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Industry Expectations of Mechanical Engineering Graduates. A Case Study in Chile*

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The formal introduction of professional skills to the graduation profile of engineering students has highlighted the importance of non-technical skills in engineering programs. However, there is little agreement among academics as to both the extent of knowledge required in particular skills and what is the right mix of the technical and professional skills. These two issues are reviewed in this paper in terms of graduate attributes from the perspective of employers of mechanical engineering graduates. A survey of Chilean industry revealed a significant discrepancy between the desired and actual graduate profiles with almost all attributes rated as relevant but not used frequently or vice versa. Interestingly, the least discrepancy and the least relevance were found for technical skills with particular reference to the design and conduction of experiments. The apparent importance of professional skills over technical skills is discussed in the context of employers' expectations that are not necessarily aligned with current educational programs. It was concluded that instruction in professional skills should be embedded into the technical courses to promote active, reflective and student-centered learning.

Keywords: ABET outcomes; accreditation; case study; engineering education; graduate attributes

1. Introduction

The demands of the engineering profession, rising beyond technical rationality, have motivated a worldwide reform of engineering education [1]. This reform implies a shift from an instruction to a learning paradigm [2–6] with the effect that students are evaluated in terms of learning outcomes rather than the contents of the curriculum. This shift is desirable and has become the cornerstone of the requirements introduced by engineering accreditation agencies (such as the Accreditation Board for Engineering and Technology—ABET, Engineering Council of UK, Engineers Australia and the Engineering Council of South Africa—ECSA) [5]. The revised evaluation criteria for accreditation emphasize the development of professional skills [6], i.e., skills that are not particularly pertinent to the technical content of study, but are important in professional practice. Such skills are often referred to as professional or soft skills.

In this context, finding a balance between technical and professional skills is a critical challenge for engineering schools, particularly in countries such as Chile, as will be discussed in this paper. The issue of professional skills in the engineering curriculum is similar to the more general problem of so-called generic (or transferable) skills in broader higher education.

Traditionally, the emphasis in university programs has been on the development of discipline specific knowledge and skills (disciplinary or vocational skills). However, increasing importance has recently been placed on the development of generic skills [7]. It is now a common practice for undergraduate curricula to be finely balanced between disciplinary knowledge and the more universal generic skills. Such demands come from stakeholders in higher education and, in particular, from the two most interested groups: employers, who wish for the best prepared workers, and students, who wish for the best employment. Interestingly, some authors argue that much of the disciplinary knowledge constitutes 'transient skills', whereas communication, teamwork, leadership and analytical and critical thinking represent more permanent skills [8].

An additional reason for stressing professional skills in undergraduate engineering programs is that an engineer cannot succeed in practice if he or she is

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assessed only on strong technical capabilities [2]. As the range of employment opportunities for engineers expands, it becomes vital to develop soft skills before leaving university, i.e., before graduates enter the job market [3]. There is no doubt that in order to use their technical skills, engineering graduates need to consider market forces, the social and environmental impact of their work, and, at each instance, communicate effectively. This shift of employers' expectations toward a customer-oriented execution of the engineering profession inevitably raises the importance of non-technical skills. In fact, criterion 3 of the current ABET criteria for accrediting engineering programs [4] suggests five technical and six non-technical student outcomes, giving the impression that professional skills outweigh technical skills. Depending on the implementation, the resulting profile of a mechanical engineering graduate might be similar to that of, say, an industrial engineering graduate, giving rise to the question whether striving for such a mix of competences would allow mechanical engineering students to achieve the quality of technical skills expected by the profession.

Although graduates of mechanical engineering can pursue academic careers or get involved in entrepreneurial and other activities, the vast majority usually opts for employment in the industrial sector. For this reason, the design of the study programs is traditionally motivated and aligned to the activities and necessities of the local industrial sector. For example, it is not uncommon to emphasize subjects relevant for automobile or aerospace industry at universities located close to major car or aircraft manufacturers. Examples of how the expectations of local industry can affect the engineering education, in particular how it can contribute to curriculum design, have been discussed in literature for selected universities in Australia [9], Malaysia [10], New Zealand [11], the Palestinian Territories [12], and the United States [13]. However, as new technologies and business models are introduced, along with increasing complexity of engineering projects, coverage of newer topics is required [14] and, consequently, there is no general consensus as to what makes the body of knowledge for mechanical engineering graduates [15]. Industry is also challenging universities to broaden curricula beyond design and scientific inquiry to the greater domain of professional leadership and entrepreneurship [16]. Therefore, the central theme of this paper is to address and assess the optimum combination of technical and professional skills for today's mechanical engineering graduates based on a survey conducted in Chile in 2011.

Many universities around the world claim to imbue various generic skills in their graduates and state policies that should foster their development [17]. The question as to whether these skills can be taught at all has been answered positively, with the notion that active and cooperative teaching techniques seem to be necessary in order to succeed [6]. A few years after the introduction of the revised ABET accreditation criteria it has been confirmed that the change has improved the professional readiness [5, 18] and a positive graduates' perception seem to corroborate it as is shown for chemical engineering graduates of University of Cape Town [19]. However, the learning and teaching approaches used to develop professional skills are still being debated. Some argue that professional skills can be developed as a companion to technical skills by adopting non-traditional teaching methods, for instance, project-based learning [20, 21]. Others opt for a formal introduction of special courses devoted to the soft skills [22]. Although, there is no clear indication as to which approach is more effective, most authors agree that professional skills should be taught within the discipline as an integrated part of the program.

The 2005 study by Martin *et al.* [19] confirmed the importance of both technical skills and communication, teamwork and interpersonal skills in the workplace for successful engineering practice. They pointed out that due to the complex interactions between different skills, especially since the non-technical skills are built on a technical basis, deficiency in the technical arena would affect abilities in those other areas. Several studies have been reported on how to construct individual courses [23], and also on how to evaluate content across the curriculum in relation to the needs of the engineering industry [24] or, in other words, to fulfill the accreditation criteria.

None of the accrediting agencies (including ABET) specifies the degree to which each learning outcome should be mastered by a graduate, whereas the decision of what is the right mixture of the graduate's skills, although it has a strong impact on the design of the curriculum, is not straightforward. A study of the relative perception of educational outcomes in civil engineering revealed that not all ABET educational attributes are considered to have the same level of significance and perhaps should not be stressed equally in an engineering program [25, 26]. Anecdotal evidence also shows that alumni, professionals and employers do not believe that the ABET attributes, in general, reflect all the skills and knowledge required for some mechanical engineering positions, especially at the entry level.

A misplaced emphasis on the individual learning outcomes would inevitably lead to a "competency gap", i.e. the difference between the importance and performance of a particular skill. Meier *et al.* [27] have shown how competency gaps can be evaluated for the non-technical skills. Motivated by closing a particular competency gap, Fisher *et al.* [28] conducted a study of business knowledge and skills necessary for engineering technology graduates at the entry level and after 3–5 years of employment, exposing the discrepancies. In order to promote the development of the desired engineering profile a suitable "dose" of individual competences has to be defined. However, the vast majority of engineering programs face several challenges [29], which make a definition of the "dose" difficult.

The objectives of engineering programs in Chile are essentially different from those in other countries. For example, the origins of engineering education in Europe and the US traditionally emerged from engineering practice, while in Chile the development of engineering education has been strongly influenced by the adoption of the free market approach and the introduction of a neoliberal model [30]. As a consequence, manufacturing, technology and innovation declined [31], decreasing the impact of mechanical engineering on the economy. Whereas in a trade-based economy, most engineers are employed in sales, consulting or allied service-oriented companies, only a few remain employed in traditional manufacturing industries. This trend has possibly affected expectations of the labor market towards mechanical engineering graduates. The present study aims at reviewing these expectations in the context of graduate attributes provided by the mechanical engineering program at Pontificia Universidad Católica de Chile (PUC), currently accredited by ABET. The program takes twelve semesters to obtain the professional degree in mechanical engineering along with the academic degree of licentiate. The program is structured with thirteen basic science courses, six engineering science courses, fourteen compulsory and eight elective courses specific to mechanical engineering, as well as eight general education courses. This structure is typical for mechanical engineering programs that had been offered to recent graduates by the twelve universities that offer mechanical engineering degree in Chile.

2. Methodology

Data were collected by directly asking the industrial sector about their perceptions regarding the technical and professional skills of mechanical engineering graduates. In order to evaluate the desired and actual balance between the different skills of the mechanical engineering graduates, a semi-quantitative approach was adopted. The information obtained was then analyzed to identify the desired graduate's profile and compare it with the frequency profile, as well as the actual preparation profile of the graduates.

A semi-structured questionnaire was given out to employers of mechanical engineering graduates of various engineering specializations in Chile. The questionnaire consisted of two parts. one close-ended and the other open-ended. The close-ended part focused on relevance, frequency of use and the actual preparation of mechanical engineering graduates with respect to sixteen attributes listed in Table 1, whereas the questions and their possible answers are listed in Table 2. Questions Q1 and Q2 were designed to find the relevance of each attribute and the frequency of its use in a particular company. Question Q3 was intended to measure the preparation of the graduates, i.e., how well were the required competencies in the workplace matched by the graduates.

The attributes in Table 1 do not follow one particular set of accreditation requirements but are based on those of various accreditation bodies. The technical attributes cover issues related to technical competencies and the preparation of the graduates for design, data analysis, problem solving, experimentation and specialized software awareness. The professional skills explore issues of impact, professional and ethical aspect of engineering work, general computer skills, communication and teamwork.

Demographic information was collected to perform comprehensive statistical analysis and also to check for biases of the results. This information included the engineering specialty of the company, the initial salary offered to mechanical engineers, the number of engineers employed, the gender of the respondent, the position of the respondent in the organization. In addition, three open-ended questions were asked to obtain general views on engineering graduates in the Chilean reality and to elicit the respondent's own knowledge and perceptions about the topic [32].

- In your opinion, what are the strengths and weaknesses of mechanical engineers in Chile?
- Which technical content would you recommend to be emphasized more in the education of mechanical engineers?
- If you had the opportunity to create the study program of mechanical engineering, what would be the most important characteristics that you would strive for?

Responses to the open-ended questions were analyzed using a thematic analysis [33]. The responses were read multiple times by all the researchers involved to create an emerging thematic scheme for each question. The analysis was data driven

Table 1. List and classification of the evaluated graduate attributes

<table>
<tr><th>No.</th><th>Type of skills</th><th>Evaluated attribute</th></tr>
<tr><td>1</td><td rowspan="7">Technical (“hard”)</td><td>Apply knowledge of mathematics, science and engineering</td></tr>
<tr><td>2</td><td>Design and conduct experiments</td></tr>
<tr><td>3</td><td>Analyze and interpret data</td></tr>
<tr><td>4</td><td>Find and access information by using appropriate technologies, channels and resources</td></tr>
<tr><td>5</td><td>Design a system, component or process</td></tr>
<tr><td>6</td><td>Identify, formulate and solve engineering problems</td></tr>
<tr><td>7</td><td>Use of professional engineering software</td></tr>
<tr><td>8</td><td rowspan="9">Professional (“soft”)</td><td>Understanding of social impact of engineering work</td></tr>
<tr><td>9</td><td>Consider economic impact of engineering work</td></tr>
<tr><td>10</td><td>Consider environmental impact of engineering work</td></tr>
<tr><td>11</td><td>Knowledge of contemporary issues that affect work</td></tr>
<tr><td>12</td><td>General computer skills</td></tr>
<tr><td>13</td><td>Written communication skills</td></tr>
<tr><td>14</td><td>Oral communication skills</td></tr>
<tr><td>15</td><td>Commitment to professional and ethical responsibility</td></tr>
<tr><td>16</td><td>Function in a team</td></tr>
</table>

Table 2. Questions asked with respect to the graduate attributes listed in Table 1

Question	Values
Q1. In relation to your company/division, which of the attributes in Table 1 do you find relevant for the professional performance of a mechanical engineer?	1– Not relevant 2– Slightly relevant 3– Relevant 4– Extremely relevant
Q2. In your company/division, how often do you use the skills associated with the attributes in Table 1 that pertain to practice by mechanical engineers?	1– Never 2– Occasionally 3– Frequently 4– Always
Q3. In your experience, how do you evaluate the preparation of the recently graduated mechanical engineers?	1– Too little 2– Basic 3– Appropriate 4– Excellent

without the inclusion of initial predefined categories. Emerging codes were created and answers assigned to these categories. After the coding process, the categories were refined and checked. In order to assure that the major themes that emerged in each question were included, the results were reported based on the frequency of the most frequent categories. Finally, relationships were established with the results gathered from the closed ended questions.

The invitation to participate in the survey was extended to 635 companies operating in Chile and employing mechanical engineers between December 2010 and March 2011. First contact was established by telephone, followed by an email directing respondents to a dedicated web platform, designed and programmed especially for the study. With 102 questionnaires filled, the response rate was 16%. The survey responses came from different types of industry, covering the full range of possible employers of mechanical engineering graduates (Fig. 1). The numbers of females and engineers were respectively 9% and 17% of all respondents.

3. Results

Graphical representation of the results obtained is presented in Fig. 2. Whereas Fig. 2(a) shows a

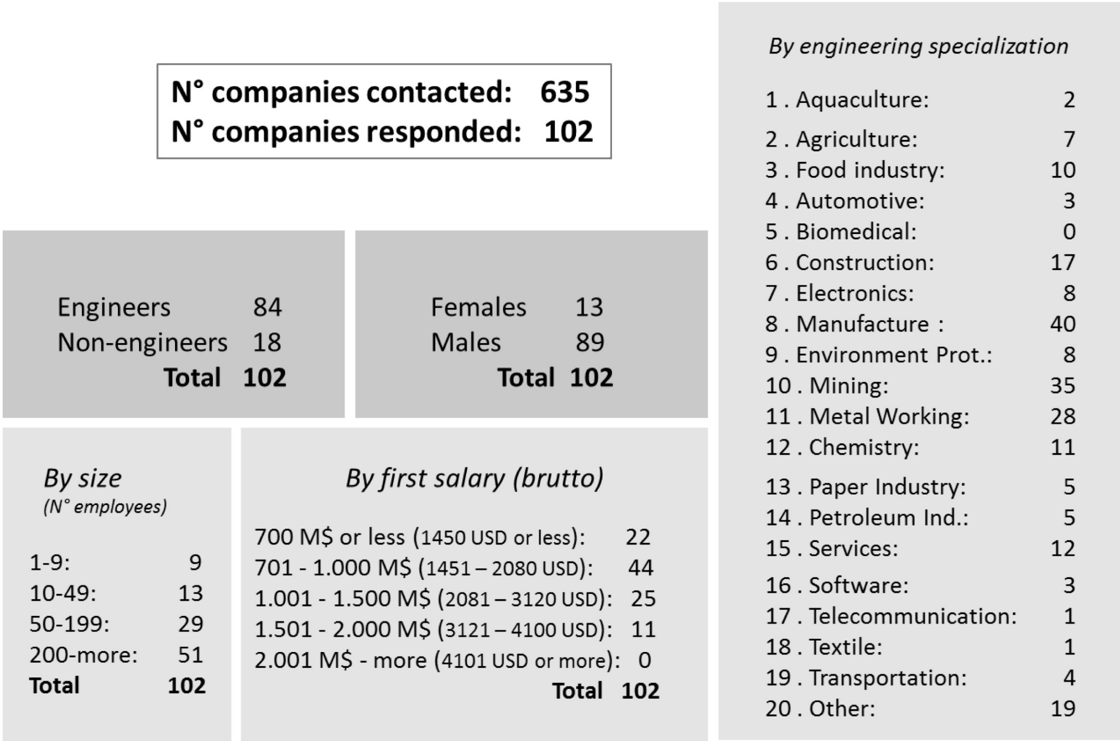

Fig. 1. Summary of statistical information from the survey.

comparison between the relevance and frequency for technical and professional skills, Fig. 2(b) compares relevance and preparation, and Fig. 2(c) illustrates analogous information for preparation and frequency. The mean values obtained for the technical skills (attributes 1 through 7) and for the professional skills (attributes 8 through 16) are 2.95 and 3.15, respectively.

Considering individual attributes, there are significant differences in what industry considers to be relevant skills, the frequency with which they are actually used and the degree to which the graduates had been prepared. For instance, "Oral communication skills" (attribute 14), "Commitment to the profession and ethical responsibility" (attribute 15) as well as "Functioning in a team" (attribute 16) seem very relevant but are used infrequently with "Oral communication skills" showing the biggest relevance-frequency of use discrepancy. On the other hand, "Use of professional engineering software" (attribute 7), rated as minimally relevant, appears to be always in use.

The analysis shows that the preparation is lower than relevance in almost all skills. Except for the ability to "Design and conduct experiments" (attribute 2) and the "Understanding of social impact of engineering work" (attribute 8) the preparation of students was perceived to be inferior to the associated relevance of the skills. There are two more skills in which preparation is considered to be more or less equal. "Find and access information by using appropriate technologies, channels and resources" (attribute 4) and "Knowledge of contemporary issues that affect work" (attribute 11). On average, preparation for technical skills is rated 0.39 and for professional skills 0.95 lower than the respective relevance. In some of the professional skills (attributes 9, 10, 12–16) preparation is considered to be particularly low.

There is also no discernable fit between the preparation of the graduates and what industry considers being frequently used skills. The average difference for the two ratings is 0.41 for technical skills and 0.72 for professional skills. The preparation exceeds or is more or less equal to the frequency of use only for "Apply knowledge of mathematics, science and engineering" (attribute 1), "Design and conduct experiments" (attribute 2), "Find and access information by using appropriate technologies, channels and resources" (attribute 4), and "Understanding of social impact of engineering work" (attribute 8). For all the other attributes there is a gap for both technical and an even larger gap, for professional skills with the largest discrepancy for "Knowledge of contemporary issues related to work" (attribute 11), "General computer skills" (attribute 12), and "Written communication skills" (attribute 13).

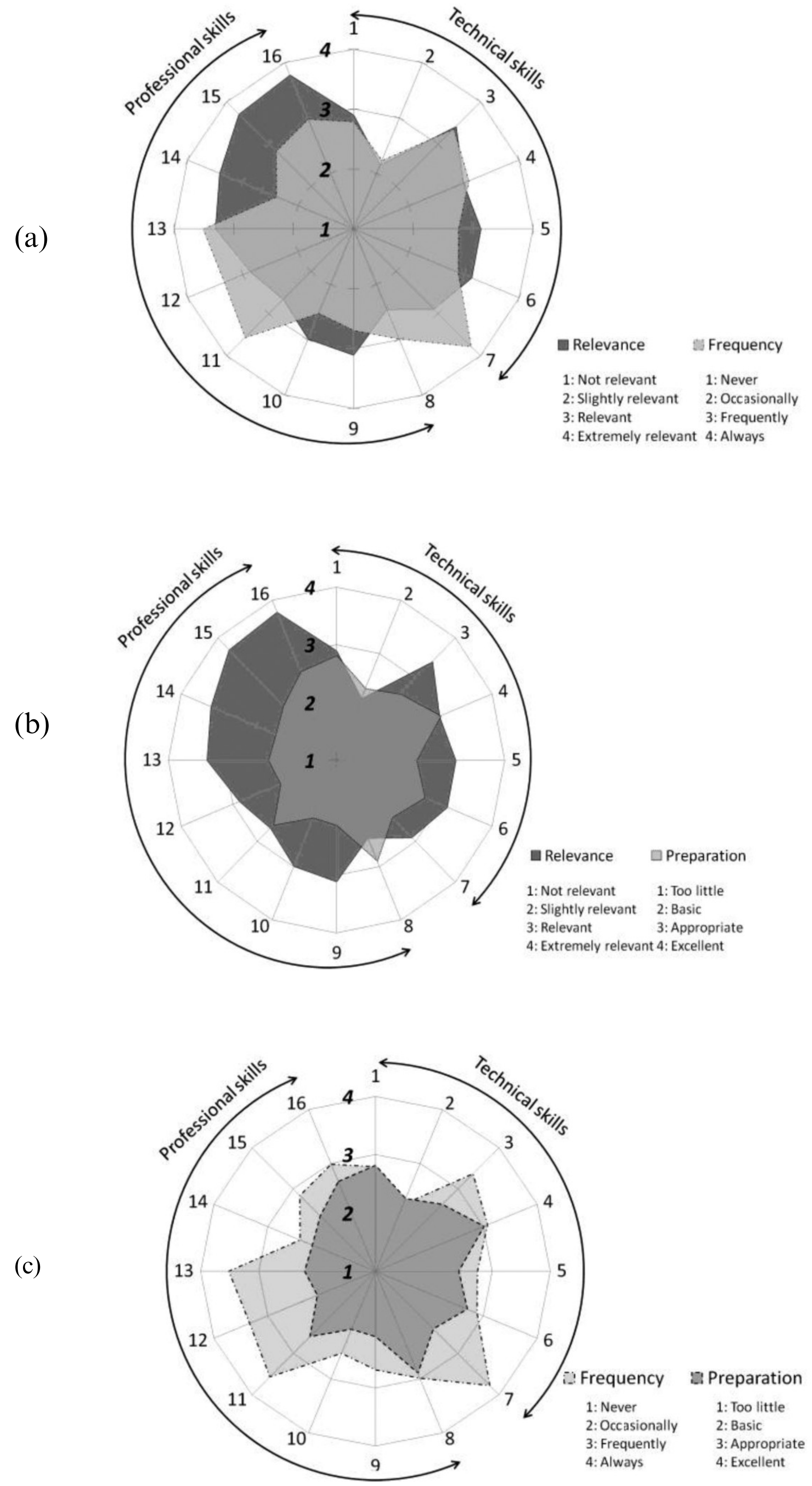

Fig. 2. Evaluation of the sixteen graduate attributes with respect to their relevance, frequency of use and quality of preparation. (a) comparison of relevance with frequency of use, (b) comparison of relevance with preparation and (c) preparation with frequency of use.

In summary, there is a slight positive correlation between the relevance and frequency of use of skills, but no correlation with the preparation as shown in Fig. 3.

In order to evaluate how different types of industry assess the relevance of attributes, the companies were divided into seven groups. There are almost no differences in answers in relation to the relevance of the attributes. Only slight differences were detected for "Design a system, component or process" (attribute 5), "Use of professional engineering software" (attribute 7) and "Consider environmental impact of engineering work" (attribute 10), as shown in Fig. 4. Interestingly, the design attribute (attribute 5) is the most appreciated by agro-food, followed by environmental and chemical companies and service providers.

The "Use of professional engineering software" (attribute 7) is most recognized in the construction industry and least recognized in services. Not surprisingly, the "Environmental impact of engineering work" (attribute 10) is the most relevant for the environmental and chemical industry, followed, unexpectedly, by service providers. In a country that relies on mining and agriculture a higher concern for the issue could be expected from these industries. The least appreciation for environmental impact is found in manufacturing and metal industries, followed by agro-food.

No significant bias has been found in answers

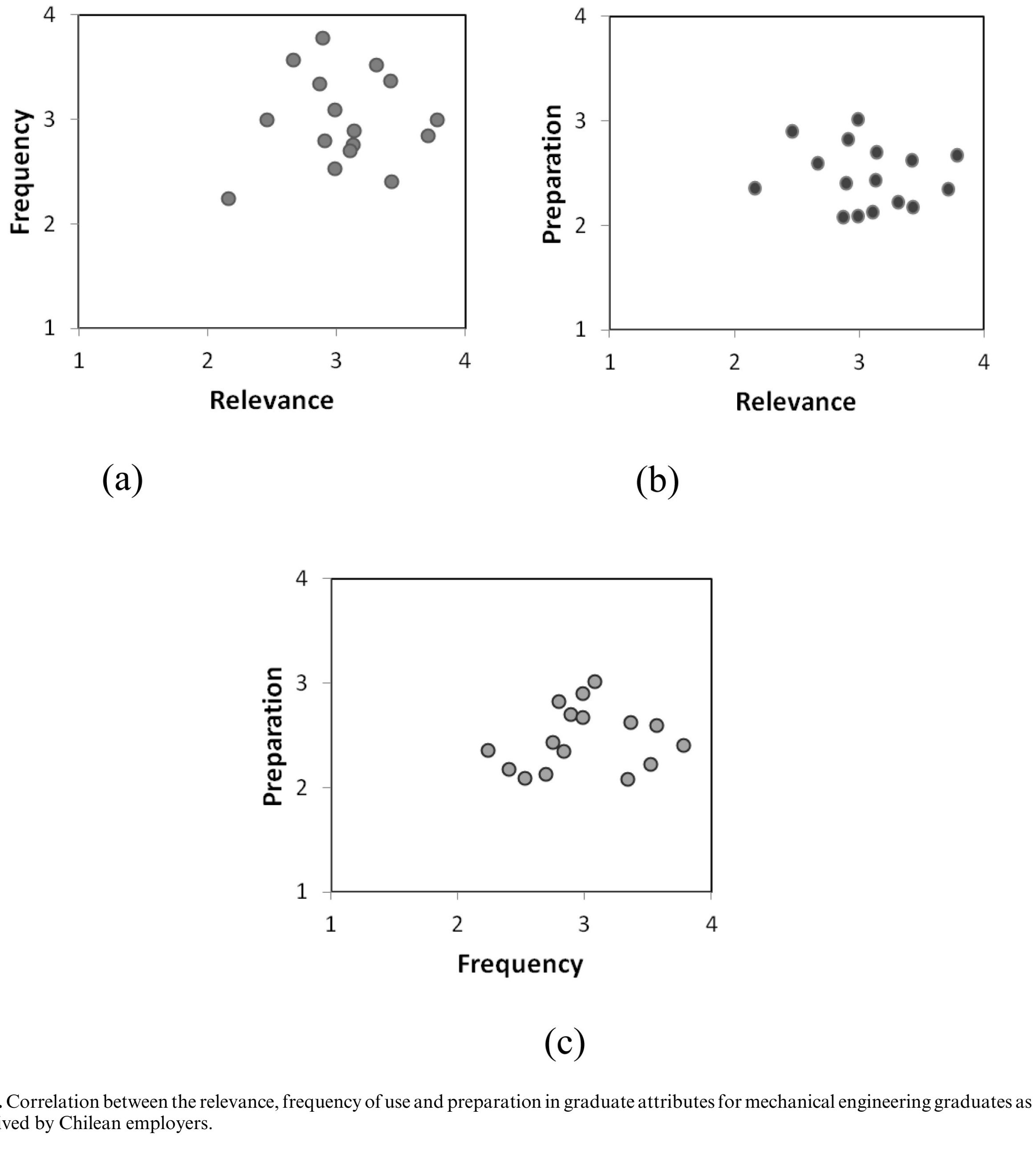

Fig. 3. Correlation between the relevance, frequency of use and preparation in graduate attributes for mechanical engineering graduates as perceived by Chilean employers.

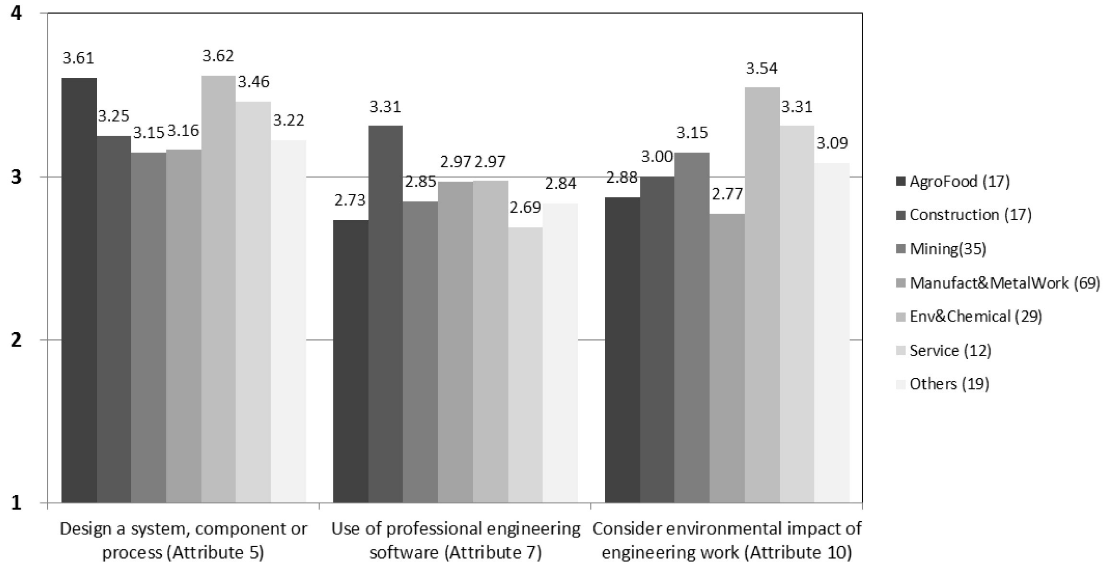

Fig. 4. Survey of relevance of three attributes in different industry groups. The numbers in brackets indicate the number of companies in the group.

provided by different genders and the university from which the respondent's graduated. The educational background (engineer/non-engineer), however, seems to slightly increase the importance of professional skills in the case of non-engineers and increase the positive perception of preparation in the technical skills in the case of engineers.

The frequency of use of technical skills falls systematically with the size of the company, whereas professional skills are equally desired and frequently used by all-sized companies. Employers that offer higher initial salaries prefer to employ graduates with a developed sensitivity to the non-technical aspects of engineering. This is partly reflected by a positive correlation between the initial salary offered and the relevance and frequency of use of the social, economic and environmental impact of engineering work as well as oral communication skills.

The results elicited by the open-ended questions, in which respondent elaborated their own answer, are displayed below. Analysis of the open-ended questions revealed the following important strengths and weaknesses of mechanical engineering graduates (appearing in three responses or more):

Strengths

- Theoretical knowledge
- Capacity to continuously improve own skills
- Mastery of general computer skills

Weaknesses

(a) Preparation of reports
(b) Ability to draw conclusions
(c) Presentation and defence of own ideas
(d) Practical experience, i.e. ability to relate to engineering practice
(e) Leadership and team management
(f) Use of foreign languages
(g) Passion for the profession.

Consistent with the results obtained from analysis of the closed-type questions, most of the weaknesses are related to interpersonal skills. The lack of proficiency to communicate ideas effectively in writing (a, b) and orally (c), the lack of capacity to collaborate and lead groups (e) correspond with the attributes 13, 14 and 15, respectively. An aspect not detected by the closed-type questions is the use of foreign languages (f). The results of the open-ended question regarding the technical content of the mechanical engineering program showed a positive correlation between the engineering activity of a company and the technical content indicated. For instance, mining companies and their suppliers would like to employ graduates who are adept in the mining processes and to the machines employed in mining operations. One respondent noted directly that "the most important competences are defined by objectives of the position occupied by the engineer". This kind of tendency is natural and should only serve for modification of a teaching program when a vast majority of the graduates finds employment in that sector. No specific technical content has been detected that would cross more than two engineering specializations.

The answers to the question regarding the characteristics that should be strived for in a mechanical engineering program most frequently indicated the relevance to engineering practice. The most frequent suggestion for the curriculum was to increase the number and variety of professional practices ("students know the theory of machinery but have never seen it working"), and also to promote practice-oriented thinking at all stages of the curriculum. One responded noted that "knowledge is well conveyed by the universities but one capacity, observed in European and North American engineers, is missing—the ability to work with their own hands when necessary". The second most repeated characteristic was the development and mastery of professional skills, in particular, the management of human resources, teamwork, and the consideration of ethical and social aspects. Finally, the respondents frequently desired a detailed understanding of the function and maintenance of mechanical machines specific to the engineering specialization of the company.

4. Discussion

The discrepancy between the mean evaluation of the relevance of technical and professional skills indicate that, according to the industry, technical skills are less relevant than professional skills. This general discrepancy is consistent with the study of Fisher *et al.* [28] who reported that the most critical areas to be developed in entry level engineers were project management, communications, team skills, business ethics, legal issues and quality management practices. The observation that respondents with non-engineering backgrounds tend to value professional skills over technical skills could be explained by the possibility that the non-engineers responding to the survey would be involved in the process of contracting new engineers (human resources in larger companies) but had no real experience of working with them. The bias toward professional skills in such a situation would be natural. The averages for frequency of use produce the same value, 2.99, for both technical and professional skills, suggesting that, in practice, the two types of skills are balanced.

However, the discrepancy between what industry considers relevant and the frequently used skills suggests that industry would prefer to have students prepared best in skills that are not necessarily the most frequently used. It could be explained by a circumstance in which some skills, in practice, are more critical than others or by taking some of the skills simply for granted. For instance, in effect, an engineer that does not communicate properly with the clients might lose his job, but he would not have got it in the first place if he did not know how to perform a specific calculation.

The general mismatch between the relevance of attributes and the preparation of graduates might indicate a competency gap in the educational programs. Although the School of Engineering at Pontificia Universidad Católica de Chile gives valid ABET and national accreditations, it should be noted that the survey concerned all mechanical engineering graduates working in Chile, irrespective of their institution of training. Therefore, no discussion of how the particular educational program correlates with the results obtained will be conducted.

However, the relevance–preparation discrepancy might also indicate overstated expectations of the employers. In particular, the highest mismatch found for professional skills could be explained by an observation that these skills are linked to general experience and maturity and, although they could be developed before the engineer begins his or her professional life, they will inevitably improve with time and practice. This result is consistent with the findings of Baytieh and Naja [34]. The relevance–preparation discrepancy was found to vary for different industries. This observation could be explained by the relative perception within a particular branch of industry, rather than deficiencies in the curriculum, as all industries recruit from the same pool of graduates, which allows interpretation of the discrepancy.

The least valued attribute is the "Ability to design and conduct experiments" (attribute 2). This could be due to the nonchalant attitude of Chilean companies towards R&D activities. Since the adoption of a free trade policy by Chile in the 1970s, local manufacturing has declined and more products have been systematically imported. The free trade policy combined with the culture of lack of confidence in national technological products has systematically discouraged local manufacturers from developing or even improving their own goods [31]. Even when a particular company is involved in manufacturing and/or processing it normally acquires all of its equipment, and often its expertise, from abroad. That would explain the low evaluation and appreciation of the relevance and frequency of use of the ability to design and conduct experiments.

The general bias towards professional skills is then related to the fact that the majority of graduates are employed in sales and services. Consequently, the importance of skills associated with these activities has diminished. However, the influence of the Organization for Economic Co-operation and Development (OECD), of which Chile is a recent member [35, 36], is now becoming apparent and the importance of innovation—especially technological innovation—has been raised, reviving the traditional role of mechanical engineers. Therefore, we could expect a rise in the appreciation and relevance of this attribute in the future.

The least appreciation of the design attribute (attribute 5) was found for mining, manufacturing and metal work and construction industries. All of these industries are strong contributors to the countries' national product and thus provide the majority of employment, but these categories of industries are not primarily involved in designing any equipment, device or system as they produce artifacts, elements and other goods using equipment provided by third parties.

All the results of the open-ended questions corroborate the necessity of stressing the development of professional skills by mechanical engineering students. This part of the survey revealed an aspect not detected by the closed-type questions, which is the necessity of using foreign languages. This aspect is normally not included in the requirements for accreditation because it is supposed that graduates exercise their profession in their country of origin. However, in a country where most of the industrial production is imported, the use of foreign language becomes a necessity.

It should be noted that the findings of this study were based on a survey with a limited number of respondents. Although the response rate was reasonable it would be hard to extend the study further due to the limited size of the private sector in Chile. For the possible extension of the study, inclusion of focus groups should be considered.

5. Conclusions

This paper has reported a questionnaire-based study to evaluate the graduate attributes that are most desired by Chilean employers of mechanical engineering graduates. In the opinion of Chilean employers, the overall relevance of professional skills outweighs the relevance of technical skills. There is an unexpected difference between what industry considers relevant in terms of attributes and what it regards as the frequently used attributes. This observation seems to confirm the challenge experienced by academic staff when designing an educational program. The specific conditions of the development and operation of the local economy may explain the Chilean industries' preference for professional skills over technical skills, as the main economic activities are typically based on trade rather than manufacturing and processing.

In conclusion, employers assess the graduates, and thus the associated educational programs, from their own perspective and naturally expect the newly employed to effectively function in the company immediately. From that perspective, the industry would prefer to employ a graduate who already has a minimum of practical experience in order to eliminate, or substantially minimize, the initial training period. Thus, the graduate should be soundly familiarized with the activities performed by the company prior their graduation. This can only be achieved by exposure to industrial practice/ training with at least two periods of 6–8 weeks each. Increasing the number of hours dedicated to out-of-campus practices would reduce the time needed to deliver the technical competences (provided that the practices focus on it), which, unlike the practical skills, are harder to acquire after graduation.

However, instruction in the professional skills should also be embedded in the technical courses as they are inseparable in current engineering practice. There is a great opportunity for teaching those skills, while at the same time delivering technical content. Furthermore, teaching professional skills within the program also enhances the ability for lifelong learning. The key point here is not to replace one kind of learning with the other (soft instead of technical) but to merge both in a way so that learning is more active, reflective and student-centered.

This study has explored the point of view of the employers but not all graduates will necessarily decide on industrial practice. The curriculum should also accommodate students who plan for an academic career, self-employment or other entrepreneurial activities.

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