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# **ECORFAN-Journal Colombia**

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In the first article we present, *STEAM Girls Club: A strategy to reduce the gender gap and develop soft skills* by González-Barrón, María Teresa, Alvarado-Medellín, Marisela and Barrios-Rodríguez, Lilia Gabriela, with adscription in the Universidad Tecnológica de Altamira, as the next article we present, *Generation of Assisted Learning Objects: The UTNG Case* by Rodríguez-García, Anastacio, Barrientos-Avalos, Eduardo and Méndez-Mendoza, Maricela, with adscription in the UT del Norte de Guanajuato, as the next article we present, *Prevention of suicidal ideation, workshop proposal*, by Mena-Álvarez, Andrea, with adscription in the Universidad Autónoma de Chiapas, as the next article we present, *Academic burnout in accounting university students: Evidence from Two Mexican Contexts*, by Aceves-López, Jesús Nereida, Cruz-Sánchez, Zoily Mery, Aceves-Cordova, Erika Soledad and González-Navarro, Nora Edith, with adscription in the Instituto Tecnológico de Sonora and Universidad Autónoma de Chiapas..

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
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# STEAM Girls Club: A strategy to reduce the gender gap and develop soft skills

## Club de Niñas STEAM: Una estrategia para reducir la brecha de género y generar habilidades blandas

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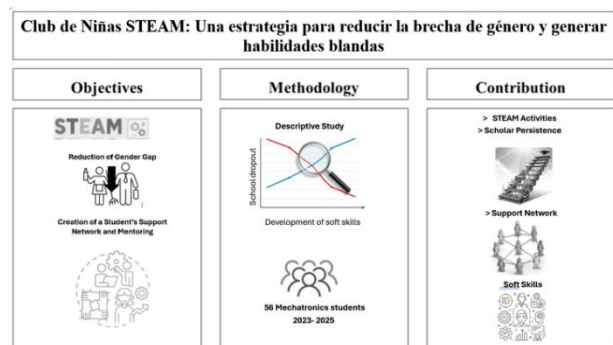
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**Abstract**

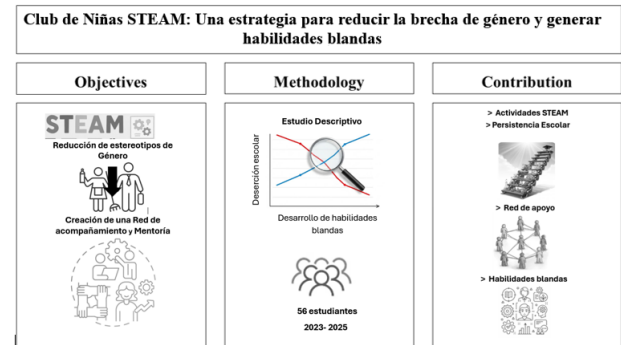
The objective of this research is to present the STEAM Girls Club as a strategy that helps reduce the gender gap by decreasing dropout rates among its members and by developing soft skills through the educational approaches used within the club, such as service-learning and mentoring. The study, which is mixed-method, longitudinal, and descriptive, analyzes dropout rates and the development of soft skills among the club members over time. The population consisted of 56 women enrolled in the Mechatronics program. The results show a lower dropout rate among members compared to that reported by the generational cohort. Furthermore, there was evidence of strengthened skills such as leadership, empathy, teamwork, effective and assertive communication, listening ability, and more. The findings suggest that active participation in the club contributes to comprehensive development and academic success.

**Resumen**

El objetivo de esta investigación es presentar al club de niñas STEAM como una estrategia que permite reducir la brecha de género, al disminuir la deserción de sus integrantes y al generar habilidades blandas a través de los enfoques educativos que operan dentro del club, como lo son el aprendizaje servicio y las mentorías. El estudio, de tipo mixto, longitudinal y descriptivo, analiza la deserción y el desarrollo de habilidades blandas en las integrantes del club a lo largo del tiempo. La población estuvo compuesta por 56 mujeres que cursaron la carrera de Mecatrónica. Los resultados muestran una menor deserción en las integrantes, comparado con la reportada por cohorte generacional. Asimismo, se evidenció el fortalecimiento de habilidades como liderazgo, empatía, trabajo en equipo, comunicación efectiva y asertiva, capacidad de escucha, etc. Los hallazgos sugieren que la participación activa en el club contribuye a la formación integral y al éxito académico.



Service-learning, Gender gap, Mentoring



Aprendizaje-servicio, Brecha de género, Mentorías

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## Introduction

Our current job market demands outstanding professionals in science, technology, engineering, art, and mathematics [STEAM]. For this reason, jobs related to these fields are currently among the highest paid. [CIMAD & Movimiento STEM, 2020].

Unfortunately, in Mexico, women have been underrepresented in STEAM fields, with men being the ones who stand out the most. Only 30% of women pursue a STEM degree, and of those, just 8% study engineering, manufacturing, and construction [García & Torres, 2022]. Only 3% of Nobel Prizes in sciences have been awarded to women [Bello, 2020]. This disparity or inequity between men and women is known as the gender gap and is largely responsible for the wage gap [Saravia & Cifuentes, 2024].

This issue is so important that one of the Sustainable Development Goals is precisely to overcome the various manifestations of gender gaps, since equity is the foundation for a prosperous and sustainable world [Bello, 2020].

One way to help close the educational gender gap would be to reduce dropout rates among women in STEAM fields.

Miller & Croft [2022] found that one way to decrease dropout rates was by involving students in university center activities, as this creates a sense of belonging. Additionally, they noticed that these activities promoted meaningful relationships between students in lower and upper-level courses.

According to García-Bullé [2022], mentoring can contribute to the retention of female STEAM students. She even asserts that mentoring helps realize the potential of a STEAM student not only in her field of study but also in her empowerment, resilience, leadership, self-confidence, and self-esteem, especially when mentors are peers or similar.

Therefore, one of the strategies aimed at contributing both to gender equity within our community and to the development of soft skills among female university students stems from the STEAM Girls Club project. This educational initiative was launched at the beginning of 2023 in the Mechatronics program at the Technological University [UT] of Altamira.

Through mentoring and various activities inside and outside the university, it seeks to foster the interest and active participation of girls and young women in STEAM fields. This initiative is also based on the service-learning [S-L] approach, which combines academic learning with social engagement, allowing students to apply their knowledge in real contexts and develop skills such as empathy, leadership, and critical thinking.

This pedagogical approach supports the development of 21st-century skills, both technical and socio-emotional, and strengthens the social commitment of university students, making the STEAM Girls Club a replicable model of educational innovation with social impact and a gender perspective. The club aligns with the principles of equity, inclusion, and educational transformation, generating a positive impact on both the girls benefiting and the young mentors.

Therefore, this article will focus on explaining the use of the STEAM Girls Club as a strategy to reduce dropout rates among women in STEAM professions while also helping to develop soft skills in female university students.

First, the topic of dropout rates among women in STEAM will be detailed; next, service-learning [S-L] will be discussed; then, mentoring will be addressed; and finally, the STEAM Girls Club will be explained in detail.

## 1. Dropout of Women in STEAM

One of the problems many students face is academic dropout. Within STEAM fields, the dropout of women is an even more significant issue due to the low number of women who choose to study these careers.

Approximately 47% of students do not complete their studies, and in the most disadvantaged socioeconomic sectors, this percentage increases to 79.3% [Medrano & Flores, 2017].

The dropout rate of women in STEM education is also particularly high. Women disproportionately leave STEM disciplines during their studies and professional careers. This gender gap in science widens during the transitions from high school to higher education [CIMAD & Movimiento STEM, 2020].

## Article

Once women enter STEM programs, they are more likely to drop out and not return. The percentage of women entering these fields is much lower than that of men, and many women leave during their training, resulting in fewer women graduating in these professions. Specifically, science requires commitment, time, and effort due to the rapid and constant changes in this field.

Many adult women, who have family responsibilities [such as caregiving], may distance themselves from these areas due to a lack of confidence in meeting these expectations. This situation affects professional development and is reflected in the scarcity of women in higher-level positions, partly because there are fewer women candidates for those jobs [Quispe, 2023].

Regarding the dropout of female students in the Mechatronics program at UT Altamira, the rates were 38.4% for the 2018-2022 cohort, 20.5% for 2019-2023, 42.8% for 2020-2024, and 50% for 2021-2025. Therefore, it can be concluded that the dropout rate among women has increased worryingly.

One of the reasons found is that many women who choose to study a STEAM career may drop out due to demotivation caused by impostor syndrome, which is a form of self-sabotage—a fear of failure experienced by some women whose main belief is insufficiency despite success or feeling less competent than they should be [Quiroz et al., 2023].

It has also been found that many women studying in predominantly male groups, which is common in STEAM professions, are easy targets for aggression or sexual harassment. This can lead female STEAM students to drop out in order to escape such harassment and violence [Olarte 2018].

## 2. Service-Learning

According to the Secretaría de Educación Pública [2024], the New Mexican School promotes service-learning as an educational practice that fosters relationships between schools and the community.

Service-learning is a teaching tool that combines the acquisition of academic competencies with the provision of a meaningful, solidarity-based service to society. Its goal is to educate students by bringing them closer to real-world situations through socio-educational projects that help foster learning in values. It is based on reflection about the social environment, its functioning dynamics, and social problems and inequalities. It requires collaboration between educational institutions and community service organizations [Salcedo, 2019].

Service-learning differs from general community service in that it aims to integrate curricular content learning [Secretaría de Educación Pública, 2022]. It must also meet three essential conditions: the student must be the protagonist of the project, supported by their academic advisor; the student must acquire curricular knowledge while applying it in a spirit of solidarity; and all actions must address real needs in society [Salcedo, 2019].

One of the most recognized researchers in service-learning is Andrew Furco, who confirms that through service-learning projects, students improve their academic learning and classroom relationships [Martínez et al., 2024].

According to Medina [2023], service-learning has a personal impact on students. By overcoming challenges and experiencing a sense of achievement, they gain self-confidence and discover their strengths. They also learn to work as a team and develop leadership skills. Research has demonstrated the pedagogical potential of this practical philosophy or methodology to influence: academic development, civic development, vocational and professional development, ethical and moral development, and personal and social development. It also promotes student-teacher participation as a strategy for school improvement and strengthens collaborative relationships between schools and other community institutions [Mayor, 2018].

Along this path, students discover the true meaning of learning. It is not only about acquiring academic knowledge but about cultivating socio-emotional skills that will accompany them throughout their lives. They learn to be compassionate leaders, to develop effective communication skills, and to work as a team toward a common goal [Medina, 2023].

## Article

Salcedo [2019] found that service-learning acts as a factor of academic resilience, helping to prevent school dropout by providing numerous psychological benefits. He even emphasizes that the teacher becomes a "resilience tutor," an empathetic support figure who offers students a space where they can feel useful in the face of challenging situations.

Ultimately, service-learning not only raises awareness but also fosters student commitment to the Sustainable Development Goals, while they acquire knowledge and skills, and strengthen attitudes and values [Martínez et al., 2024].

### 3. Mentoring

Mentoring is a process of guidance and support from a more experienced person, known as the mentor, toward another person seeking to gain that experience, known as the mentee [Gutiérrez, 2020].

Women's mentoring has proven to be a highly effective method, especially for young children, who naturally tend to imitate their parents [Reyes & Novoa, 2015; Macías et al., 2021].

Mentoring programs for STEAM students aim to: promote gender equality; increase opportunities for women in STEAM fields; provide support, guidance, and role models; raise awareness and encourage reflection on gender stereotypes and biases; and invite women to become part of a support network [Duoc UC, 2024].

The positive influence of role models on women at the beginning of their professional careers has long been recognized. Young women who have role models tend to have higher self-esteem, greater confidence in their abilities, and increased satisfaction with their chosen profession. Therefore, mentoring is a valuable tool for fostering scientific identity and career development among female students [Quiroz et al., 2023].

Women's mentoring has the significant advantage of not only motivating women to enter science and technology fields but also promoting their retention in these careers.

Through mentoring—and by establishing a relationship of support and learning—life experiences and knowledge are shared, inspiring other women to follow in their footsteps and grow within these fields [García-Bullé, 2022].

Although it may be assumed that the best mentors are experienced professionals, research shows that the benefits of mentoring are often greater when mentors are peers or near-peers, as long as they receive prior training. For this reason, mentoring is also used at various academic stages of students' education [García-Bullé, 2022; Quiroz et al., 2023].

In our country, a more recent mentoring program has been implemented with the support of the British Council. Since 2021, the program has funded training for women from the National Council of Humanities, Sciences, and Technologies to serve as mentors. The outcomes and progress of this program have significantly benefited both the mentors and the female students who received mentorship [Quiroz et al., 2023].

Among the additional benefits observed for mentors, a study found that 82% reported mentoring had a positive impact on their performance in terms of learning and skill development. Another benefit was the expansion of their professional network. It also helped them become more aware of their behavior and communication, speak more assertively, show greater empathy, provide better feedback, improve emotional intelligence, become more patient and humble, adapt to others' needs, improve their listening skills, and more [Escuela de Mentoring & Red GEM España, 2023].

### 4. STEAM Girls Club

The STEAM Girls Club is an educational initiative led by around 50 female students and six higher education teachers that aims to reduce gender stereotypes in the fields of science, technology, engineering, arts, and mathematics by encouraging scientific vocations among elementary school girls through mentorship by university students.

The project is primarily aimed at girls between the ages of 6 and 12 from elementary schools, as well as female engineering students, who actively participate as mentors and facilitators of scientific workshops.

## Article

The club is implemented through hands-on activities, playful workshops, school visits, participation in science outreach events, technical training, and socio-emotional development. Activities take place both within the university and in local elementary schools.

University students design materials and carry out activities through mentorships, allowing young girls to identify with their mentors, break down gender stereotypes, and engage with science in an accessible and fun way. At the same time, this strengthens the university students' technical, communication, and leadership skills.

In fact, a study was conducted presenting the results of a series of electronics workshops carried out in three public elementary schools as part of the STEAM Girls Club. The results were: knowledge about STEM careers increased by 41.3%, gender stereotypes were modified by 8.3%, preference for STEM careers rose by an average of 36.5%, and the mentoring method was effective in 43.75% of the cases [González et al., 2024]

This project takes place in a context where female representation in science and technology fields remains low, and it aims to help close this gap through service learning, peer mentoring, and the creation of support networks. Furthermore, it promotes a replicable and sustainable model that connects curricular content with socially impactful actions, creating a more equitable, inclusive, and transformative educational community.

The initiative promotes interdisciplinary integration through the design and implementation of scientific workshops, demonstrations, and educational activities in which university students explain concepts in physics, electronics, programming, chemistry, and clean energy to elementary school girls. This work involves translating technical knowledge into accessible language, fostering in university students the ability to communicate complex ideas, plan educational sessions, solve problems in real time, and adapt to diverse educational contexts.

From a cross-disciplinary perspective, the club also enables collaboration with other key disciplines for the comprehensive development of the students.

This initiative also aligns with service-learning, by linking curricular content with socially impactful actions, which strengthens both the students' sense of belonging and their ethical responsibility to their community. In this way, the club becomes a living extension of the classroom, where technical skills are consolidated and key 21st-century competencies are developed—such as leadership, teamwork, innovation, systems thinking, and social commitment.

Among the club's activities, it is worth noting that from January 2023 to August 2025, a total of 18 activities have been carried out: four training sessions, seven school visits, and seven participations in events such as “Knowledge Detectives”, “Children's Week”, the “Second National STEM Girls Meeting”, among others.

In conclusion, the STEAM Girls Club functions as a space for curricular integration across academic terms, involving students from various academic levels who work together, collaborate, and learn from one another—fostering a horizontal, intergenerational, and highly formative community of practice.

## Methodology

This study is descriptive in nature, as it examines two main variables within a specific population: school dropout and soft skills development. School dropout is defined as the permanent or temporary abandonment of studies by a student before completing the corresponding curricular program. It was measured through the review of attendance records and academic performance in course evaluations. Soft skills development is understood as the improvement of non-technical competencies such as communication, teamwork, leadership, and critical thinking, which were assessed through qualitative observation during STEAM Girls Club activities and through records of participation in conferences, events, training sessions, and workshops.

The study follows a mixed-methods approach, integrating both quantitative data [attendance percentages, grades] and qualitative data [observations and narrative records]. It is also longitudinal, as it analyzes the population over a period from January 2023 to August 2025.

## Article

The population consists of 56 women who enrolled in the Mechatronics TSU [University Technical Degree] program from January to April 2023 and continued their engineering studies through to May–August 2025, while also being active members of the STEAM Girls Club. Their ages ranged from 17 to 22 years.

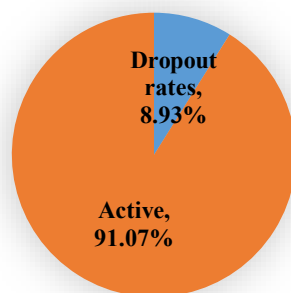
The combination of quantitative and qualitative criteria allows for a more comprehensive assessment: attendance records and academic grades provide objective and comparable data, while the observation and documentation of activities offer contextual insights into the quality and type of skills developed.

## Results

### Quantitative Results on Dropout Rates

In the results obtained regarding dropout, it was observed that the dropout rate among the STEAM Girls Club population from 2023 to August 2025 was five students, which corresponds to 8.93%. See Figure 1.

#### Box 1



**Figure 1**

STEAM Club Dropout Rate

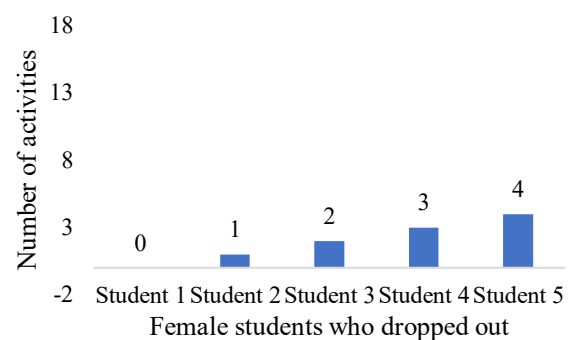
*Source: Author's own work*

### Quantitative Results on Participation

The average number of events in which students participated was 2.7 events [15.37%]. A total of 26 students [46.42%] participated in more events than the average. The most active student, who remains involved in the club, has participated in nine activities [50%]. The second most active student has taken part in seven activities [38.88%]. In total, 91% of the students have participated at least once in club activities.

Regarding the participation of the students who eventually dropped out of the club, it is worth mentioning that one student never participated [0%], another student took part in only one activity [5.5%], one attended two [11.11%], another supported three [16.66%], and the remaining student participated in four activities [22.22%]. See Figure 2.

#### Box 2



**Figure 2**

Participations of female students who dropped out from the activities in the club

*Source: Author's own work*

### Qualitative Results – Soft Skills

Regarding the qualitative results, it was observed that the students developed creativity and empathy through the design of educational materials for training workshops aimed both at elementary school girls and at peers from earlier academic terms.

They also improved their communication skills, active listening, patience, and empathy, as they effectively interacted with approximately 578 younger children during school visits, mentorship sessions, workshops, and other events.

Leadership and empowerment were observed in eleven students [19.29%], who led two induction and training sessions for new members of the club—one in January 2025 and another in February of the same year.

Problem-solving skills were also demonstrated, as students managed to repair and troubleshoot workshop materials in at least three separate instances.

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Teamwork was evident in all 18 events, particularly in one called the \*Science Circus\*, where students collaborated to write scripts and create stage design.

Finally, the students demonstrated a strong commitment to sustainable development and community engagement, as all their work was carried out on a voluntary basis.

### Conclusions

The authors' claims can be verified. The STEAM Girls Club, by implementing the Service-Learning [S-L] approach and mentorships, helps significantly reduce dropout rates [Salcedo, 2019; Miller & Croft, 2022 and García-Bullé, 2022]. This is especially evident when comparing the dropout rate within the club [8.77%] to that of the most recent cohort [50%]. However, further studies are needed to determine whether the STEAM Girls Club has a long-term impact on each generation's dropout rate.

An analysis of student participation shows that 60% of the students who dropped out participated less than average in club events. This could suggest that the club's impact on reducing dropout rates increases with greater participation in its activities.

Regarding soft skills, the authors' observations on the Service-Learning approach are confirmed by the fact that the students worked in teams and developed leadership, effective communication, and a commitment to sustainable development [Mayor, 2018; Medina, 2023 y Martínez et al., 2024].

Regarding the mentorships, it is important to note that they developed both within and outside the club, as many new mentors [at the technical level] looked up to the club members from higher semesters [engineering level] as role models. This reflects what the authors have stated — that mentorships help expand students' support networks, while also fostering friendships among them. It was also evident that the mentorships helped them become more aware of their language, communicate assertively, and develop patience and empathy. [Escuela de Mentoring & Red GEM España, 2023].

It is recommended to expand this study using a standardized instrument or survey that allows for a deeper analysis of the soft skills developed by students through their participation in the STEAM Girls Club. Additionally, it would be valuable to compare groups of women who are members of the club with those who are not, or with students from other academic programs. It is also suggested to continue monitoring the gender gap and dropout rates to assess the club's long-term impact.

### Declarations

### Conflict of interest

The authors declare no interest conflict. They have no known competing financial interests or personal relationships that could have appeared to influence the article reported in this article.

### Authors contribution

*González-Barrón, María Teresa:* Contributed to the Project idea, research method, investigation, project administration, writing-and editing original draft, data analysis.

*Alvarado-Medellín, Marisela:* Contributed to conceptualization, review original-draft, sharing findings with the whole research team, provide feedback.

*Barrios-Rodríguez, Lilia Gabriela:* Data analysis, translation of original-draft, sharing findings with the whole research team.

### Availability of data and materials

The information used in this research regarding student dropout rates is available in the evaluation records and the grading platform of the University of Altamira. As for the information related to the activities and their participants, it can be found in the activity log of the STEAM Girls Club.

These results were handled by the author and co-authors, respecting confidentiality at all times, as well as the university's privacy agreement. Microsoft Office Excel was used for the analysis.

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## Abbreviations

S-L	Service-Learning Approach
STEAM	Science, technology, engineering, art and mathematics
STEM	Science, technology, engineering and mathematics
UT	Technologic University

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## Generation of Assisted Learning Objects: The UTNG Case

### Generación de objetos de aprendizaje asistidos, caso UTNG

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#### Abstract

This study evaluates the effectiveness of using artificial intelligence-assisted learning objects [LO] in teaching teachers the fundamentals of Python programming. Through action research in education, a set of artificial intelligence tools, such as Claude, NotebookLM, DeepSeek, ChatGPT, Copilot, and Wayground, were developed with the aim of creating useful learning artifacts such as automated quizzes, web pages, and podcasts. These elements were combined into a digital object, a learning and assessment instrument, that was used in a course for UTNG teachers. The research was based on eight parts: usability, ease of use, clarity, alignment with goals, interest, feedback, transfer to classes and total satisfaction by type of LO [web pages, audios, guided exercises, videos, simulators]. The data show that LOs that use AI offer great opportunities to enrich the teaching-learning processes by facilitating dynamic experiences tailored for the student. Their use requires careful review and conscious adjustment by teachers, maintaining a balance between new technologies and humanism in pedagogy.

#### Resumen

El estudio hace una evaluación de la efectividad de usar objetos de aprendizaje [OA] asistidos con inteligencia artificial en la enseñanza a profesores sobre los fundamentos de programación en Python. Por medio de una investigación-acción en educación, se trabajaron un conjunto de herramientas de inteligencia artificial, como Claude, NotebookLM, DeepSeek, ChatGPT, Copilot y Wayground; con el objetivo de hacer artefactos útiles para aprender como cuestionarios automáticos, páginas web y podcasts. Estos elementos se unieron en un objeto digital instrumento de aprendizaje y evaluación que se usó en un curso para maestros de UTNG. La investigación se basó en ocho partes: usabilidad, sencillez de uso, claridad, alineación con metas, interés, retroalimentación, transferencia a las clases y satisfacción total por tipos de OA [páginas web, audios, ejercicios guiados, videos, simuladores]. Los datos muestran que los OA que usan IA ofrecen grandes oportunidades para hacer más ricos los procesos de enseñar-aprender facilitando experiencias dinámicas y hechas para el alumno. Su uso exige revisión cuidadosa y ajuste conciente por parte de los profesores, manteniendo balance entre nuevas tecnologías y humanismo en pedagogía.

#### Generation of Assisted Learning Objects: The UTNG Case



Artificial intelligence education, learning objects, teacher training

#### Generación de objetos de aprendizaje asistidos, caso UTNG



Inteligencia artificial en educación, objetos de aprendizaje, capacitación docente

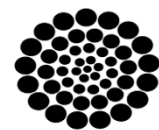
**Area:** Promotion of frontier research and basic science in all fields of knowledge

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## Article

**Introduction**

AI-enhanced learning objects [LOs] integrate structured educational content with adaptive properties, which individualize learning experiences and support automated intelligent feedback. The value of these works lies in their empiricism about the effectiveness of new technologies for teaching—in this case, new technologies related to Python programming, which can transform the school environment by automatically analysing code and generating exercises that adapt based on student outcomes.

This research examines eight specific aspects [perceived usefulness, ease of use, clarity, alignment with learning objectives, engagement, feedback, transfer to the classroom, and overall satisfaction] differently across LO types [web pages, audio, guided exercises, videos, simulators]. It is characterized by the fact that teachers are also students and can learn from two different perspectives: the efficiency of the learning process and the application to pedagogy.

It applies a non-experimental quantitative methodology using multilevel statistical analysis and includes iterative improvement frameworks focused on specific findings.

**Central Problem and Hypothesis**

The main challenge is the discrepancy between the theoretical promise of AI-supported learning outcomes and what has been demonstrated regarding their actual impact on the quality of programming instruction.

The main hypothesis is that learning outcomes will present different levels of satisfaction depending on the type and dimension of learning outcomes evaluated, with simulators and guided exercises being the modes that obtain the highest ratings of usefulness and transfer to the classroom from users.

The article comprises the following sections:

**Theoretical Framework:** conceptual basis of learning outcomes and educational AI.

**Methodology:** non-experimental quantitative design, teachers as participants, evaluation instrument.

**Results:** descriptive and inferential analysis by dimension and type of learning outcome.

**Discussion and Conclusions:** interpretation of results and suggestions for practical and institutional implementation.

**Theoretical Framework**

This theoretical framework examines how IA technologies enhance autonomous and creative learning, aligning with the needs of digital-native students in today's educational landscape

**Wayground**

Wayground was originally known as Quizizz, providing an online quiz tool that now includes expanded capabilities for active learning with AI. According to [Gupta, 2025], founder and CEO, the new brand reflects the platform's growth from a simple formative assessment tool to a space for teachers to find, import, or create all the educational content they need and deliver it to students anywhere, anytime.

Enabling this is the introduction of generative AI, and the corresponding product that makes it one-click to generate interactive quizzes, passages, questions, and multi-part assignments from a web page [Kelly R., 2025]. This is the kind of power that is formative for everyone and removes the technical constraints that have limited teachers in the past.

Today, Wayground is used in over 150 countries and by 2025 will serve 90% of schools in the United States, leading the interactive digital assessment industry.

**Microsoft Copilot**

Microsoft Copilot is an AI-based assistant integrated into Windows and Microsoft 365. It's a tool that helps students develop critical thinking, creativity, problem-solving, and digital collaboration skills. All of this is achieved through intelligent content generation [writing, scripting, and document creation]; voice can be used instead of a keyboard, allowing students to understand instructions in natural language. It performs semantic file searches in Windows, not only finding exact word matches but also understanding the meaning of what you type.

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It can also filter information from images and scanned documents based on file type, date, or content.

It is developed as a programming assistant for GitHub Copilot; its main features include auto-completion and code and command suggestions, a chat that allows interaction with programming questions, and a summary of changes, facilitating reviews.

At the [Norwegian University of Science and Technology, 2024], a study was conducted to evaluate the impact of Microsoft Copilot Chat on computer science teaching, which resulted in improved understanding of technical concepts, increased student participation, development of problem-solving skills, and positive feedback for teachers.

### Claude

Claude is developed by Anthropic, a company founded by former Open AI researchers. The first version was released in 2023, and later evolved into Claude 2 and Claude 3.5 Sonnet.

What sets it apart from other AIs is its safety philosophy, which avoids generating harmful information, ensuring responsible responses, avoiding discriminatory behaviour, and aligning them with human values, including respecting social norms and cultures and adapting to human contexts.

It supports students in understanding and reasoning for themselves, rather than just copying answers. This is achieved with the help of the Learning tools [it functions as a tutor that generates questions, proposes exercises, and helps solve problems] and Explanatory [it provides detailed, step-by-step explanations of a topic with examples].

Its AI can be integrated with other platforms [Moodle, Canvas, Google Classroom, Blackboard], allowing for the generation of study guides, summaries, access to course materials, and personalization of the learning experience.

### NotebookLM

It's AI research and writing assistant. It was launched in 2023 as Project Tailwind, and in August 2025, Google integrated it as Google Workspace for Education.

Currently, two versions are available: the free version and the NotebookLM Plus version. It allows users to upload PDF documents, Google Docs, presentations, and web links to generate high-quality audio summaries, videos, mind maps, and reports. It also provides automated feedback on assignments and projects, based on the characteristics specified by the user.

Unlike other AI assistants, it works only with information provided by the user, eliminating the risk of hallucinations and transforming chaotic information into structured and useful results.

### Chat GPT

GPT stands for Generative Pre-trained Transformer, an artificial intelligence model designed to learn language patterns by reading large volumes of text and subsequently generating coherent responses. The first version was released in 2018 by Open AI, followed by significant improvements with GPT-2 [2019], GPT-3 [2020], and GPT-4 [2023].

Currently, GPT-3.5 is offered in different plans: GPT-4 Plus, with free and limited access; GPT-4 Plus, through a monthly subscription; and GPT-4 Enterprise, with a variable cost based on usage and required scale. The latter provide faster, more accurate, and more adaptable responses to each user's needs.

One of its unique features is its ability to interact in a natural and understandable way, thanks to training that combines human correction of responses with reinforcement learning, which has improved its coherence and behaviour. In this way, GPT has become an accessible and useful tool for educational, creative, and professional tasks.

### DeepSeek

It was launched in 2023 by a Chinese company specializing in artificial intelligence research. It is characterized by its Open-Weight approach, a philosophy that promotes openness and empowerment for developers and companies, allowing the model to be customized to their needs without relying on external APIs. It also facilitates the processing of sensitive information on local servers, thus avoiding data transfer to third parties.

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This initiative encourages global collaboration among developers, who can contribute to its improvement, create model variants, and find innovative applications.

It is completely free, with no strict restrictions or the need for paid subscriptions. It offers an extensive context of 128k tokens, enabling the analysis of long documents, code debugging and analysis, as well as coherent and extended conversations without losing previous information. It is also capable of comparing ideas and synthesizing information from multiple sources.

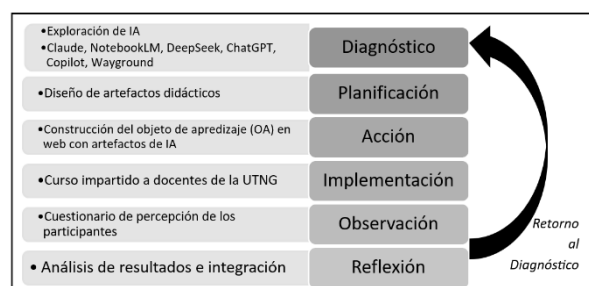
Thanks to its development in a Chinese cultural and linguistic environment, DeepSeek has a superior understanding of Chinese character structure, including idioms, cultural references, and specific social contexts.

### Student Learning

Teaching is, above all, a profession governed by rules, whose fundamental intention is to generate learning processes, where educational practice is put into motion. It is a set of intentional actions of an "I" to generate learning in a "you," carried out in the classroom or any other place, but which truly educate.

Considering that students currently enrolled at the university level are digital natives, they have grown up immersed in technology, so their way of communicating and interacting is different, ignoring this creates an unmotivating context, leading us to the behaviourist pedagogical model, which aims to systematize, measure, manipulate, evaluate, classify, and project how students will behave after instruction.

### Box 1



**Figure 1**

Research - action methodology

*Adapted from [Kemmis & McTaggart, 1998]*

Currently, modern pedagogy emphasizes that students must develop their own personality and cognitive abilities. Thus, there is an intersubjectivity, where it is constituted by the teacher and the student. Both are different, but actions are taken to understand the same thing or something close to it.

Online materials facilitate active and autonomous learning, allowing people to learn by doing while sharing a common language.

Cesar Coll describes, "The challenge is not to use technology to do the same thing we did without it, but to do things differently, to create new learning opportunities, and to expand the spatial and temporal boundaries of educational activity."

### Methodology

This research was developed under the educational action research approach, as it allows teachers and researchers to reflect and transform their practice through a cycle of diagnosis, planning, action, observation, and reflection [Elliott, 1993].

In the first stage, various artificial intelligence tools such as Claude, NotebookLM, DeepSeek, ChatGPT, Copilot, and Wayground were explored and applied to design and produce AI-assisted teaching artifacts. These teaching artifacts ranged from automated questionnaires to web pages and podcasts. Subsequently, some of these artifacts were gradually integrated into a web page designed to build a constantly evolving digital learning object.

In a second stage, this object was implemented within a course taught to teachers at the UTNG, thus allowing its applicability to be assessed in a real-life training context. Finally, a questionnaire was administered to evaluate participants' perceptions of the pedagogical usefulness of the artifacts and the impact of the use of AI in the design of educational materials.

This methodology is relevant since it articulates the production of knowledge with the continuous improvement of teaching practice, see figure 1, and integrates both technological innovation and critical reflection on its use in educational contexts [Carr & Kemmis, 2003].

**Results**

The results obtained include: the website, which is programmed in HTML, CSS, and JavaScript with development assisted by the AI Claude, but adapted and installed on a freely accessible server. For this, it is essential that the teacher has experience in the aforementioned languages.

The result can be seen in Figure 2 and is available online at the following URL: <https://tuxmex.github.io/curso-python-tutorial/>

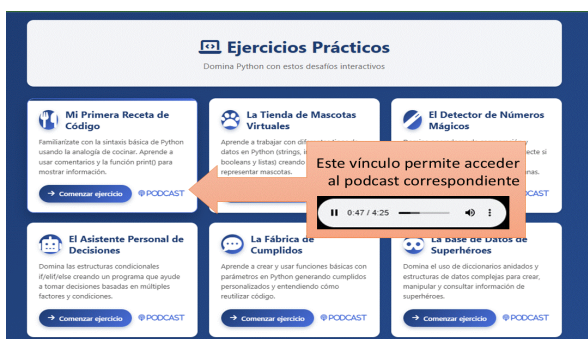
**Box 2**



**Figure 2**  
Screenshot of the Python course website  
*Created figure*

Likewise, various teaching artifacts were developed, seeking to provide different alternatives to explain the topics that make up the course, including guided exercises and explanations through digital content in audio form, better known as podcasts [see figure 3].

**Box 3**



**Figure 3**  
Practical exercises screen  
*Created figure*

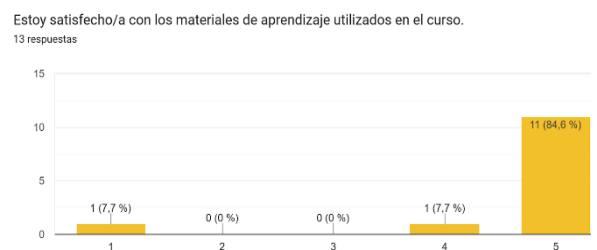
All of these artifacts are developed with the help of an AI. However, the teacher aims for them to be logically coherent and appropriate for each topic. Each artifact was created based on a specific need, which was provided to the AI to process.

It's important to note that each of these tools allows for fast, high-quality work, but they are constantly monitored and adapted by the teacher. Each one is a great experience, making it very clear what AI is capable of, from a simple text summary to an almost human-like explanation via audio, even with the teacher's own voice.

The development of the teaching artifacts presented was not only an additional teaching material, but also an opportunity to immerse oneself in the world of AI, geared toward one of the most important tasks of our existence: learning.

Once the learning objects were developed, they were tested with 13 teachers, who were given a 10-question questionnaire in order to collect their impressions and suggestions in order to ultimately seek to improve said objects. A brief summary of the results obtained is shown below: The majority, that is, 76.9% of those surveyed, consider that the course materials helped them better understand the concepts; 84.6% considered them easy to use in terms of navigation, access, and clear instructions; regarding the level of explanation and sequencing, it is adequate for their profile, 69.2% considered it adequate; 76.9% considered the material aligned with the course objectives and maintained their interest and motivation, receiving useful and timely feedback. 84.6% were satisfied with the materials used [see Figure 4]. These results indicate that the vast majority of students found the learning objects useful. Considering the level of teacher demand, it can be said that while improvements are needed and even efforts to adapt the materials to different profiles, the acceptance and utilization rate are very positive and validate the usefulness of AI assistance. The satisfaction level is shown in Figure 4.

**Box 4**



**Figure 4**  
Satisfaction Level  
*Figure result from Google Forms*

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No less important were the contributions made by participants, which should be taken into account for future editions of the course. Some of their contributions were: "Great course! I think if I could ask for anything, it would be much more time, please!"; "Continue in-person training!"; In these contributions, and in the majority of those received, a great acceptance of the learning objects can be detected. But something very important is that they recognize the opportunity to have a teacher at the helm. It is emphasized that AI assistance is very important, but the teacher is a key player in the teaching-learning process. The questionnaire used for data collection is attached as a supplement at the end of this document.

### Conclusions

The research concludes that AI-assisted learning objects represent a valuable opportunity to enrich teaching and learning processes. These teaching materials allow teachers to dedicate more time to pedagogical planning and reflection, while students enjoy more dynamic and personalized educational experiences. Artificial intelligence offers the possibility of accelerating the generation of ideas and resources in a matter of minutes, although its use requires critical and conscious review by teachers, who must evaluate, adapt, or even rework artifacts when necessary.

The use of artificial intelligence in education, therefore, must be undertaken gradually and strategically, taking advantage of its benefits without becoming overly dependent. The role of the teacher remains central: they must guide the educational process, guarantee quality experiences, and maintain a balance between technological innovation and pedagogical humanism.

Artificial intelligence is a powerful tool for better engaging with students, but it does not, on its own, constitute the entirety of teaching strategies. Teachers must also complement those limitations that AI cannot overcome, such as fostering critical thinking, social interaction, and creating a space for debate and reflection.

Consequently, the contemporary challenge is learning to coexist with AI as an educational resource, taking advantage of the best that technology offers while always prioritizing the human and educational aspects.

Teaching requires constant updating; however, in the current context, this need takes on an immediate character. Teachers must adapt to new generations, who operate in digital environments characterized by the immediacy of information and the abundance of technological resources. In this scenario, it is essential that teachers design and offer learning objects that are not only engaging but also promote meaningful and sustainable educational experiences.

However, instant access to information must be accompanied by processes of reflection, critical awareness, and in-depth analysis so that students can develop intellectual independence and autonomy in their learning. To achieve this, the role of teachers is essential, as they must balance the use of emerging technologies with the development of cognitive and socio-emotional skills that allow students to transcend the immediacy of data and construct knowledge in a critical and responsible manner.

### Annexes

#### Data Collection Instrument:

In an effort to improve the teaching resources used in the course you have just taken, we kindly ask you to answer the following questions. The information provided is anonymous and confidential.

Thank you very much for your time and cooperation!

Instructions: Select the option that best represents your opinion. Likert scale from 1 [Strongly disagree] to 5 [Strongly agree], except where another type of response is indicated.

#### Tables and adequate sources.

1. The course learning materials helped me understand Python concepts.
2. The materials were easy to use [navigation, access, clear instructions].
3. The level of explanation and sequencing of the materials were appropriate for my profile.
4. The materials were aligned with the course objectives.
5. I received useful and timely feedback through the materials [solutions, hints, self-assessments].

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6. I believe I can apply what I have learned in activities or exercises beyond the content of the material.
7. I am satisfied with the learning materials used in the course.
8. Which of the following material formats was most useful for your Python learning?
  - a. Web pages/guided readings
  - b. Audio elements/podcasts
  - c. Guided exercises/step-by-step practices
  - d. Videos/micro-lessons
  - e. Other
9. Which of the following material formats did you use most frequently?
  - a. Web pages/guided readings
  - b. Audio elements/podcasts
  - c. Guided exercises/step-by-step practice
  - d. Videos/micro-lessons
  - e. Other
10. What recommendations or suggestions can you offer to improve the learning materials used in the course?

**Declarations****Conflict of interest**

The authors declare no interest conflict. They have no known competing financial interests or personal relationships that could have appeared to influence the article reported in this article.

**Author contribution**

*Rodríguez-García, Anastacio:* His contribution lies in the conception of the project. He initiated the exploration and study of AI tools for the generation of learning objects. He provided the technical knowledge for the generation of educational artifacts, implementing the theory and practice of the LO and its methodology.

*Barrientos-Avalos, Eduardo:* His work involved practical design of the methodology. He created the assessment instrument in the predetermined dimensions, as well as the statistical analysis of participant data and the generation of research results.

*Mendez-Mendoza, Maricela:* She is dedicated to the analysis of the theoretical framework through a bibliographic review and pedagogical validation of the contents, and the writing/revision of the document with educational experience.

**Availability of data and materials**

The data supporting the conclusions of this article are available from the corresponding author upon reasonable request. The digital learning object developed in this study is publicly accessible at <https://tuxmex.github.io/curso-python-tutorial/> and <https://github.com/tuxmex/curso-python-tutorial>.

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**Abbreviations**

AI	Artificial Intelligence
CSS	Cascading Style Sheets
GPT	Generative Pre-trained Transformer
HTML	HyperText Markup Language
IA	Inteligencia Artificial
LO	Learning Object
OA	Objeto de Aprendizaje
UTNG	Universidad Tecnológica del Norte de Guanajuato

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### Prevention of suicidal ideation, workshop proposal

### Prevención de la ideación suicida, propuesta de taller

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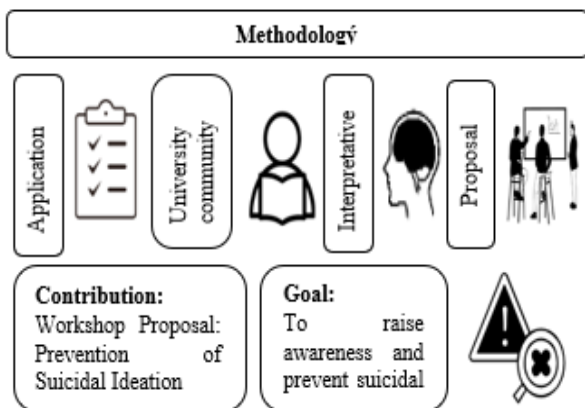


#### Abstract

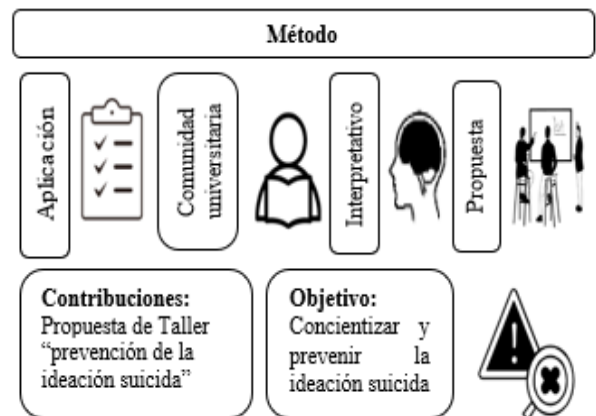
This study addresses the prevalence of suicidal ideation within the university student community and seeks to identify the pattern of affectation that precedes a suicide attempt. The aim is to raise awareness and promote prevention regarding this phenomenon. The research concludes with a pedagogical workshop designed for undergraduate faculty at the Autonomous University of Chiapas [UNACH]. This workshop is intended to equip educators, administrative staff, and others with the necessary knowledge to detect and refer cases of suicidal ideation within the student community.

#### Resumen

El presente estudio aborda la prevalencia de la ideación suicida en la comunidad estudiantil universitaria, trata de identificar la tendencia de afectación que precede al intento suicida. Lo anterior, con el objetivo de concientizar y prevenir respecto a este fenómeno, la investigación propone al final un taller pedagógico dirigido a docentes de licenciatura en la Universidad Autónoma de Chiapas [UNACH]. Este taller está diseñado para equipar a las y los educadores, administrativos, entre otros, con el conocimiento suficiente para detectar y canalizar casos de ideación suicida en la comunidad estudiantil.



Suicidal ideation, Prevention, Workshop



Ideación suicida, Prevención, Taller

**Area:** Strengthening the scientific community.

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Peer review under the responsibility of the Scientific Committee MARVID®- in the contribution to the scientific, technological and innovation Peer Review Process through the training of Human Resources for the continuity in the Critical Analysis of International Research.



## Introduction

The prevalence of suicidal ideation has been a phenomenon that has impacted the university student community, as it has become a trend, reflecting symptoms or signs prior to the attempt.

That is why the present research aims to propose an educational workshop that allows for the detection, awareness, and prevention of suicidal ideation in undergraduate students, aimed at university staff, in order to gain knowledge about it. It begins by defining the concepts that structure suicidal ideation, allowing them to be understood and interpreted by the reader. Subsequently, the context and, as a result, the components are addressed, and the educational workshop is described in text form as a strategy that allows interaction with university staff. In addition, the institutions and suicide prevention actions that promote early detection for the various cases presented are explored, allowing the main risk factors in the institution to be categorised, from the regular to the emerging, which will serve to carry out and structure the workshop proposal.

Therefore, the question is asked: Does the proposed educational workshop support teachers in raising awareness and preventing suicidal ideation among UNACH students? To this end, three moments are composed that open up an analysis of suicidal ideation.

The educational workshop, being a methodological strategy, consists of a gradual sequence that involves various tasks to transfer knowledge, which in turn must be structured and organised in a logical manner. When implementing the workshop, it is essential to consider its stages in order to carry it out effectively and thus ensure that participants contribute and share their reflections on what is required. The workshop can be designed in various ways, but it is extremely important to consider its purpose, so that the workshop is not only aimed at learning, but also at collective action on the topic being developed.

### 1. Concept of suicidal ideation.

For a better understanding of 'suicidal ideation', both concepts are described etymologically, allowing us to broaden our knowledge of this topic, with the aim of recognising the aspects of this problem and its public magnitude.

The following concepts, which are presented below, will therefore provide the basis for this research work.

The Royal Spanish Academy [RAE], [2023] tells us etymologically that the word 'ideation' derives from 'to ideate' and epistemologically means 'genesis and process in the formation of ideas.' On the other hand, the word "suicide" etymologically derives from 'modern Latin *suicidium*,' which in turn derives from 'Latin *sui* "of oneself" and *-cidium* "-cide".'

Epistemologically, it means 'action or behaviour that harms or can seriously harm the person who performs it.' *suicidium*, and this from the Latin *sui* "of oneself" and *-cidium* "-cide" and epistemologically 'Action or behaviour that harms or can seriously harm the person who performs it', so it is understood that suicidal ideation moderates in the subject, beginning with a thought related to the intention to take one's own life.

Bahamón et al. [2018] define it as follows: Suicidal ideation is one of the initial phases of the suicidal process, in that it invades the subject's thoughts with ideas about death and the meaninglessness of life. [...] Suicidal ideation is inevitably present in those who have taken their own lives and therefore becomes a stage that allows for the early detection of risk factors that can be addressed in a timely manner to prevent the transition to attempted suicide or completed suicide. [p.9]

That is why suicidal ideation is determined to be a persistent tendency that has not yet taken shape, considering it to be an unstructured or fantastical contemplation, with the aim of causing self-harm, tentatively affecting one's own body and even reaching consummation. Expanding on the characteristics of this aspect, the authors allow us to see and recognise how this phenomenon is composed, considering it to be multifactorial, as it gives rise to various types of mechanisms for attempting to take one's own life.

### 2. Types of suicide

Suicidal ideation has its cognitive origin in factors associated with the individual, which manifest themselves in psychological, social, or clinical aspects, among other aspects that affect the individual's instability.

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Suicide begins to be contemplated based on various causes; however, it is important to emphasise that there are different types of suicidal ideation, which may contain elements of planning that increase the possibility of death.

The conceptualisation of suicidal ideation leads us to make this distinction between the 'intention to die' and the 'intention to act,' as these are classifications of this phenomenon that must be identified in individuals at risk of suicide. Beck [1979, as cited in Magno and Cruzado, 2021] 'classified suicidal ideation into two types: passive and active ideation' [p. 149].

### Methodology

Research methodology [RM] or scientific research methodology is the science that provides researchers with a series of concepts, principles, and laws that enable them to efficiently channel the scientific research process towards excellence.

The object of study of IR can be defined as the scientific research process, which consists of a series of logically structured and interrelated steps. This study is based on a set of characteristics and their relationships and laws. [Cortés y León, 2004, p.8]

The steps for the research that make up the methodological plan are established, providing orderly theoretical support or sustenance, using the 'general and specific objectives' as a basis, which will serve in the collection of data and, in turn, the analysis and interpretation of the desired results. Paradigm. A research paradigm is a theoretical reference that allows the reality of a social conception to be studied. It is also part of the methodological process that aids in the understanding of the analysis of results. From the perspective of Marín [2007, cited in Miranda and Ortiz, 2020], the paradigm is considered as follows:

This perspective places the paradigm as a conceptual structure, based on beliefs and theoretical and methodological assumptions, which, as the author states, guides a particular scientific community within its worldview, reinforcing the values and knowledge they share as a collective. [p.5]

The choice of paradigm to be used will depend on the characteristics of the research. It should be understood that there are three types of paradigm, which are: Positivist [empirical] paradigm. Interpretive [hermeneutic] paradigm. Critical [dialectical] paradigm. In this research, the interpretive paradigm prevailed, considering its characteristics, in order to achieve a causal description-interpretation, that is, what are the reasons that cause the subject to behave in a certain way in society from a given context, so that reality can be understood based on facts, in order to construct a criterion that will help to understand the subjects' perception and where it aims to go. Roca, C. [2020] states the following about the interpretative paradigm:

The objective of interpretative research is to understand how members of a given social group, through their participation in social processes, create their particular reality and give it meaning, and to show how these meanings, beliefs, intentions, etc., enable them to carry out social action. [p.2]

Therefore, interpretation, being linked to hermeneutics, aims to go beyond the literal meaning to give the sense or conception of possible theories. That is why the selection of this paradigm will allow for analysis and understanding of the research that will lead us to establish a result.

Approach When conducting research, it is extremely important to consider the choice of approach in relation to the methodological process, as it will serve as a link to the aforementioned paradigm. 'Qualitative approach is understood as "the methodological procedure that uses words, texts, discourses, drawings, graphics and images" [...] qualitative research studies different objects to understand the social life of the subject through the meanings developed by the subject' [Katayama, 2014, as cited in Sánchez, 2019].

The function of the research approach is to provide the theoretical perspective that will be addressed within the problem, with the points of view that it will raise approaching reality.

Approaches are also responsible for directing the problem-solving process and are strongly associated with research paradigms and designs; each has its own characteristics and methodological tools that are used to collect and analyse information.

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[Acosta, 2023, p. 84] Thus, in relation to the above, it is determined that the approach that best suits the interests of the research is the qualitative one, as it provides the appropriate orientation for carrying out an in-depth, reflective study for the understanding and deduction of the study. Methods are considered to be a set of techniques that aid the research process, and the use of tools that will enable a particular result. They are also known as strategies that aim to uncover information about a specific topic. Unlike methodology, which is used at the beginning when a problem to be solved is posed, methods are used during the research process, being the necessary tools for the resolution stage.

In this way, it is a series of steps for problem solving, revealing the main phenomenon that causes the problem, allowing for a reasoned description by the author. Finol and Vera [2020] summarise it as follows:

The method refers not only to the set of steps for the development of the research process, but also implies the praxis to be carried out by the researcher in accordance with the paradigm, where each method has its own structure and dynamics of application, that is, its own methodology. [p.11]. That is why, within the research itself, the choice of method in this research leans towards the inductive because it will take into account observation and experience of reality to arrive at the construction of general laws, which is useful for generating new knowledge.

### Population and sample

The form is aimed at undergraduate students in a convenient method, such as the students where the researcher teaches for several semesters. It consists of non-probabilistic sampling in which the units are selected for inclusion in the sample because they are the most easily accessible to the researcher.

The aim is to obtain specific data regarding the description of suicide cases close to them. By describing and understanding each concept that generalises this risk variable, it is possible to identify the areas most affected, as well as to raise awareness of the impact and risk among students in the educational environment and how the family and economic context also influence individuals with suicidal ideation. Population.

The population with which the research will be carried out consists of university students enrolled in selected semesters of the bachelor's degree programme in education, with a total of 101 participants, both male and female, from the Faculty of Humanities C-VI, located in Tuxtla Gutiérrez. Sample. For the sampling used in this research, it was decided to survey students in the 5th and 8th semesters of the morning shift, and then select the age for the sample from the total population. It was determined that, of the 101 [100%] students, only 80 mixed students aged 22-25 would be considered.

A questionnaire was used as an instrument for collecting information, as it consists of a group of questions that measure one or more variables that have been established in the research. The questions can be open or closed and are administered via telephone call or personal internet. Arias [p.38]

The questionnaire will contain 22 mixed-type questions [open and closed] with a series of predetermined answers, classified into personal dimensions, family-economic and social situations, and suicide information. This requires the user to be able to enter data in a structured manner, which helps to fulfil the purpose of storing and processing the required data

### Results

The presence of suicidal ideation in the student population demands the implementation of prevention strategies aimed at mitigating behaviours that compromise the physical and psychological integrity of students. In this context, the implementation of teacher training workshops is justified as a necessary intervention, given that educators are primary agents in the school environment due to their direct and continuous contact with students.

Consequently, it is imperative to provide them with theoretical and practical tools that enable the early identification of risk indicators associated with suicidal behaviour, thus facilitating timely referral and support.

For this reason, the implementation of a theoretical and practical workshop is proposed, aimed at providing teachers and administrative staff with fundamental tools for identifying students with possible indicators of suicidal ideation.

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At the same time, the aim is for teachers to become key agents in the prevention process and in the timely referral of detected cases to the appropriate authorities.

The design of the proposed workshop, entitled 'Prevention of Suicidal Ideation,' has the following curriculum structure:

### **Sub-competency 1. Contextualisation of suicidal ideation**

#### **Topics:**

- I. Concept of suicidal ideation and suicide.
  - I.I Statistics and context of suicide in Mexico.
  - I.II Types of suicide and methods of suicide.
  - I.III Myths about suicide.
- II. Common causes of suicidal ideation.

### **Sub-competence II. Models and factors.**

#### **Topics:**

- I. Models
  - I.I. Stress-Diathesis Model
  - I.II. Suicide as a Process Model.
  - I.III. Self-destructive behaviours
- II. Risk factors

### **Sub-competence III. Warning signs and action protocol.**

#### **Topics:**

- I. Warning signs of suicidal ideation.
- II. Strategies for detection
  - II. I Anxiety and depression test [Beck BDI-II, Stress]
  - II. II School activities.
- III. Action protocol.
- IV. Prevention techniques.

The research allowed the collaborators to participate in the presentation of the results during the lecture held as part of World Suicide Prevention Day, an event held at the Faculty of Humanities [C-VI] of the Autonomous University of Chiapas. Likewise, as a by-product of the study, a bachelor's thesis was written.

The workshop was designed with the participation of UNACH education students Deborah Abigail González Custodio and Lizeth Sánchez Martínez, as well as Dr Gabriela Duque Peña, an expert in curriculum design and suicide.

## **Conclusions**

The scientific relevance of this research project lies in its innovative approach to a contemporary phenomenon of great social relevance. The need for a workshop for teachers and administrators on suicidal ideation is relevant due to the data provided by the questionnaires on the growing concern about suicidal ideation in students and, therefore, their mental health and the key role that teachers and administrators play in identifying and supporting young people at risk. In an educational setting, teachers are often the first to notice changes in behaviour, attitudes or warning signs that could indicate suicidal thoughts in students.

However, without adequate training, they may lack the tools and knowledge necessary to deal with these cases effectively and empathetically.

The social relevance of research to generate a workshop on suicidal ideation will provide teachers with essential skills to: Clearly explain the results and possibilities for improvement.

## **Declarations**

### **Conflict of interest**

The authors declare no interest conflict. They have no known competing financial interests or personal relationships that could have appeared to influence the article reported in this article.

### **Author contribution**

*Mena-Álvarez, Andrea:* Contributed to the original product concept, data collection, and methodological design.

*González-Custodio Deborah Abigail, Sánchez-Martínez, Lizeth and Duque-Peña, Gabriela:* contributed to the design of the curricular structure of the workshop proposal.

### **Availability of data and materials**

The data supporting the findings of this study are available from the corresponding author upon reasonable request

## Article

**Funding**

This research received no external funding. It was conducted using the author's personal resources.

**Abbreviations**

UNACH Autonomous University of Chiapas  
REA Royal Spanish Academy

**References****Antecedents**

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## Academic burnout in accounting university students: Evidence from Two Mexican Contexts





### Burnout académico en estudiantes universitarios de Contaduría: Evidencia desde Dos Contextos Mexicanos

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#### Abstract

This study examines the prevalence of academic Burnout syndrome among Public Accounting students at the Universidad Autónoma de Chiapas [UNACH], comparing it with previous findings from the Instituto Tecnológico de Sonora [ITSON]. Using a quantitative approach and the MBI-SS instrument, three dimensions were assessed: emotional exhaustion, cynicism [motivation], and academic efficacy, in a sample of 84 students. Results show a generally low prevalence of Burnout at both institutions, though significant differences were found. UNACH students reported higher levels of cynicism and lower academic efficacy, while ITSON students showed greater emotional exhaustion. Factors such as academic status, employment, and place of residence influenced the outcomes. The study highlights the importance of addressing Burnout in underexplored academic contexts such as accounting and calls for the implementation of institutional strategies focused on prevention and psychoeducational support to promote student well-being and academic performance.



**Academic burnout, University students, Public accounting**

#### Resumen

Este estudio analiza la prevalencia del síndrome de Burnout académico en estudiantes de Contaduría Pública de la Universidad Autónoma de Chiapas [UNACH], comparándola con resultados previos del Instituto Tecnológico de Sonora [ITSON]. Con un enfoque cuantitativo y el uso del instrumento MBI-SS, se evaluaron tres dimensiones: agotamiento emocional, cinismo y eficacia académica, en una muestra de 84 estudiantes. Los resultados reflejan una prevalencia general baja en ambas instituciones, aunque con diferencias significativas: en la UNACH se detectaron mayores niveles de cinismo y menor percepción de eficacia académica, mientras que en el ITSON destacó el agotamiento emocional. Factores como la situación académica, laboral y el lugar de residencia influyeron en los resultados. El estudio resalta la importancia de atender el Burnout en carreras poco exploradas como contaduría, y propone implementar estrategias institucionales de prevención y apoyo psicoeducativo para mejorar el bienestar estudiantil.



**Burnout académico, Estudiantes universitarios, Contaduría pública**

**Area:** Promotion of frontier research and basic science in all fields of knowledge

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Peer review under the responsibility of the Scientific Committee MARVID®- in the contribution to the scientific, technological and innovation Peer Review Process through the training of Human Resources for the continuity in the Critical Analysis of International Research.



## Article

**Introduction**

In today's university context, students' emotional well-being has become a growing concern, especially in light of the increasingly intense academic demands they face on a daily basis [Llanes, et al. 2022].

In light of this situation, one of the most relevant phenomena in this area is academic burnout syndrome, a condition that goes beyond common stress and manifests itself in students in the form of emotional exhaustion, demotivation, and a negative perception of their own academic performance [Caballero et al., 2010; Rosales and Rosales, 2013].

Although this problem has been widely studied in areas such as medicine and psychology, it has been little explored in economic and administrative disciplines, despite their high educational demands.

It is therefore essential to understand its impact in these academic contexts in order to design effective strategies that promote the mental health and academic success of future professionals [Vizoso & Arias, 2018].

**Definition of academic burnout syndrome**

Academic burnout syndrome is defined as a negative emotional, physical, and mental response that arises during prolonged periods of high educational demands. It is characterised by being a syndrome that does not appear suddenly, but rather builds up gradually from the accumulation of educational demands that exceed the student's ability to cope with them in a healthy way [Risa, 2022; Estrada, et al. 2018].

The main characteristic of burnout syndrome is that it manifests itself through three key symptoms: emotional exhaustion, which presents as a constant feeling of tiredness, fatigue and lack of energy in the face of academic activities; cynicism, which manifests itself through a negative, indifferent or distant attitude towards studies, classmates and the value of university; and finally, low academic efficacy, which consists of a perception of incompetence, insecurity in one's own abilities, and feelings of academic failure [Caballero et al., 2015].

Unlike temporary stress, academic burnout tends to be persistent, affecting the student's psychological well-being and performance, as well as being associated with symptoms such as anxiety, insomnia, somatisation, depression and even suicidal ideation [Cuevas, et al., 2024].

Although this syndrome was originally conceptualised within the workplace [Schaufeli, et al., 2009], subsequent research has adapted it to the university context, recognising that students face multiple sources of pressure comparable to those of a formal worker [Caballero et al., 2010]. In the educational environment, factors that trigger burnout include academic overload, tight deadlines, teamwork, interpersonal conflicts, and pressure to achieve standards of success, especially in the advanced stages of a university career [Zabalza & Vilas, 2017].

**Academic burnout in accounting students**

Although burnout syndrome has been widely studied in disciplines such as medicine, psychology, and education, its approach in economic and administrative careers, such as accounting, has been limited, especially in Spanish-speaking countries.

However, recent research has begun to show that accounting students also face highly demanding academic conditions that make them vulnerable to developing this syndrome [Salami et al., 2018].

The accounting degree requires constant updating of technical knowledge, mastery of tax and financial regulations, as well as highly complex mathematical and analytical skills. Added to this is the pressure to pass rigorous exams, complete practical assignments and integrative projects, and prepare for future professional certifications [Suarez, et al. 2020; Ison et al. 2020].

International research such as that of Salami et al. [2018] in Nigeria identified that the assessment environment in accounting is a determining factor in the onset of academic burnout. It has even been noted that academic stress in accounting begins in the first semesters and intensifies as the degree programme progresses, especially in students who work and study simultaneously [Bjornsen-Ramig et al., 2024].

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In a study conducted by Chui et al. [2023], which analysed the presence of burnout syndrome in a sample of 161 Peruvian university students studying accounting and finance between their fourth and tenth academic semesters, the results showed that 39.6% of participants had a high level of emotional exhaustion, while 30.7% showed a high prevalence of cynicism.

Likewise, a greater presence of academic ineffectiveness was observed in students aged 30 or younger. In terms of gender analysis, it was identified that women reported a higher prevalence of burnout syndrome at medium and low levels compared to men.

The present study aims to conduct a comparative analysis between the results obtained by Aceves-López et al. [2024] at the Technological Institute of Sonora [ITSON] on the prevalence of burnout syndrome in students of the Bachelor's Degree in Public Accounting and those obtained in a similar sample of students of the same degree at the Autonomous University of Chiapas [UNACH]. The purpose of this comparison is to seek and identify relevant similarities and differences between the two populations, with the aim of informing interventions that promote the emotional well-being and academic performance of students.

This research is particularly relevant for the analysis of academic burnout syndrome in accounting programmes within the Mexican context, as it highlights a problem that, although present, has been little studied in this field.

By focusing on two higher education institutions with different social and geographical realities, the study provides a broader perspective on how burnout manifests itself in accounting students in Mexico and offers key elements for institutional decision-making in terms of prevention and psychoeducational intervention.

Given this situation, with the intention of raising awareness and shedding light on burnout in higher education students, the following question is asked: What is the level of academic burnout syndrome in higher education students enrolled in the Bachelor's Degree in Public Accounting programme at UNACH who are currently attending classes, and what are the similarities and differences with the results previously obtained in ITSON students?

## Methodology

This research adopts a quantitative approach, with a non-experimental, cross-sectional, and descriptive design. Data collection was carried out using the Maslach Burnout Inventory-Student Survey [MBI-SS] instrument, developed by Schaufeli, Martínez, Salanova, González-Romá and Bakker [2002], using the version adapted and validated in Colombia by Hederich and Caballero [2016]. This instrument is aimed at higher education students of both sexes, regardless of their field of study.

The MBI-SS consists of 14 items distributed across three dimensions: academic efficacy [5 items], emotional exhaustion [5 items] and cynicism [4 items]. Each item is answered using a five-point Likert scale [1 = never, 2 = rarely, 3 = sometimes, 4 = almost always and 5 = always]. The scores obtained are added up within each subscale, generating a total score per dimension. These scores are then classified into three levels of burnout: low [1%–25%], medium [30%–75%] and high [80%–99%], which allows the degree of impact to be identified in each of the three dimensions evaluated.

For its application, the questionnaire was digitised using the Google Forms platform and distributed among active students in the Bachelor's Degree in Public Accounting and Bachelor's Degree in Economics and Finance programmes at the Autonomous University of Chiapas [UNACH] during the January-June 2025 semester. Each participant was asked to give their informed consent and to respond voluntarily and respectfully. For security and institutional validation reasons, responses were limited exclusively to institutional emails.

For comparison purposes, access was granted to the database of previous research conducted by Aceves-López et al. [2024] at the Technological Institute of Sonora [ITSON], which served as a reference for the comparative analysis. All data were processed using SPSS statistical software to ensure rigorous treatment of the information obtained.

## Results

Initially, the sample consisted of 97 students. However, this was reduced to 84 participants, as 86.6% belonged to the fifth semester.

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Because the records for other semesters were not statistically representative or homogeneous, it was decided to exclude them from the analysis to maintain data consistency.

The final sample consisted of 84 fifth-semester students enrolled in the Bachelor's Degree in Public Accounting at the Autonomous University of Chiapas [UNACH]. In terms of gender, 59.5% were women and 40.5% were men. Regarding their place of origin, 64.3% identified themselves as local students, while 35.7% were from outside the area.

In terms of age, the majority of participants [84.5%] were between 18 and 20 years old, followed by 14.5% between 21 and 23 years old, and only one student [1.2%] was over 23 years old.

Regarding their academic status, 91.7% said they were regular students, while 8.3% identified themselves as irregular. In terms of occupation, 44% of respondents said they worked in activities related to their career, followed by 32.1% who did not work, and 23.8% who did work, although in areas unrelated to accounting.

Regarding the means of transport used to attend university, the majority [83.3%] indicated that they use public transport, followed by those who have their own vehicle [7.1%], those who are transported by another person [6.0%], and finally, those who walk [3.6%].

Finally, in terms of area of residence within Tuxtla Gutiérrez, 36.9% live in the north, 32.1% in the south, 20.2% in the centre, and 10.7% near the faculty.

The reliability analysis of the instrument was performed using Cronbach's alpha coefficient, and the results obtained were satisfactory in the three dimensions evaluated: emotional exhaustion had a value of 0.761, cynicism reached 0.883, and academic efficacy obtained 0.875.

The overall coefficient of the instrument was 0.850, indicating high reliability and meeting the commonly accepted minimum standards [ $\geq 0.70$ ] for statistical interpretation of the results.

**Box 1****Table 1**

Reliability statistic

Sub-scales	No. Elements	Cronbach's alpha
Exhaustion	5	0.761
Cynicism	4	0.883
Academic effectiveness	5	0.875

Regarding the overall results obtained from the MBI-SS scale, clear patterns were identified in the three dimensions of academic burnout syndrome.

In the emotional exhaustion dimension, most participants were in the medium range [48.8%], followed by the low range [41.7%], while only 9.5% had high levels of exhaustion, suggesting a moderate presence of emotional fatigue among students.

With regard to the cynicism dimension, a similar distribution was observed: 41.7% were at the medium level, 34.5% at the low level, and 23.8% at the high level, indicating that a significant portion of the sample experiences a certain degree of detachment or indifference towards their academic activities.

Regarding the dimension of academic efficacy, the results were mostly positive. 85.7% of students reported high levels of efficacy, reflecting a strong perception of personal competence in the academic field. Ten point seven per cent were in the medium level, while only three point six per cent had low levels of efficacy, indicating that only a small proportion may be facing significant difficulties in their academic self-efficacy.

Finally, on the overall Burnout Index, the majority of students [72.6%] were at the low level, followed by 19.0% at the medium level and 8.3% at the high level, indicating that, in general terms, the group studied does not show a high prevalence of the syndrome, although subgroups that may require specific attention were identified.

**Box 2**

**Table 2**

Overall statistics

Variable	Low level		Medium level		High level	
	%	Frequency	%	Frequency	%	Frequency
Exhaustion	41.7%	35	48.8%	41	9.5%	8
Cynicism	34.5%	29	41.7%	35	23.8%	20
Efficacy A.	3.6%	3	10.7%	9	85.7%	72
Burnout	72.6%	61	19.0%	16	8.3%	7

Turning to the comparative results, statistically significant differences were found between regular and irregular students in the dimensions of cynicism and academic efficacy.

In the case of cynicism [ $t = -2.545$ ;  $gl = 82$ ;  $p < 0.05$ ], irregular students presented a higher mean [ $M = 2.57$ ] compared to regular students [ $M = 1.83$ ], indicating a greater attitude of detachment and demotivation towards their studies.

Likewise, in the academic efficacy dimension [ $t = -2.374$ ;  $gl = 82$ ;  $p < 0.05$ ], regular students showed a significantly higher perception of efficacy [ $M = 1.14$ ] than irregular students [ $M = 1.57$ ], suggesting that the latter face greater difficulties in terms of their academic self-efficacy.

**Box 3**

**Table 3**

Statistical Comparison of cynicism and efficacy by academic status [regular/irregular]

Academic status	Half cynicism	T	gl	P	Medium efficiency	T	GI	P
Regular	1.83	-2.545	82	0.013	1.14	-2.374	82	0.020
Irregular	2.57				1.57			

With regard to the students' employment status, the results of the analysis indicated that there are differences between the groups [ $F = 1.977$ ;  $p < 0.05$ ], with the lowest levels of exhaustion found among students who do not work, while the highest levels correspond to those who work in jobs unrelated to their degree programme. Those who work in activities related to their academic field also show exhaustion, although to a lesser degree than those who work outside their professional field.

These data suggest that participation in the workplace can influence students' emotional well-being, and that this influence varies depending on the relationship between work and career. In this sense, jobs that are consistent with academic training may have a less negative impact on the level of emotional exhaustion, while employment in unrelated areas may represent an additional source of stress.

**Box 4**

**Table 4**

Statistic Comparison of attrition variable by student location

Employment status	Media	F	P
Work related to the area	1.7838	1.977	.007
Non-area related work	1.900		
I do not work	1.3074		

Regarding the students' geographical area of residence within the city of Tuxtla Gutiérrez, significant differences were also found among the students with respect to the academic efficacy variable [ $F=3.292$ ;  $p < 0.05$ ], suggesting that place of residence may be related to the perception of efficacy in academic performance.

The observed means show that students living in the city centre reported the highest level of academic efficacy, followed by those residing in the south and the north. In contrast, the lowest levels of efficacy were observed for students living close to the university, which is contrary to what might be expected under the assumption that proximity to the institution facilitates performance.

Since a lower score on this scale indicates a higher perception of efficacy, the results suggest that students living further away [especially in the centre and south of the city] tend to perceive themselves as more academically competent.

**Box 5**

**Table 5**

Statistic Comparison of attrition variable by student location

Employment status	Media	F	P
Central Zone	1.000	3.292	.025
South Zone	1.1111		
North Zone	1.2258		
Near the faculty where I study	1.5556		

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Continuing with the results, both convergences and divergences were revealed between the levels of academic burnout syndrome observed in students in the Bachelor of Public Accounting programme at the Autonomous University of Chiapas [UNACH] and the data previously obtained from students at the Technological Institute of Sonora [ITSON].

In general terms, both groups showed a low overall prevalence of burnout syndrome, which is reflected in the percentages of students at the low level: 72.6% in the case of UNACH and 79.9% in the case of ITSON. This coincidence suggests a relatively favourable perception of the academic environment in both institutions.

However, when disaggregating the dimensions that make up the construct of academic burnout, significant differences emerge. In the dimension of emotional exhaustion, a higher percentage of students with high levels was identified at ITSON [15.6%] compared to 9.5% reported at UNACH. This finding could be indicative of greater exposure to chronic academic stress in the ITSON sample, possibly influenced by curricular or contextual factors.

With regard to the cynicism dimension, 23.8% of UNACH students presented high levels, compared to 17.6% of ITSON students. This result suggests a higher incidence of attitudes of detachment or disinterest in academic activities in the UNACH sample, which could be associated with negative perceptions of the institutional environment or a weaker connection with the curriculum content.

The academic efficacy dimension yielded predominantly positive results in both populations, being more pronounced at ITSON, where 91.3% of students were in the high range, compared to 85.7% at UNACH. However, it is noteworthy that UNACH reported a higher percentage of students with low perceptions of efficacy [3.6%] compared to ITSON [1%], which may be an indicator of academic risk that warrants attention from tutoring and institutional support programmes.

With regard to contextual variables, both studies confirmed that irregular academic status is significantly associated with higher levels of cynicism. Additionally, at UNACH, irregular students also reported a significantly lower perception of academic efficacy, while at ITSON, a higher level of general burnout was evident among them. These findings reinforce the notion that academic irregularity is a vulnerability factor for the development of burnout symptoms.

A particularly notable difference between the two studies relates to employment status. While no statistically significant differences were observed between the different employment groups at ITSON, relevant variations were found at UNACH. At the latter, students who did not work had the lowest levels of emotional exhaustion, while those who worked in jobs unrelated to their academic training had the highest levels. These results suggest that compatibility between the workplace and academic career may moderate the effects of occupational stress on student well-being.

In terms of area of residence, the ITSON study did not report significant differences in any of the dimensions of the syndrome, while at UNACH statistically significant differences were found in the dimension of academic efficacy, with students residing in the city centre reporting a higher perception of academic competence. This finding, contrary to what would be expected under the premise that geographical proximity to the institution favours performance, could be reflecting socio-economic, cultural or time management differences.

Finally, it should be noted that the ITSON study incorporated additional variables such as gender and age group, finding that women report higher levels of emotional exhaustion and that older students experience higher levels of cynicism and burnout.

These dimensions were not addressed in the UNACH research, which limits comparability in these areas and suggests future lines of research for a broader characterisation of the phenomenon.

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**Conclusions**

The findings of this research show that, although the overall prevalence of academic burnout syndrome among public accounting students at UNACH and ITSON is mostly low, there are substantial differences in the manifestation of its dimensions. In particular, a higher proportion of cynicism and lower perception of academic efficacy was identified in UNACH students, while ITSON reported higher levels of emotional exhaustion. These differences may be linked to institutional characteristics, curricular structures, or contextual dynamics specific to each university.

Both studies agreed that students with irregular academic trajectories had higher levels of cynicism and, in the case of UNACH, also a lower perception of academic self-efficacy. This pattern is consistent with previous research highlighting the vulnerability of students facing academic interruptions, as they tend to experience greater emotional distancing and difficulties in maintaining motivation and academic performance [Rodríguez-Villalobos et al., 2019].

In relation to the employment situation, a significant difference was observed between the two institutions. At UNACH, students who do not work showed lower levels of exhaustion, in contrast to those who work in jobs unrelated to their field of study, who reported greater emotional exhaustion. This finding contrasts with that of Caballero [2006], who found that working students do not necessarily experience higher levels of burnout and may even develop a stronger perception of self-efficacy. These discrepancies could be attributed to the nature of the job and the way in which academic and work demands are articulated.

On the other hand, variables such as age and gender were not considered in the present applied research at UNACH, which represents a significant limitation. Previous studies, such as those by Chui et al. [2023], have shown that women tend to experience higher levels of academic burnout, and that younger students more frequently exhibit symptoms of cynicism and professional ineffectiveness, although these differences are not always statistically significant [García et al., 2024].

Overall, the results allow us to conclude that, although there is a general favourable trend in terms of the low prevalence of academic burnout, structural and personal factors that significantly influence its onset persist.

Therefore, it is imperative that higher education institutions design and implement comprehensive strategies for prevention, early detection, and psychoeducational support that consider not only academic conditions but also the working, contextual, and personal conditions of students.

Finally, it is recognised that this research has significant limitations, including the restriction of the analysis to a single cohort of fifth-semester students at UNACH. However, it is important to note that these limitations open the door to future research that expands the sample, diversifies the academic profiles considered, and deepens the multivariate analysis of academic burnout syndrome.

This is especially true in a population as little studied as university students in fields such as accounting and finance. It is precisely by deepening the analysis that we will not only better understand its causes and manifestations, but also design more effective strategies that promote students' emotional well-being and academic performance [Madigan, et al, 2023].

**Declarations****Conflict of interest**

The authors declare no interest conflict. They have no known competing financial interests or personal relationships that could have appeared to influence the article reported in this article.

**Author contribution**

*Aceves-López, Jesús Nereida:* Contributed to the project idea, research method and technique addition, the data collection at ITSON, as well as the delivery of results.

*Cruz-Sánchez, Zoily Mery:* Contributed to application of the instrument at UNACH.

*Aceves-Córdova, Erika Soledad:* Contributed Database development.

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*González-Navarro, Nora Edith*: Contributed Searching and organizing bibliographic references

**Availability of data and materials**

The research data are in the possession of the research group and are available for future research.

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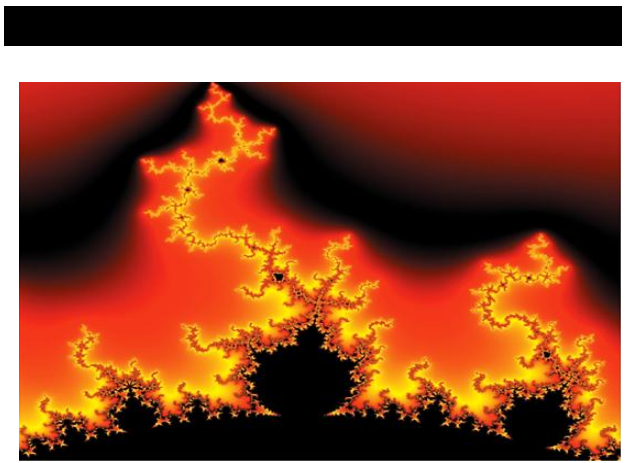
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ANN Artificial Neural Network

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