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## **DEVELOPMENT OF SOFT SKILLS IN ENGINEERING STUDENTS: COLLABORATIVE WORK**

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**Summary.** This work focuses on the development of soft skills focused on the engineering student, based on the collaborative work model, which is currently important for employers that the graduate is integrated into the work team and can obtain favorable results, for this work a quantitative methodology was used, where a questionnaire was applied that allows to know the social skills possessed by students, the development of the same was on a Likert scale, it was applied through an online platform, it was applied through an online platform, obtaining a sample of 530 undergraduate students in engineering at a university in the northeast of Mexico, then the answers were analyzed, to subsequently obtain as results that the way to integrate is in groups to perform teamwork, as conclusions it is important that students develop during their stay in collaborative work, because this includes effective communication, negotiation, empathy and leadership, which is a skill that is required in the working world.

**Keywords:** soft skill, student, collaborative work.

## **DESARROLLO DE COMPETENCIAS BLANDAS EN ESTUDIANTES DE INGENIERÍA: TRABAJO COLABORATIVO**

**Resumen.** El presente trabajo se enfoca en el desarrollo de las competencias blandas centradas en el estudiante de ingeniería, basado en el modelo de trabajo colaborativo, que actualmente es importante para los empleadores que el egresado se integre al equipo de trabajo y pueda obtener resultados favorables, para este trabajo se utilizó una metodología cuantitativa, donde se aplicó un cuestionario que permite conocer las habilidades sociales que poseen los estudiantes, el desarrollo del mismo fue en escala de Likert, se aplicó a través de una plataforma en línea, obteniendo una muestra de 530 estudiantes de licenciatura en ingeniería en una universidad del noreste en México, posteriormente se analizaron las respuestas, para posteriormente obtener como resultados que la forma de integrarse es en grupos para realizar trabajo en equipo, como conclusiones es importante que estudiante desarrolle durante su estancia en el trabajo colaborativo, porque este incluye una comunicación efectiva, negociación, empatía y liderazgo, que es una habilidad que se requiere en el mundo laboral.

**Palabras clave:** habilidad blanda, estudiante, trabajo colaborativo.

## **Introduction**

Currently, most higher education institutions emphasize the need to include the development of both hard and soft competencies in the curriculum, in order to meet the personal, academic and professional demands required by the context in which we live.

Hard competencies are the technical knowledge and experience necessary to perform a job, while soft competencies are interpersonal qualities, social skills and personal attributes of each individual. These refer to a broad group of skills, behaviors and qualities that enable people to function efficiently in their environment, have effective relationships, perform work professionally and achieve the goals they set for themselves (Lippman et al., 2014). Soft skills are considered complementary to hard skills, which are trained in universities, due to their important role in the current context. However, although these are discussed as important, there is a lack of consensus on their characterization and implementation (Yan, et al., 2019).

Higher education institutions are aware that having an adequate level in educational quality and training, not only imply a certain mastery of the contents of a given educational program, but students also have the need to fully develop the necessary competencies and skills to have greater chances of successfully participating in the labor market (Garcia, 2016).

As the industry sector has advanced, it has become vital to incorporate more people with talent, not only technical or cognitive talent that is deployed through hard skills, but also to adequately develop soft skills, as these complement each other. Soft skills have been one of the most important traits and variables determining success in job performance for at least the last decade (Pandey et al., 2022).

Currently, soft skills, also considered as non-cognitive, are more valued by employers than hard skills in the workplace, as it helps in determining that they possess a willingness to work collaboratively, are perseverant and demonstrate leadership in decision making.

Garcia (2018, p.9), mentions that "The National Research Council and the National Academy of Sciences of the United States categorize the 21st century skills into three: cognitive, interpersonal and intrapersonal skills", and that the subject who possesses the three aforementioned skills will be able to develop successfully.

The Organization for Economic Cooperation and Development (OECD) during 2016 included in the test named as The Programme for International Student Assessment of the OECD (PISA) the importance of collaborative work development as a soft skill (OECD, 2016), and three years later established that smaller companies when surveyed externalized that graduates lack soft skills for innovation, therefore, collaborative work and leadership are skills considered of importance for recruiters (OECD, 2019).

Ortega (2016) highlights that the results of a survey applied in some work teams, revealed the absence of collaborative work, therefore highlights the priority that young people develop soft or non-cognitive skills, and these should be generated from an early age, presenting the position that society requires a flexible, proactive and responsible youth with a capacity for critical thinking, who can perform collaborative work and have willingness to solve problems in a committed manner. In a society that is moving towards transformation, soft skills, therefore, are not something that is sought "preferably" to be had, but are as important as cognitive skills, because although these are essential to ensure that the work is done correctly, unless they are combined with people's soft skills, such as the ability to work collaboratively, negotiation and leadership, among others, it is what allows the professional potential of those involved in this transformation to increase.

It is considered that nowadays after the COVID-19 pandemic, the need to develop the capacity for collaborative work has become evident, for example, the capacity for effective communication, collaboration and negotiation, so that the individual can communicate his or her central objectives, implement changes efficiently and persuade others to achieve the fulfillment of common strategies. In general, this is not an easy task, as it requires sufficient emotional intelligence, empathy and confidence from the individual. These skills can be strengthened through activities designed in learning environments that include the use of digital technologies, such as the use of digital platforms for videoconferencing and case resolution, like MSTeams, and Power point, Canva or Genially for group presentations.

According to Robles (2012), employers consider soft skills to be a significant and important attribute for job applicants, as soft skills of new employees are required to be as highly regarded as hard skills, as requirements have changed (Pitan, 2017). Thus, both employers and higher education institutions have not only realized the need to provide graduates with the competencies and skills that facilitate their incorporation into the labor market, but also allow them to adapt better.

In this context, collaborative work has generated a great deal of attention, as essential skills are discussed in an increasingly globalized, dynamic and complex world. Requiring graduates to be able to solve specific work problems, to have the necessary skills to face new challenges and the ability to negotiate (Baneres & Conesa, 2017).

Few researches focus on the level of students' acquisition of different skills applied to collaborative work, in support of learning throughout their university education, the same happens with researches focused on establishing the relationship of collaborative work skills and the specific socio-academic characteristics of students. In this sense studies such as the one conducted by Al-Alawneh and Ashour (2011), Beigi and Shirmohammadi (2012), Chamorro-Premuzic et al, (2010), Lozano-Rodriguez et al. (2020) and Rodríguez-Gómez et al. (2018), have attempted to establish possible relationships between collaborative work skills and gender, academic experience, or academic performance.

The UANL, in its vision 2030, considers multi-, inter- and transdisciplinary collaborative work within the institutional attributes, establishing it as "the configuration of intellectual and institutional work, in which experts from various disciplines are integrated into teams to face with greater probability of success, and with a high ethical sense, complex issues raised by reality" (UANL, 2022, p. 73)

For this reason, an academic project should be established through a scheduled methodology to develop collaborative work in engineering students through the Integrated Learning Product (ILP), limiting it in a first phase to those taking the Ethics, society and profession learning unit, establishing as justification what the labor field is requesting.

### **Target**

The general objective is to develop the soft competence of collaborative work in students of Ethics, Society and Profession through activities of a pedagogical methodology that allows monitoring and measuring the development of the Integrated Learning Product.

#### Specific objectives:

Establish an appropriate pedagogical methodology to develop collaborative work in accompanying the design and construction of their IPA, with activities designed in a learning environment that allows monitoring and measurement.

Analyze through surveys and reports the development of the collaborative work competency with the implemented methodology.

## **Method**

The method used for the analysis of this project is quantitative which, according to Hernández Sampieri, et al, (2014), which consists of collecting data, analyzing, establishing guidelines and testing theories, and the non-probabilistic sample criterion will be used, where the selection depends solely on the characteristics for the research, having as the object of study a universe of 530 undergraduate level students studying between seventh and ninth semester of any of the ten educational programs offered by the School of Engineering of a Northeastern Public University and who meet the requirement of being taking the Ethics, Society and Profession Learning Unit.

In the first stage of the project planning, the Goldstein and Col, 1978 social skills questionnaire was selected for the application of this study, which was adapted and translated in (1995) by Tomás, where six dimensions are grouped to analyze from basic social skills to planning skills. This instrument has already been validated, so it has reliability, Bautista, 2011 and it is an ipsative test that, according to Cattell, 1998 is a multiscale measurement, which can be applied individually.

The items related to the questionnaire are composed of 50 items, within the procedure and data collection for subsequent analysis according to the type of questions, the Likert scale was used with five response options to choose from: 1 Is never uses the skill, 2 Rarely uses the skill, 3 Sometimes uses the skill, 4 Often uses the skill and 5 Always uses the skill or almost always. Respondents will answer the instrument through the digital platform. Once the answers are available, they will be analyzed, in order to consecutively define the learning strategies that will be carried out focused on the student, in order to later use the methodology that supports the development of soft skills, specifically collaborative work.

## **Results**

Clear presentation of the results obtained. The overall objective of the project is to identify whether soft skills are developed in the pilot groups, in particular, collaborative work. Among the expected results is to identify whether students develop the ability to work collaboratively, taking into consideration the Integral Learning Product, which in this case is a Research Project applying scientific methodology where they solve a problem or ethical conflict in the field of engineering, so that they can, through active learning strategies, develop effective collaborative work.

The design of the learning environment during the first phase will be applied only to certain pilot groups so that the researchers can have control of the results. We hope that the second phase will include sharing the experience of the researchers with other members of the Academy in order to replicate the project by proposing different strategies or providing feedback on the impact on the different groups. And, finally, in a third phase, a survey was applied to employers, so that they can express whether the engineering graduate has developed the ability to work collaboratively and, if so, apply it to the other learning units of the academic unit or, if not, make the necessary adjustments to the project so that it meets the objective established at the beginning.

Once the instrument was applied, and through the teachers' experience with the pilot groups, it was found that students perform adequately in the collaborative activities, which in this case were implemented through the MSTeams platform. This tool allows work teams to collaborate on Microsoft documents, so that the teacher can track the participation of each team

member, and account for the participation and the degree of contribution. This methodology opens the opportunity for students to negotiate and make decisions while advancing in the development of the research, they can also generate virtual meetings that can be recorded as evidence of the collaborative work.

Analyzing the results of the applied instrument, it stands out that the students consider that they choose the best way to integrate themselves in a work group before a certain activity with 19.6%, while 40.4% say that it happens quite frequently and only 2.5% consider that they do it very seldom. Meanwhile, in the area of negotiation, only 10.2% of the students who responded to the survey favored it, while 45.5% said that it happens to them only sometimes. And when it comes to establishing a negotiation system during the performance of the activity, 21.7% favor it, while 21.2% say only sometimes. On the subject of empathy during communication, 30.6% say they look for it very often, while 21.3% say it only happens sometimes. Finally, on the subject of agreements and decision making, 36.2% seek to resolve difficult situations in collaborative activities, while only 1.9% say that they rarely seek to do so.

### **Discussion and conclusions**

Finally, university graduates must be efficient in their professional performance. For this purpose, not only solid hard competencies are required, but also soft skills that enable them to solve real-life problems. One of the functions expected of higher education institutions is to provide training in soft skills such as: problem solving, critical thinking and collaborative work, among others, so that this research project allows the development of these skills, in particular that of collaborative work.

Training in the engineering area is strongly focused on the development of hard competencies, being problematic to include these skills as pointed out by Hirsch, (2017). Therefore, the importance of this project and the methodology applied, in which the teacher's accompaniment in the development of the PIA throughout the semester through the MSTeams platform and face-to-face sessions, has made it possible to guarantee the integral formation of the student, favoring the development of social skills, not only collaborative work, but also effective communication, negotiation, collaboration and leadership. Some of the observations from the implementation of this methodology, is that by opening up the research project and allowing for an introduction to ambiguity (leaving open-ended instructions for students to make all decisions about the topic, and proposing solutions) creates a space for students to think, research and collaborate so that they can come up with possible solutions and make decisions about which one they think is best, substantiate it and then determine its real-life application. This is an approach to the reality of contexts in the 21st century, where problems are complex (Eiris, Wen & Gheisari, 2022), perhaps not well defined and the answer is not obvious to professionals, who will need to collaborate in multidisciplinary teams looking for possible solutions and applying experience and knowledge (NCR, 2011). the last section will present the conclusions of the article and then the main conclusions. Where appropriate, limitations and proposals for continuity will be included.

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