Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

https://doi.org/10.23913/ride.v16i32.2946

Scientific articles

Análisis multidimensional del proceso para elaborar el proyecto de titulación por opción curricular en estudiantes de educación superior: Ingeniería

Multidimensional Analysis of the Process for Developing the Degree Project through a Curricular Option in Higher Education Students: Engineering

Análise multidimensional do processo de desenvolvimento do projeto de conclusão de curso por opção curricular em cursos de ensino superior na área de Engenharia

Ricardo Hurtado-Rangel
Instituto Politécnico Nacional, México
rhurtador@ipn.mx
https://orcid.org/0009-0002-1641-0912

Isabel Albarran-Carmona*
Instituto Politécnico Nacional, México
ialbarranc@ipn.mx
https://orcid.org/0009-0006-4470-1302

Everardo López-Sierra
Instituto Politécnico Nacional, México
elopezs@ipn.mx
https://orcid.org/0009-0008-7763-2037

Yair Alvarez-Ruiz
Instituto Politécnico Nacional, México
yalvarezr@ipn.mx
https://orcid.org/0009-0007-2854-587X

Luis Enrique Murillo-Yañez
Instituto Politécnico Nacional, México
lmurilloy@ipn.mx
https://orcid.org/0000-0002-4637-5671

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Rosalba Zepeda-Bautista
Instituto Politécnico Nacional, México
rzepedab@ipn.mx
https://orcid.org/0000-0003-0988-8619

*Autor para correspondencia

Resumen

Este trabajo se desarrolló desde un enfoque multidimensional, con el objetivo de identificar los factores que condicionan la conclusión del proyecto de titulación por opción curricular en estudiantes de educación superior. El estudio utilizado fue de tipo cuantitativo, correlacional y transversal, donde se aplicó un cuestionario tipo Likert con validez del constructo, mostrando alta consistencia interna, mediante un alfa de Cronbach de 0.89 a una muestra de 197 alumnos de la carrera de Control y Automatización (ICA) de la Escuela Superior de Ingeniería Mecánica y Eléctrica unidad Zacatenco (ESIME) del Instituto Politécnico Nacional (IPN), que cursaban el ciclo escolar 2024-2025. Los datos obtenidos se analizaron mediante correlaciones, componentes principales y conglomerados. Los resultados revelaron asociaciones significativas ($p \leq 0.05$) entre procedimiento de elaboración del trabajo y estructura del trabajo ($r = 0.57$), asignaturas y control de avances ($r = 0.58$), plan de trabajo y gestión de dificultades ($r = 0.53$) y, asesoría oportuna y retroalimentación ($r = 0.59$). Asimismo, los estudiantes con mayor probabilidad de concluir su proyecto poseen claridad metodológica, organización en su plan de trabajo, actitud proactiva ante dificultades y acceso constante a asesoría puntual. En contraste, los conglomerados (clústeres) con menor avance presentan deficiencias en la estructuración del proyecto, menor dominio de técnicas de investigación y asesorías insuficientes. Los resultados confirman que la formación metodológica sólida y el acompañamiento académico sistemático constituyen elementos decisivos para fortalecer los índices de titulación por opción curricular.

Palabras clave: análisis multivariado, asesoría, titulación, educación superior, proyecto investigación.

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

Abstract

This work was developed using a multidimensional approach, with the objective of identifying the factors that influence the completion of the graduation project under the curricular option modality in higher education students. This was a quantitative, correlational, and cross-sectional study, where a Likert-type questionnaire with construct validity was applied, showing high internal consistency, with a Cronbach's alpha of 0.89 to a sample of 197 students from the Control and Automation Engineering program (ICA) at the Escuela Superior de Ingeniería Mecánica y Eléctrica, Zacatenco campus (ESIME) of the Instituto Politécnico Nacional (IPN), during the 2024-2025 academic cycle. The data obtained were analyzed using correlations, principal components, and cluster analyses. The results revealed significant associations ($p \leq 0.05$) between the thesis project elaboration procedure and the research project structure ($r = 0.57$), subjects and progress control ($r = 0.58$), work plan and management of challenges ($r = 0.53$) and, timely advising and feedback ($r = 0.59$). Likewise, students with a higher probability of concluding their project demonstrate methodological clarity, organization in their work plan, a proactive attitude toward difficulties, and have consistent access to timely advisement. In contrast, the conglomerates (clusters) with lower progress show deficiencies in project structuring, lower mastery of research techniques, and insufficient advisement. The results confirm that solid methodological training and systematic academic support constitute decisive elements to strengthen graduation rates by curricular option.

Keywords: multivariate analysis, advisement, graduation, higher education, research Project.

Resumo

Este estudo foi desenvolvido a partir de uma abordagem multidimensional, com o objetivo de identificar os fatores que influenciam a conclusão do projeto de conclusão de curso por opção curricular em estudantes do ensino superior. O estudo foi quantitativo, correlacional e transversal, no qual um questionário do tipo Likert com validade de construto, apresentando alta consistência interna (alfa de Cronbach de 0,89), foi aplicado a uma amostra de 197 estudantes do curso de Controle e Automação (ICA) da Escola Superior de Engenharia Mecânica e Elétrica, Unidade Zacatenco (ESIME), do Instituto Politécnico Nacional (IPN), matriculados no ano letivo de 2024-2025. Os dados obtidos foram analisados por meio de

correlações, componentes principais e análise de cluster. Os resultados revelaram associações significativas ($p \leq 0,05$) entre o processo de pesquisa e a estrutura do trabalho ($r = 0,57$), o acompanhamento do progresso nas disciplinas ($r = 0,58$), o planejamento do trabalho e a gestão das dificuldades ($r = 0,53$) e o acompanhamento e feedback oportunos ($r = 0,59$). Além disso, os alunos com maior probabilidade de concluir seus projetos demonstraram clareza metodológica, organização no planejamento do trabalho, proatividade diante das dificuldades e acesso consistente a orientação acadêmica oportuna. Em contrapartida, os grupos com menor progresso apresentaram deficiências na estruturação dos projetos, menor domínio das técnicas de pesquisa e orientação insuficiente. Os resultados confirmam que uma sólida formação metodológica e um apoio acadêmico sistemático são elementos cruciais para o aumento das taxas de conclusão de curso por opção curricular.

Palavras-chave: análise multivariada, orientação acadêmica, conclusão de curso, ensino superior, projeto de pesquisa.

Date Received: December 2025 **Date Accepted:** May 2026

Introduction

Higher education can be understood as a formative stage following upper secondary education, with the objective of training critical professionals capable of solving social problems. In this sense, international organizations such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the UN have defined educational policies that consider inclusion, quality, and equity as essential principles for men and women, which can be achieved through higher education.

UNESCO (1998) defines higher education as studies, training processes, and research activities undertaken after upper secondary education in institutions officially recognized as centers of advanced training. The UN recognizes higher education as an essential means of fostering the holistic development of individuals, as outlined in Sustainable Development Goal 4, which establishes this commitment for 2030, including equitable access for men and women to quality technical, professional, and university programs (United Nations, 2015).

According to Cortijo et al. (2023) argue that higher education is a crucial space for human development, fostering critical, ethical, and social skills, not just disciplinary knowledge. Acevedo et al. (2024) emphasize the importance and relevance of study programs, ensuring they address social, economic, and cultural needs. Martínez & Letor

(2022) incorporate university social responsibility as a central element in education, and Sandoval-Acosta & Reyes-Zúñiga (2025) stress the integration of digital and soft skills to develop abilities that empower students to enter the workforce. Consequently, higher education can be defined as a space oriented towards equity, the holistic development of university students, academic innovation, and social sustainability, contributing to the economic development of nations.

The scientific literature describes university students from different perspectives; Olórtegui-Alcalde et al. (2023) conceive of them as clients of educational services, highlighting the relationship between satisfaction and academic performance. Durán et al. (2021) define them as protagonists of their own learning, responsible for taking on challenges arising from globalization and the technological revolution. According to Naigeboren et al. (2013) commitment and responsibility are traits that contribute to the construction of identity within the university environment.

Professional certification represents the formal culmination of a professional training process and is an academic degree or official certificate that a person receives after successfully completing a higher education program . UNESCO (2021) defines it as accreditation issued by an institution that has the authority to verify the satisfactory completion of the curriculum. According to Lema et al. (2024) obtaining a professional certification is an essential requirement for demonstrating acquired knowledge, skills, and values.

In Mexico, a degree is an essential requirement for entry and retention in many jobs. It serves as a requirement for employers where the graduate possesses the necessary technical, professional, and disciplinary skills, and is linked to better outcomes in the labor market, such as higher income, greater job security, and better working conditions (OECD, 2019).

In general, universities worldwide offer diverse options and mechanisms for obtaining a degree. For this case study, the IPN's Professional Degree Regulations establish eleven graduation options, including the curricular graduation option. This option consists of passing two courses taught in the eighth and ninth semesters (IPN, 1992, art. 14). However, simply passing the courses is not enough to obtain a degree; it is also necessary to develop, present, and defend a written work before a jury, called a Graduation Project. This is the equivalent of a thesis, which is developed during the final year of studies, fulfilling the established criteria (IPN, 2024).

According to Ibarra-López (2017) the thesis in Mexico admits diverse interpretations in accordance with institutional practice and constitutes a scientific-academic document that demonstrates mastery of knowledge as a requirement for obtaining a degree through an examination record. Toing et al. (2019) point out that upon completion of a thesis, research skills are essential, as they prepare young people to responsibly address technological and social challenges. The completion of a university academic program is validated by a degree that certifies the knowledge acquired during the training process and supports the graduate's skills for professional development (Navarrete & Alcántara, 2023). Lema et al. (2024) mention that the professional degree is a requirement that not only guarantees professional training but also allows graduates to occupy higher-level positions in companies and academic institutions.

The National Development Plan recognizes higher education as a fundamental pillar for mitigating inequality and poverty and consolidating competitiveness. Therefore, graduation concludes a formative process and represents a collective achievement that increases the number of professionals capable of solving social, economic, and environmental problems (DOF, 2019). Furthermore, the National Strategic Programs of the Ministry of Science, Humanities, Technology, and Innovation promote the interdisciplinary, comprehensive, critical, and socially committed education of Mexican students (SECIHTI, 2025).

The graduation rate in public higher education institutions barely exceeded 50% in the 2023-2024 academic year, according to the National Association of Universities and Institutions of Higher Education in Mexico (ANUIES, 2024). Therefore, upon graduation, these students face challenges such as: disadvantage compared to other professionals with degrees, job insecurity, limited employability, and limited career advancement opportunities.

In this context, thesis development requires integrating several factors, such as how students acquire knowledge in their courses, receive expert guidance, and apply appropriate methodologies. This aligns with Soler's (2023) emphasis on the need for flexible approaches that encompass the diversity and complexity of educational phenomena. The objective of this study is to conduct a multidimensional analysis using correlations, principal components, and cluster analysis of variables related to the process of developing thesis projects for students in the ICA engineering program at the ESIME Zacatenco campus of the IPN. This analysis is based on the assumption that the completion of the engineering project is directly and significantly related to expert guidance and the research methodology the student receives.

Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

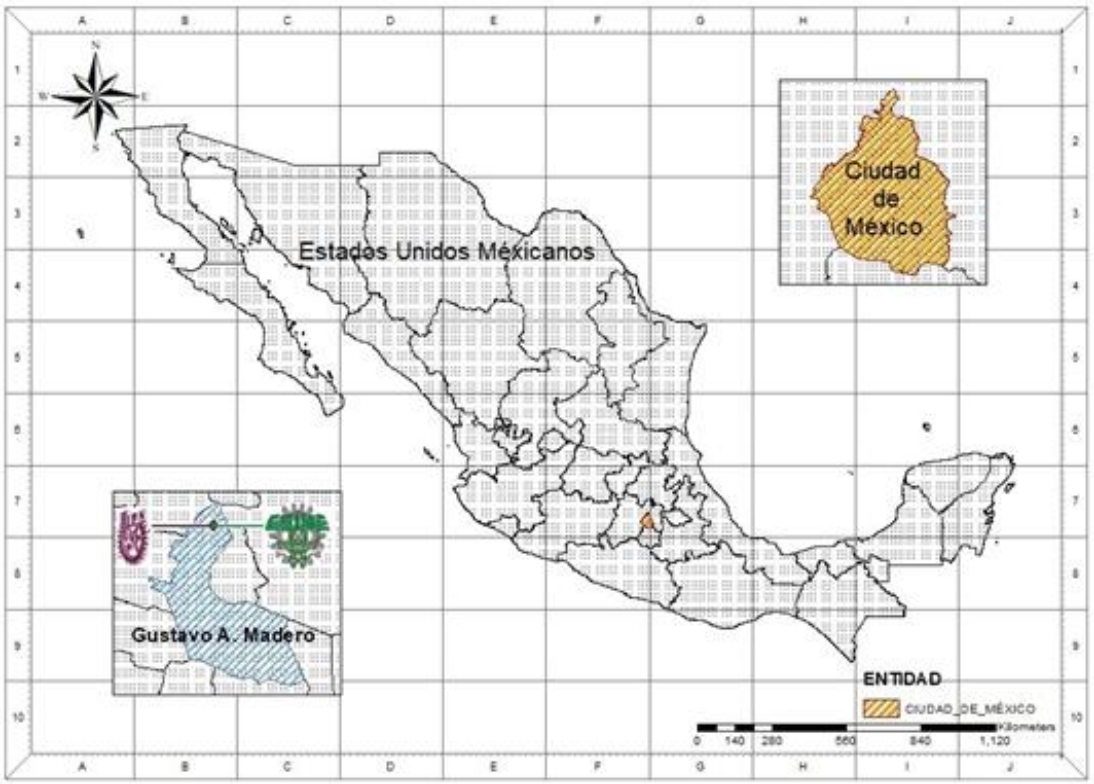
Methodology

Description of the study area

The work was carried out in the Control and Automation Engineering (ICA) program of the ESIME Zacatenco unit of the IPN, located at Av. Luis Enrique Erro S/N, Unidad Profesional Adolfo López Mateos, Zacatenco, Alcaldía Gustavo A. Madero, CP 07738, Mexico City (Figure 1).

This academic unit houses five undergraduate programs and a postgraduate and research area with a student population of 10,804 and 866 faculty members. The ICA program has an enrollment of 2,344 students, distributed across nine semesters, in morning and afternoon sessions, with 359 students in the eighth and ninth semesters (Department of Academic Control, internal information, January 2025).

Figure 1. Location of the ESIME Zacatenco unit of the IPN, Mexico City



Source: Own elaboration

Design of Assessment Instrument

For this research, an instrument with 27 questions was designed, divided into two sections. The first section characterizes the research participants according to their age and gender, and the second section consists of 25 questions. This second section was used to collect information, evaluate, and measure people's perceptions. In the educational context, surveys are frequently used due to their ease of application and implementation, as they can capture student's attitudes, opinions, and levels of satisfaction. These can be quantified and statistically analyzed. The design should consider the clarity of the items, internal consistency, and psychometric validity (Rojas & Toscano, 2025; Tanujaya et al., 2022).

The methodology used was quantitative, correlational, and cross-sectional. A Likert-type survey was developed to assess students' progress in developing their graduation projects, considering expert guidance, their attitudes and aptitudes, and the courses designed for this purpose, which are taken in the final year of their degree program. The instrument was validated by an expert panel of eight judges, achieving an overall agreement of 95.7%, indicating a high level of consensus, and a Cronbach's alpha of 0.89, demonstrating high internal consistency. Response options ranged from 1 to 5 (1 being strongly disagree; 2, disagree; 3, neither agree nor disagree; 4, agree; 5, strongly agree).

Based on the ideas of Marzano and Pickering (2005) higher education learning can be understood as a process that goes beyond the assimilation of academic content. From this perspective, students actively participate in their professional development, making decisions that influence their academic performance, such as time management, seeking academic support, and consciously applying strategies to address the challenges and demands of university life.

Learning is built upon prior knowledge and new information, enabling students to analyze, select, and utilize the resources necessary to complete their thesis project. Personal attitudes, commitment, responsibility, and perseverance play a central role in achieving the established goals.

From Marzano's approach, three dimensions were determined for this case study: learning dimension (DA), expert advice (AE), and methodology for developing the graduation project (MDPT).

1. Dimension (LD): The questionnaire gathers information to describe the student's ability to organize, self-regulate, and apply their knowledge, skills, and attitudes in the development of the graduation project. Among the variables it measures, it

considers time management, work planning, proactive problem-solving, utilization of academic advising, and self-assessment.

2. Expert Advising (EA): For this dimension, there are multiple conceptualizations regarding the thesis advisor, depending on the institution; they are called a tutor or director. Aragón & Jiménez (2022) define them as the academic advisor (expert in the area or topic to be developed) who guides, directs, and supports the student in the development of the thesis and obtaining the degree. Vicario-Molina et al. (2020) state that they also influence professional training, quality of work, and student satisfaction.

There are many approaches, roles, purposes, natures, characteristics, and implications surrounding advising, among other things, but for the purposes of this work, it is conceived as a formative, systematic, and qualitative process, centered on an academic interaction whose result is the development and defense of the thesis (Carruyo, 2007). It is necessary to measure the extent to which advising influences the thesis process, considering the organization of the sessions (days, times, and defined spaces), the clarity of the objective and scope of the topic, the advisor's support in resolving doubts, and timely feedback.

Finally, the performance of the subjects was analyzed: Prospective Project Development (DPP) and Engineering Project (PI), taught during the last two semesters of the degree, which are responsible for coordinating the development of the project for graduation by curricular option, and are therefore responsible for providing the methodology and monitoring the preparation, registration, and presentation or defense of the works.

3. Methodology for Developing the Graduation Project (MDPT). This dimension represents the techniques, steps to follow, and/or a structured guide for the student to develop their work. According to Hernández et al. (2014) it provides the necessary tools to formulate important questions, determine the appropriate strategies for conducting the research, and achieve results that generate knowledge. Moreno et al. (2023) distinguish it and make two important divisions: a normative-instrumental vision, organized into rules and procedures; and a constructive vision, where methodology is understood as the theoretical skill related to the methods, techniques, tools, and designs selected to develop the research.

In this dimension, and based on the previous definitions, the instrument assesses the student's knowledge and mastery of the methodological process for completing the graduation project. It considers their understanding of the curricular graduation process, their

ability to define the topic, the support received from the advisor and the professor responsible for the courses, their use of the institutional methodology, their monitoring and control of the work's progress, and their knowledge of guide formats and the elements required for its development.

The survey was applied in person at the ESIME Zacatenco unit facilities to 197 students with an average age of 23 years, where 71.5% are men who are in the last two semesters of the degree, through a convenience sampling, with a cross-sectional and non-experimental design, based on the availability of the students in September 2024.

Data Management and Analysis

A data file was created using Excel, in which twenty-five variables associated with the case study were recorded and organized. To simplify the analysis and gather relevant information, principal component analysis was applied to reduce dimensionality. By identifying the composite variables, thirteen representative components with the greatest overall variability were selected (Jolliffe, 2002). Cluster analysis was also performed to group students based on patterns of similarity in their characteristics. This multivariate technique resulted in internally homogeneous and clearly differentiated groups, and identified profiles with similar behaviors and perceptions within the analyzed population (Hair et al., 1999). The data were processed using the Statistical Analysis System (SAS, 2014).

Results

Correlation Analysis

The correlation analysis showed four significant correlations ($p \leq 0.05$) between the variables of Work preparation procedure and Work structure ($r = 0.57$), Subjects and Progress control ($r = 0.58$), Work plan and Difficulty management ($r = 0.53$) and, Timely advice and Feedback ($r = 0.59$).

Principal Component Analysis

The first four principal components explained 66.59%, while the first two explained 52.28% of the variability of the data obtained (Table 1).

The first principal component consists of the procedure for developing the work, research strategies, scope of work, work structure, and self-evaluation, with eigenvectors between 0.29 and 0.30 for minimum factor loading (Table 1); therefore, it was named

Research Methodology. The second principal component consists of subjects, work plan, difficulty management, timely advising, and feedback; therefore, it was named Advising, with eigenvectors between 0.35 and 0.43 for minimum factor loading (Table 1).

Table 1. Eigenvectors of the principal components Research methodology and consulting

Variable	Research Methodology	Consulting
Work preparation procedure	0.30	0.15
Research strategies	0.29	0.20
Subjects	0.25	0.43
Scope of work	0.30	0.01
Work structure	0.29	0.08
Work plan	0.26	0.42
Managing difficulties	0.27	0.39
Timely advice	0.25	0.42
Feedback	0.25	0.35
Self-assessment	0.29	0.04

Source: Own elaboration (2025)

Cluster Analysis

The classification of students using cluster analysis was interpreted using the regulatory framework for monitoring academic performance established by the National Council of Science and Technology (CONACYT), considering the criteria of the scholarship recipient performance evaluation form, which assesses academic performance, adherence to the curriculum, and obtaining the degree within the official timeframe. In this sense, the identified clusters reflect perception levels equivalent to the institutional evaluation categories (UNAM, n.d.) (Table 2).

The cluster results classified the students of the ICA career subjects into four clusters according to their perception to graduate by curricular option in: Completely sure to present (PTCCS), sure to present (PTCS), almost sure to present (PTCCAS) and not sure to present (PTCNS) (Table 2).

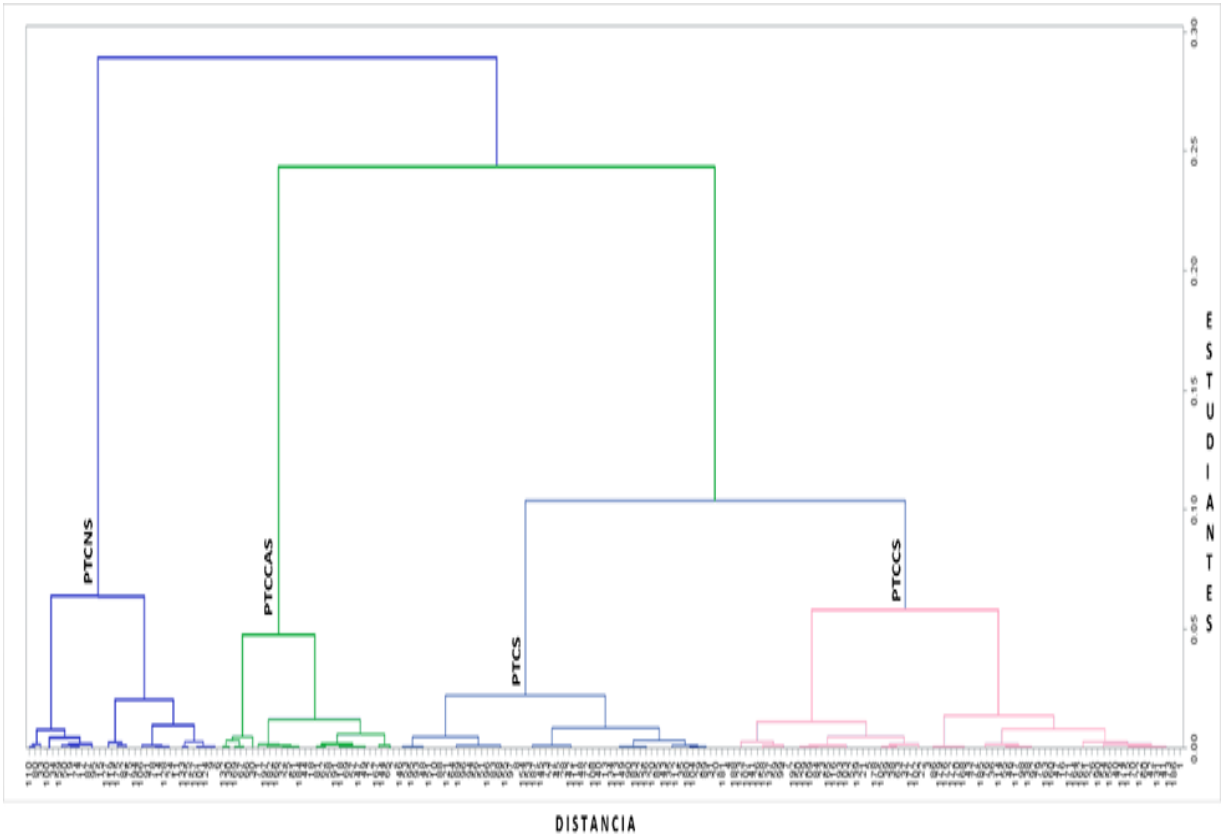
Table 2. Cluster Equivalencies with Academic Performance Evaluation

Study cluster	Conceptual equivalence in the CONACYT format
PTCCS – Completely safe to present	Excellent / Completely safe
PTCS – Insurance to present	Good / Safe
PTCCAS – Almost certain to submit	Sufficient / Almost certain
PTCNS – Not safe to present	Unsatisfactory / Unsafe

Source: Own elaboration (2025)

PTCCS and PTCS are students who respond positively to all variables, such as receiving guidance, applying methodologies, and organizing their time. Those considered "almost certain" respond negatively to some variables, while those considered "not certain" have scores and averages below the overall average. These groups are described in the following sections.

Figure 2. Dendrogram of the classification of graduation projects by curricular option.



Source: Own elaboration (2025)

Completely Safe Curricular Option Graduation Project (PTCCS)

Thirty-nine percent of the students surveyed belong to this cluster; of these, 32% are women, while the rest are men, with an average age of 23. Using a Likert scale, an average of 4.17 was obtained, where 85.5% of them mentioned at least agreeing to use a methodology to develop their project, and 92% know and use a procedure for preparing the work, with an average of 4.30.

89% agree that they have no problems gathering information on the topics they are researching, with an average of 4.40. With an indicator of 4.12 in research strategies, an average of 80.5% say they know the research techniques and actions that they will use for the development of their work.

Also, 76.6% of them consider the subjects they are taking useful in order to develop a project, since their doubts are resolved in the courses and 83.1% mention that they keep track of progress, having an average in the indicators of 4.05 and 4.21, respectively.

For the delimitation of the work, 93.5% of the students managed to clearly establish the objectives and scope, with an average of 4.61, which indicates that they were able to focus the study within the time and resources available, avoid ambiguities and ensure the viability of the project.

In the sample, 85.7% reported knowing a guide format for structuring a thesis, with a mean of 4.32, indicating that they have the fundamental elements to define, organize, and present their work. 93.5% of respondents stated that they have a work plan and follow it as scheduled, with a mean of 4.27, indicating that they are organized (Table 3).

92.2% of students in the PTCCS cluster, with an average score of 4.42, demonstrated effective management of difficulties encountered while completing their work. They also indicated that advising was timely (88.3%) and feedback was good (87%), noting that their advisors were willing to clarify doubts and provide timely feedback. Both variables showed average scores of 4.51 and 4.39, respectively, indicating that participants recognized the support received as a factor facilitating progress in their thesis projects. Finally, based on these results, 80% of these students considered their performance in the courses to be good, with an average score of 4.30 on the Likert scale.

Table 3. Indicators that influence engineering students to complete their project

Variables	Graduation Project by Curricular Option							
	Completely safe PTCCS		PTCS Insurance		Almost certain PTCCAS		Unsure PTCNS	
	Average	Indicator	Average	Indicator	Average	Indicator	Average	Indicator
Methodology	85.5%	4.17	75.4%	3.37	57.1%	3.40	9.3%	2.98
Work preparation procedure	92%	4.30	47.3%	3.37	24.1%	3.10	15.6%	2.36
Information gathering	89%	4.40	61.4%	3.72	75.8%	3.87	37.5%	3.18
Research strategies	80.5%	4.12	47.3%	3.39	37.9%	3.17	12.5%	2.58
Subjects	76.6%	4.05	49.1%	3.30	93.1%	4.53	3.2%	1.88
Scope of work	93.5%	4.61	70.2%	3.81	72.4%	4.0	37.5%	3.03
Work structure	87.5%	4.32	68.4%	3.63	48.2%	3.43	28.1%	2.58
Work plan	93.5%	4.27	56.1%	3.54	20.6%	2.77	28.1%	2.88
Managing difficulties	92.2%	4.42	52.6%	3.53	27.5%	2.73	37.5%	3.03
Progress monitoring	83.1%	4.21	50.8%	3.46	93.1%	4.37	18.7%	2.55
Timely advice	88.3%	4.51	78.9%	3.95	96.5%	4.77	18.7%	2.55
Feedback	87%	4.39	61.4%	3.67	89.6%	4.63	25%	2.79
Self-assessment	80%	4.30	66.6%	3.74	51.7%	3.53	18.7%	2.70

Source: Own elaboration (2025)

Safe Curricular Option Graduation Project (PTCS)

This cluster comprises 29% of the students, with an average age of 23, and 72% are male. The Likert scale scores obtained from the survey range from 3.3 to 3.95, generally indicating that the students do use methodologies, receive guidance, and consider their class performance to be good. Among the most relevant findings, 75.4% of the cluster uses a methodology and has a well-defined structure (68.4%) and scope of work (70.2%). Furthermore, the students recognize that their guidance is timely (78.9%); they also mention receiving feedback from their advisors (61.4%), and their self-evaluation is good (66.6%), which is relatively lower compared to the PTCCAS cluster (Table 3).

Almost certain curricular option graduation project (PTCCAS)

This group comprises 15.2% of the students, with an average age of 23, and 73.3% are male. However, it clearly differs from the other groups by presenting higher indicators in variables associated with academic support and process monitoring. Specifically, 96.5% report receiving good advising, 89.6% report receiving feedback from reviews, and 93.1% indicate that their progress in their courses is monitored. In contrast to the PTCS group, the reported feedback is lower, and compared to the PTCNS group, the classroom performance suggests that it does not contribute to the completion of their work.

Also, 75.8% of the cluster shows strengths in gathering information and selecting reliable sources, as well as clearly defining their thesis project (72.4%), which demonstrates mastery of research skills (Table 3). This establishes this group as the most consistent in organization, support, and academic progress.

Unsafe curricular option graduation project (PTCNS)

This cluster comprises 16.8% of the students, with an average age of 23, and 75.7% are male. Unlike the PTCS and PTCCAS clusters, their indicators are below 3.18, demonstrating that they do not follow or are unfamiliar with methodologies, do not receive advising support, and there is no follow-up on their coursework. Although the relatively higher proportions are observed in information gathering, work delimitation, and difficulty management (with an average of 37.5), most of the evaluated variables remain below 20% (Table 3). Overall, this cluster reflects less consolidated academic and methodological conditions, which aligns with the "not certain" category for project completion.

Discussion

Correlation Analysis

Four significant correlations ($p \leq 0.05$) were determined between the variables work preparation procedure and work structure, as well as subjects and progress monitoring. Similar results were found by Murrieta (2024) when evaluating four programs at a teacher training college and by Claret-Véliz (2024) who highlights the importance of progress monitoring and adherence to the activity schedule.

The correlation found between work planning and difficulty management lies within the learning dimension, which measures how the student commits to completing their work.

When students organize and plan their activities and goals according to the established timeframe, they demonstrate a positive attitude toward problems and challenges encountered while working as observed by Reyes-González et al. (2022) in their evaluation of students at the Catholic University of Colombia. According to Claret-Véliz (2024) the relationship between these variables shows that students who are organized and plan their activities are more likely to overcome difficulties and/or obstacles.

The correlation between timely advising and feedback lies in the dimension of expert guidance. That is, when advisors are willing to answer student's questions, they also provide timely review and feedback on their work. This is as indicated by Molina et al. (2020) in their research on personalized academic support at the University of Jaén.

Therefore, advisors serve as a guide for defining the topic, delimiting the problem, and developing the work, fostering systematic monitoring and promoting constant review, which in turn improves the coherence, depth, and quality of the work. As Reséndiz-Castro & Zepeda-Bautista (2021) mention , this involves supporting the student throughout their entire educational process, from topic selection to the emotional and logistical management of the work.

Principal Component Analysis

The first component was named research methodology, defined as a set of systematic, technical, ordered, and logical procedures taught in the courses that enable students to achieve the objectives established in their projects. According to Muñoz (2011) this involves using a coherent structure that aligns the problem, the theoretical context, the objectives, and the methodological framework.

It is worth mentioning that the professors who teach the subjects have the responsibility to avoid a superficial or dogmatic understanding of the methodology. This is so that students can appropriate it from a more contextualized, critical, and adaptable perspective, as a tool that is systematically, logically, and well-foundedly tailored to the problem in order to generate valid and reliable results (Arias, 2006).

The variable "procedure for developing the work" is part of the main component, since students need a guide to follow. Some authors agree that developing a research project requires following a systematic structure that allows them to accurately identify the research problem, theoretically support the research, justify its relevance, and establish coherent objectives (Lavado-Puente et al., 2025).

During their academic training, university students acquire and develop strategies in human development, methodology, research, and other areas, which they put into practice in their final semesters. Therefore, the variable of research strategies is considered relevant. According to Marín et al. (2023) research strategies can be understood as sets of planned procedures.

Defining the scope of the research is key to conducting a study, as it establishes the object of study and the necessary actions. A well-defined problem statement facilitates the organization of the work, reduces thematic dispersion, and promotes the completion of the research. As Elizondo & González (2021) point out, these stages represent critical phases of the research process, requiring constant revisions, repeated readings, and successive adjustments until a concrete definition of the object of study is achieved.

Following a structured approach to the work is crucial, as it serves as a guide for incorporating progress and ensuring the project's success. This structure is important for defining the problem, justification, objectives, and methodology, since these are key elements for the project's development and defense. This aligns with Ocaña (2018) on thesis configuration and Azuero (2019) on defining the methods, tools, and techniques to consider for justifying and clarifying decision-making.

The student's self-assessment was considered, allowing them to evaluate their learning experience, which is reflected in the results of the degree process. According to Köppe et al. (2024) it is important to observe how a reflective process defines the proactivity and autonomy of individual learning; therefore, self-assessment allowed for the measurement of quality criteria and growth in the research process. Similarly, Hostia et al. (2025) establish in their research on learning strategies in the university setting that the conscious application of metacognitive strategies, such as prior organization of work, continuous monitoring of one's own performance, and regulation of the mental processes involved in self-regulation by the student, reflect self-assessment.

The second main component was called advising, where the teacher guides the student in the preparation of the work with academic, motivational implications, observations and/or corrections, support and autonomy which influence their satisfaction and performance (Castro-Rodríguez, 2025).

Hernández et al. (2014) consider advising, a guide for the student, from the formulation of the problem to the final writing, among the implications observed is the requirement of structured support , which corrects and trains the student in critical thinking,

with academic validation that guarantees that the work meets the criteria of rigor, with continuous feedback providing constructive observations at each stage of the project.

The variable "subjects" was included to measure the extent to which these subjects are influencing the development of the work. According to Pastora et al. (2020) in the research methodology class, they mention that students are not only prepared to carry out their final degree project, but their research skills, synthesis abilities, and analytical skills are also emphasized in relation to their graduation process.

The variables of work plan and difficulty management are crucial for completing the project. When students use a guide, organize advising sessions, consider the established timeframe for developing the work, and seek out techniques, tools, and strategies to overcome obstacles, they can successfully complete their thesis. According to Quijada (2018) the student's attitude during advising sessions is key, as their proactivity and conflict resolution skills demonstrate how they influence academic success, especially in the development of a thesis.

The variables of timely guidance and feedback demonstrate the advisor's responsibility, willingness, and level of commitment to addressing questions, observations, and recommendations in a timely manner. Along these lines, Schiavinato & Difabio (2025) argue that feedback should be effective and bidirectional, as this exchange strengthens critical thinking and builds a socio-affective relationship that influences the student's motivation and perseverance.

Cluster Analysis

Principal component analysis, with the reduction to 13 variables for cluster analysis, allowed for the generation of a classification into four clusters. Based on the results, it is clearly established which students will complete and present their thesis projects, and which will not. This research found that PTCCS and PTCS have higher indicators and averages, which contributes to their project completion and presentation compared to the PTCCAS and PTCNS clusters.

The results obtained in the PTCCS and PTCS clusters demonstrate knowledge and use of research methodologies and strategies. Students define and follow structured procedures and plans in the development of their work. The difference lies in the higher scores and averages of the first cluster. This is due to the inclusion of research methodologies and techniques in the course content, which are essential for defining the topic and the overall

project. The suggested bibliography addresses methodologies such as those proposed by Hernández et al. (2014) from quantitative, qualitative, or mixed approaches, as well as those mentioned by García (2004) which employ a practical and structured approach, among other recommended authors. This further demonstrates that the courses fulfill the syllabus content.

Another important aspect is that these two student groups follow the methods and recommendations provided by their advisors and courses, which are also based on bibliographic sources. According to Eco (2010) the thesis process begins with the selection of a specific, viable, and well-defined topic. It requires planning through a provisional outline to guide the logical structure of the work, ensuring clarity, coherence, and academic rigor in the writing, among other recommendations. This procedure demonstrates that students are disciplined and committed to their work. They also gather information, organize it, and utilize various sources. This contrasts with Espinoza's (2020) observation that university students do not master strategies for searching for information from reliable sources, which limits the quality of their work.

In the PTCCS and PTCS clusters, it is evident that by using research strategies, their engineering work strengthens the research process and improves its quality. Azuero's (2019) interpretation supports the idea that these strategies include organized actions to define the problem, review theoretical background, structure the conceptual framework, select methods for collecting and analyzing data, and present the results.

The courses taught for the development of the thesis project are essential for this engineering program, as they allow students to define and delimit the topic, structure the work and/or methodology, plan the work, receive academic guidance, and prepare for the defense. For the PTCCS and PTCS clusters, these courses do not present any problems; unlike the issues described in the research by Ugarte & Salvatierra (2020) the absence of thesis-focused courses within university curricula does not create disadvantages for these students, graduates, or those who have already received their degrees.

The PTCCS and PTCS clusters claim to have developed a structure and plan for their graduation project, taking into account the established formats and timelines. According to Reyes -González et al. (2022) those who use planning strategies, schedules, and prioritize their activities achieve their goals and reduce obstacles in the development of their work. Defining the scope of the project is another important and fundamental aspect, as it determines the methodological framework that guides the student in developing their work.

Similarly, Bonet et al. (2023) indicate that the thesis structure consists of a set of essential elements organized into sections and/or chapters that comprise the final work.

In this study, managing difficulties is conceived as a strategic attitude adopted by students to anticipate and confront the challenges inherent in the research and writing process. This approach implies that students are willing to seek new techniques and strategies to meet the demands of their thesis, qualities found in PTCCS and PTCS, and, as Claret-Véliz (2024) affirms contribute to their training and ability to develop and defend their projects.

The PTCCS and PTCS clusters agree that the support received is a helpful factor that facilitates progress in their thesis projects. It can be stated that timely advising and feedback are fundamental variables for successfully completing the work. The findings align with Soto (2020), where regular advising is a key component for conducting, developing, and completing research. Other authors affirm that adapting advising to the specific needs of students increases the likelihood of them finishing their theses (Chávez-Fernández et al., 2024).

Self-assessment allowed us to measure student's self-awareness regarding their ability to conduct research. A key point is the positive perception of their performance in class, which aligns with and strengthens the research process. This is evidenced in the results of the PTCCS and PTCS assessments. As Sánchez (2023) mentions, self-evaluation directly influences academic performance and supports student's potential, consequently facilitating the achievement of goals.

The results of the PTCCAS showed that these students received guidance, review and feedback, as well as support in their subjects to define the project, monitor progress, and had no problems in gathering information.

On the other hand, they struggle with administration, organization, planning, and the use of research strategies for developing written work, meaning they do not meet the challenges presented to them. As Reyes-González et al. (2022) point out, low-achieving students lack clear strategies, planning, and organizational tools, which does not guarantee success in academic work.

Finally, the PTCNS cluster represents the group with the least favorable conditions. According to the analysis of their indicators and average values, these students will not complete their thesis projects, nor will they pass their courses. This is because the findings

show deficiencies in the advising processes, limited knowledge or mastery of methodologies for developing the thesis work, and consequently, poor performance in their courses.

Conclusions

The twenty-five questions posed in the instrument were grouped into three dimensions called: Learning dimension, expert advice and methodology for developing the graduation project.

The results of the correlation, principal component, and cluster analysis revealed that if the student manages their difficulties positively, receives guidance, maintains support in the subjects, and uses a research methodology, all these variables significantly influence the completion of the thesis project.

The findings from the correlation analysis indicate that students who take the courses and adopt a defined work methodology, in addition to having support for resolving doubts, tend to maintain systematic control of their progress. At the same time, this group of students receives continuous expert guidance and follows instructions, which benefits the completion of the work.

Students who generally follow procedures also organize their work, which promotes the use and development of an appropriate methodology. The correlation between the procedure for preparing the work and its structure suggests that mastery of processes, tools, and methods is associated with a suitable structure for academic work.

The main findings showed that methodology and advising are key factors in successfully completing a thesis. Methodology, by integrating research procedures and strategies, helps to structure the work coherently and with a solid foundation, while advising ensures guidance, feedback, and support from the problem formulation stage to completion. Therefore, it is recommended to promote specific tutoring sessions, as well as formative follow-up that integrates methodology, advising, and self-evaluation to guarantee academic rigor and the development of research skills.

The analysis differentiated student's perceptions of graduating through their chosen curriculum into four clusters. This classification shows a conceptual correspondence with the institutional criteria for monitoring and evaluating academic performance used by CONACYT, which reinforces the relevance of the results for understanding graduation pathways in higher education.

The PTCCS and PTCS clusters demonstrated an acceptable command of methodological elements, as well as the attitude they adopted in problem-solving during the development of the work. In contrast, the clusters with the lowest probability of completing the work, corresponding to PTCCAS and PTCNS, showed a lack of organization, planning, and methodological appropriation in the degree courses.

It is suggested that methodological training be designed, implemented, and implemented to strengthen it, as well as standardizing criteria for advising, support, and reviewing the progress of student work. Improving these components will help students develop high-quality thesis projects and contribute to the project's success.

Future lines of research

The study analyzed variables related to graduation by curricular choice and academic factors corresponding to project completion. However, the phenomenon is multidimensional, and some variables were not included in the analysis. Therefore, it is recommended that future research include components such as income, motivation, and academic stress to broaden the explanation of the process and support the design of effective intervention strategies.

References

Acevedo, C. F., Meneses, C. P., & da Silva, M. M. A. (2024). *La noción de calidad de la educación superior y sus principales componentes: Un estado del arte*. *Educación Superior y Sociedad*, 36(1), 22–49. https://doi.org/10.54674/ess.v36i1.867

Asociación Nacional de Universidades e Instituciones de Educación Superior [ANUIES]. (2024). *Anuarios estadísticos de educación superior*. https://www.anuies.mx/informacion-y-servicios/informacion-estadistica-de-educacion-superior/anuario-estadistico-de-educacion-superior

Aragón, V. L. F., & Jiménez, M. A. (2022). *Buenas prácticas de supervisión de tesis de grado y posgrado*. *Pensar en Movimiento: Revista de Ciencias del Ejercicio y la Salud*, 20(1). https://doi.org/10.15517/pensarmov.v20i1.50522

Arias, F. G. (2006). *Mitos y errores en la elaboración de tesis y proyectos de investigación* (3.ª ed. actualizada y corregida). Editorial Episteme.

Azuero, A. Á. E. (2019). *Significatividad del marco metodológico en el desarrollo de proyectos de investigación*. *Revista Arbitrada Interdisciplinaria Koinonía*, 4(8), 110–127. https://www.redalyc.org/articulo.oa?id=576861156005

Bonet, C. O., Mazot, R. A., Casanova, G. M., & Cruz, P. N. R. (2023). *Proyecto de investigación y tesis: Guía para su elaboración*. *MediSur*, 21(1), 274–288. http://scielo.sld.cu/scielo.php?script=sci_abstract&pid=S1727-897X2023000100274

Carruyo, D. D. C. J. (2007). *Conversando con tutores y asesores de tesis*. *Visión Gerencial*, 6(número especial), 16–32. https://www.redalyc.org/articulo.oa?id=465545877006

Castro-Rodríguez, Y. (2025). *Satisfacción con la supervisión (asesoría) de tesis por parte de estudiantes de pregrado*. *Revista Médica Electrónica*, 47, e5857. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1684-18242025000100021

Chávez-Fernández, A. M. V., Salazar, S. M. E., & Fasabi, H. K. I. (2024). *Asesoría integral como estrategia frente a las dificultades en los proyectos de tesis de posgrado*. *Comuni@cción*, 15(3), 212–223. https://doi.org/10.33595/2226-1478.15.3.1069

Claret-Véliz, A. (2024). *Cómo defender una tesis desde la experiencia de un tesista, docente e investigador*. *Gestio et Productio*, 6(10), 94–105. https://doi.org/10.35381/gep.v6i10.105

Cortijo, R. G., Riquelme, S. V., & Galvis, M. J. D. (2023). *La educación superior como plataforma para el desarrollo humano*. *Revista Latinoamericana de Estudios Educativos*, 53(2), 367–384. https://doi.org/10.48102/rlee.2023.53.2.548

Diario Oficial de la Federación. (2019). *Plan nacional de desarrollo 2019–2024*. https://www.dof.gob.mx/nota_detalle.php?codigo=5565599

Durán, C. C. M., Páez, Q. D. C., & Nolasco, S. C. (2021). *Perfil, retos y desafíos del estudiante universitario en el siglo XXI*. *Boletín Redipe*, 10(5), 189–198. https://doi.org/10.36260/rbr.v10i5.1296

Eco, U. (2010). *Cómo se hace una tesis: Técnicas y procedimientos de estudio, investigación y escritura* (9.ª reimp.). Gedisa.

Elizondo, C. M., & González, V. M. del C. (2021). *Delimitación del problema y la pregunta de investigación*. Universidad Nacional Autónoma de México. https://librosoa.unam.mx/handle/123456789/3295

Espinoza, F. E. E. (2020). *La búsqueda de información científica en bases de datos académicas*. *Revista Metropolitana de Ciencias Aplicadas*, 3(1), 31–35. https://www.redalyc.org/pdf/7217/721778104006.pdf

García, C. F. (2004). *La tesis y el trabajo de tesis: Recomendaciones metodológicas para su elaboración*. Limusa.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1999). *Análisis multivariante* (5.ª ed.). Prentice Hall Iberia.

Hernández Sampieri, R., Fernández-Collado, C., & Baptista Lucio, M. del P. (2014). *Metodología de la investigación* (6.ª ed.). McGraw-Hill Education.

Hostia Luque, T. V., Hernández Sono, V. Y., Mendoza León, O., Pérez Mena, C., & Reyes González, M. E. (2025). *Metacognición como estrategia para lograr aprendizajes en estudiantes universitarios*. *Revista InveCom*, 5(4), e504074. https://doi.org/10.5281/zenodo.14867733

Ibarra-López, P. (2017). *La titulación por tesis en México: El problema de su conceptualización*. *Dilemas Contemporáneos: Educación, Política y Valores*, 4(3).

Instituto Politécnico Nacional. [IPN]. (2024). *Criterios de operación de la opción de titulación curricular que se imparten en la ESIME Zacatenco*. Escuela Superior de Ingeniería Mecánica y Eléctrica, Subdirección Académica.

Instituto Politécnico Nacional. [IPN]. (1992, abril) [IPN]. *Reglamento de titulación profesional del Instituto Politécnico Nacional*. *Gaceta Politécnica*.

Marzano, R. J., & Pickering, D. J. (2005). *Dimensiones del aprendizaje: Manual del maestro* (2.ª ed.). Instituto Tecnológico y de Estudios Superiores de Occidente.

Muñoz Razo, C. (2011). *Cómo elaborar y asesorar una investigación de tesis* (2.ª ed.). Pearson Educación.

Murrieta, O. R. (2024). *Escritura académica en educación superior: Dificultades y desarrollo de saberes con apoyo de las TIC*. *RIDE. Revista Iberoamericana para la Investigación y el Desarrollo Educativo*, 15(29). https://doi.org/10.23913/ride.v15i29.2044

Naciones Unidas. [ONU]. (2015). *Educación superior*. https://www.un.org/es/impacto-acad%C3%A9mico/educaci%C3%B3n-superior

Naigeboren, G. M., Caram, G., Gil de Asar, M., & Bordier, M. S. (2013). *¿Qué significa ser estudiante universitario? Representaciones de los alumnos de ciencias de la educación de la UNT*. En *V Congreso Internacional de Investigación y Práctica Profesional en Psicología; XX Jornadas de Investigación y IX Encuentro de Investigadores en Psicología del MERCOSUR*. https://www.aacademica.org/000-054/451

Navarrete, C. Z., & Alcántara, S. A. (2023). *Innovaciones tecnológicas en el proceso de titulación en la Universidad Nacional Autónoma de México*. *Educación Superior y Sociedad*, 35(2), 262–291. https://doi.org/10.54674/ess.v35i2.818

Ocaña, O. A. (2018). *La configuración de la tesis doctoral: Su estructura, redacción, defensa y publicación*. *Revista Latinoamericana de Estudios Educativos*, 14(2), 102–131. https://doi.org/10.17151/rlee.2018.14.2.6

Organización para la Cooperación y el Desarrollo Económicos. [OECD]. (2019). *Educación superior en México: Resultados y relevancia para el mercado laboral*. OECD Publishing. https://doi.org/10.1787/a93ed2b7-es

Olórtegui-Alcalde, L. M., Deroncele-Acosta, A., Romero-Salas, M., Aguilar-Morante, W. F., & Olórtegui-Alcalde, O. W. (2023). *El estudiante universitario como cliente: Relación con la satisfacción estudiantil y el rendimiento académico*. *Universidad y Sociedad*, 15(3), 535–544. http://scielo.sld.cu/scielo.php?script=sci_abstract&pid=S2218-36202023000300535

Pastora Alejo, B., Fuentes Aparicio, A., Rivero Padrón, Y., & Pérez Falco, G. (2020). *Importancia de la asignatura metodología de la investigación para la formación investigativa del estudiante universitario*. *Revista Conrado*, 16(73), 295–302

Quijada, L. K. Y. (2018). *Rasgos de la excelencia en la investigación: Proactividad, pasión por el conocimiento y resiliencia*. *Sinéctica*, 51. https://doi.org/10.31391/s2007-7033(2018)0051-011

Reséndiz-Castro, M., & Zepeda-Bautista, R. (2021). *Marco de trabajo de la función de tutoría universitaria para favorecer la permanencia estudiantil con enfoque cibersistémico transdisciplinario*. *RIDE. Revista Iberoamericana para la Investigación y el Desarrollo Educativo*, 12(23). https://doi.org/10.23913/ride.v12i23.1009

Reyes-González, N., Meneses-Báez, A. L., & Díaz-Mujica, A. (2022). *Planificación y gestión del tiempo académico de estudiantes universitarios*. *Formación Universitaria*, 15(1), 57–72. https://doi.org/10.4067/S0718-50062022000100057

Rojas, M. E. R., & Toscano, G. J. (2025). *Instrumento para la evaluación de la satisfacción del aprendizaje: Diseño, validación y análisis psicométrico de una escala Likert*. *Dilemas Contemporáneos: Educación, Política y Valores*, 13(1). https://doi.org/10.46377/dilemas.v13i1.4743

Sánchez, L. A. F. (2023). *Autoconcepto y rendimiento académico de estudiantes universitarios*. *Universidad, Ciencia y Tecnología*, 27(118), 61–68. https://doi.org/10.47460/uct.v27i118.687

Sandoval-Acosta, J. A., & Reyes-Zúñiga, C. G. (2025). *Identificación de las competencias blandas para tutores en educación superior: Un estudio sistemático*. *RIDE. Revista Iberoamericana para la Investigación y el Desarrollo Educativo*, 16(31). https://doi.org/10.23913/ride.v16i31.2497

Schiavinato, N. S., & Difabio, H. (2025). *La supervisión de tesis como relación dialógica: La importancia de la retroalimentación en las prácticas de enseñanza de la escritura*. *Praxis Educativa (Argentina)*, 29(1), 1–17. https://doi.org/10.19137/praxiseducativa-2025-290112

Secretaría de Ciencia, Humanidades, Tecnología e Innovación. [SECIHTI]. (2025). *Programas nacionales estratégicos*. https://secihti.mx/pronaces/

Soler, G. R. A. (2023). *El método científico y el pensamiento complejo para la investigación en la educación superior actual*. *Logos Ciencia & Tecnología*, 15(2), 147–160. https://doi.org/10.22335/rlct.v15i2.1780

Soto, F. C. H. (2020). *Factores asociados a la elaboración de tesis en la Universidad Nacional de Asunción, Paraguay*. *Actualidades Investigativas en Educación*, 20(2), 500–527. https://doi.org/10.15517/aie.v20i2.41676

Tanujaya, B., Indra, P. R. C., & Mumu, J. (2022). *Likert scale in social sciences research: Problems and difficulties*. *FWU Journal of Social Sciences*, 16(4)

Toing, C. A., Sabir, F., & Willison, J. (2019). *Research skills that men and women developed at university and then used in workplaces*. *Studies in Higher Education*, 44(12), 2346–2358. https://doi.org/10.1080/03075079.2018.1496412

Ugarte, P. F. M., & Salvatierra, M. Á. (2020). *Los procedimientos empíricos en el proceso de titulación profesional en la universidad pública*. *Revista Scientific*, 5(16), 82–98. https://doi.org/10.29394/Scientific.issn.2542-2987.2020.5.16.4.82-98

Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura. [*UNESCO*]. (1998). *Conferencia mundial sobre la educación superior*. https://unesdoc.unesco.org/ark:/48223/pf0000116720

Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura. [*UNESCO*]. (2021). *Guía práctica: Aplicación de la convención mundial sobre el reconocimiento de las cualificaciones relativas a la educación superior*. https://unesdoc.unesco.org/ark:/48223/pf0000374905_spa

Universidad Nacional Autónoma de México. [UNAM]. (s. f.). *Formato de evaluación del desempeño del becario CONACYT*. https://posgrado.unam.mx/filosofia/?p=583

Vicario-Molina, I., Martín-Pastor, E., Gómez-Gonçalves, A., & González, R. L. M. (2020). *Nuevos desafíos en la educación superior: Análisis de resultados y dificultades en el trabajo fin de grado*. *Revista Complutense de Educación*, 31(2), 185–194. https://doi.org/10.5209/rced.62003

Contribution Role	Author(s)
Conceptualization	Isabel and Ricardo (same)
Methodology	Rosalba and Yair (same)
Software	Rosalba, Isabel and Ricardo (same)
Validation	Everardo and Luis (same)
Formal Analysis	Ricardo, Isabel and Rosalba (same)
Investigation	Isabel and Ricardo (same)
Resources	Isabel, Rosalba, Ricardo, Yair, Luis and Everardo (same)
Data curation	Ricardo, Isabel and Rosalba (same)
Writing - Preparing the original draft	Isabel, Rosalba, Ricardo, Yair, Luis and Everardo (same)
Writing - Reviewing and Editing	Isabel and Ricardo (same)
Display	Yair, Luis and Everardo (same)
Supervision	Rosalba
Project Management	Not applicable
Acquisition of funds	Not applicable