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A Systematic Mapping Study on Soft Skills in Software Engineering

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Abstract: To participate in software development projects, team members may need to perform different roles and be skilled in diverse methodologies, tools and techniques. However, other skills, usually known as "soft skills" are also necessary. We report the results of a systematic mapping study to identify existing research on soft skills in software engineering and to determine what soft skills are considered relevant to the practice of software engineering. After applying an explicit mapping protocol, 44 papers were finally selected, and 30 main categories of soft skills were identified. At least half of the studies selected mention five skills: communication, teamwork, analytical, organizational, and interpersonal skills. We also identified the data collection methods commonly used for research on this topic: job advertisements and surveys were the main ones. The results of this work are of interest to researchers in human aspects of software engineering, to those responsible for Human Resource in software development companies, and to curriculum designers in careers related to software engineering and development.

Keywords: Soft Skills, Software Engineering, Systematic Mapping Study
Categories: D.2

1 Introduction

Software development is a highly technical activity that requires people to have knowledge and experience in diverse software processes, methodologies, tools and techniques, but also to perform various functions in software projects. When software companies assemble project teams or hire new professionals, they often tend to emphasize the knowledge and technical skills of potential candidates. However, the human dimension may be as critical as technical capacity [Acuña, 06]. When people work together on a software project, other skills are necessary to implement activities such as communicating and interacting with other team members and stakeholders in the project, managing time, presenting progress of the project, negotiating with the customer, solving problems and making decisions, among others.

According to Capretz, software professionals should delve into these nontechnical issues and recognize that the people involved in the software development process are as important as the processes and the technology itself [Capretz, 14]. The reason for addressing these human factors is mainly the recognition that software engineers could benefit from greater self-awareness and of others' perspectives to develop their soft skills, which in turn can positively influence their work [Ahmed, 13]. Even though soft skills often play a critical role in career advancement, many professionals, especially engineers and other highly technical people, pay little attention to this fact [Chou, 13]. Soft skills are also mentioned in the literature as "non-technical skills", "people skills", "transferable skills", "social skills", or "generic competencies".

The purpose of this paper is to report the results of a systematic mapping of literature regarding soft skills in software engineering. A systematic mapping or mapping study is a form of secondary study intended to identify and classify the set of publications on a topic. Its value lies partly in identifying areas where there is scope for a fuller review (the group of related studies), and also to find out in which areas there may be a need for more primary studies [Kitchenham, 16].

As mentioned by Batteson et al. [Batteson, 16], two research methods have prevailed within the literature regarding the study of soft skills. The first approach seeks to identify discrete skills considered soft skills. This method typically involves eliciting lists of soft skills from relevant stakeholders in a given domain, through surveys and interviews. The other research approach commonly seen starts with an existing list of soft skills and tests them in relation to some capacity, such as determining those skills which are most likely to predict performance, or testing the agreement of importance of different skills across different participant groups.

In this work we took the first approach: our objective is to identify discrete skills that are considered soft skills in the domain of software engineering, starting from studies included in the literature mapping. Besides, we also want to know how often the identified skills are mentioned in the reviewed literature and what research methods are usually used in researching this topic.

We postulate that, if software engineers are to develop soft skills and relate them to software projects roles and development activities, soft skills need to be clearly articulated and defined. Using the list of soft skills gathered from the studies included in our mapping, the second research approach mentioned above may be used by ourselves and other researchers and stakeholders, to follow on the study of this topic.

Thus, we consider the results of this work particularly relevant to: a) researchers interested in the human aspects of software engineering, b) managers responsible for Human Resource in software development companies and team leaders of software development projects, c) curriculum designers of study programs related to software development and information technology, d) students and professionals.

The rest of this paper is organized as follows. In section 2 we provide background information about what is meant by the term "soft skills" and its relevance to software engineering professional practice and education. In section 3 we describe the research method followed to perform this mapping study. In Section 4 we report the results of the analysis of the selected studies included in the mapping and answer our research questions. A discussion of those results is presented in Section 5 and threats to validity are presented in Section 6. Finally, conclusions and further work are presented in Section 7.

2 Background

In this section we present a brief review of general literature on the subject of soft skills. We highlight the lack of a single definition, review three typical approaches to conceptualize the term and identify common components, in order to develop a working definition for this study. In addition, we argue on the relevance of soft skills in software engineering practice and education, and we describe the related work.

2.1 Soft skills in general literature

Several authors have tried to define and characterize the term “soft skills”, but the general understanding is that this is a very complex task. In this sense, Matteson, Anderson and Boyden [Matteson, 16] mention that the literature on soft skills is confusing, and that even though it is recognized that soft skills are important, when pressed to describe particular soft skills, the concept becomes “murky”. Also Ramesh and Ramesh [Ramesh, 10] consider that “soft skills” is an abstract, and somewhat “nebulous”, concept, and Prince [Prince, 13] considers that the term can be interpreted in many different ways.

According to Dell’Aquila et al. [Dell’Aquila, 2017], it is difficult to find a universal definition of the concept of soft skills or an all-encompassing definition that provides a succinct insight. To these authors, “soft skills” is a broad concept that subsumes many dimensions of the personal sphere development, involving a combination of emotional, behavioral and cognitive components; because of this, it is arduous to determine what to include or exclude in the definition of soft skills.

Despite this manifest difficulty, we can find in literature three broad approaches to define or characterize the concept of "soft skills": by giving an explicit definition, by giving examples of specific soft skills, and by comparing them to the so-called technical or “hard” skills.

Some definitions taken from general literature on the subject states that soft skills are "people skills backed by our emotional intelligence that help us behave in a socially acceptable manner and adapt ourselves to a social environment” [Verma, 09], “a compendium of several components like attitude, abilities, habits and practices that are combined adeptly to maximize one’s work effectiveness” [Ramesh, 10], and as “interpersonal skills that demonstrate a person's ability to communicate effectively and build relationships with others in one-on-one interactions as well as in groups and teams” [Kamin, 13].

A summary of more than 30 other definitions taken from literature, along with an extensive discussion regarding the many aspects involved in what are called “soft skills” is given in [Dell’Aquila, 17], and in [Matteson, 16].

Due to the vagueness of the definitions given above and the difficulty of arriving to a unified definition, some authors try to characterize this kind of skills by giving examples of what they consider “soft skills”. Thus, soft skills encompass skills as varied as communicating, managing conflict, negotiating, team-building [Kamin, 13], leadership, motivation, time management, presentation skills [Rao, 10], problem-solving, analytical thinking, flexibility, assertiveness [Bhatnaga, 12], mentoring and coaching, establishing business relationships, nonverbal communication and body language [Goldberg, 14], stress management, customer service skills, mediation skills [Aamodt, 16], personal ability to function harmoniously with others, openness to

learning new ideas, and tolerance to not-so-pleasant situations and differences in opinions [Verma, 09], just to name a few.

The third approach used by some authors to characterize soft skills is to contrast them with the so-called "hard skills". This term usually refers to the technical ability and the factual knowledge needed to do the job [Klaus, 08], technical competencies that an individual possesses through educational learning and practical hands-on application [Bhatnaga, 12], which are usually associated with technical knowledge and understanding of a process [Prince, 13].

The general opinion among these authors and others is that hard skills alone might not be sufficient to be successful in the professional life [Bhatnaga, 12]. Soft skills are as essential to success as technical skills [Goldberg, 14]; they complement hard skills by making effort much more effective [Ramesh, 10], and are critical for the success or failure of any individual in the workplace [Klaus, 08], [Tulgan, 15]. While hard skills are useful in a specific area of activity and may become obsolete over a period of time because of changing technologies, soft skills are useful in all areas of activity - not only in professional life, but also in personal and social life [Rao, 10].

Despite the diversity of approaches and opinions on the concept of "soft skills" reviewed so far, it is still possible to identify four common components in it, as shown in Table 1.

Component	Authors	Definition
Abilities	[Klaus, 08] [Ramesh, 10] [Rao, 10]	Competence in an activity or occupation because of one's skill, training, or other qualification.
Attitude	[Ramesh, 10] [Rao, 10]	A predisposition or tendency to respond positively or negatively towards a certain idea, object, person, or situation.
Habits	[Verma, 09] [Ramesh, 10]	An acquired (learned rather than innate) behaviour pattern regularly followed until it has become almost involuntary.
Personality traits	[Klaus, 08] [Verma, 09] [Rao, 10]	Traits that reflect people's characteristic patterns of thoughts, feelings, and behaviours.

Table 1: Components of soft skills

For this study, we will refer to "soft skills" as the combination of the abilities, attitudes, habits, and personality traits that allow people to perform better in the workplace, complementing the technical skills required to do their jobs and influencing the way they behave and interact with others.

One final aspect we want to comment, that have been pointed out by some authors, is the apparently difficulty of assessing or measuring soft skills [Bhatnaga, 12], [Tulgan, 15]. To Thomas, the most common, and highly effective, method for assessing non-technical skills is by using a behavioral marker system [Thomas, 18]. Such a system is defined as a framework that sets out observable, non-technical behaviors that contribute to superior or sub-standard performance within a work environment [Klampfer, 01]. Behavioral markers can be used in any domain where behaviors relating to job performance can be observed. In the domain of software engineering, one such a system has been proposed by Lacher and colleagues to measure a set of non-technical skills of software professionals [Lacher, 15].

2.2 Relevance of soft skills in software engineering practice and education

Several authors have argued about the relevance of soft skills in the practice of software engineering and the need to incorporate this topic in the curriculum of software engineering in higher education.

In this sense, Zurita et al. affirm that there is currently an increasing need for students to develop not only technical competences, but also those so called "soft skills" in order to perform professional activities in an effective and efficient way in a globalized world [Zurita, 16].

Radermacher and Walia [Radermacher, 13] present a study conducted to determine in which areas graduating students most frequently fall short of the expectations of industry or academia. One of those areas is, precisely, personal or soft skills; they single out oral and written communication, teamwork, problem solving, critical thinking, ethics, and leadership as examples of this kind of skills.

Sedelmaier and Landes [Sedelmaier, 15] have proposed a body of skills for software engineering (SWEBOS) on the basis that there are no sound guidelines that indicate which non-technical skills are particularly relevant for software engineers. To these authors, non-technical or soft skills (such as communication, collaboration, and teamwork) are as important as factual or technical knowledge, because software is usually developed in teams of individuals.

The impact of this kind of skills, or its absence, has been highlighted by Starkweather and Stevenson who claim that the main source of failure of software development projects is the lack of soft skills or the consideration of soft issues [Starkweather, 11]. Bancino and Zevalkink mention that for technology-intensive projects (such as software projects), industry studies put the failure rate somewhere between 40% and 70%, and that a recent survey of more than 250 technical leaders cited a lack of soft skills as the biggest reason for project failure [Bancino, 07].

More recently, Capretz and Ahmed [Capretz, 18] consider that a missing link in software engineering is the soft skills set that are essential in the software development process. Under this consideration, although soft skills are among the most important aspects in the creation of software, they are often overlooked by educators and practitioners. These authors also agree in that even the latest guideline for teaching and learning software engineering, namely SWEBOK V3.0 and IEEE/ACM Curriculum Guide, highlights technical competence and gives only marginal consideration to vaguely characterized nontechnical (soft) skills.

One last aspect regarding the relevance of soft skills relates to what is called "employability". To Hillage and Pollard [Hillage, 98], employability is a multi-

dimensional construct that includes: the ability to secure first employment; the ability for an individual to transfer between positions at the same employer, and the ability to secure employment from a new organisation.

In a study of the factors that influence new graduate employability, Finch et al. [Finch, 13] found that out of 17 individual employability factors measured, five of the six highest ranked factors were soft-skills. In addition, their findings illustrate that, when hiring new graduates, employers place the highest emphasis on soft-skills and the lowest on academic reputation.

Finally, Ramesh and Ramesh [Ramesh, 10] affirm that the corporate world puts great emphasis on soft skills, and organizations look and recruit people with exceptional soft skills from among the pool of technically skilled people.

2.3 Related work

To the best of our knowledge, there are no studies focused on soft skills in software engineering with the depth and extent presented in this paper. Similar studies found are the following.

Beecham et al. presented a systematic literature review focused explicitly on "motivation", one of the several skills that appear mentioned as soft skills in literature [Beecham, 08]. The objective of this review was to plot the landscape of current reported knowledge in terms of what motivates developers, what de-motivates them and how existing models address motivation.

Naiem et al. presented what they call a "simplified" literature review in [Naiem, 15]. The purpose of this paper is to highlight the gaps that exist for computer science graduates in Egypt. In this work, the author excluded all studies conducted before 2009 as they consider that old data might not be reliable. The review included only 21 studies, after applying a somewhat vague inclusion criterion: "the study had to be published in a well-established journal or conference and published on 2009 or later".

Iriarte and Bayona presented a literature review focused on the link between a project manager's soft skills and the success of a project; that is, what soft skills in the role of IT (Information Technology) project manager are most influential on project success [Iriarte, 17].

Our study differs from those above mentioned in that a) our focus is on all the soft skills related to the practice of software engineering mentioned in literature, and not just on the particularities of motivation, and b) we analyze soft skills related to general software engineering practice and not just the role of project managers. In addition, we did not limit our search to studies published after a specific year.

3 Research Method

Based on the guidelines provided in [Kitchenham, 16], the steps taken for this mapping study were: 1) Definition of research questions, 2) Search of the relevant literature, 3) Selection of relevant studies, 4) Data Extraction 5) Data aggregation and synthesis.

3.1 Research questions

The main research question stated to guide this study was as follow:

- RQ1: What are the soft skills considered relevant to the practice of software engineering?

By relevant we meant those skills that are considered connected or associated to the practice of software engineering, and that we want to gather from the empirical studies included in the mapping.

By software engineering we meant the application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software, as defined in [IEEE, 90].

As one of the goals of a mapping study could be to identify research methods used in researching the topic [Kitchenham, 16], the second research question was:

- RQ2: What are the data sources or research methods used to identify those soft skills?

Finally, due to the vagueness of the concept of soft skill and the lack of a unified definition (as explained in Section 2), the third research question was:

- RQ3: How are the identified soft skills defined or characterized?

3.2 Search strategy

The identification of the relevant literature to the study involves, firstly, the definition of the search strings to be used in bibliographic databases. For the construction of these search strings, the following keywords were used: "soft skills", "non-technical skills", "people skills", "personal skills", "generic competencies", “transferable skills”, “softskills”, "software engineering", "software development", and "software projects".

To perform the search process, the following bibliographic databases were consulted: ACM Digital Library (portal.acm.org), SpringerLink (www.springerlink.com), ScienceDirect (www.sciencedirect.com), and IEEExplore (ieeexplore.ieee.org).

Since each of these databases proposes a different way to enter the search strings and the logical operators OR and AND, we chose to use short search strings of the form <string1> AND <string2>, where <string1> contains alternately the terms "soft skills", "non-technical skills", "people skills", "personal skills", “transferable skills”, “softskills” and "generic competencies", while <string2> contains alternately the terms "software engineering", "software development" and "software projects".

Thus, 21 searches were carried out in each database, giving a total of 84 independent searches. The process ended on December 15, 2017.

3.3 Inclusion/exclusion criteria for study selection

Selection criteria, also called inclusion / exclusion criteria, are used to identify, from the whole set of papers returned by the search process, only those that provide direct evidence about the research questions.

The criteria for study inclusion and exclusion defined for this study were:

- Inclusion: a) journal articles and conference proceedings records without considering specific publication dates, b) articles presenting results of empirical studies specifically related to software engineering. In order to be included in the mapping, a study must meet both criteria.
- Exclusion: a) articles published in journals or conference proceedings not refereed, b) articles that referred to studies about soft skills in ICT generically, technical support, hardware or software installation or maintenance, or technology infrastructure, c) articles in which the data sources or the data collection procedures were not specified, d) items based on expert or author opinion (position papers), summaries of articles, book prefaces, journal editorials, readers' letters, summaries of workshops, tutorials, and poster sessions. Any paper that met at least one of these criteria was excluded from the map.

When a paper appeared repeatedly in our search, we counted it only once.

3.4 Data extraction

A data extraction form, implemented as an Excel spreadsheet, was defined to extract the relevant information from the selected papers.

From each paper, the following data was recorded:

- Bibliographic data.
- Research method and data sources reported.
- How the author(s) named the concept "soft skills".
- The soft skills listed in the study, worded exactly as they appear in the respective paper.
- The definition or characterization (if any) of the soft skills listed in the study.

Data extraction from each paper was done independently by two of the authors and then compared to verify that no datum was missing, and that all soft skills mentioned had been recorded in the data extraction form.

Data extraction was performed manually. The decision of not using software tools to perform automatic extraction was based on the results of a study by Marshall and Brereton, which concludes that, based on their evidence, most of the tools they identified were in the initial stages of development and use, and therefore there were very few empirical corroboration data on its effectiveness [Marshall, 13].

3.5 Data aggregation and synthesis

A first review of the soft skills recorded in the spreadsheet revealed that many of them appeared in more than one paper with the same or slightly different name. Data aggregation consisted in the creation of groups or categories of soft skills that, independently of the denomination given in the respective paper, represent (in our consideration) the same general underlying skill. Some examples of the application of this criterium are given below. See Table 4 for bibliographic data of referred papers.

For example, "written and oral communication" [p11] and "exhibit several communication styles" [p32] were grouped under the "Communication skills" category, as they refer to the same underlying skill.

However, not all the cases were as simple as this one. For example, the soft skill "negotiates to arrive at a consensus or compromise" [p18] was put under the group "Negotiation skills", because the word "negotiates" appears in the name given by the author. In this group we also put the skill named "consensus building" [p33], because the word "consensus" also appears in the name given to the skill. Another example is the case of the soft skill "possess a 'be the customer' mentality" mentioned in [p3]. After analyzing the context and the explanation given by the author about its meaning, it was included in the "Customer orientation" category.

After grouping the soft skills in their respective categories, we were in position to count how many times the skills in each category are mentioned in the selected papers. In sub-section 4.3 we present the results of this process.

4 Results

In this section we present the outcomes of the search process, the list of papers selected after applying the inclusion/exclusion criteria, and the answers to the research questions.

4.1 Search results

With the keywords defined in sub-section 3.2, we performed the described search process in each of the bibliographic databases. Table 2 shows how many papers were found in each one.

Database	Papers found
IEEExplore	177
SpringerLink	694
ScienceDirect	898
ACM Digital Library	45
Total:	**1814**

Table 2: Search results in bibliographic databases

The figures in the “Papers found” column consider all the papers retrieved, before applying the inclusion/exclusion criteria.

4.2 Studies selected for the review

From the extensive lists of studies obtained through the searches, a selection of the relevant ones was done by reading and analysing the title, abstract and keywords of each article, discarding the ones that were clearly unrelated to the research subject and those that were duplicated. Then, the studies selected in the previous step were carefully reviewed by reading the Introduction, Methodology section, Results section, and Conclusion and applying the inclusion and exclusion criteria presented in Section 3.3. If reading the above items was not enough to decide whether to include it or not, the study was read in its entirety.

After discarding those items that did not meet the inclusion/exclusion criteria and those that, although containing some of the search keywords, were not directly related to the focus of the investigation, the final set was reduced to 44 papers. Of them, 43 are written in English and one in Portuguese.

References to the selected papers, classified by year of publication, are shown in Table 3. Full bibliographic data of these studies is given in Table 4.

Year of publication	Reference	Quantity
1999	p1	1
2000	p2	1
2001	p3	1
2002	p4	1
2003	----	0
2004	p5	1
2005	p6	1
2006	p7	1
2007	p8	1
2008	p9, p10	2
2009	p11, p12, p13, p14	4
2010	p15, p16, p17, p18, p19, p20	6
2011	p21, p22, p23, p24, p25, p26, p27	7
2012	p28, p29, p30, p31, p32, p33	6
2013	p34, p35, p36	3
2014	p37, p38	2
2015	p39, p40	2
2016	p41, p42	2
2017	p43, p44	2
	Total	**44**

Table 3: References to the selected papers, classified by publication year

The interest for studying the subject of soft skills in software engineering appears to have increased since 2009, as 34 studies were reported between that year and 2017.

Ref.	Bibliographic data
p1	Seffah, A.: Training developers in critical skills, IEEE Software, Vol. 16, No. 3, pp. 66–70, 1999.
p2	Orsted, M.: Software development engineer in Microsoft. A subjective view of soft skills required, Int. Conf. Softw. Eng. ICSE 2000 New Millennium, pp. 539–540, 2000.
p3	Bailey, J., Stefaniak, G.: Industry Perceptions of the Knowledge, Skills, and Abilities Needed by Computer Programmers, in 2001 ACM SIGCPR conference on Computer personnel research, 2001, pp. 93–99.
p4	Noll, C., and Wilkins, M.: Critical Skills of IS Professionals. A Model for Curriculum Development, Journal of Information Technology Education, Vol. 1, No. 3, pp. 143–154, 2002.
p5	Gallivan, M., Iii, D., Kvasny, L.: Changing Patterns in IT Skill Sets. A Content Analysis of Classified Advertising, The Data Base for Advances in Information Systems, Vol. 35, No. 3, pp. 64–87, 2004
p6	Downey, J.: A framework to elicit the skills needed for software development, in ACM SIGMIS CPR Conference on Computer personnel research - CPR'05, 2005, p. 122.
p7	Khamisani, V., Siddiqui, M., Bawany, M.: Analyzing Soft Skills of Software Engineers using Repertory Grid, in 2006 IEEE International Multitopic Conference. INMIC '06, 2006, pp. 259–264.
p8	Laporte, C., Doucet, M., Bourque, P., Belkébir, Y.: Utilization of a Set of Software Engineering Roles for a Multinational Organization, in International Conf. on Product-Focused Software Process Improvement, 2007, pp. 35–50.
p9	Jalil, Z., Shahid, A.: Is Non-Technical Person a Better Software Project Manager?, in 2008 International Conference on Computer Science and Software Engineering, 2008, pp. 1–5.
p10	Lewis, T., Smith, W., Harrington, K., Hall, W.: Are Technical and Soft Skills Required? The Use of Structural Equation Modeling to Examine Factors Leading to Retention in the CS Major, in ICER'08 Fourth International Workshop on Computing Education Research, 2008, pp. 91–99.
p11	Colomo-Palacios, R., Casado, C., García, A., Gómez, J.: It's not Only about Technology, It's about People: Interpersonal skills as a part of the IT Education, in Second World Summit on the Knowledge Society, WSKS 2009, 2009, pp. 226–233.
p12	Fernández-Sanz, L. F.: Personal Skills for Computing Professionals, IEEE Computer, Vol. 42, No. 10, pp. 110–112, 2009.
p13	Ferrari, R., Madhavji, N., Wilding, M.: The Impact of Non-Technical Factors on Software Architecture, in LMSA '09, Leadership and Management in Software Architecture, 2009, pp. 32–36.
p14	Gillard, S.: Soft Skills and Technical Expertise of Effective Project Managers, Issues in Informing Science and Information Technology, Vol. 6, 2009, pp. 723-729.
p15	Capretz, L F., Ahmed, F.: Making Sense of Software Development and Personality Types, IT Professional, Vol. 12, No. 1, pp. 6–13, 2010.
p16	Colomo-Palacios, R., Cabezas, F., García, A., Soto, P.: Generic Competences for the IT Knowledge Workers: A Study from the Field, in Third World Summit on the Knowledge Society, WSKS 2010, 2010, pp. 1–7.
p17	Fernández-Sanz, L.: Analysis of Non-Technical Skills for ICT Profiles, in 5ta. Conferencia Ibérica de Sistemas y Tecnologías de Información, CISTI 2010, 2010, pp. 524–529.

Ref.	Bibliographic data
p18	Purao, S.: Designing a Multi-Faceted Metric to Evaluate Soft Skills, in SIGMIS-CPR'10, 2010, pp. 88–90.
p19	Stevenson D., Starkweather, J.: PM critical competency index: IT execs prefer soft skills, International Journal of Project Management, Vol. 28, No. 7, pp. 663–671, 2010.
p20	Vale, L., Bessa, A., Vasconcelos, P.: Relevant Skills to Requirement Analysts According to the Literature and the Project Managers Perspective, in 2010 Seventh International Conference on the Quality of Information and Communications Technology, 2010, pp. 228–232.
p21	Ahmed, F., Campbell, P., Beg, A., Capretz, L.: What Soft Skills Software Architect Should Have? A Reflection from Software Industry, in 2011 International Conference on Computer Communication and Management, 2011, vol. 5, pp. 565–569.
p22	Bakar A., Ting, C.-Y.: Soft Skills Recommendation Systems for IT Jobs: A Bayesian Network Approach, 3rd Conference on Data Mining and Optimization (DMO), pp. 82–87, 2011.
p23	Colomo-Palacios, R., Casado, C., Tovar, E., Soto, P., García, A.: Is the Software Worker Competent? A View from Spain, in 4th World Summit on the Knowledge Society, WSKS 2011, 2011, pp. 261–270.
p24	González, D., Moreno, L., Roda, J.: Teaching 'Soft' Skills in Software Engineering, Global Engineering Education Conference, 2011, pp. 630–637.
p25	Pinkowska, M. and Lent, B.: Evaluation of Scientific and Practice Approaches to Soft Skills Requirements in the ICT Project Management, in IBIMA Business Review Journal, 2011, vol. 2011, pp. 1–12.
p26	Pinkowska, M., Lent, B., Keretho, S.: Process based identification of software project manager soft skills, in 2011 Eighth International Joint Conference on Computer Science and Software Engineering (JCSSE), 2011, pp. 343–348.
p27	Vale, L., Bessa, A., Vasconcelos, P.: The Importance of Professional Quality of Requirements Analysts for Success of Software Development Projects: A Study to Identify the Most Relevant Skills, in 25th Brazilian Symposium on Software Engineering, 2011, pp. 253–262.
p28	Ahmed, F.: Software Requirements Engineer: An Empirical Study about Non-Technical Skills, Journal of Software, Vol. 7, No. 2, pp. 389–397, Feb. 2012.
p29	Ahmed, F., Capretz, L. F., Bouktif, S., Campbell, P.: Soft skills requirements in software development jobs: a cross-cultural empirical study, Journal of Systems and Information Technology, Vol. 14, No. 1, pp. 58–81, 2012.
p30	Ahmed, F., Capretz, L. F., Campbell, P.: Evaluating the Demand for Soft Skills in Software Development, IT Professional, 14, 1, pp. 44–49, 2012.
p31	Litecky, C., Igou, A. J., Aken, A.: Skills in the management oriented IS and enterprise system job markets, in 50th Annual Conference on Computers and People Research, 2012, pp. 35–43.
p32	Thurner V., Böttcher, A.: Expectations and Deficiencies in Soft Skills. Evaluating student competencies in Software Engineering education, in 2012 IEEE Global Engineering Education Conference (EDUCON), 2012, pp. 1–7.
p33	Yu, L., Xin, X., Liu, C., Sheng, B.: Using Grounded Theory to Understand Testing Engineers' Soft Skills of Third-Party Software Testing Centers, in 3rd International Conference on Software Engineering and Service Science, 2012, pp. 403–406.
p34	Ahmed, F., Capretz, L. F., Bouktif, S., Campbell, P.: Soft Skills and Software Development: A Reflection from Software Industry, International Journal of Information Processing and Management, Vol. 4, No. 3, pp. 171-191, 2013.

Ref.	Bibliographic data
p35	Herrmann, A.: Requirements Engineering in Practice. There is no Requirements Engineer Position, in 19th International Working Conference, REFSQ 2013, 2013, pp. 347–361.
p36	Matturro, G.: Soft skills in software engineering: A study of its demand by software companies in Uruguay," in 2013 IEEE/ACM 6th International Workshop on Cooperative and Human Aspects of Software Engineering (CHASE), 2013, pp. 133–136.
p37	Bender, L., Walia, G., Fagerholm, F., Pagels, M., Nygard, K., Münch, J.: Measurement of the Non-Technical Skills of Software Professionals: An Empirical Investigation, in 26th International Conference on Software Engineering & Knowledge Engineering (SEKE 2014), 2014, pp. 478–483.
p38	Sedelmaier Y., Landes, D.: Software Engineering Body of Skills (SWEBOS), in 2014 IEEE Global Engineering Education Conference (EDUCON), 2014, no. April, pp. 395-401.
p39	Matturro, G., Raschetti, F., Fontan, C.: Soft Skills in Software Development Teams. A Survey of the Points of View of Team Leaders and Team Members, in 2015 IEEE/ACM 8th International Workshop on Cooperative and Human Aspects of Software Engineering, 2015, pp. 101–104.
p40	Bootla, P., Rojanapornpun, O., Mongkolnam, P.: Necessary Skills and Attitudes for Development Team Members in Scrum. Thai Experts' and Practitioners's Perspectives, in 12th International Joint Conference on Computer Science and Software Engineering (JCSSE), 2015, pp. 184–189.
p41	Gupta, R., Manikreddy, P., GV, A.: Challenges in Adapting Agile Testing in a Legacy Product, in 11th International Conference on Global Software Engineering (ICGSE), 2016, pp. 104-108.
p42	Pieterse, V., van Eekelen, M: Which Are Harder? Soft Skills or Hard Skills?, In: Gruner S. (eds) ICT Education. SACLA 2016. Communications in Computer and Information Science, vol 642, Springer, pp. 160-167.
p43	Jia, J., Chen, Z., Du, X.: Understanding Soft Skills Requirements for Mobile Applications Developers, 2017 IEEE International Conference on Computational Science and Engineering (CSE) and IEEE International Conference on Embedded and Ubiquitous Computing (EUC), 2017, pp. 108-115.
p44	Daneva, M., Wang C., Hoener, P.: What the Job Market Wants from Requirements Engineers? An Empirical Analysis of Online Job Ads from the Netherlands, 2017 ACM/IEEE International Symposium on Empirical Software Engineering and Measurement (ESEM), Toronto, ON, 2017, pp. 448-453.

Table 4: Bibliographic data of selected papers

4.3 Answer to Research Question 1

As stated in sub-section 3.1, RQ1 is: What are the soft skills considered relevant to the practice of software engineering?

To answer this question, we extracted the skills mentioned in each paper as explained in sub-section 3.4 and grouped them in categories as explained in sub-section 3.5.

The different named skills included in each category are as follow, ordered alphabetically by category name:

- **Analytical skills:** analytical skills, analysis capacity, strong analytical skills, capacity of analysis, analytical thinking, capacidade de análise, analytical, abstract and cross-linked thinking, analytical and conceptual thinking, capacity for analysis and synthesis.
- **Autonomy:** autonomy, independence, ability to work independently, ability to work in an autonomous way, autonomy/independence, self-management, autonomia, autonomy and self-reliance, independent, working independently.
- **Change management:** change management, capacity to adapt to varying situations, open and adaptable to changes, ability to deal with ambiguity and change, capacity to adapt to changes, facilidade de adaptação a mudanças, adapting and responding to change, dealing with change.
- **Commitment/Responsibility:** commitment, compromise skills, responsibility, sense of responsibility, ability to work thoroughly and handle responsibilities carefully, willingness to assume personal responsibility.
- **Communication skills (oral / written):** communication skills, interpersonal communications, verbal communication skills, communication, ability to communicate at multiple levels, conversation skills, word power and writing proficiency, written and oral communication, oral and written communication in mother tongue, oral and written communication, oral and writing skills, facilidade de comunicação oral/escrita, written communications, exhibit several communication styles, face to face communication.
- **Conflict management:** conflict management, conflict resolution, handles conflict maturely, capacity to resolve conflicts, conflict prevention, recognition and resolution skills, dealing with conflict, capacidade para resolver conflitos, ability to resolve conflicts constructively, managing conflicts.
- **Creativity:** creativity, creative thinking.
- **Critical thinking:** critical thinking, pensamento critico, thinking (logical, creative, critical) skills.
- **Customer orientation:** customer orientation, posess a "be the customer" mentality, customer-oriented, orientation to customer needs, orientação para as necessidades do cliente, ability to work closely with users and maintain positive user or client relationship, responds to and anticipates clients/customers' goals.
- **Decision-making:** decision making, acting, valuing, thinking and deciding skills, judgment and decision-making, to have the ability to make critical decisions under pressure, capacity to judge, capacidade de julgamento.
- **Ethics:** ethics, ethical commitment, work ethics, ethical and professional moral, ethical behaviour skills, integrity/honesty/ethics, high ethical values and moral courage, behave according to social and ethical norms.
- **Fast learner:** fast learner, fast learning.
- **Flexibility:** flexibility.
- **Initiative:** initiative, taking initiative skills, proatividade, idea initiation skills, proactive behaviour, initiative and enterprise, proactivity.

- **Innovation:** innovation, capacity to innovate, innovative/creative mind, capacidade para inovar, innovative.
- **Interpersonal skills:** interpersonal skills.
- **Leadership:** leadership, leading and supervising.
- **Listening skills:** active listening skills, listening skills, active listener, capacity to listen, capacidade para ouvir.
- **Methodical:** methodic, capacity for methodical work, capacidade metódica.
- **Motivation:** motivation, motivation to work, self-motivation.
- **Negotiation skills:** negotiation skills, negotiates to arrive at a consensus or compromise, negotiating, negotiation/consensus-building.
- **Organizational/Planning skills:** organizational skills, ability to plan, organize, and lead projects, being organized, organization skills, planning, organization and planning, work and task planning, planning and organization, senso de organização, planning and organizing, sense of organization, management and planning.
- **Presentation skills:** presentation skills, delivering presentations, rhetoric, oratory and presentation proficiency, presenting and communicating information.
- **Problem solving skills:** problem solving skills, problem solving process, strong problem-solving skills, ability to solve problems in a self-directed fashion, even without external push.
- **Results orientation:** results orientation, results-oriented, drive for results, be results oriented, orientação para resultados, achievement orientation skills, delivering results and meeting customer expectations.
- **Stress management:** stress management, ability to withstand stress without losing control, deal well with risk and stress, tolerância à pressão, stress and workload management, stress handling, pressure tolerance, ability to work calmly and efficiently, even under time pressure or occupational stress, coping with pressure and setbacks, work under stress skills, withstanding pressure.
- **Team management:** team management, team cohesion management skills.
- **Team work:** team work, teamwork, ability to work collaboratively in a team project environment, team player, working in teams, participates as an effective member of a team, capacity for teamwork, ability to cooperate with others in a team, working in teams.
- **Time management:** time management, scheduling skills, time and self-management, ability to plan the time realistically, of setting up schedules, and of completing tasks in an organized manner.
- **Willingness to learn:** willingness to learn, motivation to learn, striving for life-long learning, eagerness to learn, willingness and ability to become acquainted with novel subjects and areas over their complete professional career in a self-directed manner, active learning, lifelong learning.

After grouping the soft skills, we counted how many times the skills in each category are mentioned in the selected papers, as shown in Table 5. Column "%"

indicates the percentage of the selected papers that mention a soft skill included in the respective category.

Soft skill	Freq.	%
Communication skills	40	91
Team work	30	68
Analytical skills	24	55
Organizational/Planning skills	24	55
Interpersonal skills	23	52
Leadership	21	48
Problem-solving skills	21	48
Autonomy	19	43
Decision-making	15	34
Initiative	14	32
Conflict management	14	32
Change management	13	30
Commitment/Responsibility	13	30
Stress management	13	30
Customer orientation	12	27
Flexibility	12	27
Ethics	11	25
Results orientation	11	25
Time management	11	25
Innovation	10	23
Presentation skills	10	23
Creativity	9	20
Critical thinking	9	20
Negotiation skills	9	20
Listening skills	8	18
Motivation	8	18
Willingness to learn	8	18
Fast learner	7	16
Team management	5	11
Methodical	4	9

Table 5: Main categories of soft skills and number of times they appear mentioned in the selected papers

We also found many other soft skills that appear mentioned just one or two times in the selected studies. What follows is a partial list of these other soft skills: administration skills, appearance, ability to understand diversity, ability to visualize/conceptualize, ability to apply knowledge, ability to multitask, ability to give and receive constructive criticism, being persistent, business skills, coaching, conducting investigations, cooperates with people with different personalities, race or gender, courage, entrepreneurship, credibility, interviewing skills, role playing skills, moderation, efficiency, sales, diplomacy, professionalism, follow directions, setting

and managing expectations, minuteness, trustworthiness, patient, prediction, political savvy, managing power, environmental sensibility, openness, punctuality, rapport building, reliability, social graces, understand business culture, passionate, willingness to travel, positive attitude, coding habit.

4.4 Answer to Research Question 2

As stated in sub-section 3.1, RQ2 is: What are the data sources or research methods used to identify those soft skills?

Table 6 shows the different data collection methods reported as used in the selected studies, and the frequency of use.

Research/data collection method	Studies	%
Job advertisings	17	39
Survey (online or by e-mail)	13	29
Literature review (no systematic)	12	27
Interviews	6	14
Focus groups	2	4
Experiment	1	2

Table 6: Data collection methods used in the selected studies

Several papers report the use of more than one of these methods to collect data; that is why column "%" does not sum up 100. For example, in [p37], the authors report the use of literature reviews and of focus groups consisted of employers, software engineering and computer science industrial professionals and instructors. Another example is [p3], which reports the use of site interviews, focus groups, and a web-based survey as data collection methods.

4.5 Answer to Research Question 3

As stated in sub-section 3.1, RQ3 is: How are the identified soft skills defined or characterized?

Only four of the selected papers present a definition of some soft skills; they are [p20], [p28], [p30], and [p43]. Those definitions taken from those papers are shown in Table 7.

Soft skill category	Definition
Communication skills	Communicate orally and writtenly in simple, concise, unambiguous, and easily understood way [p20]. The set of skills that enables a person to convey information so that it is received and understood [p28]. The ability to convey information so that it is well received and understood [p30]. The ability to communicate effectively with others [p43].
Conflict management	The ability to solve conflicts of interest in work situations [p20].

Soft skill category	Definition
Customer orientation	The ability to identify and meet the needs of its customers [p20].
Team work	The ability of an individual who is good at working closely with other people [p28]. The ability to work effectively in a team environment and contribute toward the desired goal [p30]. The ability to cooperate with other teammates during teamwork [p43].
Analytical skills	The ability to understand and explain each part of a whole, to know better than nature, functions, causes, among others [p20]. The ability to break a situation down into its component parts, recognize what needs to be done and plan a suitable course of action in a step-by-step way [p28]. The ability to think logically, analyse and solve problems [p43].
Organizational/Planning skills	The ability to sort, prioritize and control the execution of their tasks according to plan, and the resources under their responsibility [p20]. The ability of an individual to assess and prioritize tasks and ensure that they are completed in a timely manner [p28]. The ability to efficiently manage various tasks and to remain on schedule without wasting resources [p30]. The ability to make people work efficiently [p43].
Interpersonal skills	The person's ability to behave in ways that increase the probability of achieving the desired outcomes [p28]. The ability to deal with other people through social communication and interactions under favourable and inauspicious conditions [p30].
Problem-solving skills	The ability to evaluate a situation and to identify an appropriate solution that meets the customers' needs [p28]. The ability to understand, articulate, and solve complex problems [p30]. The ability to think logically, analyse and solve problems [p43].
Autonomy	The capacity to govern themselves by their own means [p20]. The individual's capability to operate with a reduced level of supervision to plan and successfully complete tasks independently [p28]. The ability to carry out tasks with minimal supervision [p30]. The ability to complete work independently [p43].

Soft skill category	Definition
Decision-making	The ability to judge alternatives and take appropriate decisions [p20]. The ability to make sensible decisions based on available information [p30].
Initiative	The ability to propose and / or take any action without the need for others to come to ask or say [p20]. The ability to be active and optimistic to meet challenging work [p43].
Change management	The ability to adapt and work effectively with different situations and face of change [p20]. The ability of an individual to accept changes in the carrying out of tasks without showing resistance [p28]. The ability to accept and adapt to changes when carrying out a task without showing resistance [p30].
Commitment/Responsibility	To be responsible for the work [p43].
Ethics	The ability to follow a set of rules and precepts of value, order, and morality [p20].
Results orientation	The ability to achieve and/or exceed sales goals and/or objectives [p20].
Innovation	The ability to identify and create new ideas and opportunities [p20]. The ability to produce or propose imaginative and practical solutions to business problems [p28]. The ability to come up with new and creative solutions [p30]. To have creative thinking to put forward new ideas [p43].
Critical thinking	The ability to determine carefully and deliberately accepted, refutation or suspension of the trial about a particular piece of information [p20].
Listening skills	The capacity to consider what the interlocutors are reporting [p20].
Fast learner	The ability to adapt to new tasks, roles, or challenges effectively and with ease [p28]. The ability to learn new concepts, methodologies, and technologies in a comparatively short timeframe [p30]. To have interest in learning and have the ability of self-learning in short time [p43].
Methodical	The ability to use a set of steps, neatly arranged, set by methods (techniques) to solve a particular issue or problem [p20].

Table 7: Definitions of some soft skills taken from selected papers

The selected papers did not include any definition about the following categories of soft skills: Creativity, Flexibility, Leadership, Motivation, Negotiation skills, Presentation skills, Stress management, Team management, Time management, and Willingness to learn.

5 Discussion

The primary purpose of the present mapping study was to identify existing research on soft skills in software engineering to identify what soft skills are considered associated to the practice of software engineering. After applying an explicit mapping protocol, 44 papers were finally selected for further analysis and the lists of the soft skills mentioned in them were extracted and grouped in 30 categories, as shown in Table 5.

To create those categories, we followed the procedure describe in sub-section 3.5 and thus, it is debatable that they represent distinct and independent soft skills. In fact, we recognize that some overlap may exist between some categories.

For example, "presentation skills" (the skills needed to deliver an effective presentation to a variety of audiences) requires "organizational skills" to prepare and organize what to deliver in the presentation, "interpersonal skills" to create empathy with the audience, "decision-making skills" to decide what material to include in the presentation, and "communication skills" to adequately transmit what is intended to present. Similarly, conflict management require negotiation and problem-solving skills as well as oral communication and listening skills.

In aggregating the skills into those distinct categories, we wanted to outline a list of discrete soft skills in order to advance in the study of their characteristics and their relationships to the practice of software engineering. Other disciplines besides software engineering, such as psychology, sociology, and human resource management, can contribute to better define or conceptualize the set of soft skills and shed light on their relevance and influence in software engineering practice.

An analysis of the data collection and research methods used in the selected studies indicates that they rely mostly on job advertisings, followed by surveys to professionals and practitioners, as shown in Table 6. Job ads, published in newspapers or in job advertisements portals, are one of the preferred ways software companies use to advertise job positions when they need to recruit new talent. These ads should reflect what the industry asks for job positions in software engineering.

The data in Table 6 reveal that the primary studies included in the mapping have mainly taken the first research approach described in the Introduction, that is, the elicitation of lists of discrete skills considered soft skills from relevant stakeholders [Batteson, 16].

On the other hand, Clarkson mentions that the tasks that technical people carry out fall into three rough groupings: those done primarily as individuals, those done primarily with other people and those done primarily as leaders of a team. Each grouping gives rise to a different type of interaction and thus a different set of soft skills [Clarkson, 01].

In our opinion, here is where our mapping study shows a gap in existing research that establishes the need for more primary studies to move from collecting lists of soft skills to studying what different sets of soft skills are required to each grouping of

tasks during software projects, and their incidence in the general practice of software engineering.

Thus, we consider the results of this mapping study to be of value for graduate students and researchers interested in the human aspects of software engineering. Our results can be taken as a starting point to frame an investigation on the subject within its general context, such as a prior analysis of the state of the art (a fundamental part of the process of preparing any academic work), and to plan and develop new studies to further determine the impact that those skills have on main drivers of software project success, such as teamwork, interpersonal communication, decision making and problem solving.

In the Introduction we argued that the results obtained are also relevant to Human Resource managers in software development companies and team leaders of software development projects, and to curriculum designers in careers related to software development and information technology.

As stated above, the main data collection method used in the selected studies was job advertisings published in newspapers and in job portals. What those ads reflect is what software companies ask for to new hires, but there is no indication of whether or how those skills are assessed in hiring decisions or evaluated later on, while people are working for the company.

If we assume that companies do really assess those skills at hiring time or they periodically do so later, then those responsible for recruitment and selection can use the results of this study to determine what kind of soft skills are demanded by peer organizations, and take them into consideration along with other organizational aspects such as organizational culture, characteristics of the software development projects they usually run, and the values and skills of other members of the organization and their projects teams.

On the other hand, it seems reasonable to think that any software project manager or team leader will prefer team members that are able to work harmoniously in the team, make decision and solve problems, negotiate and manage conflicts successfully, communicate well and establish good interpersonal relationships.

Thus, even if we do not make the above assumption, the results of this study are still useful for Human Resource managers and software projects team leaders to be aware of what non-technical skills are usually demanded by the industry and to identify which of them may be suitable for their environment. As argued by Capretz, Ahmed and da Silva, it is impossible to exclude human factors from software engineering experience during software development because software is developed by people and for people [Capretz, 17].

Regarding the usefulness of the results for curriculum designers of study programs related to software development and information systems, Capretz and Ahmed affirm that at present very few programs in software engineering touch on the topics of teamwork and the evaluation of soft skills [Capretz, 18]. According to these authors, it is even difficult to find a university that has a full course on the human aspects of software engineering and consider it unfortunate that the soft skills topics are far from being part of conventional software engineering education.

Here, we can raise a question: if soft skills are a concept so difficult to define, how can they be taught?

From the discussion given in Section 2, although it is hard to have a single, unified definition of the concept of soft skills itself, there are approximations to the notion of soft skills, and there is also agreement on several specific soft skills. In this sense, to Clarkson soft skills are like any other skills. He considers that we can teach the techniques, but individuals must learn the skill by themselves; they must develop familiarity and ease with the techniques, and they must adapt their own behavior to give appropriate responses to new situations [Clarkson, 01]. Under this consideration, one of the challenges is to choose the appropriate teaching or training method that gives an individual the opportunity to develop the new skills, within a context that is close enough to the job he will perform in the labor market. Examples of novel approaches to teaching soft skills are given in [Dell'Aquila, 17] where the authors present and discuss several concrete experiences of educational games and training tools applied to a variety of soft skills, such as negotiation, decision-making, leadership and problem solving.

In Rao's opinion, there must be an effective coordination between academia, students, industry and principals of educational institutions to improve this type of skills among students [Rao, 14], because these skills -in his opinion- improve the employability of professionals. Therefore, knowing what the most demanded soft skills in the practice of software engineering are, is of interest for undergraduate students who will turn to the labor market, and also for graduate professionals seeking to advance their professional careers. In this sense, Richter and Dumke affirm that about 80% of people who fail at work do not fail because of lacking technical skills, but rather because of their inability to relate or communicate well with other people in a team [Richter, 15]. Communication skills and teamwork are the two most often mentioned soft skills, as shown in Table 5.

One final aspect we want to discuss is the finding that only 4 papers present definitions of specific soft skills (Table 7), some of them difficult to interpret and to grasp their meaning (for example, interpersonal skills as in [p28] or critical thinking as in [p20]). To advance in the study of soft skills it will be necessary to better characterize them and use those characterizations in new research to test their value and incidence in the practice of software engineering.

6 Threats to validity

Several threats to validity have been identified for this systematic review.

First, the keywords used in the search strings as alternative names to "soft skills" (sub-section 3.2) may not be all the possible options. In our case, we used the different names found in the literature when writing the background section.

Second, we only accessed the set of databases that were available to us (subsection 3.2). There are other bibliographic databases and therefore we could have missed some important studies about the subject.

Third, because of the lack of a formal and unified definition of what a "soft skill" is, as described in Section 2, it is arguable whether some of the skills reported as "soft" are actually soft skills. In this case, we counted as "soft skills" all the skills mentioned as such in the selected studies.

Finally, the soft skills grouped in the categories presented in section 4 are the most mentioned in the papers included in the mapping. As the main data sources used

in those papers were job ads, surveys and interviews, it is unclear how strong the correlation is between being mentioned in those sources and being of value to the practice of software engineering, a topic that deserves more research.

7 Conclusions and Future Work

In this study, conducted as a systematic mapping of literature, we identified 44 research papers that report empirical studies regarding the topic of "soft skills" in software engineering. The number of studies finally included in the mapping indicates that discussion and research on this topic is relevant to the software engineering community, and that is mainly focused on eliciting lists of discrete skills that are considered soft skills. The results of our study, which followed a predefined mapping protocol, allowed us to answer the three research questions initially posed.

To the first research question (*What are the soft skills considered relevant to the practice of software engineering?*), the 30 soft skills categories constructed represent those most mentioned in relation to the practice of software engineering. Among them, communication skills, team work, analytical skills, organizational skills, and interpersonal skills are mentioned as such in at least half of the reviewed papers.

Regarding our second research question (*What are the data sources or research methods used to identify those soft skills?*), six research or data collection methods were identified as applied by researchers to study this topic. From them, job advertisings and the use of surveys to software engineering practitioners (online or by e-mail) are reported as the two most common.

Regarding our third research question (*How are the identified soft skills defined or characterized?*), we found explicit definitions of only 20 soft skills of the 30 categories identified, some of them some of them confusing and imprecise. This may be indication of how difficult it is to accurately define these skills.

As further work, we are now working with some software companies in Uruguay to investigate, among other things: a) what impact have these soft skills (or its dearth) on software teams performance and on software projects outcomes, b) what soft skills are less developed in the members of their project teams, and c) what actions could be taken to develop those skills, in order to enhance software development teams performance and software projects outcomes.

Another aspect of great concern is the inclusion of the topic of soft skills in the software engineering curriculum at university level. In this sense, we are now also working on a survey among universities in Latin America to determine if, and how, soft skills are taught in study programs related to software engineering, software development, or computer science. Our aim is to create a network or a community of practice of educators and researchers to foster research and teaching of human aspects of software engineering and, in particular, the subject of soft skills.

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