on pages 19, 20, and 41.

SCRUM.ORG. *Scrum.org The Scrum Framework Poster*. 2009. Disponível em: <https://www.scrum.org/resources/scrum-framework-poster>. Referenced on page 20.

SEVERANCE, C. Discovering javascript object notation. *Computer*, IEEE, v. 45, n. 4, p. 6–8, 2012. Referenced on page 44.

STANDISH, G. *The CHAOS report. 2015*. Accessed in 2019. Referenced 2 times on pages 15 and 19.

STAPLETON, J. *DSDM, dynamic systems development method: the method in practice*. [S.l.]: Cambridge University Press, 1997. Referenced on page 19.

STEVENS, M.; NORMAN, R. Industry expectations of soft skills in it graduates: a regional survey. In: ACM. *Proceedings of the Australasian Computer Science Week Multiconference*. [S.l.], 2016. p. 13. Referenced 2 times on pages 24 and 28.

TAN, C.-H.; TEO, H.-H. Training future software developers to acquire agile development skills. *Communications of the ACM*, v. 50, n. 12, p. 97–98, 2007. Referenced on page 28.

TRICHET, F.; LECLÈRE, M. A framework for building competency-based systems dedicated to human resource management. In: SPRINGER. *International Symposium on Methodologies for Intelligent Systems*. [S.l.], 2003. p. 633–639. Referenced 2 times on pages 21 and 22.

VALENTIN, E.; CARVALHO, J. R. H.; BARRETO, R. Rapid improvement of students' soft-skills based on an agile-process approach. In: IEEE. *2015 IEEE Frontiers in Education Conference (FIE)*. [S.l.], 2015. p. 1–9. Referenced 4 times on pages 15, 24, 28, and 36.

VOORHEES, R. A. Competency-based learning models: A necessary future. *New directions for institutional research*, Wiley Online Library, v. 2001, n. 110, p. 5–13, 2001. Referenced on page 22.

WINTERTON, J.; DEIST, F. D.-L.; STRINGFELLOW, E. *Typology of knowledge, skills and competences: clarification of the concept and prototype*. [S.l.]: Office for Official Publications of the European Communities Luxembourg, 2006. Referenced on page 22.

WIRFS-BROCK, R. J. Designing with an agile attitude. *IEEE Software*, IEEE, v. 26, n. 2, p. 68–69, 2009. Referenced on page 28.

WIRFS-BROCK, R. J. Skills for the agile designer: seeing, shaping and discussing design ideas. In: ACM. *Proceedings of the ACM international conference companion on Object oriented programming systems languages and applications companion*. [S.l.], 2010. p. 323–326. Referenced on page 28.

WOHLIN, C. Guidelines for snowballing in systematic literature studies and a replication in software engineering. In: CITESEER. *Proceedings of the 18th international conference on evaluation and assessment in software engineering*. [S.l.], 2014. p. 38. Referenced on page 27.

A APPENDIX - Survey Protocol

Federal Rural University of Pernambuco - UFRPE
Computing Department - DC

Survey Protocol about the relevance of a set of 10 Soft Skills for Software Engineers working within Agile Teams and for the companies of the Digital Port of Recife.

Author

Thiago Alves Bastos

Recife, October 2019.

A.1 General Information

A.1.1 Subject

Explaining a Survey about the relevance of a set of 10 Soft Skills for Software Engineers working within Agile Teams and for the companies of the Digital Port of Recife. The motivation for this research came from the importance of understanding the human factors inside of Agile Teams, specially the Soft Skills, and the fact that there is a gap between what the companies are expecting from the Software Engineers and what they really have, specially in their first-time job.

A.1.2 Researches

Thiago Alves Bastos
Student of the Bachelor of Computer Science Course of the Computing Department (DC), Federal Rural University of Pernambuco (UFRPE).

Professor Suzana Cândido de Barros Sampaio
Computing Department (DC), Federal Rural University of Pernambuco (UFRPE).

A.1.3 Goals

The present work has the goal of proposing an MVP of an instrument which allows a Software Engineer to make a self evaluation about his/her Soft Skills. In order to reach this goal, it was necessary to create the present Survey Protocol, that will give necessary information to the development of the instrument. The Survey has the following goals:

- Understand the final public that would use the instrument;
- Highlight what are the 8 most important Soft Skills among the 10 most mentioned Soft Skills in the Literature;
- Understand the actual relevance given by the companies of the Digital Port of Recife about the Soft Skills of their Software Engineers.
- Raise awareness of the Software Engineers about the relevance of the Soft Skills for their careers.

A.1.4 Relevant Points

- It will took about 8 minutes to answer the Survey;

- The Survey must be answered by Software Engineers working within Agile Teams inside the Digital Port of Recife;

A.1.5 Confidentiality

Only the researches mentioned on section 1.2 will have access to the answers of the Survey. The results of the research will be presented in this work without mentioning any personal information about the Software Engineer or the company that he/she work for, in case he/she mentions it through the open questions of the Survey.

A.1.6 Remuneration

The Software Engineers who will answer the Survey will not receive any remuneration for participating in this work.

A.1.7 Benefits

The Software Engineers who will participate answering the Survey will not receive any benefits.

A.1.8 Contact for information about the research

In case of any doubts about the Survey, questions about the usage of the answers or about additional information about this work, you can get in touch with the researcher Thiago Bastos, through the following e-mail addresses: alves.thiagobastos@gmail.com ou thiago.bastos@ufrpe.br.

A.1.9 Agreement

The participation on the Survey is completely voluntary and the Software Engineer can refuse to answer it.

A.2 Survey

Qual a atual relevância que as Soft Skills têm no mercado de computação e quais Soft Skills são as mais relevantes para um Engenheiro de Software?

Oi, me chamo Thiago Bastos e sou estudante de Ciência da Computação pela Universidade Federal Rural de Pernambuco - UFRPE. Estou fazendo uma pesquisa para entender sobre a relevância das habilidades não técnicas (Soft Skills) dentro da área de computação e identificar quais soft skills são mais importantes para um Engenheiros de Software.

Para isso, gostaria de pedir de 5 a 8 minutos do seu tempo para que você possa me ajudar com essa pesquisa. Sua contribuição e visão é muito importante e será considerada nesse processo.

Informações extras:
- Soft Skills: são habilidades relacionadas ao comportamento, personalidade, emoção (ou inteligência emocional) e experiência - e podem ser um pouco subjetivas de acordo com o contexto, podendo ser chamadas de habilidades não técnicas também. Alguns exemplos são: comunicação, liderança, organização, trabalho em equipe, ética, entre tantas outras.

Pesquisadores:
- Thiago Alves Bastos
- Suzana Cândido de Barros Sampaio

*Obrigatório

Qual a sua idade? *

- ◯ até 20 anos.
- ◯ de 21 a 25 anos
- ◯ de 26 a 30 anos
- ◯ de 31 a 35 anos
- ◯ de 36 a 40 anos
- ◯ de 41 a 45 anos
- ◯ de 46 a 50 anos
- ◯ mais de 50 anos

Qual seu sexo? *

- ◯ Masculino
- ◯ Feminino
- ◯ Prefiro não informar

Qual seu grau de formação? *

- ◯ Ensino Médio Completo
- ◯ Ensino Superior Incompleto
- ◯ Ensino Superior Completo

Quantos anos de experiência profissional você tem? *

- ◯ até 5 anos
- ◯ de 6 a 10 anos
- ◯ de 11 a 15 anos
- ◯ de 16 a 20 anos
- ◯ mais de 20 anos

Soft Skills de um Engenheiro de Software

Agora, de acordo com a sua experiência como Engenheiro de Software, análise a relevância de cada afirmação abaixo marcando de 1 a 5, sendo 1 o nível menos relevante e 5 o mais relevante.

Habilidade de se fazer claro dentro do projeto. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Habilidade de levar informações de forma precisa para todas as partes necessárias dentro do projeto. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Habilidade de ser um guia/mentor para as demais pessoas dentro do projeto. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Habilidade de motivar as pessoas para alcançar os objetivos do projeto. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

É importante respeitar quanto e como os outros membros do projeto conseguem contribuir. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Habilidade de manter um bom relacionamento, sinergia com meus companheiros de equipe. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Ser capaz de completar uma atividade no tempo determinado. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Ser pontual para com as atividades do projeto, como reuniões, por exemplo. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Ser capaz de me adaptar facilmente a mudanças. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Ser capaz de manter em mente os interesses (objetivos) do projeto. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Ser proativo dentro do projeto. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Ser interessado em aprender novas coisas dentro do projeto. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Ser capaz de equilibrar interesses diferentes dentro do projeto, visando manter um bom relacionamento no trabalho. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Ser capaz de contratar novas pessoas para o projeto. *

	0	1	2	3	4	5	
menor relevância	○	○	○	○	○	○	maior relevância

Ser capaz resolver desentendimentos dentro do projeto. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Saber como trabalhar com pessoas que têm objetivos distintos. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Ser capaz de entender os requisitos do projeto. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Ser capaz de aplicar diferentes maneiras de pensar para resolver desafios. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Tratar todos igualmente independente da senioridade. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Saber suas liberdades e seus limites pessoais e profissionais dentro do projeto. *

	1	2	3	4	5	
menor relevância	○	○	○	○	○	maior relevância

Durante sua entrevista de emprego você notou que suas competências não técnicas (Soft Skills) foram avaliadas? *

- ○ Sim
- ○ Não

Na empresa em que você trabalha existe algum tipo de atividade com o objetivo de melhorar as suas soft skills? *

- ○ Sim
- ○ Não

Possui atividades para melhorar as Soft Skills

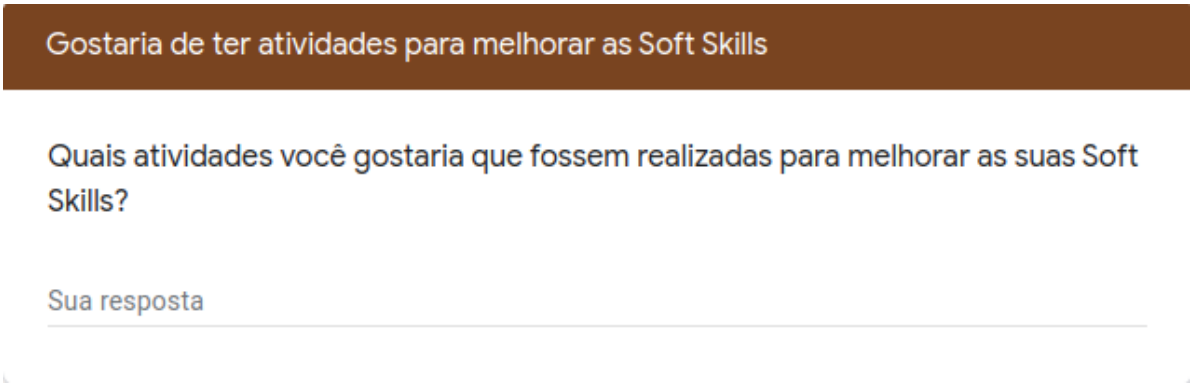
Na empresa que você trabalha quais atividades são realizadas para melhorar as suas Soft Skills?

Sua resposta

Não possui atividades para melhorar as Soft Skills

Você gostaria que tivesse atividades para melhorar as suas soft skills? *

- ○ Sim
- ○ Não


Gostaria de ter atividades para melhorar as Soft Skills
Quais atividades você gostaria que fossem realizadas para melhorar as suas Soft Skills?
Sua resposta

B Appendix - Soft Skill Catalog

- **Communication:**
  - **Synonyms:** Presentation, Oral presentation, Oral / Written English, Writing issue queues, Oral / Written English and Writing.
  - **Changed From Technical to People Factor:** YES
  - **Definition:**
    * Written, verbal and body language. The ability to be clear, articulate, to the point, inclusive and take the audience on a journey. Recognition that different mediums need different treatment [8].
    * The exchange of proper information, delivered accurately and consistently to all relevant parties [E1].
- **Leadership:**
  - **Synonyms:** Influence and control, Decision Making and Critical Thinking.
  - **Changed From Technical to People Factor:** NO
  - **Definition:**
    * Is providing direction and guidance to individuals and groups. It involves the ability to choose and apply appropriate styles of management in different situations. Besides displaying leadership with his or her team, the individual needs to be seen as a leader in representing the project to senior management and other interested parties [E1].
    * Is providing direction and motivating others in their role or task to fulfil the project's objectives [E2].
- **Teamwork:**
  - **Synonyms:** Team Building.
  - **Changed From Technical to People Factor:** YES
  - **Definition:**
    * Adopting a sense of responsibility to the team and respecting others for what they can contribute. Able to resolve conflicts and contribute to team success without degrading relationships [8].

    - Is about bringing people together to realise a common objective. Teams are groups of people working together to realise specific objectives. Project teams are commonly multi-disciplinary; specialists in different disciplines work together to realise complex outcomes. Teamwork is about building a productive team by forming, supporting and leading the team. Team communication and team relationships are among the most important aspects of successful teamwork [E1].

- **Self-management:**
  - **Synonyms:** Time Management/Planning, Pace, Punctuality and Self-reflection.
  - **Changed From Technical to People Factor:** NO
  - **Definition:**
    - Being self-motivated, completing tasks, showing initiative, good work ethic and sense of timeliness, doing what is asked, being ready to participate and offer opinions while acknowledging there is more to learn [8].
    - Self-reflection is the ability to acknowledge, reflect on and understand one's own emotions, behaviours, preferences and values and to understand their impact. Self-management is the ability to set personal goals, to check and adjust progress and to cope with daily work in a systematic way. It includes managing changing conditions and dealing successfully with stressful situations [E1].
    - Self-Management is a systematic and disciplined approach to cope with daily work, changing requirements and to deal with stressful situations [E2].

- **Dealing with Change:**
  - **Synonyms:** Openness, Tolerance of ambiguity, Open-mindness, Managing yourself, Self-control and Working with ambiguity.
  - **Changed From Technical to People Factor:** NO
  - **Definition:**
    - Openness is the ability to make others feel they are welcome to express themselves, so that the project can benefit from their input, suggestions, worries and concerns. Openness is necessary as a means of benefiting from others' knowledge and experience. Since a project manager works with various professionals, openness is an important competence: most of the team members have an area of expertise where they are more

knowledgeable than the project manager. The relationships in the team are built on mutual respect, trust and reliability [E2]

- **Eagerness to learn:**
  - **Synonyms:** Attitude, Autonomy, Active Learning and Independent learning.
  - **Changed From Technical to People Factor:** NO
  - **Definition:**
    - Glass half full optimism, pro-active, positive, confident and curious. Willing to learn, able to take feedback and adaptable [8].
- **Negotiation:**
  - **Synonyms:** None
  - **Changed From Technical to People Factor:** NO
  - **Definition:**
    - Negotiation is the process between two or more parties that aims to balance different interests, needs and expectations in order to reach a common agreement and commitment while maintaining a positive working relationship. Negotiation includes both formal and informal processes such as buying, hiring or selling or regarding requirements, budget and resources in projects [E1].
    - Negotiations are the means by which parties can resolve disagreements concerned with the project or programme to arrive at a mutually satisfactory solution. A well developed ability to negotiate can help the project manager to avoid real conflicts. Project negotiations should be conducted with due regard to each party's interests and positions. A win-win situation is the desirable result, conducted in an open manner. However, it should be recognised that some negotiations are very political and/or commercial and that compromises often have to be reached which may not leave all parties totally satisfied [E2].
- **Conflict Management:**
  - **Synonyms:** Conflict & Crisis and Handles conflict maturely.
  - **Changed From Technical to People Factor:** NO
  - **Definition:**
    - Conflict and crisis includes moderating or solving conflicts and crises by being observant of the environment and by noticing and delivering a remedy for disagreements. Conflicts and crises may include events and

situations, character conflicts, stress levels and other potential dangers. The individual must handle these scenarios appropriately and stimulate a learning process for future conflicts and crises [E1].

* This competence element covers ways of handling conflicts and crises that can arise between different individuals and parties involved in a project or programme. Conflicts and crises can arise in projects, and in contract negotiations, despite processes and guidelines designed to prevent this happening. They can occur at all levels, largely because there are different parties working together with their own distinct aims. Conflicts can also arise when people who do not know each other come together to work on a project sometimes under enormous pressure. A process for handling conflicts and crises should be set the start of the project. Crisis management starts with good risk analysis and scenario planning on how to handle any foreseeable crises [E2].

- **Problem Solving:**
  - **Synonyms:** Problem Identification, Aptitude, Resourcefulness, Analytical.
  - **Changed From Technical to People Factor:** YES
  - **Definition:**
    * - Ability to apply existing technical skills to seek out alternatives and learn new skills fast. Able to interpret requirements and problem solve [8].
    * Is the ability to apply various techniques and ways of thinking to defining, analysing, prioritising, finding alternatives for and dealing with or solving challenges and problems. It often requires thinking and acting in original and imaginative ways and stimulating the creativity of individuals and the collective creativity of the team. Resourcefulness is useful when risks, opportunities, problems and difficult situations arise [E1].
- **Ethics:**
  - **Synonyms:** Fit socially, Personal integrity and reliability.
  - **Changed From Technical to People Factor:** YES
  - **Definition:**
    * Fit socially, not necessarily outside work, but definitely in work. Treat the receptionist and the cleaner with respect, recognize everyone is there to help. Avoid “playing the rules”, for example, using up every sick day [8].
    * The delivery of projects benefits involves making many individual commitments to get things done. Individuals must demonstrate personal integrity

and reliability because a lack of these qualities may lead to a failure of the intended results. Personal integrity means that the individual is acting in accordance with his or her own moral and ethical values and principles. Reliability is acting dependably, according to expectations and/or agreed behaviour [E1].

* Ethics embraces the morally accepted conduct or behaviour of every individual. Ethical behaviour is the basis of every social system. In organisations, certain ethical standards are usually included in contracts of employment and cover the professional rules of conduct and behaviour that are expected of employees. They may also have a legal basis, where the organisation is required to conform to standards set out within a legal or regulatory framework. Ethics allows people to conduct the project and deliver the results in a satisfactory manner. Ethics represent personal and professional freedoms as well as limits. Ethics should be respected to allow people to function without moral conflict in the project and in relation to interested parties and society [E2].

C Appendix - Soft Skills Mapped per Paper

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[E1]	[E2]	[E3]	Total
Communication	X	X	X	X	X	X	X	X							X			**9**
Leadership	X	X	X	X	X			X		X	X				X	X	X	**11**
Teamwork	X		X	X	X			X	X	X	X				X			**9**
Self-management	X	X	X	X	X			X							X	X		**8**
Dealing with Change	X		X					X								X	X	**5**
Eagerness to learn	X		X	X	X			X										**5**
Negotiation	X									X		X	X		X	X		**6**
Conflict Management	X				X					X				X	X	X		**6**
Problem Solving	X			X	X			X		X					X			**6**
Ethics								X		X					X	X		**4**