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Didactic strategies to strengthen soft skills in the graduate profile of the Industrial Maintenance engineer

Estrategias didácticas para fortalecer las habilidades blandas en el perfil de egreso del ingeniero en Mantenimiento Industrial

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Abstract

Currently, organizations give greater importance to soft skills as part of the profile of those who integrate into their organizations and not only that they have the necessary technical knowledge to develop their jobs. The program of the Industrial Maintenance career is made up of technical, training and administrative subjects, but the latter two are not recognized as important by the enrollment of students. The graduates of the engineering in Industrial Maintenance have a recognized level of hard skills according to what the industry requires, by comments of the same students at the time of entering the labor field, they realize how necessary it represents to have an effective and efficient performance in companies integrated not only with technical knowledge but also with soft skills. The objective of this research isto propose and implement didactic strategies to strengthen soft skills in the graduate profile of the Industrial Maintenance Engineer. It consists of a bibliographic and / or documentary and field research through interviews and surveys to teachers, students and graduates to determine the importance of soft skills in the graduation profile of engineering students in Industrial Maintenance of the Technological University.

Skills, didactic, graduates

Resumen

Actualmente las organizaciones proporcionan mayor importancia a las habilidades blandas como parte del perfil de quienes se integran a sus organizaciones y no solo que cuenten con los conocimientos técnicos necesarios para desarrollar sus trabajos. El programa de la carrera de Mantenimiento Industrial está conformado por materias técnicas, formativas y administrativas, pero a estas dos últimas no se les reconoce como importantes por parte de la matrícula de alumnos. Los egresados de la ingeniería en Mantenimiento Industrial cuentan con un reconocido nivel de habilidades duras acorde a lo que la industria requiere, por comentarios de los mismos alumnos al momento de ingresar al campo laboral, se dan cuenta lo necesario que representa contar con un desempeño eficaz y eficiente en las empresas integrado no solo con el conocimiento técnico sino también con habilidades blandas. El objetivo de la presente investigación es proponer e implementar estrategias didácticas para fortalecer las habilidades blandas en el perfil de egreso del ingeniero en Mantenimiento Industrial. Consiste en una investigación bibliográfica y/o documental y de campo mediante entrevistas y encuestas a docente, alumnos y egresados para determinar la importancia de las habilidades blandas en el perfil de egreso de los alumnos de ingeniería en Mantenimiento Industrial de la Universidad Tecnológica.

Habilidades, Didáctica, Egresados

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Introduction

Nowadays, organizations are more aware of the importance of integrating personnel with transversal skills, that is to say, integral professionals in all aspects, because technical knowledge can be easily substituted by machines, but the human part or soft skills cannot.

Graduates of Industrial Maintenance Engineering have a recognized level of hard skills according to what the industry requires, but according to comments from the students themselves when they enter the labor field, they realize how necessary it is to have an effective and efficient performance in companies to have not only technical knowledge but also soft skills.

Therefore, it is necessary to implement didactic strategies that contribute to the students of Industrial Maintenance Engineering to recognize the importance of soft skills as part of the graduation profile, avoiding or minimizing that they classify the formative and administrative subjects as filler, and that they really value the learning that this type of subjects provide in their professional performance.

The objective is to propose and implement didactic strategies to strengthen the soft skills in the graduate profile of the Industrial Maintenance Engineer, by planning an awareness program that includes not only the formative and administrative subjects, but also the technical subjects where teachers contribute to change the paradigm that only technical or empirical knowledge is required, but also emphasize the importance of the student developing soft skills in the practices that are carried out as part of the subjects, as well as with extracurricular activities.

One general and two specific hypotheses are posed.

General hypothesis: Soft skills are an important part of the graduation profile of Industrial Maintenance Engineering students at the Technological University of Chihuahua.

First specific hypothesis: In order to improve the professional performance of Industrial Maintenance graduates, it is necessary to plan an awareness program about the importance of soft skills.

Second specific hypothesis: It is necessary to implement extracurricular activities to develop the soft skills of Industrial Maintenance students.

The first section addresses the need for professionals to have developed soft skills for an efficient performance in Industry 4.0.

The second section presents the results of the analysis of the subjects that make up the curriculum of the Industrial Maintenance Engineer career at the Technological University of Chihuahua.

In the third section, the student perception of the formative, technical and administrative subjects can be visualized.

The fourth section analyzes the results in relation to the activities to strengthen the learning of soft skills according to the responses of students, teachers and graduates.

Industry 4.0 and soft skills

The concept of soft skills is practically new, it goes hand in hand with the advances in the industrial revolution, so it is necessary to consult publications in relation to the requirements of the profile of personnel who intend to join the labor sector.

Currently with the fourth industrial revolution, companies are looking for employees not only with technical knowledge but also with band skills that allow personnel to make decisions, negotiate, lead work teams, communicate assertively, among other skills. According to Gómez - Gamero (2019, p. 2) "robotization and technological change implies opportunities and increases productivity and demand for jobs that require problem-solving capabilities, abstract and creative thinking, as well as social skills".

The 2020 curriculum of the Industrial Maintenance Engineering program at the Technological University of Chihuahua was consulted to analyze the hours assigned by type of skills (hard or soft). As well as the subject sheets of the different subjects to know the knowledge, learning objectives and competencies, and to determine how they contribute to the development of soft skills.

ISSN 2523-2495

Skills 4.0

Deveci & Nunn (2018) and Holguín et al. (2018), assert that "engineering students are considered weak in soft skills, which should be further developed during their university career and which are requested by employers in today's labor market".

According to (Elena Zepeda-Hurtado et al., 2019) "the main tool for the realization of an engineer's work is knowledge, and the central task is to generate ideas. These knowledge workers add value to the company and its products through their ideas, analysis, judgments, synthesis capacity and designs".

According to Perez (2020, p. 10) universities need to focus "not only on training all members of their community in the basic knowledge of disciplines or work, but also on encouraging the development of multiple skills and competencies, specific to the needs of the technological context, so that, from soft skills such as collaborative work, creativity and critical thinking, graduates are prepared with a vocation for innovation and technological management, from the various areas of knowledge, but with strong support in digital and analytical tools supported in the processing of large volumes of information and technological development".

Nowadays, applying for a job represents a great challenge for graduates, due to the accelerated technological and social advances. According to Gómez (2019, p. 3) "the development of technical as well as soft skills is determinant to join the future jobs of university students with the challenges that arise in a globalized world, educational institutions must direct their efforts for the achievement of these competencies that in the labor world are valued and that students must face upon entry".

The website Ernst & Young Global Limited (2020), based on studies of the World Economic Forum, published in March 2020 an article comparing the most required soft skills in 2005 with the most demanded in 2020. The results are presented in Table 1.

Ranking	2005	2020
1	Complex problem solving	Complex problem solving
2	Coordination with others	Critical thinking
3	Talent management	Creativity
4	Critical thinking	Talent management
5	Negotiation	Coordination with others
6	Quality control	Emotional intelligence
7	Service orientation	Judgment and decision making
8	Judgment and decision making	Service orientation
9	Active listening	Negotiation
10	Creativity	Cognitive flexibility

Table 1 Comparison of soft skills 2005 - 2020
Source: Ernst & Young Global Limited

As shown in Table 1, since 2005 the ability to solve problems continues to be a priority, while aspects such as critical thinking, creativity and emotional intelligence are gaining importance.

There are a number of traditional competencies that continue to be relevant. These include: authenticity, talent building, customer focus and results. However, new soft skills such as empathy, resilience, mental clarity, inspiration and cultural connection are emerging in the business context, due to the balance that must exist between technology and humans.

Similarly, soft skills are also evolving in terms of their fundamentals, including relationship building, change management, learning orientation, problem solving, communication and teamwork. Table 2 shows this evolution.

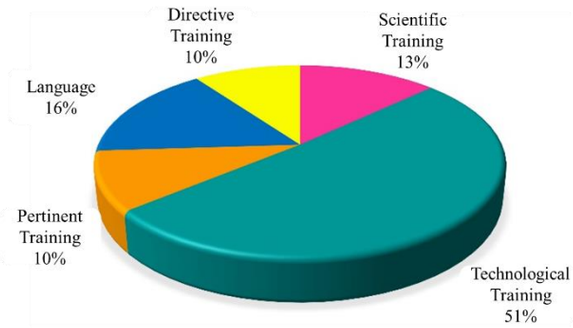
Past	News
Building relationships with super connector	Communication for purposeful work
Problem solving for 360° thinking	Teamwork for virtual coworking
Manage change to embrace disruption	Learning for intellectual innovation - creativity

Table 2 Evolution of the rationale for soft skills.
Source. Ernst & Young Global Limited

ISSN 2523-2495

General analysis of the Industrial Maintenance Engineering curriculum

An analysis is made of the percentage of representation of the subjects that make up the 2020 competency-based curriculum of the Industrial Maintenance Engineering career, where according to Graph 1, 10% contribute to management training, 13% allow the development of scientific training applied to the career, 16% contribute to the learning of a foreign language, 51% are related to technological training and 10% are made up of elective subjects, which is known as relevant training.



Graphic 1 Learning areas in Industrial Maintenance Engineering
Source: Own elaboration

Soft and hard skills are segmented by the competence they provide to the student, as part of the hard skills that are developed during the course of the Industrial Maintenance engineering career, 13% is made up of scientific training, 33% technical subjects related to the profession and 13% promote technological development, which gives a total of 59%.

The soft skills that are developed as part of the curriculum for the industrial maintenance engineer, 21% is made up of the development of administrative competencies, 16% allows the learning of a foreign language. The remaining 4% is represented by the integrating subjects, as can be seen in graph 2.

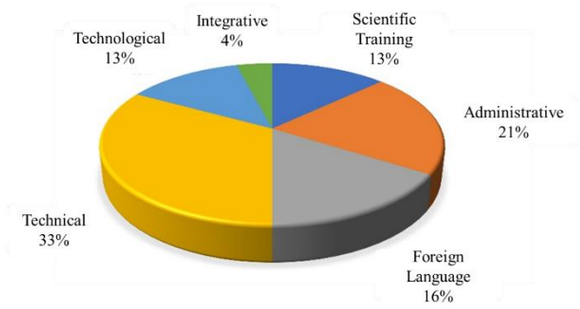
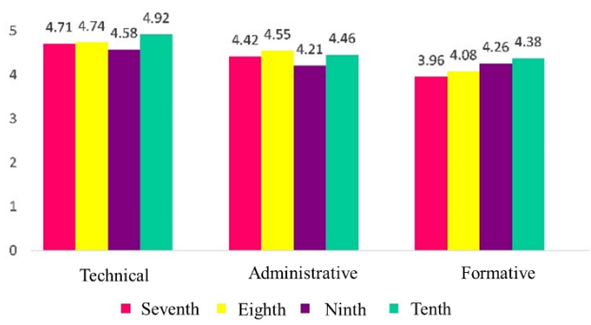


Figure 2 Competences developed in Industrial Maintenance Engineering
Source: Own elaboration

Importance of formative, administrative and technical subjects

Students from the seventh to the tenth semester of engineering were surveyed using the Likert scale, and it was observed that the perception of technical subjects had an average score of 4.74 stars, administrative subjects obtained 4.41 points and formative subjects 4.31 stars of importance according to the students. With this it can be determined that the subjects that contribute to the development of soft skills are the ones that students consider the least important.

In this section the results are not filtered considering employment status or marital status, since the level of maturity reached by the students each term has a tendency to increase the perception of the importance they give to each of the subjects, as shown in Graph 3.



Graphic 3 Comparison of the importance of the subjects by term
Source: Own elaboration

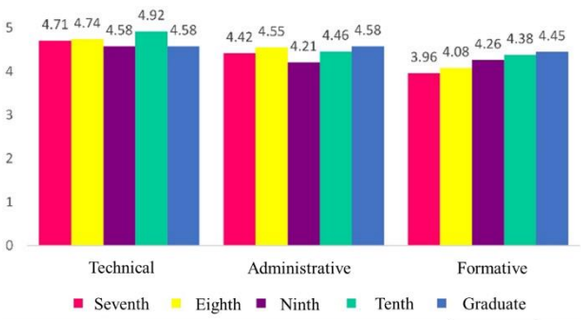
A survey was applied to graduates of Industrial Maintenance Engineering between January and May 2022, in order to know their perspective of the subjects they took, and the results were filtered by applying variables such as employment status and marital status.

ISSN 2523-2495

Subject	Overall average score	Filter by employment status	Filter by marital status and employment status
TSU and engineering technical subjects	4.58	4.60	4.36
Engineering administrative subjects	4.61	4.76	4.71
TSU administrative subjects	4.55	4.64	4.57
Formative subjects of TSU	4.45	4.64	4.64

Table 3. Comparison of the perception of the subjects among the graduates
Source: Own elaboration

In the comparison in Graph 3, the results of the graduates are added and an increase is observed in the importance given to all the subjects taken; a noteworthy fact is that they assign the same level of importance to the technical subjects that strengthen the hard skills and to the administrative subjects that strengthen the soft skills, for professional and labor performance with 4.58 points on a scale of 5 points; the formative subjects, although they increase the importance score in a linear manner, reach only 4.45 points, as is observed in Graph 4.

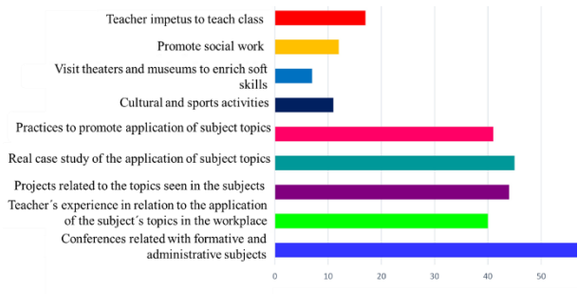


Graphic 4 Comparison of the importance assigned from seventh grade to graduation
Source: Own elaboration

Determination of didactic strategies for the strengthening of soft skills

The students were asked about the activities that they consider can contribute to strengthen the assessment of the level of importance for the work performance of the administrative and formative subjects. The students consider it important to attend conferences related to the formative and administrative subjects, as well as to carry out internships, projects and solve practical cases that allow them to apply the topics contained in these subjects.

Another relevant aspect for the students is the professor's experience in the application of these subjects in the work environment, as shown in Graph 5.

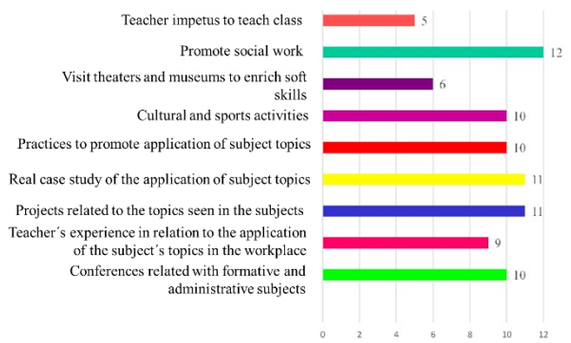


Graphic 5 Activities to reinforce the learning of soft skills according to the students
Source: Own elaboration

The same question is posed to the teachers, i.e., what activities do they consider can be carried out to strengthen the students' interest in formative and administrative subjects? 60% agree that it is necessary to encourage social work, 55% think that it is necessary to work on the contents of the subjects through projects and real practical cases.

50% of the professors agree that it is necessary for students to attend conferences related to the formative and administrative subjects, to promote cultural and sports activities, and to carry out internships related to the topics covered in the subjects.

Finally, 45% of the professors consider important the professor's experience with the application in the work environment of the contents of the formative and administrative subjects. Graph 6 shows the trend.



Graphic 6 Activities to strengthen the learning of soft skills according to teachers
Source: Own elaboration

ISSN 2523-2495

The teachers were also asked about the application of the topics seen by the students during their studies in the formative and administrative subjects, for an efficient professional performance. Eighty-five percent agree on the importance of teamwork in the workplace, 75% consider the need to develop emotional intelligence, 70% focus on fostering personal and professional values, 65% think that leadership is fundamental, 60% believe that effective communication and negotiation are necessary for the graduate to be able to perform in the workplace. Finally, 55% agree on the importance of covering planning and creativity, while only 40% consider it necessary to organize time and delegate activities. This is shown in Figure 7.

Graphic 7 Soft skills required by students in the workplace according to teachers' perception
Source: Own elaboration

Teachers also consider it necessary to carry out activities that allow the development of soft skills in students, among these activities they mention working on internships and projects as in the integrative subject, but focused on strengthening soft skills; they also propose collaborative work with other careers at the university, designing and exhibiting prototypes using the topics seen in the formative and administrative subjects, research work, dynamic classes, practices in computer labs, but above all, relating the contents with the application in the work environment.

The teachers affirm that they personally need to develop cultural skills, adaptation, effective communication, conflict management, time management, resilience, customer orientation, teamwork, leadership, proactivity, negotiation, proactivity and adaptation to change. They also consider it necessary to work on issues to improve critical thinking, socialization and social adaptation.

Didactic strategies for the development of soft skills in industrial maintenance engineering students

A documentary research is carried out on teaching-learning strategies that contribute to the strengthening of soft skills of students, among them are the following:

Inverted class and m-Learning

The inverted classroom methodology proposes to turn the current teaching methods upside down, the teacher provides the theoretical contents and the student interacts, practices and actively participates in the class. Outside the school context, the student studies the lessons and analyzes the material, participates in forums, debates, brainstorming and develops team work with the teacher as facilitator and curator of information.

At the professional level, the application of this model is facilitated by the maturity of the students; it is the key to distance education modalities, such as those implemented for more than two years as a result of the COVD-19 contingency.

An essential tool for the Inverted Classroom methodology nowadays are cell phones, in this regard Sánchez-Rivas, E.; Sánchez-Rodríguez, J. & Ruiz-Palmero, J. (2019) mention that m-Learning is an evolution of online education (e-learning) based on the incorporation of mobile devices to didactic contexts.

The materials that the teacher can share with the student are magazine or newspaper articles, videos, digital books.

Lego Serious Play

Lego is a brand of building blocks of bright colors, it gives the user the opportunity to imagine whatever he can imagine, although it can be categorized as a children's toy, its versatility makes it an excellent strategic ally of training for schools and organizations, because it encourages imagination and teamwork, which helps to develop innovative processes.

ISSN 2523-2495

The Lego Serious Play methodology is a tool with which the student can learn to create through playful exercise, it is based on a phrase of Albert Einstein "Games are the highest form of research". This tool allows the balance between a rigid, square adult, who looks to the future with the inner child who is creative and curious.

The main benefits of this technique are that it contributes to strengthen multiple intelligences, integrates social, cognitive and emotional dimensions in group activities, allows to face conflicts in a productive way, promotes creative thinking, encourages participation, equality and effective communication.

Education in values

Education in values requires the participation of teachers, students and the university community. This methodology is not limited to classroom teaching, to the learning contents of the subjects, and to the skills and topics related to the career that the students are studying, but it must also set objectives related to moral and civic issues, with the purpose of forming responsible professionals.

In today's environment, characterized by social complexity and economic and cultural globalization, this tool becomes important in order to train professionals capable of taking on new challenges and committing themselves actively and effectively in the construction of a much more just, inclusive, equitable and intercultural environment.

The education in values in professional training consists of humanizing the profession, developing an integral personality, through the example of the teaching exercise and university environment that allows developing integral future engineers in Industrial Maintenance.

Social Work

Promoting social work, either by visiting nursing homes, hospitals and boarding schools, allows the student to develop a feeling of empathy towards other people, as well as to value that they have health, a home, a family.

These types of activities help to humanize the professionals, putting them in contact with perspectives that they may never have had to face.

Conferences on administrative and formative topics

Facilitate conferences by professionals with experience in leadership, motivation, emotional intelligence, strategic planning, negotiation, environmental aspects, resilience.

It is also important to promote talks with graduates to share with students the importance of soft skills in their professional performance and how they apply them, to raise awareness among students regarding the application of the topics covered in administrative and formative subjects.

Stays

In the process of learning soft skills, it is very important that the student "after the modeling, performs in the educational context the practice of what has been observed" (Guerra-Baez, 2019, p. 5). This aspect is carried out through professional internships and students' stays in the productive sector, which they carry out at the end of the TSU and engineering levels.

During the period where the student develops a stay in the productive sector, he/she continues to receive advice both from a teacher who serves as an educational advisor, as well as from a business advisor who monitors the student's behavior in the company. According to Guerra- Baez (2019, p. 5). "it is expected that the student manages to generalize the application of the soft skills that were trained in the context of higher education to work and personal interaction scenarios".

Methodology to be developed

Hypotheses

General hypothesis: Soft skills are an important part of the graduation profile of Industrial Maintenance Engineering students at the Technological University of Chihuahua.

First specific hypothesis: In order to improve the professional performance of Industrial Maintenance graduates, it is necessary to plan an awareness program about the importance of soft skills.

ISSN 2523-2495

Second specific hypothesis: It is necessary to implement extracurricular activities to develop the soft skills of Industrial Maintenance students.

Research techniques

Bibliographic and/or documentary

Consultation of publications related to the concept of soft skills, the importance in the graduation profile of professional level students at the time of integrating into the labor sector in the era of industry 4.0.

Consult the curriculum to analyze the hours assigned by type of skills (hard or soft). As well as the subject sheets of the different subjects taken in Industrial Maintenance engineering, to know the knowledge, learning objectives and competencies, to determine the contribution to the development of soft skills. It is also necessary to investigate teaching methods to develop soft skills.

In the field

Interview with professors of the Industrial Maintenance career who work in the industry, in order to know the importance of the development of soft skills in the sector as an entry profile to the company.

Survey to professors to determine the importance they assign to the different subjects that are part of the industrial maintenance curriculum.

Survey to students who are studying Industrial Maintenance Engineering to determine the importance they assign to the different subjects that are part of the four-month period they are studying.

Survey to graduates to determine if they consider that they have developed their soft skills and the application and importance in the labor field.

Definition of the population and sample

The research is developed in the Industrial Maintenance career of the Technological University of Chihuahua, the population is made up of all students enrolled in the engineering level from the seventh to the eleventh semester, the latter corresponds to those who are in the period of stay in the industry.

A non-random sampling is performed, since the objective of the research is to know the factors that influence the perception of the application of the soft skills of the students of all the semesters that make up the educational program at the engineering level; therefore, descriptive statistics is used for the analysis of the data. One group per quarter is selected from seventh to eleventh semester of the night shift, who are mostly composed of male students, so the survey is applied to a total of 105 students and 31 engineering students.

A survey was also applied to all teachers of the evening shift of the Industrial Maintenance career to know their opinion regarding the soft skills that a student should have as part of their graduation profile and the activities that can contribute to develop them. These data can be seen in Table 4.

Quarter	Sample size
7th	24
8th	38
9th	19
10th	24
11th (stays)	31
Evening teachers	14

Table 4 Population and sample size

Three independent variables are identified for the purposes of this research and are shown in Table 5.

Independent	Dependent
1. Quarter in which they are studying. Determine whether it is variable or constant 2. Work experience. Determine if variable or constant. 3. Marital Status. Determine if it is variable or constant.	1. Perception of soft skills according to the four-month period the student is studying. 2. Perception of soft skills according to marital status. 3. Perception of soft skills according to work experience.

Table 5 List of variables

ISSN 2523-2495

Instrument

With the support of the Outlook Forms tool, a survey is applied to teachers of the afternoon shift, to students from seventh to tenth year of engineering and to those who are in the period of internships in the companies. A Likert scale with values from 1 to 5 is used to measure the perspective in relation to the degree of importance they assign to the different subjects of the educational program that contribute to the development of soft skills, in order to analyze the trends and correlation with the different factors (marital status, work situation and term of study) that are taken into account. Table 6 shows the questions posed in the surveys and the response categories to determine the factors that intervene in the perception of the formative and administrative subjects for work and professional performance.

1. Quarter Multiple Choice	Seventh Eighth Ninth Tenth Stays
2. Marital Status Multiple Choice	Single Engaged Married or Unmarried Divorced
3. Do you have any work experience? Multiple choice	Yes No
4. Is the work you do related to the Industrial Maintenance Engineering career? Multiple choice	Completely Very Related Poorly Related Not related.
Assign according to your perception of importance for your job performance from ☆ to ☆☆☆☆☆ (answered by students from seventh to tenth grade)	
5. How important to you are the technical subjects you took during your TSU?	
6. How important are the administrative subjects that you took during the TSU for you? (Personnel Administration, Costs and Budgets, Safety and Environment)	
7. How important are the formative subjects you took during the TSU for you? (Sociocultural Formation I, II, III, IV and Oral and Written Expression I and II).	
Assign according to your perception of importance for your job performance from ☆ to ☆☆☆☆☆ (answered by students from seventh to tenth grade)	
5. How important to you are the technical subjects that you took during your TSU and engineering studies?	
6. How important are the administrative subjects you took during engineering for you?	
7. How important are the administrative subjects that you took during TSU? (Personnel Administration, Costs and Budgets, Safety and Environment)?	
8. How important are the formative subjects you took during the TSU for you? (Sociocultural Formation I, II, III, IV and Oral and Written Expression I and II).	
Teachers, students and alumni answer	
9. What activities do you think can be carried out to strengthen the students' interest in formative and administrative subjects?	The impetus with which the teacher teaches this type of subjects. The promotion of Social Work. Visits to museums and theaters to strengthen soft skills. Cultural and sports activities Internships to promote the application of the topics covered in the subjects. Projects related to the topics of the subject in the work environment. Conferences related to training and administrative subjects..
Teachers, students and alumni answer	
10. What topics seen during the course contribute to be more efficient in the work environment?	Planning Time management Delegating activities Effective communication (oral and written) Negotiation Personal and professional values. Creativity Emotional intelligence Teamwork Leadership

Table 6 Battery of questions of the questionnaire

ISSN 2523-2495

Interpretative frame of reference

Phenomenology

Instrument validation

To validate the instruments, a pilot test was conducted with students from the tutored group (IMI81N and IMI91N) and with students who finished their internship during the transition period of the September-December 2022 term, where data was collected and the effectiveness of the consultation instrument was verified, as well as the comprehension of the questions and answers.

Data validation

The reliability of the survey was calculated using Excel with Cronbach's Alpha formula in order to determine the reliability of the instrument, results and consistency. Figure 1 shows the result of 73%, which gives an acceptable reliability.

Numero de items del instrumento		4		
Sumatoria de la varianza de los items	VARS	2.876893442	VARP	2.83964855
Varianza total del instrumento	VARS	5.239742296	VARP	5.201214779
Coeficiente de confiabilidad del cuestionario	α	0.73	α	0.73

Resumen del proceso de casos			
		N	%
Casos	Valido	136	100
	Excluido	0	0
	Total	136	100

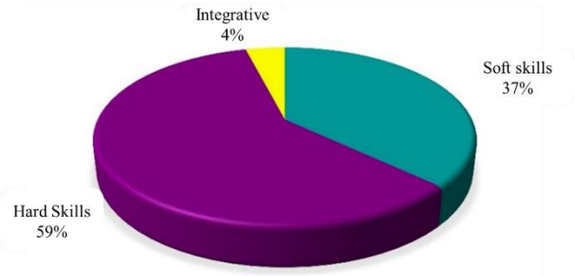
Estadistica de fiabilidad	
Alfa de Cronbach	N. Elementos
0.73	8

Figure 1 Calculation of reliability with Cronbach's Alpha

Results

General analysis of the Industrial Maintenance Engineering curriculum

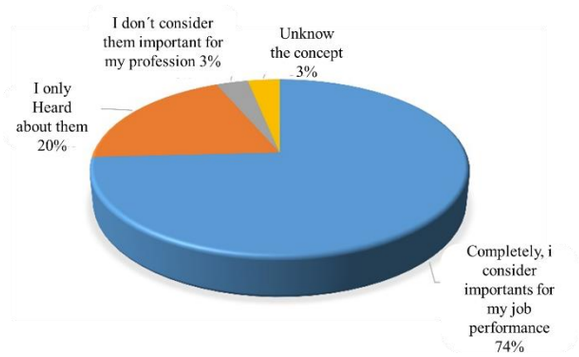
It is concluded that 59% of the subjects taken during the Industrial Maintenance Engineering course contribute to the development of hard skills or skills related to the profession the student is studying, while soft skills are represented by only 37%. The remaining 4% is made up of the integrating subjects, which are taken in the eighth quarter, where a project is proposed and in the tenth quarter the follow-up for the design and execution of the project is carried out. The main objective of these subjects is for the student to apply the hard and soft skills acquired during the course of the course, as shown in Graph 8.



Graphic 8 Development of soft and hard skills in the Industrial Maintenance Engineering program
Source: Own elaboration

Importance of formative, administrative and technical subjects

The graduates were asked about the importance that soft skills represent for them in their work performance, 74% considered them important, 20% had only heard of them, but were unaware of their application in their professional performance, 3% were unaware of the concept, and another 3% did not consider them important for their profession. Figure 9 shows the results.

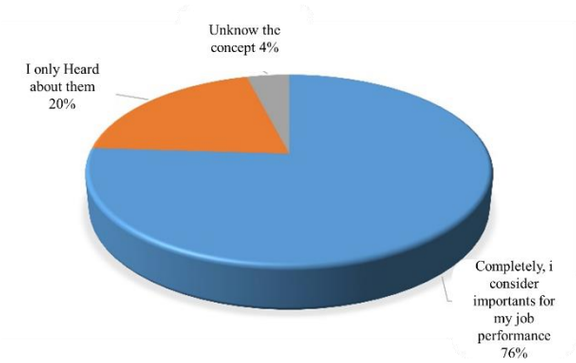


Graphic 9 Importance of soft skills in the work performance of graduates
Source: Own elaboration

If the responses are filtered taking into account only the opinion of those who are currently working, the figures change slightly; the percentage of those who consider soft skills to be important for their professional and work performance increases from 74% to 76%.

The percentage of those who have only heard of the concept but do not know its application remains at 20% and those who do not know the term soft skills is 4% as shown in Graph 10.

ISSN 2523-2495



Graphic 10 Importance of soft skills in the labor performance of employed graduates
Source: Own elaboration

Determining didactic strategies to strengthen the soft skills

The results of the surveys applied to students, graduates and professors show the importance given by students to soft skills, as well as the need to apply them in the work environment at the time of graduation from Industrial Maintenance Engineering. It is shown that marital status and work situation influence the perception of the subjects that strengthen this type of skills, as well as the four-month period they are studying, since in the tenth four-month period students begin to value the topics offered by the formative and administrative subjects.

Graduates give greater importance to soft skills than students who are still studying engineering, because they realize firsthand how necessary it is to have them developed.

A program is planned to raise awareness about the importance of soft skills in the professional performance of Industrial Maintenance graduates and the implementation of extracurricular activities to develop them is proposed.

Didactic strategies for the development of soft skills in Industrial Maintenance engineering students

For the implementation of the inverted classroom strategy, there is a Moodle platform, through which the teacher can share content such as videos or access to interactive platforms to promote learning.

The Technological University of Chihuahua is an educational institution that seeks to foster values in the university community by strengthening and promoting values such as respect for others and the environment, responsibility, honesty, tolerance, loyalty, punctuality, friendship, justice, solidarity, order and cleanliness. In addition, it has several programs that allow its strengthening, such as the inclusion area, the values program and the smoke-free school program.

To strengthen the social work in the Industrial Maintenance career, social work has been carried out in the depressurized shift for approximately 2 years, this consists of visiting a farm home, taking food and living with the children who live there. We have also delivered cleaning supplies and gifts through a program of "adoption" of a child, where each student chooses a child to sponsor and bring him/her a gift, as shown in Figure 2.

Figure 2 Example of a social work activity

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Conclusions

Soft and hard skills complement each other; it cannot be said that soft skills are more important than hard skills, nor vice versa, because a graduate must have both skills.

ISSN 2523-2495

The development of soft skills allows to perform more effectively the technical activities related to the Industrial Maintenance career. It is necessary to emphasize that according to several studies it is easier for a company to train personnel in technical subjects than to change the way of being of those who are part of their organizations, for that reason it is that they value to a great extent that a graduate mainly of engineering, apart from the knowledge related to the studies carried out, is a person who bases his behavior on values, who has the capacity to make decisions, plan, organize his time, work in team and communicate ideas in an effective way, as well as an attentive listening.

Companies also require people who are emotionally intelligent, creative and good leaders.

References

Ernst & Young Global Limited (2020). ¿Cuáles habilidades blandas buscan los reclutadores en el 2020? Guatemala. Retrieved December 9, 2022 from: https://www.ey.com/es_gt/consulting/-cuales-habilidades-blandas-buscan-los-reclutadores-en-2020

Deveci, T., & Nunn, R. Intrapersonal Communication As a Lifelong Learning Skill in Engineering Education. Retrieved February 20, 2023 from: https://doi.org/10.2399/yod.17.009

Gómez-Gamero, M. E. (2019). Las habilidades blandas competencias para el nuevo milenio. DIVULGARE Boletín Científico De La Escuela Superior De Actopan, 6(11). Retrieved January 7, 2023 from https://doi.org/10.29057/esa.v6i11.3760

Guerra-Báez, S. P. (2019). Una revisión panorámica de la formación en habilidades blandas en estudiantes universitarios. Psicología Escolar e Educacional, 23. pp. 2-8. Retrieved August 2, 2022 from: https://doi.org/10.1590/2175-35392019016464

Holguín, V. M. G., Tavera, J. A. F., & López, A. M. B. (2018). Desarrollo de habilidades blandas y el uso del Sistema de Gestión del Aprendizaje en la elaboración de proyectos prácticos en una asignatura introductoria de Ingeniería Telemática. Cuaderno de Pedagogía Universitaria, 15(29), 44-53. Retrieved May 3, 2023. Available at: https://doi.org/10.29197/cpu.v15i29.299

Pérez -Rojas J.G. (2020) Retos de las instituciones de educación superior para su articulación en la Industria 4.0, pp. 9. Retrieved May 9, 2023 from: https://doi.org/10.22430/24223182.1584

Sánchez-Rivas, E.; Sánchez-Rodríguez, J. & Ruiz-Palmero, J. (2019). Percepción del alumnado universitario respecto al modelo pedagógico de clase invertida. *magis*, Revista Internacional de Investigación en Educación, 11 (23), 151-168. doi: 10.11144/Javeriana.m11-23.paur

Zepeda-Hurtado, M. E., Cardoso-Espinosa, E. O., & Rey-Benguría, C. (2019). El desarrollo de habilidades blandas en la formación de ingenieros. Científica, 23(1),61-67. Retrieved May 9, 2023 from http://www.redalyc.org/articulo.oa?id=61458265007.

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