

## Professional identity of the engineers at the Tecnológico Nacional de Mexico, Oaxaca campus

### Identidad profesional de los ingenieros del Tecnológico Nacional de México, campus Oaxaca

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#### Abstract

This article presents the analysis of the professional identity of the engineering graduates from the Tecnológico Nacional de México (TecNM) Oaxaca campus, to achieve this a qualitative methodology was used, the data collection method was carried out through in-depth interviews with the graduates from the years 2014 to 2022 from the different engineering degrees offered at the institution. It was found that the professional identity of the engineers is shaped by the people who have influence on the choice of the career, the process they live at the moment of taking the degree, upon finishing it, subsequently upon performing it. This process is complex and occurs in different aspects from how they see themselves as students and later as professionals, and how their social environment perceives them, where it must be recognized that it is also marked by the subjectivity of the perception they have of themselves.

#### Identity, Women, Engineering

#### Resumen

El presente artículo plantea el análisis de la identidad profesional de las egresadas de ingeniería del Tecnológico Nacional de México (TecNM) Instituto Tecnológico de Oaxaca (ITO), para lograrlo se utilizó una metodología cualitativa, el método de recolección de datos se realizó a través de entrevistas a profundidad a las egresadas de los años 2014 al 2022 de las diferentes ingenierías que se ofertan en la institución. Se encontró que la identidad profesional de las ingenieras se va conformando desde las personas que tienen influencia en la elección de la carrera, el proceso que viven al momento de cursar la carrera, al terminarla, posteriormente al ejercerla. Este proceso es complejo y se da en diferentes aspectos desde cómo se ven como estudiantes y posteriormente como profesionales, y cómo las percibe su entorno social, donde se debe reconocer que también está marcado por la subjetividad de la percepción que tienen de sí mismas.

#### Identidad, Mujeres, Ingeniería

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## Introduction

The participation of women in engineering areas occurs in a lower proportion than of men. In recent years, it has been incorporated into the public agenda that more women are integrated into these areas, even though women have accessed University education, this does not occur in all branches of knowledge.

Engineering training not only has to do with the acquisition of knowledge and skills but also with how they are identified, in such a way that the study of professional identity is important to understand how the process occurs from the moment it is decided to study engineering, education in higher level institutions, as well as professional practice.

This article includes the professional identity of female engineers who graduated from the Chemical, Mechanical, Industrial, Computer Systems, Electronic, Electrical, and Civil engineering careers. It is important to mention that the institution also teaches Business Management Engineering, but it was discarded because ANUIES classifies it within Administration and not part of engineering.

This is where professional identity becomes relevant, because it implies about itself in reference to an area of job performance (Valero 2021), at the same time about its process of being part of a society (Luna 2021) and its context (Fuentes 2020).

Thus, “identity implies a way of feeling, understanding and acting in the world where social and personal factors are integrated” (González 2019), coupled with the fact that “it is interrelated with traditional gender characteristics, giving way to new forms of practice the profession” (Marquinez 2021)

In such a way that “it is not an objective reality nor is it the same as a role, but rather a discursive and mental construction that individuals use to express a certain mode of looking and feeling in relation to their environment” (Bolívar 2016).

Professional identity gives value and meaning to the profession because it implies “a set of knowledge that guides professional decisions and, above all, the moral ethical framework that guides the professional to coexist in a social and environmental way” (Cuadra 2021), the same as the Professionals internalize it by associating it with their performance (Blanco-Acheverry 2022), in the case of engineering they have a scientific and technical orientation (Walter et. Al. 2019).

According to Ferreira, “professional identity is self-perception over time, in terms of a planned sequence of learned actions, executed by a person in an interaction situation that requires specific theoretical and technical knowledge” (as quoted by García Dottor, et al. al.2022).

“Professional identity is found in this framework, where the social and the personal come together to give rise to a construction composed of professional models, relational processes and continuous biographical processes” (Blanco 2022).

This performance of female engineers is “conjugated, therefore, in a dynamic framework where discourses of power are presented with practices of exclusion and impact on participation in certain sectors of work, in ways of connection, in the existence of tense relationships between work and family (Rosero 2019), which has to do with paradigms established by families or society.

The study of professional identity is important because it allows us to understand how female engineers perceive themselves personally and professionally and how their environment contributes to their training and professional performance, in such a way that it allows us to identify elements to face the situations that make it difficult for them to access to these higher level study areas.

## Background

A study in Mexico carried out by Razo (2008) found that the majority of those interviewed in his study had conditions that encouraged entry into engineering in addition to taking the mathematical physics area in high school.

Studies have been carried out on women's participation in higher education, but there are fewer in engineering fields.

In the state of Oaxaca, the project “Professional identity of engineering graduates from the Tecnológico Nacional de México/Instituto Tecnológico de Oaxaca from 2014 to 2022” that was carried out at the TecNM Oaxaca campus is the first in the state that includes the issue of identity of female engineers in which a statistical analysis of the participation of women in this area was carried out and it was found that there is a difference between each of the careers offered in the institution, being chemical engineering where the number of women is greater than men, while in electronic engineering and mechanical engineering the percentage is less than 8%.

**Methodology to be developed**

For this project, a qualitative methodology was used, for this an analysis of the literature was carried out, making a theoretical review, as well as the different approaches from which professional identity has been addressed in order to determine the categories to be used in the research, it is important to mention that it was found that professional identity is formed along with personal identity, for this reason personal aspects and their environment were integrated without losing the central focus of the research. To achieve this, the following were proposed:

<b>Before choosing to study engineering</b>	<ul style="list-style-type: none"> <li>- Schools where they studied.</li> <li>- People who influenced the election.</li> <li>- People who supported them in their choice.</li> <li>- Institution where to study.</li> </ul>
<b>During his engineering studies</b>	<ul style="list-style-type: none"> <li>- Interaction with the classmates.</li> <li>- Interaction with teachers.</li> <li>- People who supported them.</li> <li>- Knowledge and skills they developed.</li> <li>- Family perception.</li> </ul>
<b>Professional residency</b>	<ul style="list-style-type: none"> <li>- Job performance (knowledge and skills).</li> <li>- Attitudes.</li> <li>- Difficulties that they faced.</li> <li>- How it was perceived as a professional.</li> </ul>
<b>Work life</b>	<ul style="list-style-type: none"> <li>- Job performance.</li> <li>- Attitude.</li> <li>- Perception of society, family and herself.</li> <li>- Relationship with co-workers.</li> <li>- Relationship with superiors.</li> </ul>

**Table 1** Study categories

The interview guide was developed considering the categories to be used in the research, 15 detailed interviews were applied, recorded and transcribed, the answers were classified by categories in a graphic organizer for analysis.

An analysis of the results obtained from the interviews was carried out with respect to the literature about the topic and the results were discussed.

**Results**

A great varied of results were found, since that not all of them have the same high school education or come from the same social environment, due to young people who come from the city of communities belonging to the state where they come to study at the TecNM Oaxaca campus.

**Before choosing to study engineering**

Most of the engineers interviewed began their career in engineering, due to the motivation of a loved person (father, uncle) to figure out that engineering is interesting, creating and applying mathematics. Another says that she was motivated because one of her teachers taught Information Technology classes at the high school where she studied, she talked to them about the career and how they could work.

Some of them have received contradictory comments, for example referring to why they want to study engineering as women, if engineering is not for women. Such comments, instead of lowering their spirits and diverting them from their goals, have served as an engine to improve and go against the current, following their purposes. Others report that in high school they took a technology or electricity workshop, which allowed them to realize that they had opportunities to study.

One of them says that a high school classmate had the intention of studying engineering but she was from a rural town and that it involved an expense that her parents could not afford, so she chose to study a short career.

**During their engineering studies**

During their training, female engineers had to work harder than men, since some of their teachers have expressed preferential actions towards men over women. Although according to school control statistics in the institution, the failure rate is lower in women than in men.

Such is the case of the anecdote of one of them, who was the original author of a program and obtained a lower rating than her colleagues who cheated the program. Having to study more than their classmates and work harder became a habit for the students.

Unfortunately, one of the graduates told the story of one of her classmates, who, when she became pregnant, could no longer continue with her training as an engineer because she could not afford to support her son and continue with her studies.

Other ones report that they have not had any impediment to study and participate in activities with their male classmates; this also depends on the engineering that they study.

Regarding the knowledge and skills developed by the students, they refer to the fact that during the course they were obtained, however, there were subjects that represented difficulties for them (such as inferential statistics, mathematics) but that was not due to gender.

**Professional residence**

In the Professional Residency stage, engineers put into practice their knowledge learned during their professional training. At this stage they face professional and personal challenges. In the professional part, they have to deal with the stigma that society expects to see a male engineer and not to a woman (like climbing a high transmission tower), however they successfully achieve the curricular part and the reinforcement of their skills, to such a degree that they are sometimes hired to enter the labor market.

**In working life**

Female Engineering is increasingly gaining ground in society and professionally since their job performance and attitude are key elements to strengthen coexistence with superiors and co-workers. The perception of society and the family improves every day since they are supported and given confidence to strengthen their development and job unemployment.

The female engineers are satisfied with their professional development, since they would generally recommend that high school graduates study engineering. Their perception as engineering graduates and certificated of Tecnológico has given them and their families satisfaction.

Unfortunately, sometimes the economic remuneration received by women is less than that of men.

**Gratitude**

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**Conclusions**

The professional identity of female engineers is related to the high school they attend, the people who encouraged them to choose the career, who in most cases were male people, also to the career they took, especially the obstacles they overcame to complete the professional career and resilience that they developed in the different semesters as they progressed in their studies.

Women have more access to university education, but in the areas of engineering the gender gap still needs to be reached, however there is progress, that is why the governments of all countries are promoting programs so that more women join the STEM areas, this will be achieved by promoting an interest for engineering areas from an early age.

It is important to mention that higher education institutions are changing and currently young women are encouraged to study an engineering career, although there are also professors, especially older ones, who discourage them.

Once they finish studying engineering, they perceive themselves as successful women, although later finding a better-paid job also makes it difficult for them. One of them says that she would like to go to work to another state but she finds limitations on the part of her family when they hinder the change of residence.

Another important aspect that they mention is that their professional performance is not always connected according what they studied, coupled with the fact that in the professional field they do not always have the same activities, responsibilities and economic remuneration as their male colleagues, but despite everything they say that they consider that studying an engineering gave them the opportunity to develop professionally in a better way than if they had not studied.

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