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## Mentoring Programs For Engineering Students As A Way To Improve Their Skills And Competencies

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## **Mentoring programs for engineering students as a way to improve their skills and competencies**

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## **ABSTRACT**

Universidad Francisco de Vitoria (UFV) in Madrid (Spain) and Universidad Vasco de Quiroga (UVAQ) in Morelia (Mexico) seek the comprehensive academic training of students: not the mere development of technical skills, but also the personal and soft skills that enable them to face their professional reality.

Educational missions in both institutions aim for sustainable development oriented towards people and the societies in which they are immersed. Their substantial actions have been designed, in such a way that active methodologies and innovative proposals are included. Among them, it is worth highlighting the provision of a personalized support system for students, in which, through a competence itinerary with their tutors, issues are addressed to help them to full development.

An added value has been identified by applying this mentoring system at engineering programs (mainly based on hard skills), when supporting students in the development of other skills.

A comparative study was carried out on the differences and similarities of the programs of both universities, from the point of view of the people who mentor and guide students. Thanks to those contributions, we have information that will allow us to adapt the processes and thus respond more adequately to the needs of engineering students in their first undergraduate degree courses. The focus group technique and a survey were used in the process.

## **1 INTRODUCTION**

### **1.1 Background**

The word accompany comes from Latin *cum-pane*, i.e., to share the same bread, literally “with bread”. It means that we are together in the process, putting both lives at stake, with their different degrees of experience, to reach mutual learning (Nicholson 2021, 281-290).

Accompanying is a human response that comes from the heart, and it is focus on the other needs. It means to walk together (who accompany and the accompanied person), and allow the other be, letting him awaken his own being. To accompany is to be, to welcome, to listen, to share, and to go out to meet the other. Accompanying is an art because the success of the accompaniment is not that of the one who accompanies, but that the other acknowledges feeling accompanied. Time is required to accompany, silence is required from one to listen to the other, and it is necessary to change the rhythm and adapt to the other. The one who accompanies does not advise, does not have magic recipes, but seeks to illuminate from his own experience those of the accompanied. Accompanying is fundamentally the action of “walking next to” a person, sharing some part of his/her itinerant life. Accompanying is, in various ways, sharing the journey and their experiences (Kaufman et al. 2022, 33-45).

## **1.2 Mentoring at UFV**

Mentoring activities developed at the UFV in the first year of Industrial Engineering students are framed in the Knowledge Management and Human Skills (KMHS) course, offered annually with recognition of 9 credits in the student's curriculum (Queiruga-Dios, et al., 2023, 907).

Mentoring process includes student's individual accompaniment, through a mentor, who is a professional trainer equipped with the necessary competences to perform this task. During classes students are accompanied by their teacher and their classmates, they are part of a community. The KMHS course aims to contribute to the comprehensive training of the student, it is a compulsory transversal and propaedeutic subject that proposes the acquisition of competences and skills through a comprehensive experience. This course is developed as an experience made of different actions. The acquisition of competences becomes a means of personal fulfillment by asking the student a question -"what do these professional skills have to do with me, with my vocation and with who I am?; and how can I live those competences with sense?"-, and then, invite him or her to discover a possible answer: that their future career depends to a great extent on how that student build him or herself today (Allen et al. 2004, 127; Crespí 2022, 852-873).

The process of accompanying students is developed through 6 meetings with each student. During these sessions, a specific route of discovery is presented to students, through questions, exercises and actions that allow them to make decisions throughout their first year at university. These meetings seek that the student acquires competences as specific as proactivity, time management, deep insight, etc. This process is carried out through questions that challenge the student to generate creative habits, and using the CRECER methodology, i.e., with Concrete, Realistic, Empathic, Programmed, Focused, and Challenging actions (CRECER is the Spanish acronym that specifically means *grow* in Spanish) (Díaz-López, 2022).

## **1.3 Tutoring at UVAQ**

The objective of the personalized accompaniment program at UVAQ is to go along with students in their integral development, focusing on 5 of the dimensions of the person: physical, psychological, academic, social, and spiritual, through the support of tutorials, growth workshops and personalized psychological care.

The establishment of an aid and accompaniment relationship arises from students and tutors contact during classes and from scheduled individual interviews. Students have the possibility of accessing two tutoring sessions throughout the semester, during which they have a space and time to share their experiences, ways of thinking and feeling, in the same way that they explore and discern about their lives, supported and guided by the tutor. These interviews take place at the university campus.

The tutor is the person who accompanies the student throughout the training in the personal, spiritual, psychic-emotional field. The tutor has a moral and spiritual sense, trained to develop this specific function. He or she has a competent academic level

based on humanist and learning theories to help young persons on their way during their time at the university. Tutors task is to serve, because they have the knowledge, experience, training and maturity to assist and attend students (Burgess, van Diggele, and Mellis 2018, 197-202).

Currently, the work team for the tutoring of the personalized accompaniment program is made up of thirteen tutors and three external specialists in Psychology. The specialists and the tutors attend to training sessions organized by the educational guidance department. This training is given twice a year in an inter-semester period to deal with the necessary issues for the development of their activity.

The student's commitments with the personalized accompaniment program are the following: To know themselves, to develop and discover their abilities as a person; to have a commitment to the tutor in the development of the activities agreed upon by mutual agreement and become aware that the only person responsible for their training and growth process is oneself; and to participate in the tutor evaluation processes, in accordance with the mechanisms established by the university.

## **2 METHODOLOGY**

A mixed methodology has been chosen for this study. First, an ad hoc questionnaire called "UFV mentoring-UVAQ tutoring for engineering students" has been conducted, based on qualitative questions. Second, a focus group has been held with the agents involved in the study. Both instruments have provided a global vision of the two accompaniment systems and have made it possible to compare them. The focus group stands out especially, because it made possible to know each other and develop this cooperative and collaborative study.

The focus group has its origin in the qualitative method of the interview, but tries to cover more agents, so that different opinions can be collected at the same time, in addition to generating a highly enriching dialogue between the parties. It is a method that lies between a meeting and a conversation, defined by some authors as a debate among a group of people, on a specific topic and with an experienced moderator (Hauer et al. 2005, 732-734; Sim and Waterfield 2019, 3003-3022).

The chosen sample was made up of advisors and mentors who accompany engineering students from the UFV and UVAQ universities. Students who have participated in the accompaniment process could have been chosen to tell their experience of the accompaniment system of these universities, but on this occasion, it has been preferred to carry out a self-analysis by those who do the accompaniment work in order to better understand both support systems and enrich themselves with the benefits of each of them. This methodology has been chosen because it provides great qualitative information (Gundumogula 2020, 299-302).

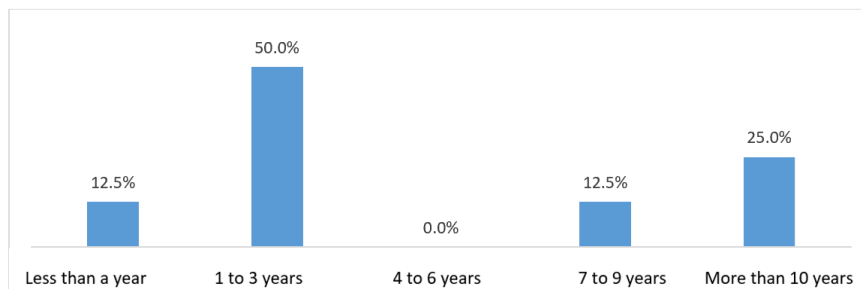
Qualitative analysis through focus groups serves as a channel for dialogue between the agents involved through which opinions, concerns, good practices and experiences are shared. In case of the UFV, the sampling of this study is of a non-probabilistic type by judgment or deliberate. Of the 270 mentors, only those who carry

out their work in the polytechnic school, in the Systems Engineering degree were chosen. At the UVAQ, only those who currently carry out their work in the Faculty of Engineering were chosen.

### 3 RESULTS

A group of eight teachers participated in this study, 75% corresponded to women and the remaining 25% to men, 25% being mentors from the UFV and 75% tutors from the UVAQ. Specifically, the faculties in which participants developed their work as mentors were Systems Engineering and Computer Security, Computer Engineering and Systems Engineering.

On average, mentors have developed their activity for 6.2 years. However, the dispersion of the values is significant (with a standard deviation of 6.15), since some of the teachers have less than 1 year of experience as mentors, while others have 15 years of experience. Fig. 1 shows this distribution, grouped by the experience of the teachers/mentors who participated in the study.



*Fig. 1. Experience of the teachers/mentors*

Regarding the experience of the mentors in engineering accompaniment, it was found that the majority have worked as tutors between 1 and 3 years. It is important to highlight that 37.5% of the consulted mentors have more than 3 years of experience and only 12.5% have less than one year of experience in processes of accompanying engineers.

#### 3.1 UFV mentoring-UVAQ tutoring for engineering students

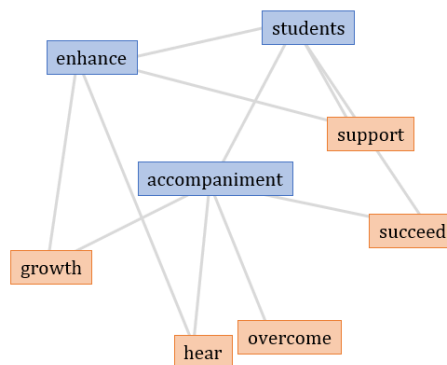
The instrument “UFV mentoring-UVAQ tutoring for engineering students” was applied to the teachers who carry out this work, having a total of eight answers related to the tutoring tasks and the advice that this implies. The following questions were proposed:

1. What has been the most difficult experience you have had as a mentor/tutor?
2. What has been the most satisfying experience you have had as a mentor/tutor?
3. Write a word that explains what to be a mentor/tutor means.
4. What do you think are the strong points of the student accompaniment system in your institution?
5. What do you think are the areas for improvement in the student accompaniment system in your institution?

Regarding the experiences classified as difficult that were obtained by the mentors/tutors, an open option was chosen, which allows a better approach to the qualitative logic of their own experiences. These open responses were categorized, and some of them appears repeatedly throughout the results: problems related to students suffering, the difficulty in helping young people to process their emotions and anxiety management, and the presence of violence in students' life, even a kidnapping case significantly affected one of the students.

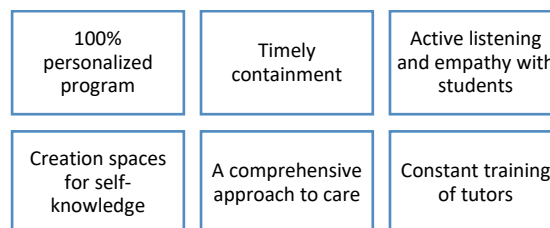
In general, personal aspects related to the mentor or tutor tasks were not mentioned, the answers were oriented to the intrinsic difficulties of working with people who are going through complicated situations in their lives. The terms that were mentioned most frequently were: loss, suffer, pandemic, mourning, anxiety and violence.

Tutors and mentors were asked about those gratifying experiences related to their work as tutors/mentors during student's accompaniment. Once again, the open responses were categorized and a diagram was generated (see Fig. 2), which shows the network of most frequently mentioned concepts and the interaction between them, being the keywords: accompaniment, students and improvement, and the rest of words are the pleasures that give meaning to the keywords.



*Fig. 2. Chart with key descriptors of the most satisfying experiences you have had as a mentor/tutor*

When questioning the mentors about the strong points of the program, they identified its comprehensiveness, the constant training of the tutors, the promotion of spaces for reflection and self-knowledge in the students through active, empathetic and an active listening, free of prejudices, as well as a space that provides containment and that allows guiding students with psychological or psychiatric care (when needed) (Fig. 3).



*Fig. 3. Strengths in the student accompaniment system at its institution*



Finally, tutors were asked about the improvement possibilities that they identify in the student accompaniment system (in their own institution), and they pointed out the need for the tutors to have an adequate number of students that allows them to maintain a personalized treatment, to have better spaces for tutoring and mentoring sessions and increase the time dedicated to them.

This opinion poll allows us to get some results from people who face the day-to-day work of tutoring students in the institutional support systems from the Francisco de Vitoria University and the Vasco de Quiroga University and becomes a very important input to improve the service offered, while providing better support to mentors and students in a process that seeks to be comprehensive, empathic and humane.

### **3.2 Focus Group**

With the group of eight teachers, a focus group was raised to discuss about the following issues:

1. In general, what would you say about the characteristics of first-year undergraduate students?
2. Specifically, what are the characteristics of engineering students? (brief description using adjectives).
3. Do you think engineering students have specific needs compared to other students in other degrees? (Only aspects that appear different or significant compared to other students).
4. Do you think that students positively value the accompaniment provided by their university? Why?
5. In what aspects do you think we can help engineering students?

In the case of the first question, mentors and tutors consider that students who are more confident in terms of the degree they have chosen, feel excited and eager to start this new stage of their lives and therefore they show a high level of motivation.

In recent years mentors and tutors show an increase in social immaturity on several students and great affective needs that they can verbalize naturally. This could be a consequence of the pandemic.

Regarding the second question, the mentors and tutors of engineering students rate them with the following adjectives: students who are especially organized, competitive, responsible, and with high levels of self-demand. Again, they speak of having a certain immaturity and irresponsibility in some cases, especially when they do not find the necessary motivation, with little contact with emotion or only superficially. A generalized apathy towards issues that have nothing to do with their discipline is perceived. In the case of engineering majors, there is a male majority, and it seems that this makes it difficult for them to express their emotions (in this sense, tutors and mentors point out that it may be something cultural). They also describe them as reserved, with logical and mathematical thinking, skilled in process issues, and with certain difficulties in relating.

Answers to the third question revolve around the emotional issue, reiterating that they are less expressive, have a hard time expressing their emotions and are more reserved than students in other grades.

Regarding the fourth question, all the mentors and tutors understand that yes, the assessment of engineering students is positive, but that in most cases it is difficult for them to understand what the support offered by both institutions means and they tend to start the processes quite closed, but when they understand it better their attitude changes radically, they are open to the process and appreciate it.

Finally, to the fifth question, the answers refer to maintaining an attitude of listening and permanent availability with them, creating with them a safe environment in which they can tell about the situations they are going through without being judged. Added to this is the need to provide them with information on what the accompaniment programs consist of. Another answer raises the possibility that one way to help students is precisely not to label them for what they are or how they are, to give them the space to be themselves.

#### **4 SUMMARY**

Accompaniment is a fundamental tool in the teaching-learning process. It provides students with a safe environment in which they can be themselves, be able to express their concerns and difficulties, and seek, with the help of others with more experience, the path to reach their goals.

Mentors and tutors report that the most difficult situations they have addressed in their work are the emotional wounds and suffering that students show in difficult situations. At the same time, the most rewarding experiences are related to how students deal with these situations and how they can generate an interpersonal relationship with the mentor or tutor. Despite the difficulties faced by first-year engineering students, such as poor socialization or difficulty to express their emotions, thanks to the accompaniment they can significantly improve these aspects according to the perception of mentors and tutors.

Both mentors and tutors highly value their work, expressing great personal satisfaction for working with students. It is important to them to see how students mature personally in the first year of their degree. As one of the trainers shared in the focus group: "it is a gift to be able to look into the lives of the students, who simply share with us who they are; it is a gift and a responsibility, because we are treading on sacred ground".

To continue developing their work, mentors and tutors consider that it is necessary to adapt the times and spaces with the students, to share more sessions with them, going deeper into the topics already proposed in the process, as well as to adapt the number of students per mentor/tutor so that they can develop their tasks with quality.

#### **5 ACKNOWLEDGMENTS**

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