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Journal High School

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The works must be unpublished and refer to topics of Higher education curricular standards, higher education training fields, higher education curricular frameworks, higher education curricular parameters and other topics related to Humanities and Behavioral Sciences.

Presentation of Content

In the first article we present *Design and validation of a measurement instrument to know university student perception of Group Tutoring topics* by Amavizca-Valdez, Laura Olivia & García-Nevares, Ana María, with adscription at the Universidad Tecnológica del Sur de Sonora, as the next article we present *Case study method. A systematic review of the literature* by Pérez-Garmendia, Gloria, Zapata-Dittrich, Abel, Zapata-Pérez, Mariana Alejandra and Zapata-Pérez, Abel Antonio, with adscription at the Instituto Tecnológico de Mérida, as the next article we present *Educational games as an alternative for teaching the periodic table to Tzotzil secondary school students* by Osorio-Gutierrez, Karina, Gordillo-Espinoza, Emmanuel, Trejo-Trejo, Gilberto Abelino and Domínguez-Gutú, Jesús, with adscription at the Universidad Tecnológica de la Selva, as the next article we present *Integration STEAM and Gamification in Chemistry Learning at the Secondary School Level* by Gutiérrez-Cruz, Wendy, Domínguez-Gutú, Jesús, Trejo-Trejo, Gilberto Abelino and Gordillo-Espinoza, Emmnauel, with adscription at the Universidad Tecnológica de la Selva, as the next article we present *Guided use of Artificial Intelligence for the development of written reports: Preliminary results of an academic practice* by Camero-Berrones, Rosa Gabriela, Soto-Hernández, Ana María, Lerma-Ledezma, David and Maldonado-Soto, Otilia Georgina, with adscription at the Tecnológico Nacional de México and Universidad Politécnica de Altamira, as the next article we present *Key risk prevention factors, student transformation towards the Organization* by Gonzalez-de la Garza, José Gerardo, De la-Garza-Cienfuegos, Sandra Patricia, Otriz-Ozuna Mayra Yazmin and Aguilar-Sánchez, Ana María, with adscription at the Universidad Autónoma de Coahuila, as the last article we present *Outcomes of mentoring in access to higher education and professional development: A Bibliometric analysis* by Barradas-Arenas, Ulises Daniel, Vázquez, Ma-Rosario and Pérez-Cruz, J. A., with adscription at the Universidad Autónoma del Carmen.

Content

Journal High School 9[20]1-7: e1920107
Article

Design and validation of a measurement instrument to know university student perception of Group Tutoring topics

Diseño y validación de un instrumento de medida para conocer la percepción de los estudiantes universitarios sobre los temas de Tutoría Grupal

Amavizca-Valdez, Laura Olivia*[a] & García-Nevares, Ana María[b]

[a] Universidad Tecnológica del Sur de Sonora • 2140-2018 • 0000-0003-1614-110X 877335
[b] Universidad Tecnológica del Sur de Sonora • 0009-0002-9842-8883

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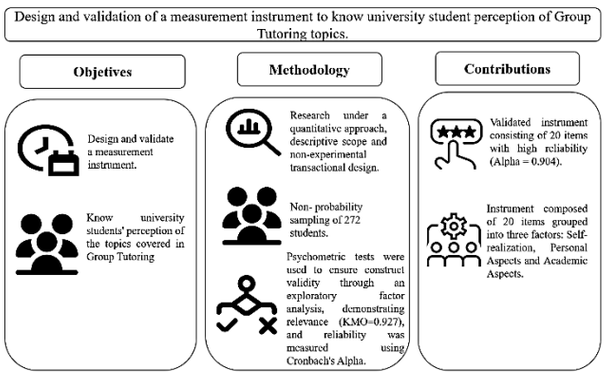
* ✉ [lamavizca@uts.edu.mx]

Abstract

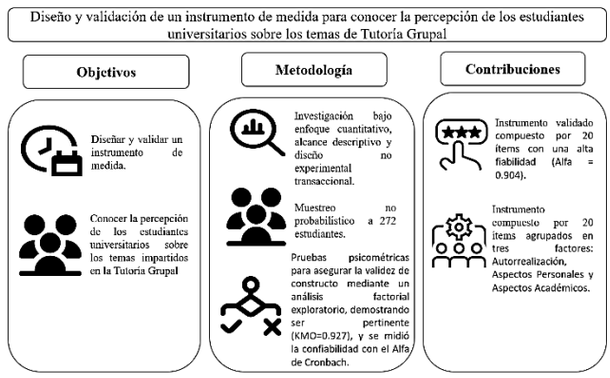
The objective of this study was to design and validate a measurement instrument, called OSTETUG, to know university students' perception of the topics covered in Group Tutoring. The research was conducted using a quantitative approach, with a descriptive scope and a non-experimental, cross-sectional design. The instrument was administered to a non-probability sample of 272 students. Psychometric tests were performed to ensure construct validity through an exploratory factor analysis, which proved to be relevant (KMO = 0.927), and reliability was measured using Cronbach's alpha. The main contribution is the validated OSTETUG instrument, composed of 20 items with high reliability (alpha = 0.904), grouped into three factors: Self-actualization, Personal Aspects, and Academic Aspects.

Resumen

El objetivo de este estudio fue diseñar y validar un instrumento de medida, llamado OSTETUG, para conocer la percepción de los estudiantes universitarios sobre los temas impartidos en la Tutoría Grupal. La investigación se desarrolló bajo un enfoque cuantitativo, con alcance descriptivo y diseño no experimental transaccional. El instrumento se aplicó a una muestra no probabilística de 272 estudiantes. Se realizaron pruebas psicométricas para asegurar la validez de constructo mediante un análisis factorial exploratorio, demostrando ser pertinente (KMO=0.927), y se midió la confiabilidad con el Alfa de Cronbach. La contribución principal es el instrumento OSTETUG validado, compuesto por 20 ítems con una alta fiabilidad (Alfa = 0.904), agrupados en tres factores: Autorrealización, Aspectos Personales y Aspectos Académicos.



Instrument validation, Group tutoring, Student perception



Validación de instrumento, Tutoría grupal, Percepción estudiantil

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

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Introduction

A review of research conducted at various higher education institutions in Mexico and other countries has revealed different ways of delivering tutoring. Some refer to tutoring as peer-to-peer support, where students help each other with their studies. Other institutions focus solely on the academic aspect, where students are free to seek out a teacher-tutor to reinforce a topic in any subject in their degree programme. [Delgado, J., 2023] Today, commitment and attention are essential to creating a positive educational environment. It is essential that tutors not only take an interest in identifying students' weaknesses or difficulties, but also strive to help them overcome any obstacles that arise in the learning process. This involves making appropriate use of the support and tools necessary for each student to reach their full potential, both academically and personally. In other words, creating a teacher-student connection that fosters a positive educational environment.

[Ponce Ceballos, S., & Aceves Villanueva, Y., 2020]. They conducted a study on the Exploration of the Behaviour of an Instrument to Evaluate the Function of Academic Tutoring in the Context of Teacher Training Colleges. This study was published in the *Ibero-American Journal of Educational Evaluation*, 13(1), 139-155. In this study, not only is an instrument applied, but its psychometric properties (validity and reliability) are analysed in a specific context (teacher training colleges), demonstrating the importance of adapting and validating existing instruments.

[Martínez, C., Pérez, P., Cusó, J. & Martínez, J. 2014] from the University of Murcia, Spain, conducted research on the perceptions of undergraduate students and tutors, with the aim of providing suggestions for improving the tutoring system, which helps students' comprehensive training and guides them in their professional training, favouring the new educational approach focused on the student and their learning. The results found were: 75% of students consider the presence of a tutor to be important for their academic development, and teachers express the need to recognise the tutorial function, since otherwise it runs the risk of being relegated to a task that depends on the availability and commitment of the teacher.

These authors conducted another study in 2015 on university student satisfaction with tutoring and the design and validation of an instrument.

The results regarding the validation of the instrument yielded the following results: In the reliability analysis performed using Cronbach's alpha coefficient, a reliability level of a= .958 was found by eliminating some items 3, 5, 15, 16, 18, 20, 21, and 25. With regard to student satisfaction with tutoring, it was found that younger students, on the scale referring to the tutor and the organisation, are more satisfied than students over the age of 25. The difficulty of continuing their studies is much greater for this type of student than for younger students, as they face greater social and family pressure and have different responsibilities, both at work and in their personal lives.

On the other hand, [León, J., Hevia, F., Vergara-Lope, S., Vinacur, T., & Zoido, P., 2022]. This source is valuable because of its current context. It addresses the validation of an instrument designed to measure the effectiveness of remote tutoring, a crucial aspect in the post-pandemic era. The objective was to develop an inexpensive, easy-to-use, and quick-to-apply instrument that would at least provide a reliable indication of whether the interventions were having an impact on fundamental and essential learning in mathematics among the most vulnerable population with the greatest learning gaps.

Similarly, [García, R., Cuevas, O., Vales, J., and Cruz, I., 2012] conducted research at the Technological Institute of Sonora on the impact of tutoring on students, focusing specifically on the academic tutoring received by students who participate in counselling of their own volition.

These authors found in their research that students who attend tutoring sessions fail less than those who do not. Of the students who did not receive tutoring, 53.78% failed subjects and 46.22% passed their subjects. In contrast, only 29.53% of students who attend tutoring failed subjects, and 70.47% did not fail any subjects. Therefore, the research by these authors demonstrates that there is a highly significant influence in attending tutoring sessions.

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Also, [Salomón and Castillo, 2016] conducted research to evaluate the tutoring programme through student satisfaction in the Academic Division of Health Sciences in the Bachelor of Medicine and Surgery programme at the Juárez Autonomous University of Tabasco. The Technological University of Southern Sonora conducts this evaluation of tutors every four months through student satisfaction, in which they found that the average age is 21 among 335 students. In terms of gender, 53% were female and 47% were male. With regard to credits earned, at the time of data collection, students who had earned 0-20%, 21.40%, and 61-80% of credits were more represented. Regarding student satisfaction with their tutor, an average of 70% was found with respect to the tutor's attitude and attention, and 58% with respect to knowledge. Slightly more than 70% of students expressed satisfaction with the tutor's attention, attitude, and knowledge, although only 58% considered the tutoring programme useful in helping them solve their problems.

On the other hand, [Alegre Bravo, A, 2025] conducted a study called 'University Tutoring Service Assessment Scale (EVSTU): Construction and Validation,' focused on the creation of the 'EVSTU,' a specific scale for students to assess the tutoring service they receive. It details the construction process and the validity (exploratory and confirmatory factorial) and reliability (Cronbach's alpha) tests. Finally, [Benavides, C. A., 2022], in his research, analyses perceptions of academic tutoring and their impact on undergraduate students in the Faculty of Education at a private university.

A mixed-methods descriptive approach was used in this research. A survey was implemented to evaluate sociodemographic aspects, the tutoring experience, and its projection. A sample of 118 students was surveyed. In the first aspect, it was observed that only 55% of students demonstrated that they had the necessary resources to participate in these spaces; however, only 38% of them had the time necessary to attend the tutorials. Although the university has spaces available, only 41% attend sporadically. In the second aspect, it was evident that one of the reasons for attending tutorials is a lack of understanding of a specific topic, with 25% showing an improvement in their academic performance, highlighting the relevance of resources.

The third aspect analyses the strategies used by the tutor, and students project tutoring as a space for autonomous learning. After analysis, it was observed that these spaces are underutilised, with evidence suggesting that this tends to be due to students' availability or lack of knowledge. From this, it can be concluded that these spaces are conceived as a good training strategy, but are not being taken advantage of.

Methodology

Before describing how the validity and reliability of the instrument were assessed, it is important to mention that this research was conducted using a quantitative approach because, in order to carry it out, data had to be collected to validate the measurement instrument on the perception of students of different TSU courses at a technological university on the group tutoring topics proposed by the Institutional Tutoring Programme (PIT) coordination to tutors for development in the classroom week after week, based on numerical measurement and statistical analysis to establish behaviour patterns.

The scope of this research is descriptive because it seeks to specify important properties, characteristics and features of the phenomenon to be analysed and describes trends in a group or population. The research design is non-experimental, transactional or cross-sectional. This methodological choice implies that the study will be carried out without intentional manipulation of the variables by the researcher. The focus is exclusively on observing, describing and analysing the phenomena as they occur in their natural environment and real context, and then analysing them.

This design is ideal for describing a population at a given moment or for establishing correlations between variables without establishing a direct and controlled causal relationship. The research was carried out in a group tutorial class with the students who attended university that day. They were provided with a link to answer the instrument from the device they had available at the time, indicating how they had to enter and what the study in progress was about, so their full cooperation was required to answer it. Similarly, the link was provided to the rest of the tutors so that they could administer the questionnaire to the different groups of students who participated in answering it.

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The sample is non-probabilistic, as the choice of elements does not depend on probability, but on causes related to the characteristics of the research. [Hernández S., 2014]. The population was all students enrolled in the Higher Technical University (TSU) courses in Business Development, Mechatronics, Industrial Processes, and Information and Communication Technologies, as well as the Aeronautical Manufacturing course during the September-December 2024 semester.

The final sample consisted of 272 students from a population of 633 of both sexes, of whom 460 were men and 173 were women from all educational programmes who were at the university at the time of the application. Their ages ranged from 18 to 22 years old, with no distinction based on sex or any other data that would discriminate against students participating in the survey.

A measurement instrument (OSTETUG) was designed, initially consisting of 22 items on a Likert scale. The purpose of the instrument is to measure students' perceptions of the topics taught in group tutorials.

Each item is rated on a 5-point scale (1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree). Scores close to 5 indicate that the student perceives the topics covered in group tutoring as highly useful for their personal, academic and self-fulfilment.

Subsequently, the psychometric properties of the instrument, such as reliability and validity, were analysed. To ensure construct validity, an exploratory factor analysis was performed. Following this analysis, the final instrument consisted of 20 items, grouped into three factors: Factor 1, Self-fulfilment: Composed of 12 items, it explains the highest percentage of variance. Factor 2 on Personal Aspects, composed of 5 items, explains the second highest percentage of variance. Factor 3 on Academic Aspects, composed of 3 items, explains the lowest percentage of variance.

The following section shows the results obtained with the reliability and validity of the instrument applied to university students belonging to one of the 191 universities in the technological system.

Results

For the design and validation of the measurement instrument, KMO and Bartlett tests were used to confirm the relevance of the factor analysis. As shown in Table 1, these statistics confirmed that the correlations between the variables are adequate and that the proposed model is statistically viable. The KMO index is a value between 0 and 1. The closer the value is to 1, the more relevant the factor analysis is (KMO=0.927).

Box 1

Table 1
KMO and Bartlett test

Kaiser-Meyer-Olkin measure of sampling adequacy		**.927**
Bartlett sphericity test.	Approx. Chi-Square	3031.266
	Gl	190
	Sig.	0.000

Source: Own Elaboration

Specifically, the KMO statistic indicates the proportion of variance in its variables that could be caused by common underlying factors, while Bartlett's test assesses whether the partial correlations between variables are sufficiently small, i.e., it verifies whether the variables are significantly intercorrelated in order to proceed with factor analysis.

Next, factor analysis was obtained using the principal component method as the extraction method. In this method, the extracted factors are eigenvectors of the rescaled correlation matrix. According to Table 2, all extracted items have eigenvalues between 0.439 and 0.770.

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Box 2

Table 2

Extraction method: principal component análisis

Ítems	Initial	Extraction
1. They lead to reflection and discussion within the group.	1.000	.439
3. They help me reaffirm my desire to belong to the school.	1.000	.683
4. They lead me to reflect on asking for help when I am unclear about the content of a subject.	1.000	.770
5. They do not help me identify my academic strengths and weaknesses.	1.000	.512
6. They help me raise my grade point average.	1.000	.534
7. They are useful as support for solving problems in the academic environment.	1.000	.498
8. They help me to learn independently.	1.000	.631
9. They encourage me to reflect on my life.	1.000	.536
10. They do not help me to develop as a person.	1.000	.624
11. They help me to express personal situations.	1.000	.566
12. They can be applied to everyday life.	1.000	.645
13. They disrupt my reflection on my self-esteem.	1.000	.578
14. They help develop thought processes.	1.000	.718
15. They lead me to reflect on my behaviour.	1.000	.623
16. They do not contribute to my health care.	1.000	.599
17. They provide sufficient tools to be applied in the workplace.	1.000	.694
18. They are not related to my personal, social, or professional life at all.	1.000	.560
19. They provide ideas for solving problems in the workplace.	1.000	.635
21. They help build rapport with future colleagues.	1.000	.657
22. They encourage you to analyse and reflect on the importance of teamwork.	1.000	.642

Source: Own Elaboration

To ensure the reliability of the instrument, Cronbach's alpha coefficient was calculated, yielding a coefficient of 0.904 for the instrument as a whole, which indicates a high degree of consistency in the measurements. Therefore, it can be stated that the instrument provides highly reliable measurements with very little margin for error. As can be seen in Table 3.

Box 3

Table 3

Reliability statistics

Cronbach's alpha	N. Of elements
.904	20

Source: Own Elaboration

Likewise, Table 4 and Table 5 show the coefficients corresponding to each of the three dimensions or factors obtained from the exploratory factor analysis. The coefficients for factor 1 are .939, for factor 2 are .778, and for factor 3 are 7.44, giving a total of 0.904 according to Cronbach's alpha.

This indicates high consistency in each of the factors as well as in the Group Tutoring Opinion Survey (OSTETUG) instrument as a whole. Thus, an instrument with a high reliability and validity index and a very low margin of error was obtained, which can be used for future research.

Box 4

Table 4

Factor coefficient 1 Self-actualisation

Ítem	Minimum	Maximum	Media	Standard deviation	Cronbach's alpha
Factor 1					**0.939**
6	1	5	4.00	.895	
7	1	5	4.09	.863	
8	1	5	4.08	.804	
9	1	5	3.87	.890	
11	1	5	3.77	.929	
12	1	5	3.95	.760	
14	1	5	3.91	.801	
15	1	5	4.06	.764	
17	1	5	3.97	.817	
19	1	5	3.98	.751	
21	1	5	4.07	.791	
22	1	5	4.26	.825	

Source: Own Elaboration

Box 4

Table 4

Coefficient of Factor 2 Personal aspects and Factor 3 Academic aspects

Ítem	Minimum	Maximum	Media	Standard deviation	Cronbach's alpha
Factor 2					**0.778**
5	1	5	3.74	1.049	
10	1	5	3.92	.952	
13	1	5	3.66	1.092	
16	1	5	3.57	1.039	
18	1	5	3.56	1.018	
Factor 3					**0.744**
1	1	5	3.75	1.196	
3	1	5	4.21	.970	
4	1	5	4.18	.943	
Total of the three factors					**0.904**

Source: Own Elaboration

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Discussion and Conclusions

With regard to the psychometric properties of the instrument, Cronbach's alpha coefficient was calculated, yielding an overall reliability of 0.904, which indicates that the instrument has high consistency in its measurements and can be said to have very little margin for error.

In terms of validity, an exploratory factor analysis was conducted to determine the structure of the instrument. Three factors were found: Factor one consists of 12 items that apply the highest number of variances corresponding to aspects of self-realisation. Factor two consists of five items related to aspects of personal life, and factor three consists of three items that explain the lowest number of variances and correspond to academic aspects.

The validation of the instrument is very important for future research within the university, as well as other educational institutions that wish to apply the instrument to understand the perceptions of their students.
As mentioned by [Pérez Cuso, F. J., Martínez Clares, P., & Martínez Juárez, M., 2015], university tutoring is considered a factor of quality and a requirement in universities. This study also presents the design and validation of a tutoring satisfaction scale in a descriptive and cross-sectional study. This study shows similarity in Cronbach's Alpha reliability above .90, which shows us the high reliability index.

It also leaves an instrument with a high reliability and validity index with very little margin of error, which can be used for future research. This instrument can be improved, especially factor three, which refers to academic aspects and obtained a percentage of 3.69 below the overall average of 3.93. More items referring to this topic can be included to increase the reliability index.

This study contributes to the university's tutoring system for decision-making regarding the topics taught. In addition, this research evaluates three processes that belong to the tutoring department, leaving the psychological counselling process to be evaluated.

Declarations

Conflict of interest

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

Contribution of the authors

Amavizca-Valdez, Laura Olivia: I contributed to the project idea, information search, review and editing, writing and execution of the project, as well as formatting the document.
García-Nevares, Ana María: I contributed to the project idea, information search, review and editing, writing and execution of the project.

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Abbreviations

OSTETUG	Opinion on Topics in Group Tutoring

References

Background

García López, R.I., Cuevas Salazar, O.; Vales García, J.J; & Cruz Medina, I.R. [2012] Impacto del Programa de Tutorías en el desempeño académico de los alumnos del Instituto Tecnológico de Sonora. Revista Electrónica de Investigación Educativa, 14(1), 106-121.

ISSN:2523-0336
RENIECYT-SECIHTI: 1702902

Martínez, C., Pérez, P., Cusó, J. & Martínez, J. [2014]. Una revisión de la tutoría universitaria: la percepción de estudiantes y tutores de los estudios de grado. Revista de Docencia Universitaria, 12(1), 269-305. Recuperado de:

Ponce Ceballos, S., & Aceves Villanueva, Y. [2020]. Exploración del Comportamiento de un Instrumento para Evaluar la Función de Tutoría Académica en el Contexto de Escuelas Normales. *Revista Iberoamericana de Evaluación Educativa*, 13(1), 139-155.

Salomón Cruz, J., Castillo Orueta, M. L., y Córdova Hernández, J.A. [2016]. Desempeño del tutor de medicina en una universidad pública. RIDE. Revista Iberoamericana para la Investigación y el Desarrollo Educativo, pag. 7 (13), 55-68.

Essentials

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

Support

Alegre Bravo, A. [2025]. Escala de Valoración del Servicio de Tutoría Universitaria (EVSTU): Construcción y validación. *Avances en Psicología*, *33*(1)

León, J., Hevia, F., Vergara-Lope, S., Vinacur, T., & Zoido, P. [2022]. Validación del instrumento de medición utilizado en el proyecto "Tutorías remotas" para acelerar aprendizajes.

Benavides, C. A. [2022]. Percepciones de estudiantes de pregrado de la Facultad de Educación de la Universidad Cooperativa de Colombia frente a la acción tutorial.

Discussions

Delgado Ospino, J. M. [2023]. Análisis de las concepciones de los estudiantes de los programas de pregrado sobre las tutorías académicas en la Universidad Cooperativa de Colombia, sede Bucaramanga.

Pérez Cuso, F. J., Martínez Clares, P., & Martínez Juárez, M. [2015]. Satisfacción del estudiante universitario con la tutoría. Diseño y validación de un instrumento de medida. *Estudios Sobre Educación*, *29*, 81-101.

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RENIECYT-SECIHTI: 1702902

Amavizca-Valdez, Laura Olivia & García-Nevares, Ana María. [2025]. Design and validation of a measurement instrument to know university student perception of Group Tutoring topics. Journal High School. 9[20]1-7: e1920107.
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Article

Case study method. A systematic review of the literature

Método de estudio de caso. Una revisión sistemática de literatura

Pérez-Garmendia, Gloria*[a], Zapata-Dittrich, Abel[b], Zapata-Pérez, Mariana Alejandra[c] and Zapata-Pérez, Abel Antonio[d]

[a] TecNM / Instituto Tecnológico de Mérida • GQP-7713-2022 • 0000-0002-1215-0175 • 291627
[b] TecNM / Instituto Tecnológico de Mérida • 0000-0002-2583-7531 • 414742
[c] TecNM / Instituto Tecnológico de Mérida • OBO-8784-2025 • 0000-0002-6562-926X • 1153409
[d] TecNM / Instituto Tecnológico de Mérida • OBO-8779-2025 • 0009-0009-9837-0694 • 2164140

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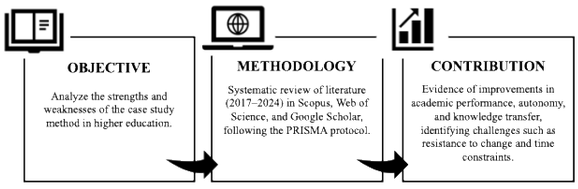
* ✉ [gloria.pg@merida.tecnm.mx

Abstract

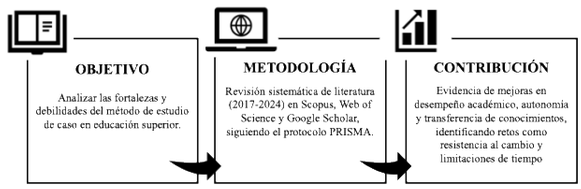
The case study approach has been consolidated in higher education as a pedagogical methodology that promotes deep, active and contextually relevant learning. This research, developed through a systematic review of the literature between 2017 and 2024, analyzes the strengths and weaknesses associated with the use of this methodology. The information was obtained from databases such as Scopus, Web of Science and Google Scholar, using rigorous inclusion criteria based on the PRISMA protocol. Among the most outstanding contributions are the improvement in academic performance, the promotion of metacognitive abilities, autonomy in learning and the transfer of knowledge to practical contexts, especially in areas such as health and education. Despite these benefits, limitations related to resistance to modifying traditional practices, heterogeneity of learning styles, and temporal constraints within academic programs are recognized. It is concluded that the case study represents an effective way for comprehensive training, as long as its implementation is supported by a favorable institutional structure, continuous teacher training and curricular adjustments that facilitate its regular use. It is recommended to develop longitudinal studies and explore student perception of this strategy, particularly in hybrid or virtual environments.



Case study method, systematic literature review, didactic strategy, meaningful learning.

Resumen

El enfoque del estudio de caso se ha consolidado en la educación superior como una metodología pedagógica que impulsa el aprendizaje profundo, activo y con relevancia contextual. Esta investigación, desarrollada mediante una revisión sistemática de literatura entre los años 2017 y 2024, analiza las fortalezas y debilidades asociadas al uso de dicha metodología. La información fue obtenida de bases como Scopus, Web of Science y Google Scholar, utilizando criterios rigurosos de inclusión basados en el protocolo PRISMA. Entre los aportes más destacados se identifican la mejora en el desempeño académico, el fomento de capacidades metacognitivas, la autonomía en el aprendizaje y la transferencia del conocimiento a contextos prácticos, sobre todo en áreas como salud y educación. A pesar de estos beneficios, se reconocen limitaciones relacionadas con la resistencia a modificar prácticas tradicionales, la heterogeneidad de estilos de aprendizaje y las restricciones temporales dentro de los programas académicos. Se concluye que el estudio de caso representa una vía efectiva para una formación integral, siempre que su implementación se apoye en una estructura institucional favorable, capacitación docente continua y ajustes curriculares que faciliten su uso regular. Se recomienda desarrollar estudios longitudinales y explorar la percepción estudiantil sobre esta estrategia, particularmente en entornos híbridos o virtuales.



Método estudio caso, revisión sistemática de la literatura, estrategia didáctica, aprendizaje significativo.

Area: Dissemination and universal access to science

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Introduction

The effectiveness of the case study method as a teaching strategy has been the subject of growing interest in the field of education, given its potential to promote meaningful and contextualised learning. According to Guevara (2023), this approach allows students to deal with real-life situations; it also promotes active and contextualised learning that facilitates the integration of theory and practice. In line with this approach, Stake (2013) mentions that the case method provides students with an opportunity to approach real-life problems from an interdisciplinary and complex perspective, not only applying theoretical knowledge but also developing interpersonal skills, such as teamwork and effective communication. In the words of Calderón *et al.*, (2023), the case method becomes a tool that not only teaches knowledge but also shapes the student's character.

Thus, the study method refers to an organised set of techniques and strategies that students use to improve their understanding and retention of academic material. These techniques may include efficient note-taking, time management, comprehensive and critical reading, summarising, and practising self-assessment. The study method is a fundamental tool that facilitates meaningful learning and promotes student autonomy. Therefore, implementing effective study methods in the classroom brings multiple benefits for both students and teachers.

As seen in the literature, the case study, as a method, has established itself as a valuable teaching strategy in higher education, promoting active and contextualised learning. However, there is a shortage of systematic reviews analysing its effectiveness and application at this level of education. Here, the current literature suggests that the method not only facilitates the understanding of complex concepts, but also fosters critical and argumentative skills in students (Maroto *et al.*, 2017; Ríos and Ortega, 2020). Therefore, it is considered appropriate to conduct a systematic review of the literature under a robust methodological framework that allows the object of study to be observed from different angles in order to obtain a robust theoretical perspective and facilitate more in-depth studies.

The study is justified by the need to consolidate evidence on the objective; that is, it has theoretical value (Hernández *et al*., 2017). The review will have several benefits, such as determining the benefits and limitations identified in the literature regarding the use of the case study method as a teaching strategy in higher education. These criteria include the methodological quality of the studies, the relevance of the topic, and the clarity in the presentation of results and conclusions (Pardal, 2023).

Now, for a better understanding of the object of study, it is mentioned that among the most notable benefits of the case study are improved academic performance, where students who apply effective study methods tend to obtain better grades and develop a deeper understanding of the topics studied, so study strategies can have a significant impact on students' academic performance.

This is also true in the development of metacognitive skills, which are integrated into study techniques that not only aid in the acquisition of knowledge but also encourage self-reflection and self-control, crucial skills for lifelong learning that allow students to evaluate their own learning process and adjust it as necessary (Zimmerman, 2002).

It also promotes student autonomy; by learning and applying study methods, young people become more autonomous learners, capable of managing their own learning process effectively. Therefore, autonomy in learning is a fundamental goal of modern education, and study methods play a key role in promoting it (Brophy, 2001).

This approach also allows students to become actively involved in solving real problems, which helps to develop critical and analytical skills. It promotes the practical application of these skills in specific situations, which is fundamental to the comprehensive education of students. Through case studies, teachers can foster critical skills such as analysis, argumentation, and decision-making, which results in more meaningful and lasting learning (Ríos and Ortega, 2020; Panting *et al*., 2022).

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Case studies allow students to explore complex and multifaceted problems, thereby helping them to develop critical thinking and apply theories in specific situations. Ríos and Ortega (2020) highlight that this methodology not only contributes to the development of argumentative skills in future teachers, but also, as the same author comments, promotes a deeper understanding of theoretical concepts in the context of the psychology of learning.

Now, analysing the object of study as a process, Mora (2017) highlights that the case study is structured in three phases: identification, decision-making and problem-solving, which provides a clear framework for its implementation in the classroom. This structure allows educators to guide students through a reflective process that culminates in the application of theoretical knowledge to practical situations.

In terms of empirical evidence, Panting *et al*. (2022) emphasise that the use of teaching strategies such as case studies is essential in health sciences education, where the practical application of knowledge is crucial for the training of competent professionals. Similarly, Moroto *et al*., (2017) describe how agricultural engineering students faced a real problem consisting of the need for reengineering solutions for various facilities in a calf feedlot. Resolving the case required the students to compile and integrate various knowledge and skills acquired in their undergraduate studies, as well as critical thinking and ingenuity.

They demonstrate that the results obtained were positive in terms of promoting collaborative work, critical thinking and active student participation in the course activities. They conclude that although the practical implementation of the teaching methodology presented some difficulties, the case method is suitable for Master's studies and propose promoting its use in other engineering courses. On the other hand, initial teacher training benefits from this approach, as shown in the work of Sevilla *et al.,* (2017); where the perceptions of future teachers on inclusive education are explored and how case studies can help to address these issues effectively.

This shows that the method's ability to address complex and diverse situations in the classroom allows future educators to reflect on their practices and improve their preparation to face the challenges of teaching in inclusive contexts.

Furthermore, Guevara (2023) highlights that identifying elements in a specific case is crucial for analysis and hypothesis formulation, reinforcing the importance of research and critical thinking in learning. Thus, the case study method is not limited to the transmission of information; rather, it becomes a tool for the development of essential skills in students.

However, there are also challenges in implementing the method, despite its numerous benefits, the effective implementation of the case study method as a teaching strategy. Among these challenges is resistance to change, as both students and teachers may be reluctant to replace traditional study and teaching strategies with new techniques. It is important to address these resistances through adequate training and ongoing support.

Another challenge is the variability in student needs, where each student has a unique learning style, which can make it difficult to implement a one-size-fits-all approach. It is crucial to adapt study strategies to the individual needs of students (García *et al*., 2025). It is essential to include time constraints, as teaching and practising effective study methods may require additional time that traditional curricula do not always allow for. It is essential to manage time efficiently in order to integrate these strategies without sacrificing curricular content. Marzano (2003).

Considering that the objective of the study was to conduct a systematic review of the literature, the study method is described as being guided by the research question.

Method

What are the main benefits and limitations identified in the literature regarding the use of the case study method as a teaching strategy in higher education? The analysis of the case study method as a teaching strategy in higher education is a relevant topic that deserves in-depth exploration. (Hernández *et al*., 2017).

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To this end, a literature review study is proposed to compile and analyse existing information on this method, its application and effectiveness in higher education contexts.

Type of study

The type of study selected is a systematic literature review (Beltran, 2005) with a qualitative approach and a descriptive scope of a single variable. This methodological approach is suitable for synthesising and evaluating existing information on the case study method in higher education, allowing for the identification of trends, gaps in research and areas for future research (Contreras *et al.*, 2023). The literature review provides a solid theoretical framework that can guide educational practice and research in this field.

Population

The population of interest for this review includes academic studies in scientific articles that address the case study method in higher education. Sources will be sought that analyse the main benefits and limitations of using the case study method as a teaching strategy in higher education. The selection of literature was based on criteria of relevance, quality and timeliness, ensuring that recent and significant research was included.

The search was conducted in academic databases such as Scopus, Web of Science, and Google Scholar, using the Boolean formula (‘case studies’ or ‘case studies’ or ‘case method’) and (‘benefits’ or ‘usefulness’ or ‘active learning’) and (‘higher education’ or “university” or ‘university students’). A range of years was established from the 1980s to the year 2024.

Instrument

The measurement instrument was a documentary record based on the set of inclusion and exclusion criteria applied to select the studies to be reviewed. These criteria included the methodological quality of the studies, the relevance of the topic, and the clarity of the presentation of results and conclusions. In addition, an analysis matrix was used to organise the information collected, facilitating the comparison and synthesis of the findings.

Analysis technique

The analysis technique used was descriptive analysis (Beltran, 2005), which allowed for the identification and organisation of recurring themes in the reviewed literature. This approach facilitated the identification of the main benefits and limitations identified in the literature regarding the use of the case study method as a teaching strategy in higher education. The analysis was carried out in several stages, beginning with the reading and coding of the texts, followed by the identification of relevant themes and sub-themes.

Methodological procedure

This literature review included the following steps: 1. Definition of the research question: What are the main benefits and limitations identified in the literature regarding the use of the case study method as a teaching strategy in higher education? 2. An exhaustive search was conducted in academic databases such as Scopus, Web of Science, and Google Scholar, using the Boolean formula (‘case studies’ or ‘case studies’ or ‘case method’) and (‘benefits’ or ‘usefulness’ or ‘active learning’) and (‘higher education’ or “university” or ‘university students’). 3. Using the PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) protocol (Figure 1), the previously defined inclusion and exclusion criteria were applied to select the studies to be included in the review. (Imaz, 2015).

Box 1

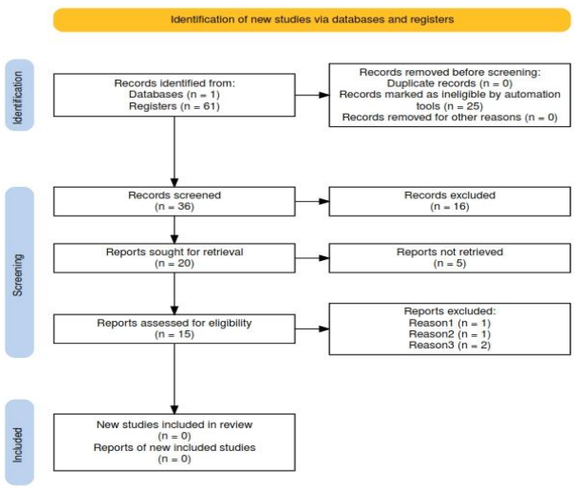

Figure 1

Prism structure for the effectiveness of the case study method as a teaching strategy

Own Elaboration

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Finally, a detailed analysis of the selected studies was carried out, organising the information in the analysis matrix and identifying key themes. The following section presents the results and discussion of the analysis.

Results

The analysis of the studies compiled in this systematic review identified a growing trend in the use of the case study method as a teaching strategy in higher education. Based on the PRISMA structure, studies from 2017 to 2024 were systematised.

Among the most notable benefits, it was found that this method fosters critical skills such as analytical thinking, argumentation, and decision-making (Ríos and Ortega, 2020), promotes the practical application of theoretical knowledge to real situations (Panting *et al.*, 2022), and strengthens the development of autonomy and metacognitive skills in students (Zimmerman, 2002).

Likewise, common challenges are reported, such as resistance to change, diversity of learning styles, and lack of time for its effective implementation in curriculum plans (Marzano, 2003).

The following graphs represent the evolution of publications per year, the main journals addressing the topic, and the countries with the highest number of research studies. The annual distribution of publications shows that there has been a consistent increase in annual publications, with one additional issue per year, reaching a maximum of eight publications in 2023 and decreasing to six publications per year in 2024 (Figure 2).

Box 2

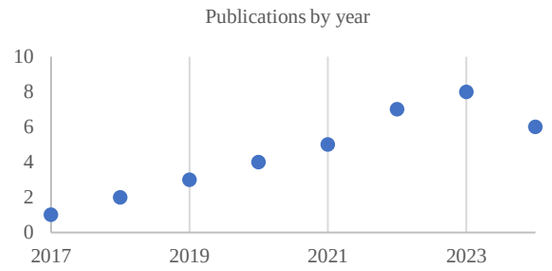

Figure 2

Publications per year in the main journals addressing the topic

Own Elaboration

The selected articles come from a wide variety of journals, the main ones being Educación y Sociedad, Revista Iberoamericana de Educación, Educación y Pedagogía, and Innovación Educativa, which stands out with six publications on the topic of case studies as a teaching strategy. The journal with the fewest publications is Ciencia Latina, with only two publications (Figure 3).

Box 3

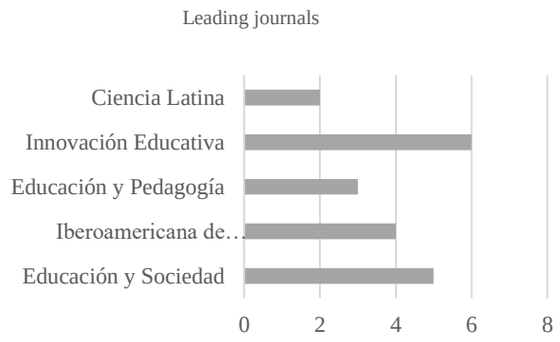

Figure 3

Leading journals addressing the topic

Own Elaboration

The countries that have published most on the topic of case methods as a teaching strategy are Mexico with six publications, followed by Spain, Colombia, Argentina and Chile with one publication each, and Chile with only two publications on the topic analysed (Figure 4).

Box 4

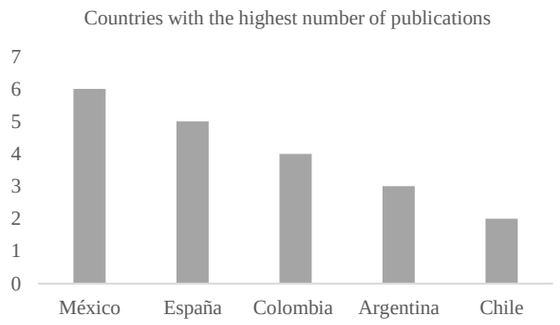

Figure 4

Countries with the highest number of publications.

Own Elaboration

The word cloud generated from the systematic review on the case study method as a teaching strategy. This visualisation highlights key terms such as learning, students, teacher, critical, strategy, case, and education, which are central to the analysis of the object of study (Figure 5).

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Box 5

Figure 5

Word cloud generated from the systematic review on the case study method as a teaching strategy

Own Work

In the systematic review of the case study method, we worked on the research question: Define the central theme of the study: the benefits and limitations of the case study method.

We consulted databases such as Scopus, Web of Science, and Google Scholar. Inclusion/exclusion criteria: Studies were filtered according to quality, recency, and thematic relevance.

Box 6

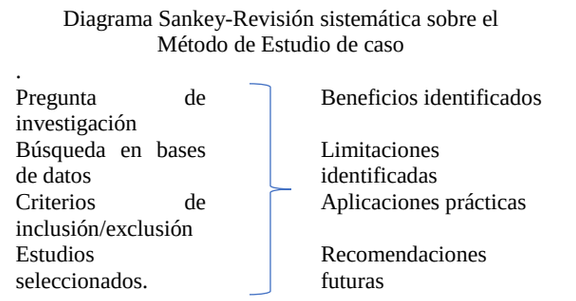

Figure 6

Sankey diagram. Systematic review of the case study method

Own Work.

The selected studies that met the criteria were analysed. The selected studies are derived from:

Identified benefits (such as critical development and practical application). Identified limitations (resistance to change, diversity of styles, lack of time). Practical applications (use in health sciences, teacher training, etc.). Future recommendations (more longitudinal studies and from the student perspective).

Discussion

The discussion of the findings derived from this systematic review highlights multiple relevant aspects of the use of the case study method as a teaching strategy in higher education. Firstly, the growing trend in publications between 2017 and 2024 reflects a consolidated interest on the part of the academic community in its pedagogical value. This growing attention suggests that the case method has not only been adopted in different disciplines, but has evolved as an essential tool for the comprehensive development of university students.

Several authors agree that the case method promotes active and contextualised learning. According to Panting *et al*. (2022), this approach facilitates the transfer of theoretical knowledge to practical situations, particularly in areas such as health sciences education. This direct relationship between theory and practice contributes to a deeper understanding of the content, which is essential in educational settings where knowledge must be applied immediately and effectively.

Likewise, case studies allow students to explore complex problems from a critical perspective. Ríos and Ortega (2020) highlight that this methodology encourages argumentation and logical reasoning, which are fundamental skills in teacher training. The learning that derives from these analytical dynamics is consolidated as meaningful because it is linked to the student's experience and reality. Added to this is the opinion of Zimmerman (2002), who points out that metacognition—a skill fostered by case studies—strengthens autonomous learning and self-regulation.

However, the challenges involved in the effective implementation of this teaching strategy cannot be ignored. Among the main limitations identified is resistance to change on the part of teachers and students (Marzano, 2003). Many actors in the education system continue to operate according to traditional models, focused on the transmission of content, which hinders the integration of participatory and constructivist methodologies such as case studies. Overcoming this resistance requires a cultural and pedagogical transformation within higher education institutions.

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In addition, variability in learning styles must be considered. Not all students respond optimally to the same type of teaching stimulus. In this sense, case studies, which require high levels of analysis, critical reading and argumentation, can represent an additional challenge for those with a preference for more structured or guided methodologies. The solution, according to Brophy (2001), lies in diversifying pedagogical strategies that accompany the case study with complementary teaching resources.

Another critical point is the time required to effectively implement this strategy. Educational institutions, by prioritising broad content coverage, often do not allow for the space necessary to apply the case method with the depth it deserves. This limitation means that, for the case study to be effective, it must be considered a structural part of the curriculum design and not an isolated activity.

Analysis

The analysis of the articles selected using the PRISMA protocol provided a precise answer to this research question. The benefits and limitations identified were organised according to thematic frequency and the pedagogical value attributed by the studies reviewed.

Main benefits identified:

Meaningful and contextualised learning. The case study method facilitates the connection between theoretical content and the practical reality of the student. This encourages active learning and promotes the retention of knowledge relevant to the professional world (Stake, 2013; Guevara, 2023).

Development of higher cognitive skills. Studies such as those by Ríos and Ortega (2020) report that case analysis stimulates critical thinking, logical argumentation, and informed decision-making, which are essential skills in the training of professionals.

Strengthening autonomy and self-regulation. The method was found to promote student autonomy by encouraging self-reflection, self-control, and learning planning (Zimmerman, 2002), key elements in higher education settings.

Applicability in complex contexts. Particularly in disciplines such as health and teacher training, the method allows real problems to be simulated and addressed, reinforcing students' professional preparation (Panting *et al*., 2022).

Main limitations identified:

Resistance to methodological change. Both teachers and students may resist active strategies because they are accustomed to expository methods. This resistance hinders the effective implementation of case studies (Marzano, 2003).
Diversity of learning styles. Not all students respond with the same effectiveness to case analysis, which requires methodological adjustments and complementary strategies (Brophy, 2001).

Curricular and time constraints. The integration of the method requires adequate curricular space for in-depth case exploration. The rigidity of academic programmes may limit its systematic use.

The review shows that the case study method is highly valued in academic literature for its positive effects on active learning, especially when it is oriented towards the development of complex skills and comprehensive professional training. However, its effective adoption depends on institutional, didactic, and attitudinal factors, which underscores the importance of training teachers in its correct implementation and adapting curricula to favour its use.

Conclusion

Based on the analysis of academic literature compiled between 2017 and 2024, this systematic review has reaffirmed the relevance of the case study method as a comprehensive and transformative pedagogical strategy in higher education. Its implementation contributes decisively to the development of critical skills, student autonomy, the application of knowledge and the strengthening of reflective practice in real contexts.

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Firstly, the evidence suggests that case studies are particularly effective in educational contexts where a direct connection between theory and practice is required. Degree programmes focused on the professional handling of complex issues—such as teaching, psychology, medicine, or social work—find in this methodology a way to bring students closer to the real conditions of professional practice, thus strengthening their capacity for analysis, ethical judgement, and decision-making.

Likewise, the method promotes a participatory and collaborative learning environment. Far from being limited to the one-way transmission of knowledge, this strategy invites students to construct meaning from experience, which coincides with the fundamentals of meaningful learning and the constructivist approach.

Through the analysis of real or simulated cases, students develop communicative, interpersonal, and metacognitive skills that would be difficult to cultivate in a lecture-based setting. However, in order to achieve the desired effectiveness, it is essential that its implementation be accompanied by favourable institutional conditions.

This includes continuous teacher training, the redesign of curricular spaces that prioritise analysis and discussion, and the development of authentic assessment tools that reflect the level of critical thinking achieved by students.

Another relevant aspect that emerges from this review is the need to adapt the method to the characteristics and needs of the student body. Not all groups respond in the same way to the challenges of case-based learning. Therefore, the design of these cases must consider aspects such as the level of complexity, the cultural and social context, and the available resources. This adaptability is key to ensuring inclusion and educational equity.

In terms of future lines of research, it is worth highlighting the advisability of developing longitudinal studies that evaluate the sustained impact of the case study method on the academic and professional trajectories of graduates.

It is also recommended to delve deeper into students' perceptions of the usefulness of the method, as well as its integration into hybrid and virtual educational modalities, which have become particularly relevant in the post-pandemic context.

Finally, this review concludes that the case study, far from being just one technique among many others, should be conceived as a teaching philosophy that places the student at the centre of the educational process. In an increasingly interconnected, complex and changing world, educating citizens to be critical, creative and committed to their environment is a priority. The case study method offers a solid pedagogical approach to moving in that direction.

Declarations

Conflict of interest

The authors declare that they have no conflict of interest. They have no known competing financial interests or personal relationships that could have influenced the article.

Contribution of the authors

Zapata Dittrich, Abel: Conceptualisation of the study, development of the theoretical framework, methodological design, data collection and analysis, drafting of the original manuscript.

Zapata Pérez, Mariana Alejandra: Support in instrument validation, statistical analysis, critical review of content, editing and proofreading of the manuscript.

Zapata Pérez, Abel Antonio: Supervision of the research project, advice on the interpretation of results, final review of the manuscript for submission.

Availability of data and materials

The data on which the conclusions of this study are based can be requested from the corresponding author. Due to [confidentiality agreements / ethical considerations / institutional restrictions], some parts of the data cannot be shared publicly.

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Researchers interested in accessing the data sets may contact the corresponding author to discuss the possibility of sharing the data under appropriate conditions.

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Abbreviations

PRISMA: Preferred Reporting Items for Systematic reviews and Meta-Analyses.

References

Background

Calderón, F., Montoya, A. y Yañez, P. (2023). Estudio de caso: una herramienta para la formación del psicoterapeuta. *Enseñanza e Investigación en Psicología*, 5(1), 1-10.

García, D., García, M., Eliseo, H. y Katt, A. (2025). Análisis estructural prospectivo para optimizar la calidad educativa de programas virtuales en educación superior. *Apertura*, 17 (1), 22-37.

Maroto, F., Gómez, A., Garrido, A., Pérez, D. y De Pedro, E. (2017). El método del caso como herramienta para la docencia y el aprendizaje en ingeniería de sistemas de producción ganadera. *Revista de innovación y buenas prácticas docentes*, 1 (1), 45-50.

Mora, M. (2017). Estudio de caso como estrategia didáctica para el proceso enseñanza-aprendizaje: retos y oportunidades. *Revista Bio-Grafía Escritos Sobre La Biología Y Su Enseñanza*, 10(19), 1533-1540.

Pardal, J. (2023). Los artículos de revisión. Orientaciones para los autores y revisores. *Revista ORL*, 14(3), e31646.

Sevilla, D., Martín, M. y Jenaro, C. (2017). Percepciones sobre la educación inclusiva: la visión de quienes se forman para docentes. *CPU-e Revista de Investigación Educativa*, 25 (1), 83-113.

Stake, R. E. (2006). Multiple case study analysis. *Guilford Press.*

Basic

Hernández, C., Ortega, S., Ortega, P. y Franco, J. (2017). Metodología de la investigación. Mc Graw Hill.

Support

Beltral, O. (2005). Revisiones sistemáticas de la literatura. *Revista Colombiana de Gastroenterología*, 20 (1), 60-69.

Contreras, O., Lésmez, J. y Castro, C. (2023). Evaluación de la Efectividad del Método de caso en la Formación Directiva para Programas de Ingeniería: Un Estudio Cuasi-Experimental. *International Journal of Professional Business Review*, 8 (10), 1-10.

Guevara, J. (2023). El estudio de caso: estrategia para la enseñanza del tema de diagnóstico para la intervención profesional en una carrera de atención a la infancia. *Educiencia*, 8 (1),14–24.

Imaz J. (2015). Aprendizaje Basado en Proyectos en los grados de Pedagogía y Educación Social: "¿Cómo ha cambiado tu ciudad?". *Revista Complutense de Educación*, 26 (3), 679-696.

Discussion

Brophy, J. (2001). Teaching. Educational Practices. Series-01

Marzano, R. J. (2003). What Works in Schools: Translating Research into Action. ASCD.

Ríos, L. y Ortega, F. (2020). Estudio de caso como estrategia para el desarrollo de la argumentación en docentes en formación. *Educação E Pesquisa*, 46.

Panting, H., Pinzón, F., Rojas, M., Fajardo, R., Badillo, S. y Peña, L. (2022). Estrategias didácticas para la educación en ciencias de la salud. *Dilemas contemporáneos educación política y valores*, 9 (2), 1-24.

Zimmerman, B. (2002). Cómo convertirse en un estudiante autorregulado: Una visión general. *De la teoría a la práctica*, 41 (2), 64–70.

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Article

Educational games as an alternative for teaching the periodic table to Tzotzil secondary school students

Los juegos educativos como una alternativa para la enseñanza de la tabla periódica en estudiantes Tzotziles de educación secundaria

Osorio-Gutierrez, Karina[a], Gordillo-Espinoza, Emmanuel[b], Trejo-Trejo, Gilberto Abelino*[c] and Domínguez-Gutú, Jesús[d]

[a] Universidad Tecnológica de la Selva • MTC-6226-2025 • 0009-0003-7492-0360 • 2022691
[b] Universidad Tecnológica de la Selva • KLD-5252-2024 • 0000-0002-2467-8209 • 657274
[c] Universidad Tecnológica de la Selva • AIC-1759-2022 • 0000-0003-2808-3939 • 334014
[d] Universidad Tecnológica de la Selva • AFR-3906-2022 • 0000-0001-8025-6089 • 524210

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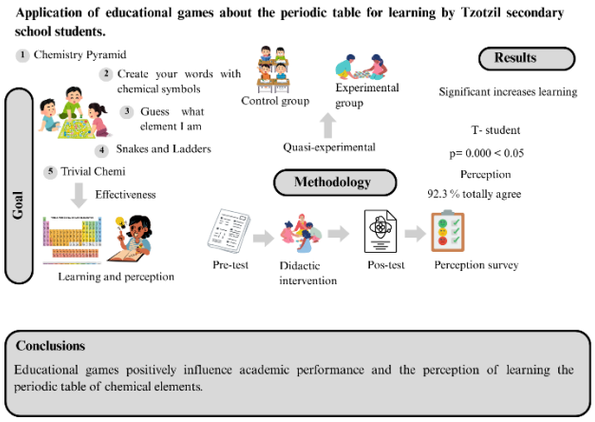
* ✉ [gtrejo@laselva.edu.mx]

Abstract

This research was carried out in a secondary school in the municipality of Chenalhó, Chiapas, Mexico; where games such as the chemistry pyramid, create your words with chemical symbols, guess what element I am, snakes and ladders and Quimi trivial were used, with the objective of evaluating the efficiency of educational games as a complementary tool in learning the periodic table of chemical elements with Tzotzil secondary school students. A quantitative approach was used, with a quasi-experimental design, in which a total of forty-eight (48) students participated, twenty-six (26) experimental group, twenty-two (22) control group. Using a Pre-test and Post-test of performance and a Likert Scale perception survey. The results showed that the application of educational games significantly increased student learning. In addition, the survey revealed that students enjoyed the games and recommended that they be used to learn chemistry.

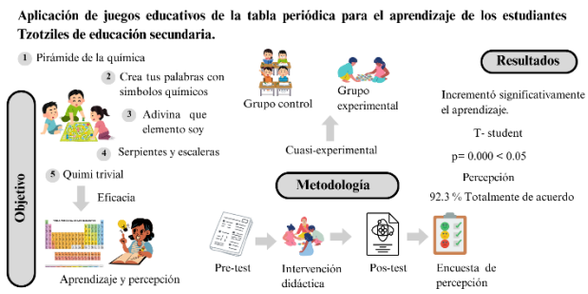


Conclusions
Educational games positively influence academic performance and the perception of learning the periodic table of chemical elements.

Chemistry, Educational Games; Constructivism; Rural Context; Secondary Education

Resumen

La presente investigación se realizó en una escuela Secundaria del municipio de Chenalhó, Chiapas, México; donde se utilizaron juegos como la pirámide de la química, crea tus palabras con símbolos químicos, adivina que elemento soy, serpientes y escaleras y Quimi trivial, con el objetivo de evaluar la eficiencia de juegos didácticos como una herramienta complementaria en el aprendizaje de la tabla periódica de los elementos químicos con los alumnos Tzotziles de secundaria. Se utilizó un enfoque cuantitativo, con un diseño cuasi-experimental, en el que participaron un total de cuarenta y ocho (48) estudiantes, veintiséis (26) grupo experimental, veintidós (22) grupo control. Empleando un Pre-test y Pos-test de rendimiento y una encuesta de percepción tipo Escala de Likert. Los resultados evidenciaron que la aplicación de los juegos educativos incrementó significativamente el aprendizaje de los estudiantes. Además, la encuesta reveló que, los estudiantes disfrutaron de los juegos y recomendaron que se utilice para aprender química.



Conclusiones
Los juegos didácticos influyen positivamente en el rendimiento académico y en la percepción del aprendizaje de la tabla periódica de los elementos químicos.

Química, Juegos educativos; constructivismo; contexto rural; Educación secundaria

Area: Development of strategic leading-edge technologies and open innovation for social transformation

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Introduction

Currently, the goal is to get students to improve the comprehension of knowledge acquired in the classroom, but this has not been easy to achieve. It has been observed that the main problem students have with understanding chemistry, specifically the periodic table, lies in the inadequate didactic and methodological treatment used by teachers for its instruction, supplemented by the students' memorization difficulties when learning the symbols of the chemical elements [Llivicura y López, 2023].

The periodic table has been one of the most powerful tools in modern science, from secondary school to upper secondary level, constituting the basis of chemistry instruction [Flores *et al*., 2022]. However, studies conducted in various countries internationally and in Latin America have shown a lack of student interest in learning chemistry, which is considered a science that uses complex and abstract language, is disconnected from reality, and has little practical utility, generating an attitude of apathy in students [Acosta *et al*., 2021].

What is described above is reflected in a considerable drop in university students pursuing scientific careers, opting for other disciplines. In fact, this lack of interest is already noticeable in secondary education, which is an area that garners less interest among adolescents [Álvarez-Herrero y Valls-Bautista, 2021].

In response to this situation, chemistry instruction in secondary education has sought to promote educational innovation dynamics to transform the didactic dimension of the educational process by modifying the purposes and characteristics of teaching, overcoming the traditional approach that focuses on the oral transmission and written reproduction of theoretical disciplinary knowledge [Suárez *et al*., 2019].

Through constructivism, Game - Based Learning (GBL) is currently a concept that has been extensively applied to develop educational strategies focused on natural sciences, such as chemistry, promoting active participation, critical thinking, and problem-solving, while fostering students' interest and motivation [Patiño y Garzón, 2024].

Games are tools that help teachers in teaching knowledge through an active methodology aimed at arousing student interest so they can fully develop their learning (emotional, cognitive, and behavioral), improving motivation, participation, and stimulation, and promoting their identity [Higueras-Rodríguez y Molina-Ruíz, 2020].

Educational games in science instruction could boost the retention of chemical concepts, problem-solving, and learning, and, above all, break with the traditional models of the teaching-learning process. This is because they have been a constructivist methodological strategy that can enhance meaningful learning and increase interest, decreasing students' fear of chemistry and the periodic table [Marcano, 2020; Hassan y Shafiq, 2023].

Statement of the Problem

Education in Mexico shows a great lack of interest in science in secondary school, reflected in the PISA 2022 evaluation results, where the country ranked third among the worst-performing countries, with an average score of 407. Around 49% (OECD average: 76%) reached Level 2 in Science, and a minority achieved Level 5 or 6 (OECD: 7%), showing a 9-point drop compared to the 2018 edition [Organization for Economic Cooperation and Development [Organization for Economic Cooperation and Development [OCDE], 2023].

Science education in Mexico, according to the INEE, has been a challenge for basic-level teachers in urban, rural, and indigenous areas. The quality of education in indigenous zones has been lower compared to the country's urban centers [Flores *et al*., 2022]. Moreover, Chiapas has a great diversity of indigenous groups; in 2020, 5.3% of the population aged 3 to 17 (1.7 million) were indigenous speakers. Due to high poverty rates, it has also been considered the State with the greatest educational gap in the country, [Network for Children's Rights in Mexico [REDIM], 2023]

The community of Belisario Domínguez is located in the municipality of Chenalhó, belonging to the Highlands of Chiapas, Mexico.

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The predominant language in this community is Tzotzil, highlighting social marginalization, the digital divide, and the lack of educational resources during instruction in basic-level educational centers, which disadvantages science education for students due to the lack of comprehension of abstract concepts. This negative attitude was evidenced in the results of the diagnostic evaluation for the 2023-2024 school year. 3° A obtained an average of 6.2 and 3° B obtained an average of 5.8, taking into account other criteria that helped obtain the final average, as the general test average alone was below 4 in both groups.

Poor study habits, lack of parental support, and deficiencies in their context have influenced chemistry instruction to be oriented towards a traditional system. Furthermore, many students do not attend classes regularly, as they travel from different hamlets or nearby communities such as Bachen, San Antonio Caridad, San José, among others. In addition, in the afternoons, most are dedicated to farm work, neglecting their extracurricular assignments due to the context's deficiencies..

Chemistry has its own language, based on the periodic table of elements. Its correct learning and handling are very important as the foundation for knowledge of this science, but its instruction has focused on rote, repetitive knowledge, causing displeasure and frustration in students due to the scarcity of tools that facilitate topic comprehension [Marcano, 2020].

According to Franco-Mariscal *et al*., [2016] learning difficulties with the periodic table among secondary students are classified into seven categories: a) memorizing instead of learning, b) incorrectly choosing concepts, c) lack of understanding of element properties, d) lack of notion of periodicity and perception of its usefulness, e) the complex and abstract nature of the concepts, f) the required reasoning, and g) deficiency in the teaching process.

Based on the last category, Álvarez-Herrero y Vall-Bautista [2021], indicate that learning the periodic table is a key tool for tackling chemistry learning in the third year of secondary school. However, its instruction has usually been imparted through an expository methodology, with lectures predominating, and consequently, students acquire a negative attitude towards chemistry.

Objetive

To evaluate the efficiency of educational games as a complementary tool in learning the periodic table of chemical elements for third-grade Tzotzil students at Technical Secondary School No. 141 in the Belisario Domínguez community of the municipality of Chenalhó, Chiapas State.

Methodology

The research was conducted under a quantitative approach with a quasi-experimental design and a descriptive scope, to evaluate the effect of an independent variable (educational games) on a dependent variable (academic performance and perception) through a control group and an experimental group [Hernández-Sampieri y Mendoza, 2018]. Through this method, the following two hypotheses were established:

H1: The application of educational games improves the academic performance of third-grade Tzotzil students at Technical Secondary School No. 141 in the Belisario Domínguez community of the municipality of Chenalhó, Chiapas State, in learning the periodic table of elements.
H2: The perception of third-grade Tzotzil students at Technical Secondary School No. 141 in the Belisario Domínguez community of the municipality of Chenalhó, Chiapas State, is high regarding the use of educational games for learning the periodic table of elements.

Sample

The study worked with intact groups. The selection of the experimental group was made based on the results of the school year's diagnosis and the Pre-test, with 3° B showing greater difficulty in learning. Therefore, the 3° A group was selected as the control group.

During the intervention, students had irregular attendance due to the contextual situations mentioned previously. Therefore, students with regular absences were excluded from the research because it could affect the validity of the results. Of the 71 students enrolled in 3rd grade, a total of 22 students from 3° A and 26 students from 3° B were considered for the research study. The gender distribution was composed of 64% women and 36% men in 3° A, and 62% women and 38% men in 3° B.

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Data Collection Instruments

To measure academic performance (dependent variable), a Pre-test and a Post-test were applied, designed and validated by the 3rd Grade teacher at Technical Secondary School No. 141 in Belisario Domínguez, Chenalhó. Bloom's taxonomy was used for the design of both tests. According to Masapanta-Carrión y Velázquez-Iturbide [2017], Bloom's taxonomy has been a model that allows classifying the level of learning expected to be achieved by students in a given discipline. The Pre-test consisted of a total of 20 questions, according to the first three levels of Bloom's taxonomy. The Post-testconsisted of the same 20 questions as the Pre-test plus 5 questions classified according to level 4 of Bloom's taxonomy.

Box 1

Table 1
Characteristics of the instrument questions

Numeration	Indicators	Type of question
1 a 5	Remembering	Multiple choice with single answer
6 a 10	Understanding	Multiple choice with single answer
11 a 20	Applying	Open (structured, with a single response option)
21 a 25	Analyzing	Open (structured, with a single response option)

Source: Own elaboration adapted from Tornero et al. (2015).

Questions 1 to 20 of the Pre-test and 1 to 25 of the Post-test have a single answer; the scoring consisted of one (1) point if correct or zero (0) if incorrect. The frequency of the number of correct answers at each level was adjusted to a score from 0 to 10 and then classified into the performance levels or categories used at Technical Secondary School No. 141.

Box 2

Table 2
Performance levels

Performance level	Scoring scale
utstanding	10
Satisfactory	8 – 9.9
Sufficient	6 – 7.9
Insufficient	≤5- 5.9

Source: Scoring scale taken from Agreement number 648 establishing genera norms for evaluation, accreditation, promotion, and certification in basic educationl.

In this research, normality tests were performed on all variables using the *Shapiro-Wilk* test (sample < 50 data) [Flores y Flores, 2021]. The PSPP application version 1.6.2-g78a33a was used. The difference between the Pre-test and Post-test of both groups was analyzed, and a p-value of 0.52 was obtained, which is greater than 0.05 ($p > 0.05$). Therefore, the data are parametric, following a normal distribution, as shown in Figure 1. Consequently, the t-Student parametric test for the calculation of the mean difference was applied, which allowed validating hypothesis H1 of the research work.

Box 3

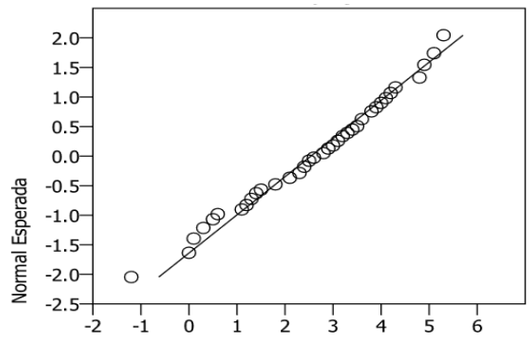

Figure 1
Shapiro-Wilk statistic Figure of the Pre-test and Post-test difference for data normality. Source: Research data

Source: Research data.

In the Figure above, it is observed that most of the data points are close to the indicated line, thus following a normal distribution. On the other hand, for the *perception* variable, a survey of 12 questions related to the use of educational games for learning chemistry was applied. The instrument was designed using the Likert scale, which consists of five response alternatives.

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Box 4

Table 4

Survey to measure perception

Questions	T Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Compared to traditional classes, do you think board games make classes more dynamic?					
2. Do you think board games are simple and easy to use?					
3. Do you think educational games in class help you improve your learning in a fun way?					
4. Do you think the games generated greater interest and participation in your learning?					
5. Do the games allow you to search for information in your notes to solve learning challenges?					
6. Do you think the games help you better understand your learning?					
7. Are you satisfied with your results obtained in the games?					
8. Do you like learning by playing in chemistry class?					
9. Should games be included in the other topics of the chemistry subject?					
10. Would you get involved in designing a game for chemistry topics?					
11. Would you like to use educational games in other subjects for your learning?					
12. Would you recommend the educational games to your classmates for their learning?					

Source: Own elaboration

To calculate the reliability of the instruments, a pilot test was applied to 20% (14) students. The reliability of the Pre-test and Post-test was determined using the Kuder-Richardson coefficient formula, and the perception survey using the Cronbach's alpha method, utilizing the PSPP program.

Box 5

Table 5

Reliability coefficients

Instruments	No. of questions	Coefficients
Pres test	20	α= 0.75
Post test	25	α=0.72
Surveys	12	α=0.70

Sourcee: Research data.

According to the range established by Ruíz [2013], a high reliability was obtained for the instruments used in the research process.

For the validation of the instruments, the *Content Validity method through expert judgment* proposed by Hernández-Nieto (2002) cited in Pedrosa *et al*. [2014]. was used. The selection of experts was based on three criteria established by Skjong y Wentworth [2001], teaching experience, academic background, and being active in the educational system. Table 6 shows the results of the instrument validity.

Box 6

Table 6

Validity by expert judgment

Instruments	**Coefficients**
Pres test	0.93
Post test	0.93
Surveys	0.95

Source: Research data

Intervention Development

The study intervention was carried out through the following phases:

Phase 1. Study Presentation

The researchers went to Technical Secondary School 141 in Belisario Domínguez to request authorization from the school principal, to whom the study objective was presented, and the project's impact was explained.

Phase 2. Study Authorization

A consent form was presented to the principal to grant permission to conduct the study with the two 3rd Grade student groups. This authorized the students to participate in the study, allowing the designed instruments and photoFigures to be taken during the study intervention. Subsequently, a timeline of activities was designed for the intervention development.

Phase 3. Game Design

For the selection and elaboration of the games, the students' prior experience with games during different stages of their growth was considered through a survey. The aim was for students to become familiar with the games, making the activity development more productive, fun, and less monotonous [Llivicura y López, 2023].

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Box 7

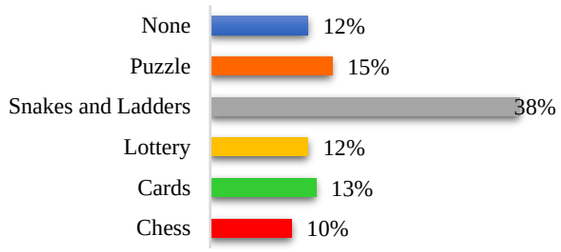

Figure 2

Question 1. What traditional board games have you played?

Source: Research data

Box 8

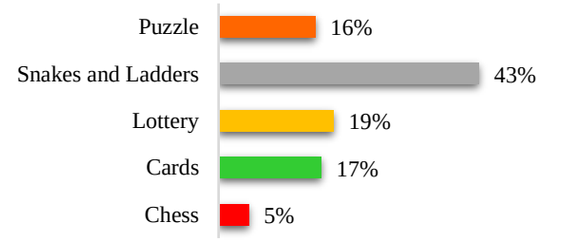

Figure 3

Question 2. What is your favorite board game?

Source: Research data

Box 9

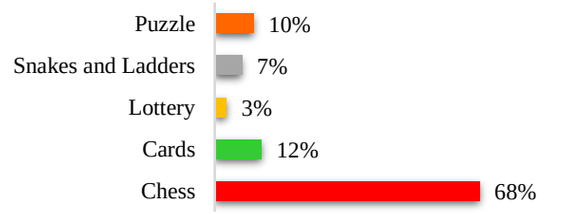

Figure 4

Question 3 Which of those games do you find most difficult?

Source: Research data

Box 10

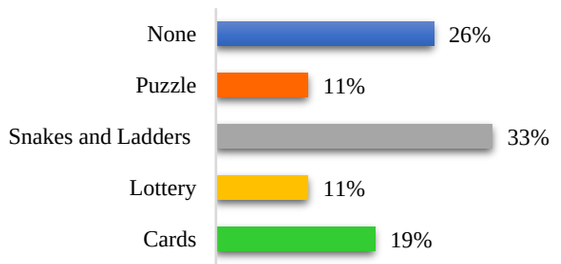

Figure 5

Question 4. Which traditional games would you like to adapt to the chemistry subject?

Source: Research data

The students indicated that the different games they have played were: 10% chess, 13% cards, 12% lotería (Mexican bingo), 38% snakes and ladders, 15% puzzles, and 12% had not played board games. They also indicated that the games they would like to adapt to learning the periodic table were: 19% cards, 11% lotería, 33% snakes and ladders, 11% puzzles, and 26% were unsure.

Based on the literature and student preference, five educational games were designed, in accordance with Dos Santos y Franco [2021], Plutin-Pacheco y García-López [2016], Marcano [2020] y Ramírez [2017]. A detailed explanation of the content, objectives, and established rules was provided.

Box 11

Tabla 7

The educational games

Games	Objetive
The Chemistry Pyramid (cube puzzle).	To become familiar with chemical elements.
Create your words with chemical symbols.	To become familiar with chemical symbols.
Guess What Element I Am.	To identify and recognize the characteristics of chemical elements.
Snakes and Ladders	To identify groups, periods, and classification of chemical elements.
Quimi trivial.	To recognize the history of the periodic table and identify characteristics, organization, classification, and periodic properties.

Source: Own elaboration

The following intervention route was followed for their application.

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Box 12

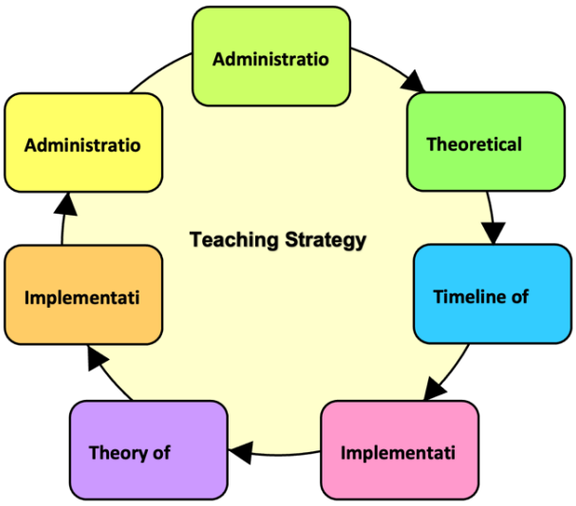

Figure 6
Intervention route for educational games
Source:Own Elaboration

Box 13

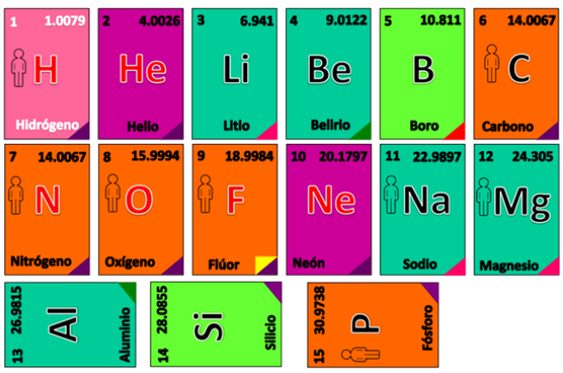

Figure 7
Examples of Cards designed for the Guess What Element I Am game.
Source: Own Elaboration

Box 14

Figure 8
Snakes and Ladders Game
Source: Own Elaboration

Box 15

Figure 9
Quimi trivial game
Source: Own elaboration.

Phase 4. Intervention

In the first class session, the topic The Periodic Table and the organized activities on the timeline were presented. Subsequently, the Pre-test was applied to determine the students' prior knowledge.

In the next session, an introduction to the periodic table was provided, and a projection was used to generally explain its organization and classification, as well as its importance in daily life.

Box 16

Figure 10
Presentation of the periodic table
Source: Own Creation

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In addition, the time travel activity was carried out, in which teams of students were provided with cards containing information about relevant scientists who made contributions to the development of the periodic table.

Box 17

Figure 11
Time travel activity
Source: Own Creation

In the following days, the adapted games were developed for topic reinforcement. The objective, learning purpose, and rules to follow were established for each game.

Box 18

Figure 12
The Chemistry Pyramid game
Source: Own Creation

Box 19

Figure 13
Create Your Words with Chemical Symbols game
Source: Own Creation

Box 20

Figure 14
Guess What Element I Am game
Source: Own Creation

Box 21

Figure 15
Snakes and Ladders game
Source: Own Creation

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Box 22

Figure 16
Quimi trivial game
Source: Own Creation

Phase 5. Final Data Collection

In the last session, the Post-test was applied to assess the students' acquired learning of the periodic table through educational games. Subsequently, the perception survey was applied to determine their perception regarding the development of the designed activities.

Results

Academic Performance.

Box 23

Table 8
Control group Pre-test scores

Grup	Performance Level	Scoring Scale	Pre test		
			Frequency	% of Students	% of Passers
Control	Outstanding	10			
	Satisfactory	8 – 9.9			
	Sufficient	6 – 7.9	4	18.2	18.2
	Insufficient	≤5- 5.9	18	81.8	
Total			22	100	18.2

Source: Research data

Box 24

Table 9
Control group Post-test scores

Grup	Performance Level	Scoring Scale	Post test		
			Frequency	% of Students	% of Passers
Control	Outstanding	10			
	Satisfactory	8 – 9.9	4	18.2	18.2
	Sufficient	6 – 7.9	7	31.8	31.8
	Insufficient	≤5- 5.9	11	50.0	
Total			22	100	50

Source: Research data

Box 25

Table 10
Experimental group Pre-test scores.

Grup	Performance Level	Scoring Scale	Pre test		
			Frequency	% of Students	% of Passers
Exp.	Outstanding	10	0	0	
	Satisfactory	8 – 9.9	1	3.8	3.8
	Sufficient	6 – 7.9	3	11.5	11.5
	Insufficient	≤5- 5.9	22	84.7	0
Total			26	100	15.3

Fuente: Source: Research data

Box 26

Table 11
Experimental group Post-test scores.

Grup	Performance Level	Scoring Scale	Post test		
			Frequency	% of Students	% of Passers
Exp.	Outstanding	10	0	0	
	Satisfactory	8 – 9.9	11	42.3	42.3
	Sufficient	6 – 7.9	11	42.3	42.3
	Insufficient	≤5- 5.9	4	15.4	0
Total			26	100	84.6

Source: Research data

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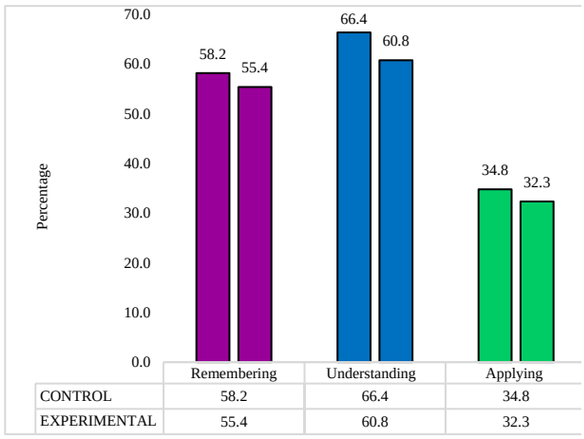
Box 27



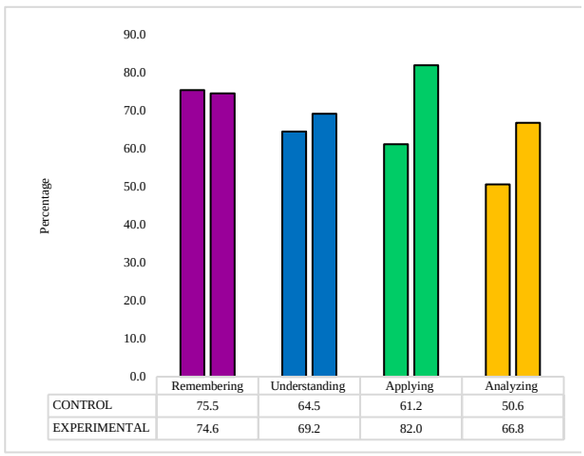
	Remembering	Understanding	Applying
CONTROL	58.2	66.4	34.8
EXPERIMENTAL	55.4	60.8	32.3

Figure 17

Percentage of Bloom's taxonomy for the Control Group and Experimental Group Pre-test.

Source: Research Data

Box 28



	Remembering	Understanding	Applying	Analyzing
CONTROL	75.5	64.5	61.2	50.6
EXPERIMENTAL	74.6	69.2	82.0	66.8

Figure 18

Percentage of Bloom's taxonomy for the Control Group and Experimental Group Post-test.

Source: Research Data

In the Post-test, both groups obtained a high percentage in the Remembering level (basic information on the history of the periodic table), regardless of the teaching strategy used. In the Understanding level, the control group obtained 64.5%, similar to the Pre-test result (64.4%). This was concerning, as it suggests that students had difficulty comprehending concepts when applying a traditional approach to understanding the main concepts of the periodic table. On the other hand, the experimental group in the Understanding of concepts obtained a percentage of 69.2%, which is higher than the Pre-test (60.8%), with an 8.4% difference in favor of the Post-test, showing a slight mastery compared to the control group.

In the Applying level, the control group obtained a percentage of 61.2%, and the experimental group obtained 82.0%, showing a 20.8% difference in favor of the experimental group, demonstrating greater mastery in knowledge of the periodic table's organization and the identification of periodic properties.

In the Analyzing level, the control group obtained a percentage of 50.6%, and the experimental group obtained 66.8%, showing a 16.2% difference in favor of the experimental group, demonstrating better mastery in interpreting complex information and understanding the relationships between them, such as the identification of characteristics, organization, classification, and properties of chemical elements.

For the validation of hypothesis (H1), the t-Student parametric test for independent samples was performed. A p-value of 0.00 was obtained, which is less than 0.05 ($p < 0.05$). Therefore, a significant difference exists; the null hypothesis is rejected, and the researcher's hypothesis is accepted: The application of educational games as a complementary tool for the periodic table of elements significantly improves the learning of third-grade Tzotzil students at Technical Secondary School No. 141 in the Belisario Domínguez community of the municipality of Chenalhó, Chiapas State.

These results are similar to those found by [Alejandria *et al*., 2023] , who performed an independent samples t-Student test with a p-value of $0.01 < 0.05$, concluding that the educational board game is effective for learning periodic table concepts. Similarly, [Valdiviezo y Zaldívar, 2023], upon applying a related samples t-Student test, obtained a p-value < 0.05; therefore, it can be affirmed that statistically significant differences exist between the means obtained in the Post-test of the control and experimental groups when implementing various games, including the three-dimensional puzzle game, and they concluded that simple games favor learning the periodic table, improving students' academic performance, motivation, and attitude. Also, [Marcano, 2020], who performed an independent samples t-Student test, obtained a p-value of 0.02, determining that the application of educational games significantly influences student learning when using games such as Chemical Jenga, Quica, the atomic deck, and Guess What Element I Am.

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Likewise, [Llivicura y López, 2023] in their research study indicated that the application of educational games as a strategy for teaching the periodic table significantly influenced student learning at a significance level of 0.05, through the t-Student test, demonstrating that games create a dynamic classroom environment through the implementation of this type of methodology, improving student attention.

Perception

The results of the survey applied to students regarding the use of educational games as a complementary tool in learning the periodic table are shown in Table 12 through analysis using Excel and PSPP software.

Box 29

Table 12
Rating scale

Category / Ítems	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	92.3	7.7			
2	50.0	15.4	26.9	7.7	
3	100.0				
4	73.1	19.2	7.7		
5	65.4	26.9	7.7		
6	61.5	30.8	7.7		
7	61.5	23.1	15.4		
8	92.3	3.8	3.8		
9	76.9	11.5	11.5		
10	57.7	11.5	11.5	19.2	
11	84.6	15.4			
12	92.3	7.7			

Source: Research data

Box 30

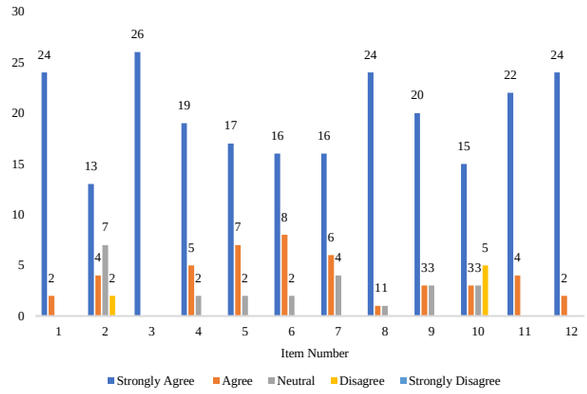

Figure 19
Statistical distribution for each response category
Source: Research data

Box 31

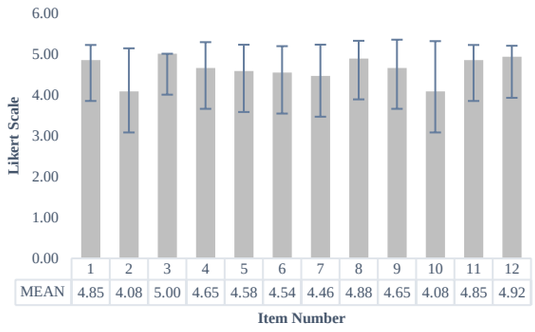

Figure 20
Mean and standard deviation of the educational games perception survey
Source: Research Data

All response means are ≥ 4.08, indicating that the use of educational games had great acceptance by the students.

Furthermore, students considered that the games help them better understand their learning (item 6), with a mean of 4.56. Item 3 stands out from the survey (Do you think educational games in class help you improve your learning in a fun way?), with a 100% percentage and a mean of 5 points, followed by item 8 (Do you like learning by playing in chemistry class?) and item 12 (Would you recommend the educational games to your classmates for their learning?), with a mean ≥ 4.89. Finally, item 1 (Compared to traditional classes, do you think board games make classes more dynamic?).

Box 32

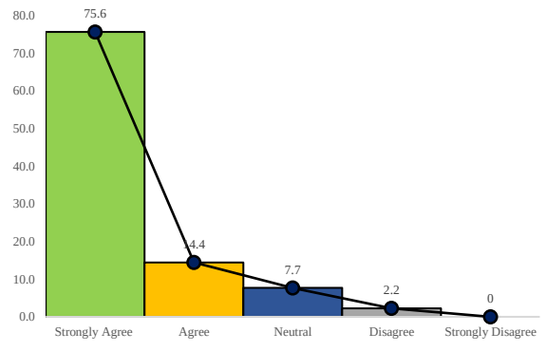

Figure 21
Percentage of perception of educational games
Source: Research data

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Box 33

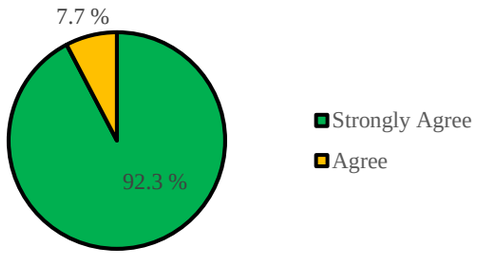

Figure 22
Global percentage of perception of educational games.
Source: Research data

In the global Figure of the 12 items, student perception showed a high percentage as the vast majority of students were Strongly Agree and Agree. The games appear to improve the level of motivation to study chemistry, which allowed the validation of hypothesis H2 of the research work.

Thus, the applied survey revealed that educational games are an effective complementary tool in learning the periodic table of chemical elements, as students enjoyed the games and recommended their application, leading to an increase in their motivation and demonstrating greater interest in the chemistry subject.

These results are similar to those obtained by [Franco *et al*., 2016; Marcano, 2020; Alejandria *et al*., 2023], who obtained high percentages of satisfaction and acceptance in their perception surveys, demonstrating that educational games are of great pedagogical utility at all educational levels and that students consider the implementation of the playful method very necessary to improve their learning.

Additionally, [Alejandria *et al*., 2023] mention that the periodic table of elements is an important topic for the teaching-learning of science at all educational levels. For this reason, games allow teaching chemistry at certain educational levels, not only improving academic performance, but also the subjective valuation of their knowledge.

Conclusions

It has been essential for teachers to be concerned about the teaching-learning of chemistry, since beyond the importance of the thematic content, it contributes to scientific and technological literacy. However, students have a negative image of it, maintaining the idea that it is a boring and, above all, difficult subject to understand. It has been shown that traditional methods, such as lectures based on memorization and interpretation, are often insufficient for teaching science [Patiño y Garzón, 2024]. In this sense, the present study has demonstrated that the application of educational games as a complementary tool in the classroom increases student learning, creating trusting learning environments.

Although educational games did not show a clear advantage in the most basic levels of Bloom's Taxonomy (1 and 2), they were effective in improving students' abilities to apply and analyze their knowledge in new situations. It is possible that other factors, such as student characteristics or classroom conditions, may have influenced the results.

Furthermore, it was evident that educational games positively influence the perception of learning the periodic table, demonstrating greater commitment and enthusiasm during activities related to the games, which suggests that these educational resources can be an effective tool to foster perception and generate greater motivation and interest in learning.

This study has not only contributed to how educational games impact student learning but has also provided important information for integrating methodologies with innovative and creative approaches to promote meaningful learning.

However, it is also important to note that this study presents certain limitations that could be addressed in future research, since, like any didactic strategy, the process of creating and/or developing educational games involves considering key processes, such as: the games being aligned with the specific learning objectives and the skills to be achieved, and the organization based on the prior knowledge and the personal and social skills that the group possesses.

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Therefore, it would be beneficial to explore other factors such as the learning style and the teacher's teaching style. Likewise, it would be relevant to investigate whether the observed benefits are maintained long-term and in different educational contexts.

Additionally, based on the findings of this study, it is recommended that future research conducts separate studies for each educational game for better adaptation to the students' level and characteristics to enhance their learning and allow the identification of possible improvements and adjustments in the implementation of these educational strategies.

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.

Contribución de los autores

Osorio-Gutiérrez, Karina: contributed with the project proposal, the methodological approach, the scope and design of the research, the design of the didactic intervention and the educational games, the development of the instruments, and the systematization and analysis of the statistical data, as well as the writing of the article.

Gordillo-Espinoza, Emmanuel: contributed to the scope and design of the research, the adaptation of the instruments, as well as the review and writing of the article.

Trejo-Trejo, Gilberto Abelino: contributed to the systematization and statistical analysis of the results, as well as the review and drafting of the article.

Domínguez-Gutú, Jesús: contributed to the methodological approach, scope, and design of the research and review of the article.

Data and materials availability

Technical Secondary School No. 141 of Belisario Domínguez, Chenalhó, provided the classroom and furniture for the development of the study intervention.

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Abbreviations

INEE	Instituto Nacional para la Evaluación de la Educación (National Institute for the Evaluation of Education).
PISA	Programme for International Student Assessment.
OCDE	Organización para la Cooperación y el Desarrollo Económicos (Organization for Economic Co-operation and Development).
REDIM	Red por los Derechos de la infancia en México (Network for Children's Rights in Mexico).
GBL	Game-Based Learning
EXP	Experimental

References

Antecedents

Acosta, J., Córdoba, Y. & Pacheco, J. (2021). Identification of contextualized situations for the teaching of natural sciences. *Boletín Redipe, 10*(6), 274-288.

Flores López, A., Sosa Martínez, B., Méndez Alonso, J. M., Catarino Centeno, R. & García Hernández, E. (2022). Adaptation of the Periodic Table to Nahuatl: a proposal for teaching and inclusion. *Chemistry Education*, 33(4).

ISSN:2523-0336
RENIECYT-SECIHTI: 1702902

Osorio-Gutierrez, Karina, Gordillo-Espinoza, Emmanuel, Trejo-Trejo, Gilberto Abelino and Domínguez-Gutú, Jesús. [2025]. Educational games as an alternative for teaching the periodic table to Tzotzil secondary school students. Journal High School. 9[20]1-15: e3920115
https://doi.org/10.35429/JHS.2025.9.20.3.1.15

Hassan, N. & Shafiq, M. (2023). Effect of Problem-Solving Method on Learning of Periodic Table by Using Game Instruction. *JCTE*. *6* (1). 118-130.

Higueras-Rodríguez, L. & Molina-Ruíz, E. (2020). What is understood by a didactic game? Contributions from teachers and student-teachers on its conception as a fundamental element in the development of the teaching-learning process. Profesorado, *Journal of Curriculum and Teacher Education, 24*(1), 266–283.

Patiño García, S. J. & Garzón, J. (2024). Effects of a video game on student learning and motivation in a Natural Sciences course. *Virtual Journal of the Universidad Católica Del Norte*, (71), 81–104.

Basics

Hernández-Sampieri, R. & Mendoza, C. P. [2018]. *Metodología de la investigación. Las rutas cuantitativas, cualitativas y mixtas*. [Research Methodology. The Quantitative, Qualitative, and Mixed Routes]. México: McGRAW-HILL Educación.

Masapanta-Carrión, S. & Velázquez-Iturbide Á. (2017). A systematic review of the use of Bloom's taxonomy in computer science education. Atas do XIX Simpósio Internacional de Informática Educativa e VIII Encontro do CIED–III Encontro Internacional, 294-299.

Pedrosa, I., Suárez-Álvarez, J., & García-Cueto, E. (2014). Evidence on Content Validity: Theoretical Advances and Methods for its Estimation. *Psychological Action*, *10*(2), 3–18.

Organisation for Economic Co-operation and Development (OCDE). (2023). *PISA 2022 Results (Volume I and II) – Country Notes: México.*

Red por los Derechos de la Infancia en México (REDIM) - Children's and Adolescents' Rights in Mexico. (2023). *Rezago educativo en la infancia y adolescencia de México 2016-2022.*

Ruíz, C. J. (2013). *Instrumentos y Técnicas de Investigación Educativa: Un Enfoque Cuantitativo y Cualitativo para la Recolección y Análisis de Datos*. [Instruments and Techniques of Educational Research: A Quantitative and Qualitative Approach for Data Collection and Analysis] (3.ª ed.). DANAGA Training and Consulting.

Skjong, R., & Wentworth, B. (2001). Expert Judgment and Risk Perception. Expert judgment and risk perception. *Proceedings of the Eleventh (2001) International Offshore and Polar Engineering Conference* (págs. 1-15). The International Society of Offshore and Polar Engineers.

Tornero, B., Ramaciotti, A., Truffello, A., & Valenzuela, F. (2015). Cognitive level of the questions formulated by preschool educators. *Education and Educators*, *18*(2), 261-283.

Supports

Álvarez-Herrero, J. F., y Valls-Bautista, C. (2021). The game as a strategy of learning chemistry among high school students. *European Journal of Science and Mathematics Education*, *9*(3), 80-91.

Dos Santos Araújo, A. C & Franco Leão, M. (2021). Elaboração e avaliação de um jogo didático do tipo quebra-cabeças para ensinar tabela periódica no 1o ano do ensino médio. REAMEC - *Rede Amazônica de Educação em Ciências e Matemática*, *9*(1), e21010–e21010.

Flores Tapia, C. E., & Flores Cevallos, K. L. (2021). Tests to check data normality in production processes: Anderson-Darling, Ryan-Joiner, Shapiro-Wilk and Kolmogórov-Smirnov. *Societas*, *23*(2), 83–106.

Plutin-Pacheco, N., & García-López, C. A. (2016). Didactic strategy based on recreation for the learning of chemistry in Cuban basic secondary education. *Cuban Journal of Chemistry*, *28*(2), 610-625.

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RENIECYT-SECIHTI: 1702902

Osorio-Gutierrez, Karina, Gordillo-Espinoza, Emmanuel, Trejo-Trejo, Gilberto Abelino and Domínguez-Gutú, Jesús. [2025]. Educational games as an alternative for teaching the periodic table to Tzotzil secondary school students. Journal High School. 9[20]1-15: e3920115
https://doi.org/10.35429/JHS.2025.9.20.3.1.15

Ramírez Amador, J. L. (2017). *Juegos: Una herramienta en el aprendizaje de química en secundaria.*[Games: A Tool in Secondary Chemistry Learning]. [Unpublished master's thesis, University of Granada]. DIGIBUG: Institutional Repository of the University of Granada.

Suárez, A., Calviño, N., Drogo, C., Bottai, H., & Reinoso, A. (2019). Study of the perception of secondary level students about chemistry and its social implication. *Chemistry Education, 30*(3), 53-63.

Discussions

Alejandria, LN., Bajenting, J. M. S., Pacatan, M. A. L. D. & Diquito, T. J. A. (2023). The use of educational board game as a supplemental tool in learning periodic table of elements among senior high school students. *American Journal of Education and Technology*, *2*(1), 60–67.

Franco-Mariscal, A. J., Oliva-Martínez J. M., Blanco-López Á. & España-Ramos E. (2016). A game-based approach to learning the idea of chemical elements and their periodic classification. *International Journal of Education, 93* (7), 1173-1190.

Llivicura, Salazar, W. M. & López, Pinagorte, I. L. (2023). Didactic games to stimulate the learning of the periodic table in first-year high school students. *Minerva Journal: Multidisciplinary Scientific Research, 4*(10), 114-122.

Marcano Godoy K. (2020). Didactic strategies for teaching and learning the chemical elements and their information in the periodic table. *Americas Education Journal, 10*(1), 84-105.

Valdiviezo, Castro, H. & Zaldívar, M. (2023). Scientific recreations to favor the learning of the periodic table in high school students with incomplete schooling. *Eclectic Chemistry,48*(4), 48-56.

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Article

Integration STEAM and Gamification in Chemistry Learning at the Secondary School Level

Integración STEAM y Gamificación en el aprendizaje de Química en el nivel de Secundaria

Gutiérrez-Cruz, Wendy*[a], Domínguez-Gutú, Jesús[b], Trejo-Trejo, Gilberto Abelino[c] and Gordillo-Espinoza, Emmnauel[d]

[a] Universidad Tecnológica de la Selva • NMJ-9693-2025 • 0009-0000-2613-0055 • 2023938
[b] Universidad Tecnológica de la Selva • AFR-3906-2022 • 0000-0001-8025-6089 • 524210
[c] Universidad Tecnológica de la Selva • AIC-1759-2022 • 0000-0003-2808-3939 • 334014
[d] Universidad Tecnológica de la Selva • KLD-5252-2024 • 0000-0002-2467-8209 • 657274

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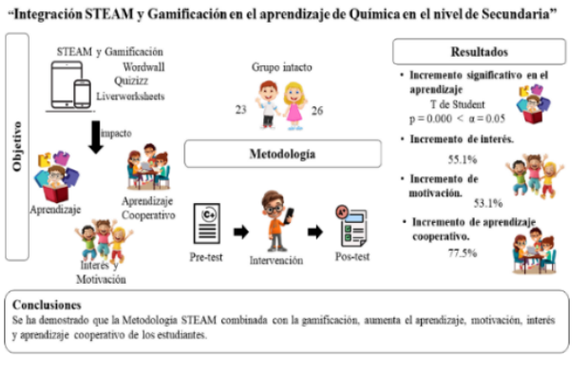
* ✉ [jdominguez@laselva.edu.mx]

Abstract

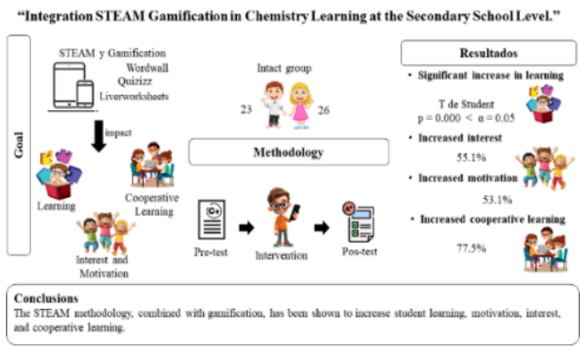
The present study was conducted at Technical Secondary School No. 96, Chalam, Mitontic, Chiapas. It focused on implementing the STEAM methodology with gamification to improve learning in Chemistry. The objective was to analyze academic performance and student perception regarding interest, motivation, and cooperative work. The study employed a quantitative methodological approach and a quasi-experimental design. Data was collected using Academic Performance Tests, Basic Science Interest Questionnaires, the Motivation and Learning Strategies Questionnaire Short Form (MSLQ-SF), and the Cooperative Learning Assessment Questionnaire (CAC). The results revealed that the STEAM methodology with gamification led to greater learning in the experimental group compared to the control group. Furthermore, students' perception of interest and motivation in learning Chemistry topics was high. Additionally, student perception regarding cooperative learning exceeded the initial research objective. This study contributes to understanding how these methodologies can significantly enhance the educational experience and foster greater student engagement in science learning.



Gamification, STEAM, Chemistry.

Resumen

El presente estudio se realizó en la Escuela Secundaria Técnica No. 96, Chalam, Mitontic, Chiapas. Se enfocó en implementar la metodología STEAM con gamificación para mejorar el aprendizaje en Química. El objetivo fue analizar el rendimiento académico y la percepción de los estudiantes sobre el interés, la motivación y el trabajo cooperativo. El estudio empleó un enfoque metodológico cuantitativo y un diseño cuasi-experimental. Los datos se recolectaron utilizando Pruebas de Rendimiento Académico, Cuestionarios de Interés en Ciencias Básicas, el Cuestionario de Motivación y Estrategias de Aprendizaje Forma Corta (MSLQ-SF) y el Cuestionario de Evaluación del Aprendizaje Cooperativo (CAC). Los resultados revelaron que la metodología STEAM con gamificación condujo a un mayor aprendizaje en el grupo experimental en comparación con el grupo control. Además, la percepción de los estudiantes sobre el interés y la motivación en el aprendizaje de temas de Química fue alta. Además, la percepción de los estudiantes sobre el aprendizaje cooperativo superó el objetivo inicial de la investigación. Este estudio contribuye a comprender cómo estas metodologías pueden mejorar significativamente la experiencia educativa y fomentar un mayor compromiso de los estudiantes en el aprendizaje de las ciencias.



Gamificación, STEAM, Química

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

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Introduction

The advancement of science and technology has transformed the educational system. Traditional teaching methods, based on memorization and passive transmission of knowledge, are insufficient to prepare students for the 21st century. In this context, the STEAM (Science, Technology, Engineering, Art, and Mathematics) methodology, integrated with gamification, aims to enhance academic performance and foster greater interest, motivation, and cooperation among third-grade secondary school students enrolled at Technical Secondary School No. 96, located in Chalam, Mitontic Municipality, Chiapas. Integrating the STEAM approach into pedagogical designs through the use of gamification in the Chemistry educational context fosters interdisciplinary learning among students. Gamification is an effective catalyst for motivation and dynamic interaction among students (Cleophas, 2020).

Gamification within the context of STEM education not only enhances the teaching and learning process but also fosters more effective exploration of disciplines at the secondary level. Furthermore, gamification was identified as a facilitator of meaningful learning, stimulating motivation and promoting the development of transversal skills. When technology is integrated, it provides students with an immersive experience in understanding curricular content and fosters emotional connection (Fuentes-Hurtado & Gonzalez-Martínez, 2019).

The gamification strategy applied in the subject of Chemistry through elements and techniques of games in the classroom seeks to facilitate the acquisition of knowledge, as well as stimulate creativity, motivation and meaningful learning (Paredes & Mello, 2021). On the other hand, given the lack of interest of students, through gamification we seek to motivate, teach, review and evaluate the concepts of Chemistry in order to awaken the interest of the student (Lozano & Sanchez, 2021)

Problem statement

Research conducted by the National Institute for the Evaluation of Education (NIEE, 2019) it mentions that 62% of high school students face a low level of learning in Science, showing a lack of scientific language, experimental skills and difficulty in organizing information.

The lack of interest and low motivation is due to the lack of relevance of the contents in the daily lives of students, traditional and decontextualized teaching, as well as the absence of active and participatory methodologies that promote meaningful learning.

In the state of Chiapas, science learning is worrying. Reports from the NIEE (2019) 70% of high school students have a low level of science learning. This problem impacts student development at the higher level.

Within the context of Technical Secondary School No. 96, located in Chalam, Mitontic, Chiapas, students face challenges in the subject of Chemistry, since the student body is immersed in an indigenous community, and their native language is Tzotzil. The lack of interest and attention is an obstacle that impacts students, especially their concentration, motivation, and active participation in class. This problem results in the inadequate application of scientific language, a lack of experimental skills, poor team collaboration, difficulty organizing information, and suboptimal academic performance.

Currently, scientific and technological advances have had a significant impact on education. The STEAM methodology emerges as a way to address these challenges through interdisciplinary integration, thus fostering critical thinking, creativity, problem-solving, and collaborative work among students. Gamification, on the other hand, applies game elements and mechanisms to non-game environments, proving to be an effective tool for motivating and engaging students.

The combination of STEAM and gamification in this research allows for the creation of interactive and engaging learning environments where students face challenges, receive rewards, and receive immediate feedback, in addition to fostering collaboration with their peers.

Objective

The research focused on analyzing student academic performance and perceptions using STEAM methodology integrated with gamification in chemistry learning.

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Methodology

The research was developed under a quantitative approach with a quasi-experimental experimental design (Hernández-Sampieri & Mendoza, 2018), through groups formed before the experiment (intact groups), having as independent variable the STEAM methodology integrated with gamification during the intervention of the study, and as dependent variables the academic performance and the perception of students towards chemistry, therefore, the following hypotheses were established:

H1: The STEAM methodology integrated with Gamification significantly improves student learning in the subject of Chemistry.

H2: Students' perception is high regarding interest, motivation and cooperative work in the subject of Chemistry, by using the STEAM methodology integrated with gamification during their learning.

Sample

The study sample was non-probabilistic and purposive, consisting of two experimental groups with a total of 49 students and a control group of 23. Written authorization was requested from the school principal, who stated that the data collected would be treated confidentially and used for statistical purposes. The gender segmentation consisted of 34 females and 38 males, between 14 and 15 years of age.

Information gathering instruments

As data collection instruments, an *ad hoc* test was applied to measure the variable "Academic Performance" which was integrated with 50 dichotomous questions and thus evaluate the topic of "Chemical Bonds". To calculate the reliability of the dichotomous instrument, the Kuder-Richardson coefficient (KR20) was used using the R software, yielding a value of p = 0.8919 located in the Very High magnitude range, being an instrument with an Acceptable reliability coefficient (Ruíz, 2013).

To measure student perception, an instrument with three dimensions (Interest, Motivation and Cooperative Learning) was used; to measure interest, the "Questionnaire of Interest in Learning through Basic Sciences" was used (Garcia *et al*., 2020), composed of 16 items, the "Short Form Motivation and Learning Strategy Questionnaire – MSLQ SF" was used to measure motivation (Sabogal *et al*., 2011), integrated with 20 items, and to measure Cooperative Learning the "Questionnaire for Measuring Cooperative Learning in Educational Contexts" was used (Fernandez-Rio *et al*., 2017) integrated with 20 items. To obtain the reliability of the polychotomous instrument, Cronbach's alpha was calculated using RStudio software, yielding a value of p = 0.7410 located in the High magnitude range, therefore, it can be said that it is an instrument with an Acceptable reliability coefficient (Ruíz, 2013).

Development of the intervention

The research intervention carried out with the students of the experimental groups was developed through the following stages:

Stage 1. Presentation of the study

To carry out the study, the research project was made known to the students of the experiment groups, likewise, before the application of the pretest, the students were explained how the dynamics of the intervention process of the strategy would be, as well as the final result that was expected to produce "Chemical Jumanji", on the other hand, they were informed that a pretest and posttest would be applied, as well as the questionnaire to measure motivation, interest and collaborative work at the end of the intervention, in the same way, it was explained to them that the results obtained in their questionnaires would be treated confidentially and for exclusive use for the analysis of the research.

Stage 2. Development

Inquiry and Presentation: Students were informed about the topics and subtopics to be investigated regarding "Chemical Bonds" through a fun dynamic called "The Sweets" teams were formed and the topics and subtopics that they would investigate and present to the group were drawn.

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Box 1

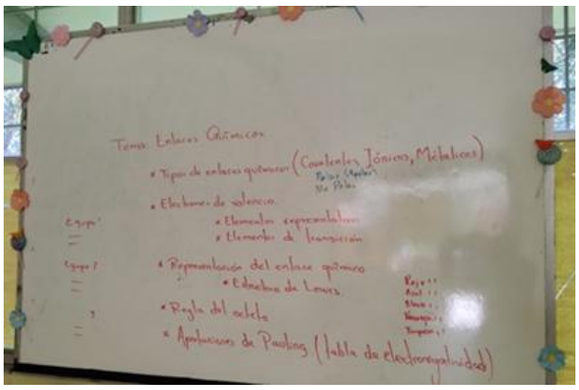

Figure 1
Topics and Subtopics for Teams
Source: Own Creation.

Box 2

Figure 2
Student presentation
Source: Own Creation.

Teacher Intervention and Platforms: In a summarized manner through interactive presentations and with the support of the game platform (Quizzis and Wordwall), team and individual activities were carried out, with the intention of strengthening the topics investigated by the students.

Box 3

Figure 3
Teaching intervention
Source: Own Creation.

Box 4

Figure 4
Use of digital platforms (Quizizz and Wordwall)
Source: Own Creation

Additional Activities and Laboratory: Additional activities were provided about the story of Jonathan Cane and The Mortals on Olympus. Students were given a printout of the lab exercise "Ionic and Covalent Bonds" so each team could gather their own materials. This way, students would learn about the electrical conductivity of materials through ionic and covalent bonds in everyday materials. In turn, the teams would complete a report on the exercise and compile a comparative table of "Chemical Bonds."

Box 5

Figure 5
Additional Activity (Jonathan Crane)
Source: Own Creation

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Box 6

Figure 6
Additional Activity (Jonathan Crane)
Source: Own Creation

STEAM Project (Chemical Jumanji): The 1995 movie "Jumanji" was presented to them with the intention that the students would know the main dynamics of the game, later the board game and its original rules were digitally introduced to them and they were informed that they would have to relate said game to the topics that they presented and strengthened through the process, likewise, they were made aware that the STEAM methodology would be applied, explaining how they would apply each acronym in the game to be developed, the students met in teams and in turn exchanged ideas with other teams from their same group and from the other group that would also do the same project, both experiment groups were jointly organized and informed the teacher that they would make a single game in which they would collaborate with each other to carry out the final product.

Box 7

Figure 7
Making of Chemical Jumanji
Source: Own Creation

Stage 3. Closing

Finally, the academic performance post-test and the instrument to measure students' perceptions of interest, motivation, and cooperative learning were administered.

The students then presented their final project and discussed their experiences during the process, mentioning that it had been somewhat difficult for them due to financial constraints, as some of their classmates did not have those means, but that they had collaborated with other types of work to create the product.

Box 8

Figure 8
Final product
Source: Own Creation

Results

Academic performance.

To test the research hypothesis (H1), the Student's t-test for independent samples was performed, obtaining a **p-value** of **0.0000**, which is lower than the established significance level of **α=0.05**. Therefore, it is concluded that there is a significant difference, rejecting the null hypothesis and accepting the hypothesis of this research, that the STEAM methodology integrated with gamification significantly improves student learning in the subject of Chemistry.

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Therefore, the implemented strategy promotes student learning, coinciding with Fuentes-Hurtado & Gonzalez-Martínez (2019), mentions in his study that gamification provides benefits in STEM subjects in secondary education and assumes that they are key elements in improving the teaching-learning process, since they influence the improvement of meaningful learning, thus improving the results in their tests or exams, this is because students get involved in their own learning when transferring the game to the educational environment, in addition to increasing motivation and the development of transversal skills.

Evaluation of perception

Once the results of the applied instrument were obtained, a scale table was defined that allowed us to evaluate the perception presented by the students, establishing the following assessment scale (Table 1), in relation to the relative frequency obtained in the statements in each instrument, which will allow us to evaluate the hypothesis.

Box 9

Table 1
Rating scale

Assessment	Perception %
Very low	[0, 25]
Low	(25, 50]
High	(50, 75]
Very high	(75, 100]

Source: Research Data.

To verify the hypothesis (H2) of the research, the results of the applied instrument show that the students' perception is at a high level in relation to the implemented teaching strategy, therefore, the research hypothesis is accepted in which the students' perception is high in relation to interest, motivation and cooperative work in the subject of Chemistry, when using the STEAM methodology integrated with gamification during their learning.

Box 10

Table 2
Student perception

Escale		F	RF
Very low	76 - 152	0	0.0%
Low	153 - 228	0	0.0%
High	229 - 304	45	91.8%
Very high	305 - 380	4	8.2%
		49	100.0%

Source: Research Data.

On the other hand, the students' perception was analyzed for each of the dimensions, the results obtained are presented below.

Interest

For the research, the Questionnaire of Interest in Learning Basic Sciences was applied (Castro et al., 2020).

Box 11

Table 3
Students' perception in the interest dimension.

Escale		F	RF
Very low	16 - 32	0	0.0%
Low	33 - 48	0	0.0%
High	49 - 64	49	100.0%
Very high	65 - 80	0	0.0%
		49	100.0%

Source: Research Data.

These results show that 100% of the students are interested in learning about the subject. These results support the research hypothesis, indicating that students show a high level of interest in implementing the STEAM methodology integrated with gamification.

The above results are consistent with the research conducted by Mallitasig y Freire (2020), who also implemented gamification as a teaching technique in teaching natural sciences to ninth-grade students. Their study revealed that gamification increases student interest in the learning process. Furthermore, they highlighted that the introduction of new methodologies makes classes more engaging, sparks students' curiosity, and fosters a greater willingness to understand the content.

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Motivation

For this study, the Motivation and Learning Strategy Questionnaire Short Form - MSLQ SF was applied (Sabogal *et al*., 2011). The questionnaire was adapted to be understandable and comprehensible to high school students.

Box 12

Table 4
Students' perception in the motivation dimension

Escale		F	RF
Very low	40 - 80	0	0.0%
Low	81 - 120	0	0.0%
High	121 - 160	45	91.8%
Very high	161 - 200	4	8.2%
		49	100.0%

Source: Research Data.

The results show that 91.8% of students show a high level of motivation, while 8.2% show a very high level, indicating a positive impact from the STEAM methodology integrated with gamification. This indicates that students develop a high level of motivation when implementing the strategy. Tamayo's (2022) research also supports these findings by highlighting that gamification not only improves academic performance but also increases student motivation. This indicates the effectiveness of implementing innovative strategies such as gamification in increasing student participation and engagement in the educational process. Both studies agree that these methodologies are not only effective in terms of learning but also promote a more dynamic and motivating educational environment.

Cooperative Learning

The Cooperative Learning Assessment Questionnaire (CAC) was applied to measure cooperative learning (Fernandez-Rio *et al*., 2017).

Box 13

Table 5
Students' perceptions of the cooperative work dimension.

Escale		F	RF
Very low	20 - 40	0	0.0%
Low	41 - 60	0	0.0%
High	61 - 80	5	10.2%
Very high	81 - 100	44	89.8%
		49	100.0%

Source: Research Data

The results show that 44 students fall within the "Very High" category (81–100) and 5 students fall within the "High" category (61–80). This indicates that a significant number of students have achieved a Very High level of performance.

The above results are similar to those obtained by Lorente *et al*. (2021), where students mention that working collaboratively was a positive experience and favored learning the subject. Therefore, cooperative work positively impacts student learning with the STEAM methodology integrated with gamification in Chemistry.

Conclusions

The STEAM methodology combined with gamification implemented in the Chemistry course focused on the topic of "Chemical Bonds," seeking to establish a connection between theoretical concepts and playful games. The results showed a significant difference between the standardized means (SDM) of the experimental groups, indicating considerable effectiveness. This suggests that the STEAM methodology integrated with gamification fosters cooperative work, interest, motivation, academic performance, and active student participation.

The research demonstrated that the implemented strategy increased learning in the experimental groups compared to the control group. Therefore, the implementation generated significant learning about chemistry, which contributed to improving students' academic performance.

Furthermore, the research revealed that the STEAM methodology integrated with gamification sparked student interest, indicating that 100% of them showed interest in the teaching strategy. Therefore, the STEAM methodology combined with gamification increases students' interest and curiosity.

On the other hand, it was found that 91.8% of students showed motivation toward the STEAM methodology with gamification. This implementation, in addition to increasing motivation, also promoted student participation and collaboration.

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Finally, the STEAM methodology combined with gamification demonstrated that 89.8% of students demonstrated the development of cooperative learning through this strategy. The data revealed a very high level of performance, indicating that initial expectations were exceeded. This difference does not invalidate the hypothesis; rather, it shows that the effects of the intervention were more effective than expected.

Through the implementation of the STEAM methodology integrated with gamification, high levels of motivation, interest, cooperative work, and academic performance were achieved, thus facilitating indirect teaching by the teacher, making students primarily responsible for their learning. This innovative strategy promoted active participation and left traditional methods of education behind.

The results obtained from the research are promising and suggest that the STEAM methodology with gamification has the potential to transform the teaching and learning of Chemistry. The study substantially improved learning compared to the control group, reflecting a significant impact. It sparked students' interest and curiosity in the subject of Chemistry, increased motivation towards the subject, as students displayed a favorable attitude, and encouraged collaboration and active participation. This resulted in more engaging, dynamic, and stimulating classes, which fostered a greater willingness to understand the content and contributed to improving the learning process.

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

Gutiérrez-Cruz, Wendy: contributed the project idea; the methodological approach, scope, and design of the research; the design of the activities in the applications; adaptation of the instruments; application of the instruments; systematization and statistical analysis of the results; and writing of the article.

Domínguez-Gutú, Jesús: contributed to the adaptation of the instruments; the methodological approach, scope, and design of the research; systematization and statistical analysis of the data; systematization of the background information for the state of the art; systematization of the data; the design of the activities in the applications; and the writing and revision of the article.

Trejo-Trejo, Gilberto Abelino: contributed to the systematization and statistical analysis of the data, and the revision of the article.

Gordillo-Espinoza, Emmanuel: contributed to the methodological approach, scope and design of the research; the writing and revision of the article.

Availability of data and materials

Technical Secondary School No. 96 provided the classroom and furniture for the development of the study intervention.

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We also thank the Principal of Technical Secondary School No. 96, who provided the facilities and training spaces to carry out this research project, as well as for allowing the pilot test to be conducted to determine the reliability of the instrument for measuring academic performance, interest, motivation, and cooperative learning.

Abbreviations

INEE	National Institute for the Evaluation of Education
STEAM	Science, Technology, Engineering, Art and Mathematics

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References

Antecedents

Cleophas, M. d. [2020]. Integration between gamification and the STEAM approach in chemistry teaching Basics. Revista de Educacao da Universidade Federal do Vale do Sao Francisco, 10(23), 78-109.

Fuentes-Hurtado, M. & Gonzalez-Martínez, J. [2019]. Que gana la STEAM con la gamificación. Revista Academia y Virtualidad, 12 (2), 79 – 94.

Basics.

Lozano, O. R. & Sanchez, A. [2021]. Diseño, aplicación y resultado de un estrategia de ludificación como actividad de cierre en clases de química, 32(4), 59 – 73.

Paredes, E. M & Mello J. D. [2021]. Efecto de la gamificación en el aprendizaje de Química en estudiantes del Centro Regional de Educación "Juan E. O'Leary" Concepción. Revista Ingeniería, Ciencias y Sociedad, 4, 36 – 45.

Hernández-Sampieri, R. & Mendoza, C. P. [2018]. Metodología de la investigación. Las rutas cuantitativas, cualitativas y mixtas. México: McGRAW-HILL Interamericana Editores, S.A. de C.V.

INNE [2019]. LA EDUCACIÓN OBLIGATORIA EN MÉXICO Informe 2019.

Ruíz, C. J. [2013]. Instrumentos y Técnicas de Investigación Educativa. Un Enfoque Cuantitativo y Cualitativo para la Recolección y Análisis de Datos. Tercera Edición. USA: Editorial DANAGA Training and Consulting.

Supports

Fernandez-Rio J., Cecchini, J. A., Mendez-Giménez, A., Méndez-Alonso D. & Prieto J. A. [2017]. Diseño y validación de un cuestionario de medición del aprendizaje cooperativo en contextos educativos. Anales de Psicología. 33 (3), 680 – 688.

Garcia, R. A., Llapa M. P., Bartesaghi, W., & Torres, J. [2020]. Diseño y validación de un cuestionario de interés en el aprendizaje de las ciencias básicas. Revista de la facultad de educaión de Albacete, 1(35), 93 – 106.

Sabogal, L. F., Barraza, E., Hernández, A., & Zapata, L. [2011]. Validación del cuestionario de motivación y estrategias de aprendizaje forma corta - MSLQ SF, en estdiantes universitarios de una institución pública - Santa Marta. Psicogente, 14 (52), 36 – 50.

Discussions

Castro, R. A., Medina, M. P., Aste, W. B. & Chávez, J. T. [2020]. Diseño y validación de un cuestionario de interés en el aprendizaje de las ciencias básicas. Revista de la facultad de educación de Albacete, 1 (35), 93 – 106.

Lorente, S., Fauquet, J., Redolar, D., Prat-Ortega, G., Pardo, A. & Bonillo, A. [2021]. El aprendizaje cooperativo mejora el rendimiento académico. Actas del VI Congreso Internacional sobre aprendizaje, innovación y cooperación, CINAIC, 119 – 124.

Mallitasig, A. J. & Freire, T. M. [2020]. Gamificación como técnica didáctica en el aprendizaje de las Ciencias Naturales. INNOVA Research Journal, 5 (3), 164 – 181.

Tamayo, P. [2022]. La gamificación y su aplicación a la asignatura de Física y Química de 4º de ESO. (Tesis de grado. Facultad de educación. Universidad de Cantabria).

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Article

Guided use of Artificial Intelligence for the development of written reports: Preliminary results of an academic practice

Uso guiado de Inteligencia Artificial para la elaboración de trabajos escritos: Resultados preliminares de una práctica académica

Camero-Berrones, Rosa Gabriela*[a], Soto-Hernández, Ana María[b], Lerma-Ledezma, David[c] and Maldonado-Soto, Otilia Georgina[d]

[a] Tecnológico Nacional de México • 1832-2024 • 0000-0003-4438-1645 • 61055
[b] Tecnológico Nacional de México • 1979-2025 • 0000-0002-8660-3413 • 317457
[c] Universidad Politécnica de Altamira • 0225-2025 • 0000-0001-8137-3308 • 899202
[d] Tecnológico Nacional de México • 1738-2025 • 0009-009-1335-8099 • 1336845

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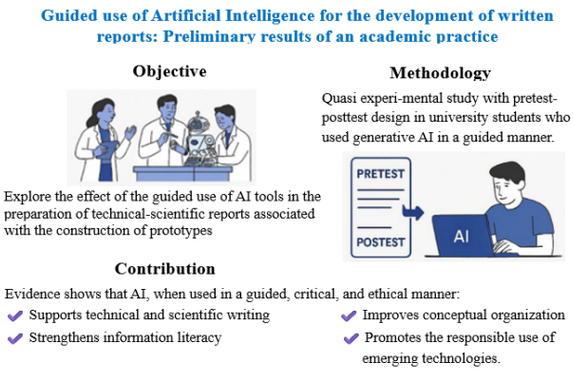
* ✉ [rosa.cb@cdmadero.tecnm.mx]

Abstract

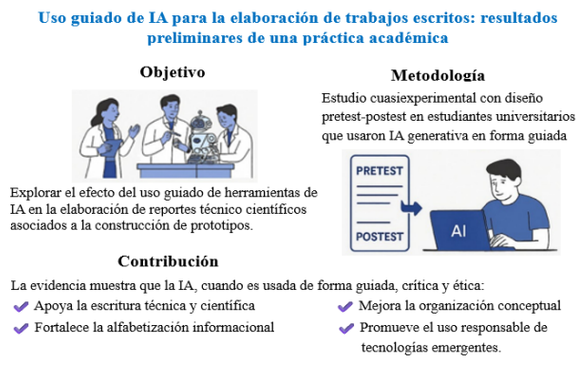
This study presents preliminary results of an academic practice focused on the guided use of Artificial Intelligence (AI) to support the development of scientific–technical reports in undergraduate Physics courses. The experience was implemented in Electromagnetism and Selected Topics in Physics within a local Science Expo context. Students designed a didactic prototype and documented it using a structured Technical Report template, complemented by a guide of AI prompts and ethical recommendations. A pre- and post-intervention survey design was applied ($n_1 = 40$; $n_2 = 34$) to analyze changes in students' perceptions regarding scientific writing skills, information literacy, and ethical AI use. Descriptive statistics and Mann–Whitney U tests revealed significant improvements in conceptual structuring, methodological documentation, information verification, and responsible AI practices. The findings suggest that combining structured templates with guided AI use constitutes an effective pedagogical strategy.



Artificial Intelligence, physics, digital skills

Resumen

Este estudio presenta resultados preliminares de una práctica académica orientada al uso guiado de herramientas de Inteligencia Artificial (IA) para la elaboración de reportes científico-técnicos en cursos universitarios de Física. La experiencia se desarrolló en las asignaturas de Electromagnetismo y Tópicos Selectos de Física, en el contexto de una Expociencias local. Los estudiantes diseñaron un prototipo didáctico y elaboraron una memoria técnica mediante una plantilla estructurada, apoyada por una guía de prompts y recomendaciones éticas para el uso de IA. Se aplicó un diseño pre y post intervención ($n_1 = 40$; $n_2 = 34$) para analizar cambios en la percepción de competencias de escritura científica, alfabetización informacional y uso responsable de IA. Los análisis descriptivos y la prueba U de Mann–Whitney muestran mejoras significativas en la estructuración conceptual, documentación metodológica y prácticas críticas de uso de IA, evidenciando el valor pedagógico del enfoque propuesto.



Inteligencia artificial, Física, competencias digitales

Area: Dissemination of and universal access to science

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1. Introduction

The incorporation of emerging technologies into teaching and learning processes has generated new dynamics in higher education. In disciplines that require the understanding of abstract concepts articulated with experimental procedures and scientific communication, the use of Artificial Intelligence (AI) tools has been rapidly adopted. These tools can generate, reorganize, and reformulate texts, opening a wide range of possibilities to support the construction of academic reports and other written communication activities. Their growing use in student practices requires not only an understanding of their potential but also an examination of the conditions under which they can foster meaningful learning and the development of digital competencies. This relevance is framed within the digital transformation of higher education institutions, where the integration of technologies does not merely involve the availability of platforms but also changes in pedagogical models, assessment practices, educational quality, and institutional implementation (Abad-Segura et al., 2020); (Benavides et al., 2020); (Bates et al., 2020).

In the educational field, AI has become an area of applied research with impacts on teaching strategies, personalization according to learners' needs, feedback processes, and task automation, although it also presents challenges related to bias, reliability, academic integrity, and ethical use (Chen et al., 2020); (Sousa & Cardoso, 2025); (Dilmurod & Fazliddin, 2021). Recent studies in Latin American university contexts have shown that AI-based assistants can support formative processes without replacing teachers' pedagogical judgment, provided that human mediation and control are maintained (Paz, 2025).

Unlike other digital resources, such as information search engines or text editors, generative AI offers added value by enabling personalized interactive support. Through direct interaction with the user, a dialogue is established that allows iterative cycles of planning, drafting, reviewing, and refining written texts. This type of interaction enables students to explore different ways of expressing ideas. In addition, generative tools provide suggestions that offer alternative approaches to organization, argumentation, and comparison.

This distinctive feature, interaction through prompts, transforms report writing into a more active and metacognitive activity, in which students not only generate text but also make decisions about content based on relevance, coherence, and conceptual precision. Several authors indicate that these characteristics can strengthen scientific communication when integrated with teacher mediation (Khalifa & Albadawy, 2024); (Malik et al., 2023). Along the same lines, generative AI-based tools have been developed specifically to assist instructors in providing formative and personalized feedback in academic writing tasks, showing favorable results when integrated as pedagogical support rather than as a substitute for the teaching role (García-Solórzano et al., 2025)

However, the same capacity to generate plausible responses also increases risks when used without clear criteria, as it may lead to errors, omissions, or biased content. Critically, the use of generative AI tools for academic writing can result in nonexistent or inaccurate references. Therefore, the literature emphasizes the importance of human verification, transparency in tool usage, and explicit rules of academic integrity regarding AI-generated content (Zhai et al., 2024); (Farrokhnia et al., 2024).

Within this framework, a guided approach becomes a central feature, as it establishes clear criteria for task execution. The use of prompts oriented toward academic purposes, combined with teacher guidance, facilitates information literacy. In this way, students learn how to formulate appropriate requests, which also involves critically reviewing and making informed decisions about the content incorporated into their texts. From this perspective, prompt engineering is understood as an emerging digital competence that improves the quality of interaction with language models by requiring specificity, contextualization, output criteria, and iterative refinement (Korzynski et al., 2023); (Eager & Brunton, 2023); (Kshetri, 2023); (Vega Figueroa, 2024).

Furthermore, to ensure traceability and control of bibliographic sources—especially when generative systems are employed—it is essential to integrate writing practices with formal bibliographic management and citation procedures.

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These practices are supported by reference managers and institutional guidelines that promote consistency and verifiability (Mendeley, 2011); (Zotero, 2025); (Universidad de Granada, 2025); (Universidad Politécnica de Valencia, 2025); (Balmaseda Espinosa et al., 2024).

The study presented in this article focuses on analyzing the academic use of AI within a formative practice related to the development of technical–scientific reports in undergraduate Physics courses. This type of product requires conceptual clarity, methodological coherence, and integrity in the use of sources, all of which are particularly relevant for the development of scientific competencies (Franco-Mariscal, 2015).

The educational proposal integrated three distinctive elements: first, a methodological guide to orient interaction with AI (including suggested prompts and recommendations for responsible use); second, the development of an experimental project or didactic prototype as the basis for the written report; and third, assessment of students' perceptions before and after the activity. This design allows observation of the articulation between technological support, disciplinary knowledge construction, and scientific communication processes. In this regard, recent evidence suggests that generative tools tend to perform better in explanatory and writing tasks but may negatively affect reasoning habits if used without guidance, reinforcing the need for accompanied and learning-oriented interventions (Akolekar et al., 2025); (Bewersdorff et al., 2024).

The main problem motivating this research is to identify how AI contributes to the preparation of academic reports produced by university students enrolled in disciplinary Physics courses, as well as to examine how students' perceptions of these tools change when they are used within a guided framework. The central hypothesis proposes that the guided use of AI promotes clearer content structuring and a greater ability to express scientific ideas, provided that teacher support encourages critical and responsible use, with emphasis on verification, traceability, and source consistency (Khalifa & Albadawy, 2024); (Farrokhnia et al., 2024); (Kalniņa et al., 2024).

Finally, in terms of academic and institutional relevance, the discussion on AI in higher education also demands clear implementation frameworks, such as ethical guidelines, teacher training, and strategies to avoid digital divides, which contextualize the need for explicit didactic proposals (Ali, 2025); (Lucero-Baldevenites et al., 2025). In this regard, Latin American educational networks have proposed specific guidelines for the responsible use of generative artificial intelligence in educational contexts, emphasizing transparency, verification, and teacher mediation (RED SUMMA Education, 2024)

At this point, it is important to highlight that most research on AI in academic writing has focused on humanities disciplines or free-structure essays. Consequently, there is a significant gap regarding the use of AI in the preparation of technical reports in basic sciences. This academic gap justifies the relevance of the present study and reinforces the need to analyze how students use AI to produce scientific texts within the framework of experimental practices and prototype design.

This article is organized into three main sections. The Methodology section describes the didactic design of the practice, the structure of the prompt guide, the participants, the data collection instruments, and the application procedure. The Results section presents the findings of the comparative analysis of students' perceptions before and after the experience. Finally, the Conclusions section discusses the educational implications of guided AI use in scientific training and outlines directions for future research.

2. Methodology

2.1 Design of the Academic Intervention

The intervention was carried out within the framework of the 2025 local Basic Sciences Expo and was implemented in two Physics courses: Electromagnetism and Selected Topics in Physics. The main objective was to explore the effect of the guided use of Artificial Intelligence (AI) tools on the development of technical–scientific reports associated with the construction of didactic prototypes. To this end, students worked with an official Technical Report template that established the structure, academic criteria, and documentation requirements of the project.

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This template included a guide with explicit recommendations on the ethical use of AI, scientific writing, integration of academic sources, and information verification.

Each team designed a didactic prototype based on a specific Physics principle related to electromagnetism, thermodynamics, fluids, optics, or waves, and prepared a technical report following the template.

In parallel, students were provided with a prompt guide to support the writing process, aimed at improving clarity, coherence, organization of ideas, and argumentative quality, without replacing students' own conceptual work. The intervention lasted approximately two weeks within the course and was integrated into regular class activities.

2.2 Participants

The intervention initially involved 40 undergraduate students enrolled in Engineering and Science programs who were taking the aforementioned courses. All participants completed the pre-intervention diagnostic survey. After the activity concluded, 34 students completed the post-intervention survey, constituting the final sample for comparative analysis. Participation was voluntary and had no impact on course grades.

2.3 Data Collection Instruments

Two structured Likert-scale surveys with values ranging from 1 to 5 were used, administered before and after the development of the technical report. Both surveys were designed to assess dimensions related to scientific writing skills, information literacy, ethical use of AI, and perceptions of the support provided by the Technical Report template. The use of questionnaires to analyze teaching practices and perceptions of competencies related to academic writing has been validated in recent educational research, supporting the methodological relevance of the instrument used in this study investigación (Strocchi et al., 2025)

The pre-intervention survey aimed to characterize students' prior experience with didactic prototypes, their frequency of use of generative AI tools, and their training in AI ethics.

It also evaluated initial self-perceptions regarding their ability to write titles, abstracts, introductions, and theoretical frameworks; plan materials and describe procedures; present results and conclusions; cite sources correctly; distinguish academic sources; and verify technical information across different media.

The post-intervention survey assessed changes in these perceptions after the guided use of AI and the Technical Report template. It considered aspects such as the perceived usefulness of the template for structuring the document, the degree of support provided in each section of the report, ease of use, clarity of language, and the impact of AI on idea generation, writing improvement, information synthesis, methodological design, and reference management. It also included items addressing identified risks, such as misinformation, dependency, or plagiarism, as well as ethical practices related to AI use, including content verification, disclosure of tool usage, and traceability of the prompts employed.

2.4 Procedure

The procedure began with the presentation of the official Technical Report template to the students, explaining its sections, the academic rationale behind each component, and institutional expectations regarding report quality. During the same session, an introduction to the use of generative AI tools as support for scientific writing was provided, illustrating examples of appropriate prompts to improve clarity, argumentative structure, conceptual synthesis, and text organization, while emphasizing the need to verify content and avoid undue dependence.

Subsequently, the pre-intervention survey was administered to establish a baseline of students' skills and perceptions. Over the following weeks, teams developed their didactic prototypes and wrote their technical reports using both the template and the prompt guide. During this stage, students were allowed to incorporate AI for specific writing-related tasks but were required to maintain full responsibility for conceptual content, technical validity, and theoretical grounding.

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Once the final report was completed, the post-intervention survey was administered to collect students' perceptions regarding the support provided by the template, the impact of guided AI use on report preparation, observed benefits, encountered difficulties, and the evolution of their ethical and critical practices regarding AI. These perceptions were distributed across six dimensions: title and abstract; introduction and theoretical framework; materials and procedures; results and conclusions; digital literacy; and ethical use of AI.

The collected data were exported to Microsoft Excel and subsequently analyzed using Python. Data consistency was verified, and descriptive statistics (mean, median, standard deviation, and relative frequencies) were calculated for each dimension.

Given that the distributions did not show normality and that two independent groups were compared (pre- and post-intervention, with different sample sizes), the non-parametric Mann–Whitney U test was applied with a significance level of $p < 0.05$ to determine whether there were significant differences between students' initial and final perceptions.

This test allowed comparison of the null hypothesis (H_0), which states that there are no significant differences in perceptions regarding AI use before and after the intervention, against the alternative hypothesis (H_1), which proposes that differences do exist and can be attributed to the guided use of the template and AI in the preparation of the technical report.

The results of this test, together with the complementary descriptive analysis, were used to interpret the effect of the intervention on the development of students' scientific writing competencies.

3. Results

3.1. Descriptive analysis pre- and post-intervention

Table 1 presents the means and standard deviations of the six dimensions evaluated before (pre) and after (post) the use of the Technical Report template and the AI prompt guide. Responses were coded on a scale from 1 to 5, where higher values indicate greater agreement or perceived competence.

Box 1

Table 1
Descriptive statistics by dimension (pre and post)

Dimension	Pre mean	Pre SD	Post mean	Post SD
Title and abstract	3.62	1.08	3.9	0.94
Introduction and theoretical framework	3.44	0.98	3.98	0.67
Materials and procedures	3.55	1.05	4.03	0.82
Results and conclusions	3.51	1.06	3.93	0.73
Information literacy	3.29	0.89	3.65	0.8
AI use and ethics	3.38	0.83	3.76	0.63

Source: Own Elaboration

The descriptive results show a consistent trend of improvement across all evaluated dimensions following the didactic intervention.

In each dimension, an increase in the post-test mean relative to the pre-test mean was observed, indicating that students perceived a strengthening of their academic skills after working with the Technical Report template and receiving guided support through AI tools.

The largest variations were observed in two dimensions that are critical to scientific report writing. Specifically, in the *Introduction and theoretical framework* dimension, the mean increased from 3.44 to 3.98, while in the *Materials and procedures* section, it increased from 3.55 to 4.03.

These differences suggest that the intervention had a notable impact on students' ability to explain scientific foundations, integrate references, and appropriately structure the methodological section of their reports.

Relevant increases were also observed in other areas of academic performance, such as *Results and conclusions*, which increased from 3.51 to 3.93; *Information literacy*, whose values rose from 3.29 to 3.65; and *AI use and ethics*, which increased from 3.38 to 3.76. These data can be interpreted as improvements in students' ability to interpret data, distinguish reliable sources, manage references, and use AI tools critically and responsibly.

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The *Title and abstract* dimension already showed a relatively high mean in the diagnostic assessment (3.62), and although the increase was more moderate, it reached 3.90 in the post-test, suggesting sustained improvement in information synthesis.

Overall, the data indicate that after the didactic intervention, conducting the report writing under established guidelines and guided support, students developed greater conceptual clarity to justify the physical principles of the prototype, properly organize the experimental procedure, evaluate the quality of academic information, and use AI as a support tool guided by ethical and critical validation criteria.

3.2 Inferential analysis

To assess whether the differences observed between pre- and post-intervention were statistically significant, the Mann–Whitney U test was applied, which is appropriate for independent samples and ordinal Likert-type scales. The results, presented in Table 2, show significant differences in four dimensions. In *Introduction and theoretical framework*, a p-value of 0.011 was obtained, while in the *Materials and procedures* dimension the p-value was 0.039. The third dimension showing significant differences was *Information literacy* (p = 0.047), and a significant difference was also observed in *AI use and ethics* (p = 0.048).

Box 2

Table 2
Mann–Whitney U test results

Dimension	U	p	Significant difference (α = 0.05)
Title and abstract	587	0.309	No
Introduction and theoretical framework	447.5	0.011	Yes
Materials and procedures	494	0.039	Yes
Results and conclusions	534	0.112	No
Information literacy	498	0.047	Yes
AI use and ethics	499.5	0.048	Yes

Source: Own Elaboration

In these areas, the intervention had a clear statistical impact, supporting the hypothesis that guided AI use, combined with a structured template, strengthens competencies related to conceptual argumentation, technical documentation, and critical verification of sources.

On the other hand, the *Title and abstract* (p = 0.309) and *Results and conclusions* (p = 0.112) dimensions did not show statistically significant differences. This may be interpreted in several ways. In the case of *Title and abstract*, students already exhibited relatively high confidence levels in this skill prior to the intervention, which may explain the reduced margin for statistical improvement. In contrast, the *Results and conclusions* dimension may be influenced by variability in the quality of the prototypes or the availability of experimental data—factors that do not depend directly on AI use or the structure of the template.

Overall, the findings indicate that the intervention strengthened those dimensions related to the cognitive structure of the report (theoretical framework, conceptual foundations, and methodological planning), as well as information literacy and digital ethics. This is consistent with the formative components incorporated into the intervention: the prompt guide, recommendations for critical AI use, and emphasis on citing and verifying information.

These results are consistent with previous research indicating that generative AI, when used with teacher guidance and clear rules, supports conceptual organization processes and improves the quality of academic writing (Khalifa, 2024**)**; (Malik, 2023). Similar findings have been reported in upper secondary education studies, where AI has been used to support formative assessment of writing, promoting reflective processes and more objective feedback (Borrayo & Sobrino, 2025). Furthermore, improvements in information literacy and ethics suggest that students internalized verification and traceability practices, which are particularly relevant given the risks associated with uncritical use of generative systems. In summary, the combination of guided AI use and a structured template constitutes an effective strategy for supporting the development of scientific–technical reports in undergraduate Physics courses, with statistically verifiable positive impacts.

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These findings reinforce the pedagogical potential of integrating AI into formative practices oriented toward scientific communication, provided that ethical and methodological frameworks accompany its use.

3.3 Perceptions of the Technical Report template

Post-intervention survey included specific items related to the Technical Report template. Mean scores (on a 1–5 scale) consistently ranged between 3.8 and 4.2, reflecting a predominantly positive evaluation, as shown in Table 3.

Box 3

Table 3
Students' perceptions of the Technical Report template

Template characteristic	Mean
The structure of the template helped me organize my project ideas	3.96
The template helped me understand what to include in each section	3.86
The template facilitated writing with a more technical and academic style	4
The template helped me better document procedures, results, and conclusions	4.07
The language of the template was clear and understandable	4.18

Source: Own Elaboration

These data suggest that the template functioned as a structural scaffold for report construction, helping clarify expectations for each section, organize information, and adopt a writing style closer to technical–scientific standards.

3.4 Use of AI during report preparation

Finally, the ways in which students actually used AI during the project were explored. Mean values for AI-related items were also high (approximately 3.9–4.3). Many students reported using AI to generate ideas or brainstorm prototype concepts (M ≈ 4.25), improve writing quality (clarity, spelling, academic style), and summarize theoretical information (means close to 3.9–4.0).

Students also indicated that AI saved time during report preparation (M ≈ 4.18) and helped them better understand the scientific concepts involved (M ≈ 4.21).

In terms of responsible practices, most respondents reported reviewing and verifying AI-generated information using academic sources (M ≈ 4.25), avoiding copy-and-paste without adaptation (M ≈ 4.0), and refraining from asking AI to fabricate data or references (M ≈ 3.9).

Open-ended responses complemented these findings: several students noted that AI was particularly useful for writing the title, abstract, and theoretical framework, while also expressing concerns about risks such as plagiarism, inaccurate information, or excessive dependence. These risks were mitigated by cross-checking sources and using their own wording.

4. Conclusions

This study analyzed the academic use of Artificial Intelligence (AI) within a guided instructional framework for the development of technical–scientific reports in undergraduate Physics courses. The findings indicate that the integration of structured templates, guided prompts, and explicit ethical criteria contributes positively to students' perceptions of their scientific writing skills, conceptual organization, information literacy, and responsible use of AI tools.

The results support the central hypothesis of this research, suggesting that the guided use of AI fosters clearer content structuring and more effective expression of scientific ideas, provided that teacher mediation promotes critical use, verification of information, and traceability of sources. In this sense, AI functions as a cognitive and communicative support tool rather than as a substitute for disciplinary reasoning or academic judgment.

From an educational perspective, the study highlights the relevance of incorporating explicit didactic strategies for AI use in science education. The combination of methodological templates, prompt engineering guidance, and ethical recommendations offers a transferable model that can be adapted to other scientific disciplines requiring experimental documentation and technical reporting.

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Some limitations should be acknowledged. The study was conducted with a relatively small sample and over a short intervention period, and the analysis focused on students' perceptions rather than on direct evaluation of written products. These aspects limit the generalization of the results.

Future research may extend this approach to other areas of basic and applied sciences, incorporate longitudinal designs, and include qualitative and quantitative analyses of students' written reports to further examine the impact of guided AI use on scientific communication and learning processes.

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

The contribution of each researcher in each of the points developed in this research, was defined based on:

Camero-Berrones, Rosa Gabriela: Conceptualization, project administration, manuscript writing, development of the academic intervention, and construction of the theoretical framework.

Soto-Hernández, Ana María: Data curation, formal analysis, statistical validation, and interpretation of results.

Lerma-Ledezma, David: Methodology, design and structuring of assessment instruments, and content validation.

Maldonado-Soto, Otilia Georgina: Fieldwork, survey administration, implementation of the didactic strategy, and follow-up with participating teams.

Availability of data and materials

The quantitative and qualitative data generated during this study are available from the corresponding author upon reasonable request.

The instruments used in the study may be provided for academic and research purposes, in compliance with participant confidentiality.

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Abbreviations

AI	Artificial Intelligence
H_0	Null hypothesis
H_1	Alternative hypothesis
IA	Inteligencia Artificial
Likert	Likert-type scale
M	Mean
p	Probability value
SD	Standard deviation
U – Mann	Whitney U statistic

References

Antecedents

Abad-Segura, E., González-Zamar, M. D., Infante-Moro, J. C., & García, G. R. (2020). Sustainable management of digital transformation in higher education: Global research trends. *Sustainability*, 12(5), 2107.

Bates, T., Cobo, C., Mariño, O., & Wheeler, S. (2020). Can artificial intelligence transform higher education? *International Journal of Educational Technology in Higher Education*, 17(1), 42.

Benavides, L. M., Tamayo Arias, J. A., Arango Serna, M. D., Branch Bedoya, J. W., & Burgos, D. (2020). Digital transformation in higher education institutions: A systematic literature review. *Sensors*, 20(11), 3291.

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *IEEE Access*, 8, 75264–75278.

ISSN:2523-0336
RENIECYT-SECIHTI: 1702902

Dilmurod, R., & Fazliddin, H. (2021). Artificial intelligence in education: Advantages and challenges. *International Journal of Engineering and Advanced Technology*, 10(6), 89–92.

Paz, H. R. (2025). *El tutor de IA en la formación de ingenieros: Diseño, resultados y rediseño de una experiencia en hidrología en una universidad argentina*.

Basics

Ali, M. (2025). Ethical frameworks for artificial intelligence adoption in higher education. *International Journal of Educational Technology in Higher Education*, 22(1), 14.

Balmaseda Espinosa, A., Gómez Hernández, J. A., & Pérez Pulido, M. (2024). Competencias informacionales y citación académica en entornos digitales. *Revista Española de Documentación Científica*, 47(1), e369.

Franco-Mariscal, A. J. (2015). La competencia científica en la educación superior. *Revista Eureka sobre Enseñanza y Divulgación de las Ciencias*, 12(3), 385–402.

Kalniņa, L., Kalniņš, G., & Drelinga, E. (2024). Academic integrity challenges in AI-assisted writing. *Journal of Academic Ethics*, 22, 57–74.

Korzynski, P., Mazurek, G., Altman, A., & Kim, Y. J. (2023). Generative AI as a productivity tool: Prompt engineering competencies. *Journal of Business Research*, 156, 113456.

Kshetri, N. (2023). Generative AI: Transforming business and education. *Computer*, 56(7), 45–49.

Mendeley. (2011). *Mendeley reference manager*.

RED SUMMA Education. (2024). *Lineamientos para el uso de inteligencia artificial generativa (IAG) en la RED SUMMA Education*.

Strocchi, M. V., Tapia-Ladino, M., & Fuentealba-Carrasco, P. (2025). Diseño y validación del cuestionario de prácticas de enseñanza de escritura académica. *Revista Española de Pedagogía*, 83(292), 591–608.

Universidad de Granada. (2025). *Guía para la citación y referencias en estilo APA*.

Universidad Politécnica de Valencia. (2025). *Guía de citación y uso ético de fuentes académicas*.

Zotero. (2025). *Zotero reference manager*.

Supports

Akolekar, N., Ma, W., & Rosé, C. P. (2025). Generative AI in education: Opportunities, risks, and pedagogical alignment. *Computers & Education: Artificial Intelligence*, 6, 100206.

Bewersdorff, A., Sailer, M., & Fischer, F. (2024). Generative AI and learning: Effects on cognitive engagement and reasoning. *Educational Psychology Review*, 36(2), 34.

Borrayo, C. L. B., & Sobrino Guerrero, P. S. (2025). Inteligencia artificial como herramienta para la evaluación formativa de la escritura en alumnos de bachillerato. *Diálogos sobre Educación*, (34).

Farrokhnia, M., Banihashem, S. K., Noroozi, O., & Wals, A. E. J. (2024). A SWOT analysis of generative AI in education. *Educational Technology Research and Development*, 72, 1–26.

García-Solórzano, D., Cabrera, N., García-Londoño, C., Marco-Galindo, M. J., Minguillón, J., Casado-Martínez, C., & Clarisó, R. (2025). *FeedSmart: una herramienta basada en IA generativa para asistir al profesorado en la elaboración de retroalimentación formativa y personalizada*. Actas de las Jornadas de Enseñanza Universitaria de la Informática (JENUI), 10, 165–173.

Khalifa, A., & Albadawy, R. (2024). Using generative AI to support academic writing skills. *Education and Information Technologies*, 29, 1831–1852.

Malik, S., Waddington, R., & Singh, A. (2023). Artificial intelligence tools and academic writing: A systematic review. *Computers & Education*, 197, 104720.

Zhai, X., Chu, X., Chai, C. S., & Jong, M. S. Y. (2024). A review of generative AI in education: Opportunities and risks. *British Journal of Educational Technology*, 55(1), 1–17.

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https://doi.org/10.35429/JHS.2025.9.20.5.1.10

Discussions

Lucero-Baldevenites, J., Martínez-Rodríguez, F., & Ríos, D. (2025). Institutional policies for artificial intelligence in higher education. *Revista Iberoamericana de Educación Superior*, 16(45), 67–89.

Sousa, M. J., & Cardoso, A. (2025). Artificial intelligence and ethical challenges in education. *Education Sciences*, 15(1), 12.

Vega Figueroa, M. (2024). Ingeniería de prompts como competencia digital emergente. *Revista Latinoamericana de Tecnología Educativa*, 23(1), 55–72.

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Article

Key risk prevention factors, student transformation towards the Organization

Factores principales de prevención de riesgos, transformación del estudiante hacia la Organización

Gonzalez-de la Garza, José Gerardo*[a], De la-Garza-Cienfuegos, Sandra Patricia[b], Otriz-Ozuna Mayra Yazmin[c] and Aguilar-Sánchez, Ana María[d]

[a] Universidad Autónoma de Coahuila • 0009-0001-4692-8969 • 1023928
[b] Universidad Autónoma de Coahuila • LZH-1184-2021• 0000-0002-7018-1252 • 320839
[c] Universidad Autónoma de Coahuila • LKL-0431-2024 • 0009-0003-0432-5507 • 297191
[d] Universidad Autónoma de Coahuila • LZG-6308-2025 • 0000-0002-2374-813X • 522909

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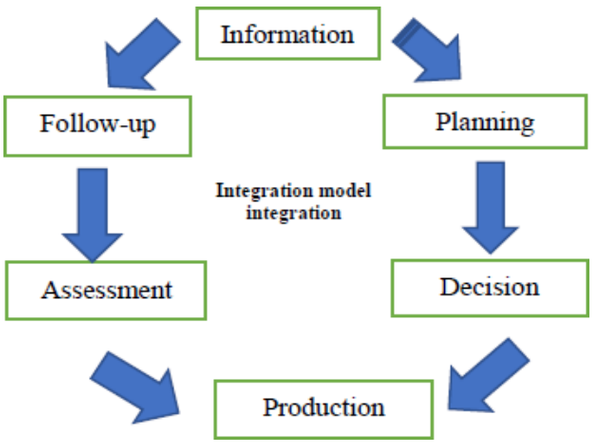
* ✉ [jose.gonzalez@uadec.edu.mx]

Abstract

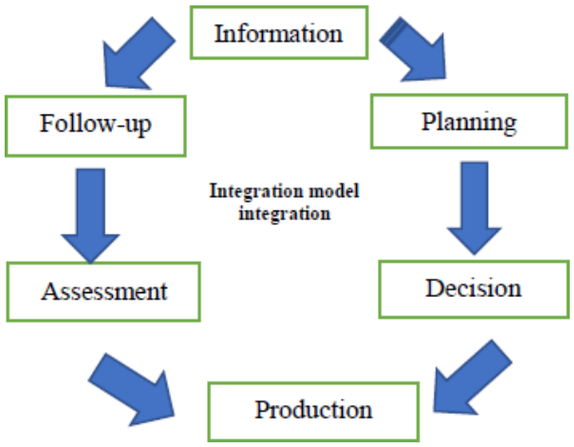
Society, culture and education have undergone significant changes; preparation in school accident prevention is of utmost importance. The students from basic level must be prepared with actions that guarantee safety, avoiding dangerous situations as much as possible, promoting the development of attitudes and values. A mixed, qualitative research was carried out with foundations of reliable databases of descriptive and quantitative type with the application of the validated instrument with a Cronbach's alpha of .81, calculation of the sample with a confidence level of 95%, a margin of error of 5%, interviews, statistical management and hypothesis testing, 9515% of the respondents.



Accidents, Prevention, School Risks

Resumen

La sociedad, la cultura y la educación a tenido un cambio significativo, resulta de suma importancia la preparación en prevención de accidentes escolares, los estudiantes desde nivel básico deben de estar preparados con acciones que garanticen la seguridad, evitando al máximo situaciones de peligro, promoviendo el desarrollo de actitudes y valores. Se realizo una investigación mixta , cualitativa con fundamentos de bases de datos confiables de tipo descriptivo y cuantitativo con la aplicación del instrumento validado con un alfa de Cronbach del .81 calculo de la muestra con u nivel de confianza del 95% un margen de error del 5%, entrevistas, manejo estadístico y comprobación de hipótesis, el 95.15% de los encuestados



Accidentes, Prevención, Riesgos Escolares

Area: Strengthening the scientific community

Citation: Gonzalez-de la Garza, José Gerardo, De la-Garza-Cienfuegos, Sandra Patricia, Otriz-Ozuna Mayra Yazmin and Aguilar-Sánchez, Ana María. [2025]. Key risk prevention factors, student transformation towards the Organization. Journal High School. 9[20]1-9: e6920109.

Introduction

Burgos García, 2011, Risk prevention and a culture of prevention must be present in the educational context, starting with basic education, as a driver of change in a society that we want to be safe and reliable.

(Gairín Sallán, Diaz Vicario, Rosales Acin & Sentinella Solé, 2014) made it clear that safety management in schools, like any organisational process, aims to improve the well-being of teachers, students, administrators and the educational community in general, optimise the organisation and functioning of the centre's activities, implement management processes in line with preventive cultural values, etc. In this sense, its management seeks to overcome unsafe situations by establishing preventive processes, strategies and behaviours.

(Barreto & Salazar, 2021) tell us that prolonged stress experienced by students due to school-related activities can affect academic performance, as well as other aspects of life, and that it is necessary to have valid instruments to diagnose this type of exhaustion, as timely diagnosis can prevent further complications. The World Health Organisation's Regional Committee for Europe (2007) resolved that one of the important objectives of its protective health policy was to reduce the incidence of major diseases and injuries by alleviating the suffering of those affected, based on the commitment of universities.

General Objective

The objective of this research is to identify teachers' knowledge of school risk prevention, train them in order to transform their education in school prevention, achieve transformation in students, and apply it in the organisation at the end of their professional career.

Specific Objectives

Analyse the main risk prevention factors in university institutions.

Assess university students' knowledge in the area of risk prevention.

Identify the main risk prevention strategies that contribute to the transformation of students into quick responders in the event of an emergency.

Development

In the field of education, the new 2030 agenda, through the SDGs, guarantees quality, inclusive and equitable education and promotes lifelong learning opportunities for students. Lozano & López, 2016, indicate in their research the importance of having knowledge of risk prevention, which is a determining factor in acquiring the necessary knowledge to contribute responsibly in the event of an accident.

Olazábal, 2024, states that employees must promote a culture of occupational risk prevention when carrying out their activities, comply with regulations, and provide companies with an analytical approach that helps them recognise their situation in terms of safety.

Adolescence represents a critical period in risk prevention behaviours (Tarín & Navarro, 2006). These are presented as practical evidence of exposure to risk factors, according to the World Health Organisation. 2013. Risk factors involve active or passive actions that pose a danger to well-being. It is urgent to wake up and begin by understanding and respecting the work of teachers in order to give the best of teaching and thus prepare our students so that the work they do in their professional lives has a real foundation of safety and risk prevention. In-depth research should be conducted on teachers' knowledge of their profession, based on their rights and obligations regarding safety and risk prevention. Aguado, 2021.

This social responsibility combines the proposal of the importance of a culture of health and safety in our educational centres. It is extremely important to train teachers in the area of safety focused on the prevention of school risks in educational units, Torres et al., 2024. The importance of the human factor in facing dangers, personality and behaviour in the face of risk, generates a transformation in the way we act in an emergency. As background to this research, training and education are fundamental to school risk prevention activities. To achieve this change, it is important to develop training and learning workshops for teachers, Mestanza et al., 2024, to promote a culture of self-care that allows for risk prevention, such as accident control or damage control. Mariño et al, 2016, propose a documentary structure that forms the safety and risk prevention system, which allows for the establishment of controls and the reduction of risks.

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Bahmani & Yibin, 2023. Defining a culture of prevention in schools means raising awareness of safety. Burgos, 2010, made it clear that in order to integrate risk prevention, the main factors must be taken into account, and one of the basic pillars is the teacher. Yang, 2022, educational accidents can be caused by factors beyond our control.

In 2017, 43% of universities were working with students on innovation and decision-making. Today, almost eight years later, 90% of institutions participate in events, workshops, and forums with the aim of creating comprehensive training in transformation and decision-making in organisations. Newman, T., & Beetham, H. (2017).

It is true that digital transformation within higher education institutions offers opportunities and challenges with opportunities for market participation. It is of great benefit in terms of security and the transformation of professionals towards value, efficiency, effectiveness, social interaction and globalised learning, which contributes to good decision-making. Mejía Delgado, O. A., & Mejía Delgado, Y. Y. (2022)

Traditionally, the university has been the institution par excellence in the transformation of student knowledge towards organisations, associated with the process of training professionals. Castillo Sánchez & Reyes Diaz, (2015).

Associated risk factors and their prevention from some psychological and neuropsychological perspectives (Alzate et al., 2012). To do this, it is necessary to return to the etymological roots of the words, which according to Andrade, Téllez and Giraldo (2013) date back to Latin, the desire to cease to exist by intentionally taking one's own life (Pérez-Olmos, Ibáñez-Pinilla, Reyes-Figueroa, Atuesta-Fajardo & Suárez-Díaz, 2008). These words are associated with conditions of self-elimination (Cervantes & Melo, 2008), and have transcended in various ways over time.

Taking into account an analysis of students in risk factors for cardiovascular disease at an average age of 19 or older, prevention programmes are essential to guide young people towards the development of healthier lifestyle habits. García-Gulfo, M. H., & García-Zea, J. A. (2012).

Risk factors that may arise with students with disabilities, how to prevent them, and multidisciplinary work and its benefits in providing quality care. Ortega Silva, P., & Plancarte Cansino, P. (2017).

Risk factors for eye diseases, prevention and diagnosis, allowing for better care from eye care professionals and corrective solutions; the sooner measures are taken, the greater the benefits. Milanés, AR, Molina, K., Milanés, M., Ojeda, & González, A. (2016).

Risk and protective factors that determine addiction prevention care. Addiction to toxic substances that, when introduced into the body, cause changes and alterations in human thought and behaviour, creating a public health problem. The use of harmful substances such as alcohol, tobacco, and other drugs produces changes in the user. Ramírez Martínez, Y., Rivera Vicencio, T., & Perry Cruz, E. (2018).

The study of the physical learning environment from an inclusive education perspective has traditionally focused on physical accessibility to educational spaces and the importance of creating physically accessible environments for educational inclusion. UNESCO, 2023.

Environmental factors in the classroom, another aspect to consider when planning, include factors such as lighting. Behavioural disorders are present at all stages of young people's lives. Currently, one in four families develops one or more disorders throughout their lives Hernández T., García A., Leal E., Peralta V., & Durán J. (2014).

H_1 = The more students learn about risk prevention factors, the more comprehensive their training in transformation and decision-making in organisations will be.

H_o= The less safety training there is, the greater the well-being of students will be.

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Box 1

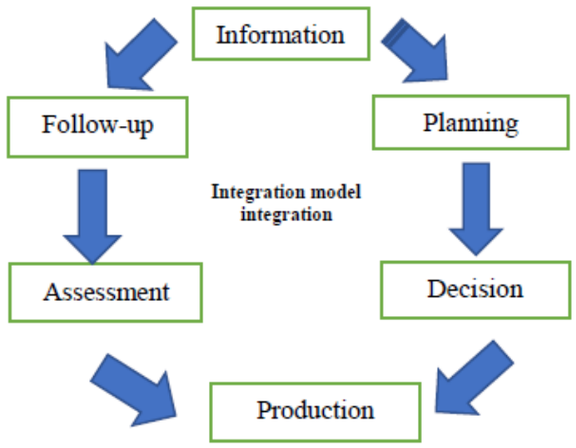

Figure 1

Comprehensive School Safety Model, which allows for the definition of a series of action, care and prevention protocols, achieving effective protection linked to a culture of prevention.

Alolah et al, 2014.

Box 2

Table 1

Most relevant regulations for educational institutions issued by the Ministry of Labour and Social Welfare in Mexico

NOM-001-STPS-2008	Buildings, Premises and Facilities.
NOM-002-STPS-2010	Fire Prevention and Protection
NOM-005-STPS-1998	Handling and storage of hazardous substances.
NOM-022-STPS-2015	Static Electricity
NOM-029-STPS-2011	Maintenance of electrical installations.

[Infrastructure Standards]

Methodology

Mixed methodological approach, qualitative with documented descriptive, non-experimental foundations, observation and interviews, quantitative, based on statistical results. An instrument was applied to 165 students with a confidence level of 90% and a margin of error of 6%, collecting data at a single point in time, at a single moment, for subsequent analysis in a database.

Results

As Gottlieb & Utesch (2022) point out, educating students about health and safety supports the arguments for safe and healthy performance, and it is the responsibility of teachers to ensure the health and safety of students. Young people in our environment lack training on health and safety both on campus and in the family or work environment.

Factor Analysis (Analysing 2 sections)

A construct was formed that allows a statistic to be chosen that seeks a correlation.

Box 3

Table 2

Bayesian correlation

Caracterización de distribución posterior para correlaciones por parejas[a]

			CUENTASCONCAPACITACION	CONOCIMIENTOPREVENSIONDERIESGOS
CUENTASCONCAPACITACION	Posterior	Moda		.062
		Media		.060
		Varianza		.006
	95% Intervalo creíble	Límite inferior		.209
		Límite superior		.092
	N		165	165
CONOCIMIENTOPREVENSIONDERIESGOS	Posterior	Moda	062	
		Media	060	
		Varianza	.006	
	95% Intervalo creíble	Límite inferior	.209	
		Límite superior	.092	
	N		165	165

In this analysis, the variance value is 0.06, indicating a posterior correlation of relative pair distribution, with a 95% credible interval with the same frequentist statistical probability, so Hypothesis H1 is accepted. Applying a health and safety plan in educational institutions contributes to the well-being of students. The results show a positive correlation with compatible data. Source: SPSS. See 25.

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Box 4

Table

Descriptive Analysis

Lim-Sup	Lim-Inf	X-X	Medias
2.51	1.62	2.06	1.61
2.51	1.62	2.06	1.56
2.51	1.62	2.06	2.04
2.51	1.62	2.06	2.37
2.51	1.62	2.06	2.11
2.51	1.62	2.06	2.59
2.51	1.62	2.06	2.18
2.51	1.62	2.06	2.18
2.51	1.62	2.06	2.68
2.51	1.62	2.06	1.55
2.51	1.62	2.06	1.39
2.51	1.62	2.06	2.55
2.51	1.62	2.06	2.17
2.51	1.62	2.06	1.69
2.51	1.62	2.06	2.72
2.51	1.62	2.06	1.62

Box 5

Table 4

Normality tests

Prueba de rangos con signo de Wilcoxon

Rangos

		N	Rango promedio	Suma de rangos
VAR00009 - VAR00006	Rangos negativos	33[a]	43.21	1426.00
	Rangos positivos	49[b]	40.35	1977.00
	Empates	83[c]		
	Total	165		

a. VAR00009 < VAR00006

b. VAR00009 > VAR00006

c. VAR00009 = VAR00006

Estadísticos de prueba[a]

	VAR00009 - VAR00006
Z	-1.401[b]
Sig. asintótica(bilateral)	.161

a. Prueba de rangos con signo de Wilcoxon

b. Se basa en rangos negativos.

```
NPAR TESTS
  /M-W= VAR00006 BY VAR00009(1 2)
  /K-S= VAR00006 BY VAR00009(1 2)
  /MISSING ANALYSIS.
```

Box 5

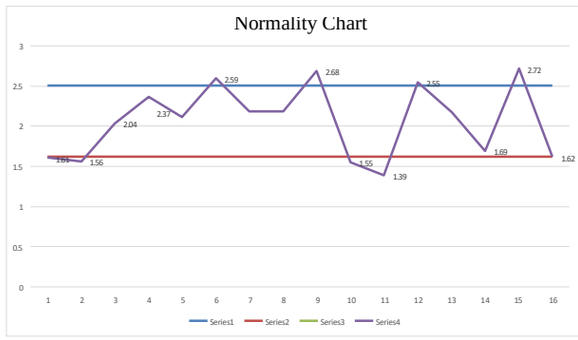

Figure 2

Normality

Reading and Interpretation (Normality)

The variables, 'Do you have knowledge of risk prevention?' (6) and 'Do you have training in cutting off the electricity supply in an emergency?' (9) exceed the upper limit of normality and are therefore significant in this study project, interpreting that the respondents 64.24% have no knowledge of this. The variables, Is there an emotional family bond? (10), and Do you communicate with your colleagues? (11), Do you receive favourable and supportive comments from your colleagues? (16), are below the lower limit of normality, indicating that they are not significant in risk prevention factors due to a lack of training and not knowing what to do in an emergency. The rest of the variables are within the normal range at ± 1δ. Therefore, the main hypothesis is accepted**.** The more students learn about risk prevention factors, the more comprehensive their training in transformation and decision-making in organisations will be.

Lilliefors significance correction.

Source: SPSS system. Version .25

The normality test is performed to identify the applicable type of statistics (see table in Annex 27).

In the normality test

We will use the Kolmogorov-Smirnov test, as we have N= 165 data points, and the Shapiro-Wilk test is used with data sets of less than 50 data points.

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Proposing the hypotheses

Ho= The data has a normal distribution
Ha= The data does not have a normal distribution

Significance level
Confidence level = 95%
Significance (alpha) = 5%

Decision criterion
If p< 0.05, we reject Ho and accept Ha_a
If p>0.05, we accept Ho and reject Ha

Decision and conclusion

As p=0 < 0.05, we reject Ho, i.e. the data do not have a normal distribution, and we accept Ha, i.e. the data do not have a normal distribution. Therefore, we will apply non-parametric statistics**.**

Box 6

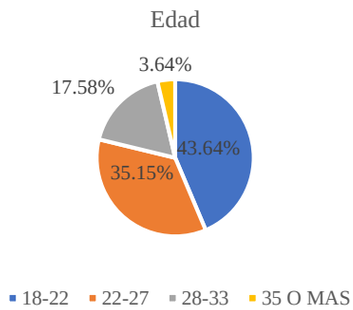

Figure 3
78.79% of respondents are aged between 18 and 27.

Box 7

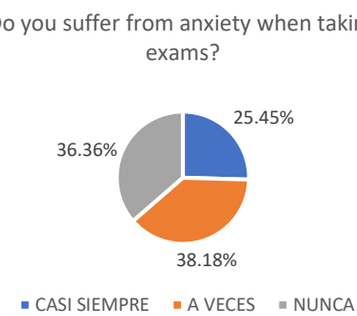

Figure 4
25.45% of respondents mention suffering from anxiety when taking an exam.

Box 8

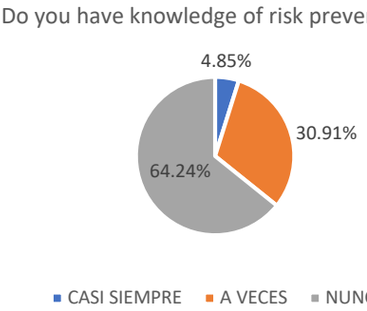

Figure 5
Only 4.85% of respondents feel knowledgeable about risk prevention.

Box 9

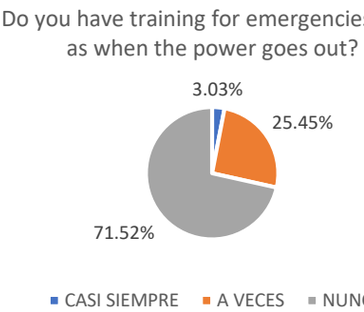

Figure 6
Only 3.03% of students are trained in case of an electrical emergency.

Box 10

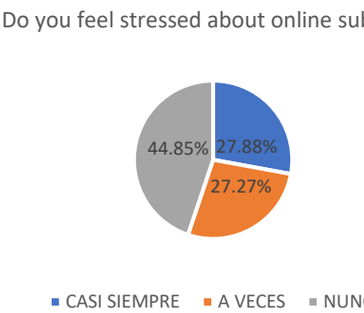

Figure 7
55.15% mentioned feeling stressed when taking the course online, due to occasional internet failures.

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Conclusions

The main risk prevention factors in the country's universities found qualitatively.

School safety is a discipline that involves the protection of students and teachers (Diaz Vicario, 2021).

Risk factors

- Design and use of small school spaces in overcrowded conditions.
- Lack of attention to discipline
- Instability
- Risks of harassment of teachers by students or vice versa
- Bullying
- Lack of supervision
- Eye and cardiovascular diseases, disabilities.

Main risk prevention factors

- Positive school climate
- Clear and high expectations for student performance
- Inclusive values and practices
- Student environment of camaraderie
- High levels of participation among teachers, students, and families
- Opportunities for students to acquire skills and abilities
- Health prevention programmes
- Prevention and support programmes for emotions such as stress and anxiety.

Conflict resolution strategies

In areas as important as safety and health, which guarantee and protect human beings, it is possible to take measures at school, contributing to a culture of prevention of school risks and the possibility of avoiding them, by providing training on a series of preventive actions.

With regard to the diagnosis made of university students, when measuring the degree of knowledge in school accident prevention, safety and health education must be a continuous process with safety update programmes, promoting training for teachers and students in case. of an emergency, it is very important to know what to do and to act responsibly in order to save a life.

According to the fieldwork carried out, the results found are significant, as 95.15% of students do not feel trained to act responsibly in the event of an emergency, and 96.97% do not know how to act appropriately in the event of an electrical emergency. Therefore, the main hypothesis is accepted: the more students learn about risk prevention factors, the more comprehensive their training in transformation and decision-making in organisations will be.

The importance of having a culture of risk prevention among university students is a determining factor in the acquisition of knowledge so that graduates can fulfil their professional duties in organisations.

Safety Strategies

1. Have a parent or guardian register
2. Organise university safety workshops
3. Organise conferences
4. Organise drills
5. Have surveillance of access to the faculty
6. Nursing unit
7. Have fire extinguishers and risk equipment
8. Put the safety manual into practice

It is necessary to constantly assess risks and decide which strategy is appropriate for the needs of the educational centre.

The risk culture focuses on three concepts

1. Prevention
2. Emergency
3. Reconstruction

Activities carried out as preventive measures, thereby reducing risks. Leue, Cruz & Ocampo, (2011).

Based on the results found, the following model, developed in-house, is shown for school safety and risk prevention.

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Box 11

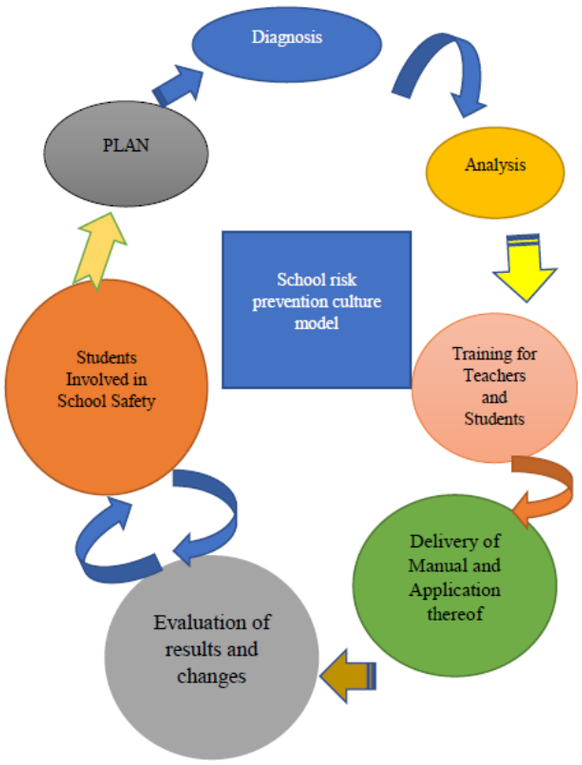

Figure 8
School Risk Prevention Model

Own development. - Guidance and recommendations for the implementation of school emergency protocols as part of the safety plan development process, seeking to take action within the educational community that will enable them to prepare and respond effectively and efficiently in the event of a disaster or emergency.

Risk prevention begins with planning, through an assessment of the most common risks in schools, where prevention strategies are applied in the following areas:

1. Prevention of cardiovascular disease
2. Prevention of obesity
3. Prevention of emotional problems
4. Prevention of drug addiction
5. Prevention in infrastructure
6. Prevention of sports risks
7. Prevention of electrical risks
8. Prevention of bullying risks

Create a training manual for teachers and students on how to respond in the event of an emergency.

References

Alzate, L., Betancur, M., Castaño, J., Cañón, S., Castellanos, P., Guerrero, J., Llanos, C., et al (2012). Factor de riesgo suicida según dos cuestionarios, y factores asociados en estudiantes de la Universidad Nacional de Colombia sede Manizales (Colombia), 2011. Centro de Investigaciones, Universidad de Manizales, Facultad de Ciencias de la Salud 2-16.

Andrade, J. Téllez, C. & Giraldo, L. (2013). La autopsia psicológica en Colombia: Exploración psicobiográfica del suicidio. Revista Internacional de Psicología 12(2). ISSN 1818-1023.

Bahmani y Yibin A. (2023) Comportamiento de evacuación de los estudiantes durante una emergencia en las escuelas: una revisión sistemática de la literatura. International Journal of Disaster Risk Reduction.

Barreto-Osma DA, Salazar Blanco HA. Agotamiento Emocional en estudiantes universitarios del área de la salud. Univ. Salud. 2021;23(1):30-39. DOI:

Burgos García, A., (2010). La integración de la seguridad y salud en los centros escolares: una visión práctica desde el profesorado. Revista de Investigación Educativa, 28(1),79-98. [fecha de Consulta 22 de noviembre de 2024]. ISSN: 0212-4068.

Burgos, G. (2011) Prevención de riesgos laborales en los centros educativos: análisis de los sistemas de formación. Universidad de Granada España. DOI: 10.4438/1988-592X-RE-2011-361-134

Castillo Sánchez, L., Reyes Díaz, S. (2015): "Los modelos de relación universidad-empresa", Revista Caribeña de Ciencias Sociales (julio 2015).

Cervantes, W. & Melo, E. (2008). El suicidio en los adolescentes: Un problema en crecimiento. Revista de la Facultad de Ciencias de la Salud DUAZARY 5(2), 148-154.

Díaz-Vicario, A., & Gairín Sallán, J. (2021). La formación en salud y seguridad del profesorado para la gestión de centros educativos seguros y saludables. Innovación educativa, (31).

ISSN:2523-0336
RENIECYT-SECIHTI: 1702902

Gairín Sallán, J., Díaz Vicario, A., Rosales Acin, M., & Sentinella Solé, X. (2014). La autoevaluación para la mejora de la seguridad integral en centros educativos. EDUCAR, 50(2), 363-381.

Gottlieb, M., & Utesch, M. C. (2022). Publish or Perish: A Scientific Blueprint for a Journal Article. International Journal of Engineering Pedagogy (iJEP), 12(3), pp. 171–177.

García-Gulfo, M. H., & García-Zea, J. A. (2012). Prevalencia de factores de riesgo cardiovascular en jóvenes de una institución universitaria. Revista de Salud Pública, 14(5), 822-830.
.
Hernández-Benítez, C. T., García-Rodríguez, A., Leal-Ugarte, E., Peralta-Leal, V., & Durán-González, J. (2014). Factores ambientales relacionados a trastornos depresivos. Revista Médica del Instituto Mexicano del Seguro Social, 52(5), 574-579.

Lozano, C. & López, J. (2016). Niveles de Ansiedad y Estrategias de Afrontamiento de un Grupo de Estudiantes Universitarios en el Valle de Aburra. Corporación Universitaria Minuto de Dios, Bello, Colombia.18.

Leue-Luna, M. M., Cruz-Cruz, B. E., & Ocampo-Dorantes, C. (2011). Percepción de la efectividad de estrategias de prevención y mitigación del riesgo en situación de desastre. Horizonte Sanitario, 10(3), 18-28.

Mejía Delgado, O. A., & Mejía Delgado, Y. Y. (2022). Transformación digital en las instituciones de educación superior a partir del Covid-19: madurez tecnológica de los estudiantes en Colombia. Revista Universidad Y Empresa, 23(41).

Mestanza Segura, Pedro Alexander, Aranda Arízaga, Juan Israel, Aranda Arizaga, Carlomagno Ulises, & García García, Darwin Mesías. (2024). Riesgos mecánicos y su influencia en la seguridad laboral de la empresa Guritbalsaflex Cía. Ltda. Revista Cubana de Salud y Trabajo, 25(3). Epub 11 de octubre de 2024.

Milanés Armengol, AR, Molina Castellanos, K., Milanés Molina, M., Ojeda León, Á. M., & González Díaz, A. (2016). Factores de riesgo para enfermedades oculares. Importancia de la prevención. MediSur, 14 (4), 1-9.

Newman, T., & Beetham, H. (2017). Student digital experience tracker 2017: the voice of 22,000 uk learners. JISC.

Olazábal, 2024. Mejora en la prevención de riesgos laborales en seguridad y salud ocupacional: caso empresa metalmecánica en una unidad minera. (2025). Industrial Data, 27(1), 115-136.

Organización Mundial de la Salud (2013). Factores de riesgo.

Ortega Silva, P., & Plancarte Cansino, P. (2017). Discapacidad: factores de riesgo y prevención y profesionales relacionados. Enseñanza e Investigación en Psicología, 22(2), 183-196.

Ramírez Martínez, Y., Rivera Vicencio, T., & Perry Cruz, E. (2018). Factores de riesgo y de protección determinantes para la atención social en la prevención de adicciones. Revista Salud y Bienestar Social, 2(1), 35-42.

Tarín, M.; Navarro J. (2006). Adolescentes en riesgo. Casos prácticos y estrategias de intervención socioeducativa. Madrid: Editorial CCS

Torres Valle, Antonio, Blanco García, Yaíma, Caballero Reyes, Claudia María, Elías Hardí, Lidia Lauren, Garea Morea, Bárbara, Perdomo Ojeda, Manuel, Cárdenas, Jorgelina César, Armas Cardona, Raúl, Carbonell Siam, Ana Teresa, & Torres Vicente, Nubia. (2024). El factor humano en la seguridad: una visión desde la conducta frente al riesgo. Revista Cubana de Salud y Trabajo, 25(3). Epub 10 de noviembre de 2024.

Pérez-Olmos, I., Rodríguez-Sandoval, E., Dussán-Buitrago, M. & Ayala-Aguilera, P. (2007). Caracterización psiquiátrica y social del intento suicida atendido en una Clínica Infantil, 2003-2005. Revista de Salud Pública 9(2), 230-240.

UNESCO. (2023). La inclusión de educandos con discapacidad en entornos de aprendizaje de calidad: Herramienta de apoyo a los países en su avance hacia la educación inclusiva.

Yang, J. (2022). Riesgos de seguridad de las escuelas primarias y secundarias en China: un análisis sistemático utilizando el método AHP-EWM.

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Article

Outcomes of mentoring in access to higher education and professional development: A Bibliometric analysis

Resultados de la mentoría en el acceso a educación superior y el desarrollo profesional: Análisis bibliométrico

Barradas-Arenas, Ulises Daniel*[a], Vázquez, Ma-Rosario[b] and Pérez-Cruz, J. A.[c]

[a] Universidad Autónoma del Carmen • 7560-2023 • 0000-0001-7122-6582 • 1006490
[b] Universidad Autónoma del Carmen • 7392-2023 • 0000-0002-4570-2546 • 826502
[c] Universidad Autónoma del Carmen • 4281-2025 • 0000-0002-9403-6519 • 468673

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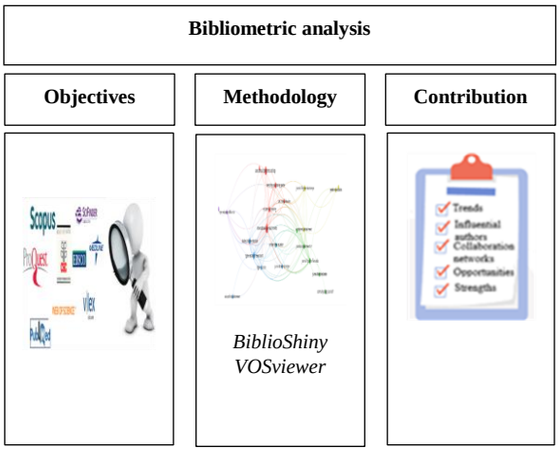
* ✉ [ubarradas@pampano.unacar.mx]

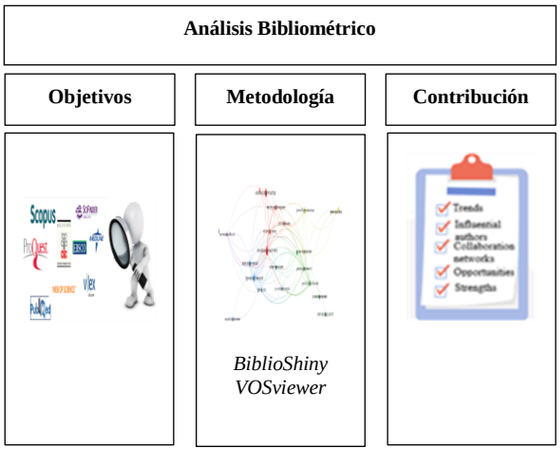
Abstract

This study analyzes the impact of mentoring in higher education through a bibliometric review of research published between 1993 and 2025 in the Scopus database. It identifies key trends, influential authors, collaboration networks, and emerging themes related to professional development, equity, diversity, and inclusion. Using tools such as Biblioshiny and VOSviewer, thematic clusters and relationships among keywords, authors, and journals were visualized. The findings reveal a growing interest in mentoring as a strategy to enhance student retention, leadership, and academic development, particularly among underrepresented populations. Institutional and cultural barriers that hinder effective implementation were also identified, emphasizing the need for structured, sustainable, and culturally relevant programs. The analysis further highlights the increasing role of digital technologies in mentoring models, while noting that these do not replace the value of human support. The study concludes that mentoring is essential for promoting more inclusive, equitable, and academically supportive educational environments.

Resumen

La investigación analiza el impacto de la mentoría en la educación superior mediante una revisión bibliométrica de estudios publicados entre 1993 y 2025 en Scopus. Se identifican tendencias, autores influyentes, redes de colaboración y temas emergentes relacionados al desarrollo profesional, la equidad, la diversidad y la inclusión. Con herramientas como Biblioshiny y VOSviewer se visualizaron clústeres temáticos y relaciones entre palabras clave, autores y revistas. Los resultados muestran un creciente interés por la mentoría como estrategia para mejorar la retención estudiantil, el liderazgo y la formación académica, especialmente en poblaciones subrepresentadas. También se observan barreras institucionales y culturales que dificultan su implementación, lo que subraya la necesidad de programas estructurados y culturalmente pertinentes. Asimismo, se destaca el papel emergente de las tecnologías digitales en los modelos de mentoría, sin sustituir el valor del acompañamiento humano. Se concluye que la mentoría es esencial para promover entornos educativos más inclusivos y equitativos.





Mentoring, Higher education, Bibliometrics

Mentoría, Educación superior, Inclusión, Bibliometría, Liderazgo

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Introduction

In recent decades, mentoring in higher education has established itself as a key strategy for promoting the academic, professional, and personal development of university students. Several studies have shown that mentoring relationships contribute significantly to student success, strengthen career paths and even promote institutional transformations aimed at equity and inclusion (Risner et al., 2020; Lund et al., 2019).

Mentoring has become key to personalised support, promoting formative dialogue and integrating both teachers and students within their respective educational contexts. At the same time, its value has been recognised in addressing specific issues such as gender inequality, organisational barriers and the lack of representation of historically marginalised groups (Barner et al., 2023; Cullen and Luna, 1993). From the teaching staff's point of view, this practice becomes a key factor in retaining academics, thereby strengthening continuous assessment programmes. All these mechanisms are highly effective but are affected by a lack of time and resources (Fountain and Newcomer, 2016).

Therefore, higher education institutions are in an initial phase of incorporating solid principles of equity, diversity, and inclusion into their policy structures, recognising that access alone does not guarantee the academic or professional success of their students (Misra et al., 2017). Similarly, mentoring is not only part of individual support, but also a tool that transforms and creates more equitable and diverse educational environments.

In turn, new information technologies are being integrated into the training processes of mentoring models with the support of artificial intelligence, opening up possibilities for improvement in academic support without leaving behind the academic support that will always be key within these processes as the central axis of the training process (Chang et al., 2024).

The aim of this research is to analyse, based on a bibliometric review, the main trends, approaches and challenges related to mentoring in higher education, emphasising its link to professional development, equity and inclusion.

To this end, an exhaustive analysis of the scientific output indexed in the Scopus database is carried out, using specialised tools such as Biblioshiny and VOSviewer, which allow the identification of thematic patterns, collaboration networks and influential authors in the field of study.

Mentoring in higher education

Mentoring in the context of higher education has established itself as a fundamental strategy for supporting the academic, professional and personal development of university students. It mentions that the use of mentoring improves academic results, while also focusing on how mentoring effectively transforms students, contributing both to their individual success and to institutional development.

Mentoring in higher education is based on identifying key situations for students in which a close and effective relationship with the mentor can be established in order to promote dialogue and professional development. It also mentions that mentoring is crucial for addressing gender inequality, especially in the development of leadership skills.

They argue that mentoring is a valuable resource, as it not only impacts students but also develops skills in mentors. They mention that mentoring is identified as a powerful resource, but it can be limited by cultural and organisational barriers.

From the perspective of faculty, mentoring facilitates the integration of new teachers, which benefits higher education institutions in terms of faculty retention and development and strengthens continuous assessment programmes. At the same time, they mention that less experienced academics often find it difficult to access mentors due to a lack of time, which limits their ability to participate in the mentoring process.

They mention that the Backpack-to-Briefcase programme connects students by developing various necessary skills with which they can establish networks for employability in pursuit of their professional development.

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Equity, diversity and inclusion

In recent decades, higher education institutions have intensified their efforts to build more equitable, diverse, and inclusive environments, aware that access to education alone does not guarantee the retention or academic success of all students. They mention that by ensuring equitable access to resources, recognition, and relationships, solid support can be built to improve gender equity in academic settings.

From a mentoring perspective, increased confidence is a benefit that can be relevant to the creation of inclusive environments. Universities need to make efforts to include inclusive and equitable work cultures, so that students, regardless of their background, receive the same level of support and opportunities for professional development.

Learning communities offer opportunities for higher education institutions to create more inclusive organisational cultures. In turn, it mentions that academic leadership is suffering from gender inequality, which is why greater female representation is required to promote equality. The excess of men in mentoring is a limiting factor for the professional development of women, all of which limits equity and diversity in higher education. Therefore, it is necessary to cultivate gender diversity by promoting new academic leaders with a greater understanding that highlights the importance of equity. All of this must be aligned with aspirations, competencies, and cultural context.

Impact of new information technologies on mentoring

Information technologies have been assertively incorporated into the construction of mentoring models for university students based on artificial intelligence. Despite their high level of efficiency, human mentors remain essential for providing personalised support and cultural sensitivity, which is crucial for inclusive and equitable mentoring.

Some universities use social media platforms to implement online mentoring spaces where teachers share their experiences and strategies, generating new forms of mentoring with attractive and innovative techniques.

Methodology

This section details the procedure used to select the articles that make up the information database used in the research. It explains the inclusion and exclusion criteria applied, as well as the sources consulted and the search strategies implemented to ensure the collection of relevant, high-quality documents.

It also provides a comprehensive description of the process of analysing the information contained in the database, specifying the techniques and tools used for the categorisation, synthesis and interpretation of the extracted data. Key methodological aspects are included, such as the analysis approach, coding criteria and strategies used to ensure the validity and reliability of the information processed.

Selection of articles

The Scopus database was used for this study, in which 158 studies were found. The terms mentoring, higher education, and professional development were used to integrate the search formula. Table 1 shows the integrated formula according to its categories, types of documents, and time frame.

Box 1

Table 1
Search formula

Formula	(TITLE-ABS-KEY ("mentorship" OR "mentoring" OR "mentor program" OR "mentoring relationship") AND TITLE-ABS-KEY ("higher education" OR "college access" OR "university admission" OR "tertiary education") AND TITLE-ABS-KEY ("career development" OR "professional growth" OR "employment outcomes" OR "career advancement" OR "job placement"))
Categories	University mentoring
Types of documents	Articles, book chapters, theses, books
Temporality	1993-2025

Source: Own Creation

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Analysis of selected information

Complete information and references for the 158 articles were extracted from SCOPUS. This information was used to create the database for this study. The bibliometric analysis was performed using the biblioshiny and VOSviewer tools. Using biblioshiny for the bibliometric review, an analysis was performed on the articles published per year in the study for the period 1993 to 2025.

Within the VOSviewer tool, various analyses were carried out with the aim of examining the underlying relationships and structures in the selected database. Through this bibliometric analysis platform, multiple aspects related to scientific production and the interaction between authors, institutions, keywords, and cited references were explored, which are mentioned below:

1. The bibliographic coupling analysis between academic journals shows how different journals are related based on shared references, allowing for the identification of thematic nuclei and implicit collaborations in the field of study.

2. In turn, an analysis of the co-occurrence of keywords and authors is carried out. This type of analysis is useful for understanding how research topics are grouped and which authors are associated with certain keywords. The bibliographic coupling map is used to analyse the relationship between documents based on the references they share. The co-citation map of referenced citations identifies which authors or works have been cited together most frequently in the academic literature.

3. The co-citation map of academic sources allows us to identify how journals and academic sources are grouped based on how many times they are cited together in other scientific articles. In turn, the co-citation map of authors allows us to identify which authors have been cited together most frequently in academic literature, which helps us understand the thematic relationships within a field of research.

In the case of the Biblioshiny tool, a detailed bibliometric analysis was carried out with the aim of examining scientific output, collaboration networks and research trends within the selected field of study. The main analyses carried out are described below:

1. Annual scientific output: this shows the evolution of annual scientific output in terms of articles published from approximately 1993 to 2025. Average Citations per Year shows the evolution of the average number of citations per article.

2. Scientific output by institutional affiliation. Most universities began their output in the last decade, which could indicate a recent surge in interest in research on mentoring, professional development, and training in higher education.

Documents with the highest number of citations. Taken together, these works stand out not only for their volume of citations, but also for their relevance and ability to guide new lines of research, especially on issues related to equity, academic leadership, and institutional strategies to support professional development.

Results

This section presents the results of the bibliometric review and explains scientific progress through the publication of articles in highly relevant journals. It then presents network analyses with the aim of recognising and analysing clusters of knowledge. Finally, it shows network analyses, bibliographic coupling, annual scientific output, and documents with the highest number of citations.

Co-occurrence and co-word network analysis

Based on a database of 158 articles, a network analysis was performed by co-occurrence and co-words of 777 keywords used by the authors. In accordance with the restrictions managed by the VOSviewer tool, 65 keywords with a minimum of three occurrences were taken (Figure 1). According to the results obtained, a dense network with various interconnected words can be observed, with a total of four clusters. The yellow ones are related to higher education, peer mentoring, medical schools, and well-being.

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The red clusters focus on the terms students, inclusion, equity, engineering education, and student development.

The green clusters are related to university, education, humans, professional competence, scientific articles, and surveys. The blue clusters include terms associated with mentoring, career development, leadership, gender, and diversity. Several key connections can be observed, such as higher education, which is a central node connecting multiple areas, indicating that it is a broad and highly relevant topic. In turn, mentoring and career development are strongly interconnected with terms such as mentors, leadership, and gender equity. Finally, students and employability are related to engineering education, equity, and professional development.

Box 2

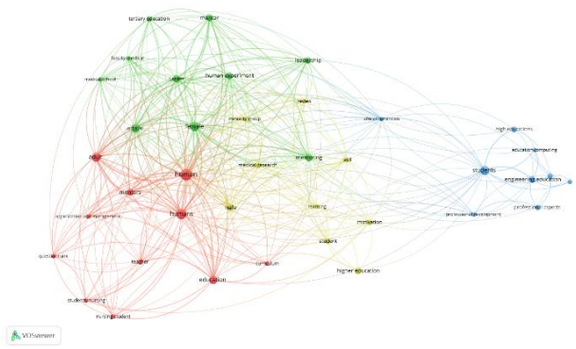

Figure 1

Co-occurrence of keywords used by the author separated by clusters about mentoring in access to higher education and professional development.

Source: Own elaboration based on SCOPUS using VOSviewer

These clusters allow us to identify the impact of mentoring on higher education, professional development, and gender equality. Career development and leadership are key topics within the analysis. There are connections between mentoring, medical education, and well-being, suggesting a focus on the professional training of university students. In turn, the analysis of terms such as inclusion and equity highlights the importance of diversity in educational processes.

Analysis of the co-citation network of authors, countries, and institutions

This analysis allows us to identify which authors have been cited together most frequently in academic literature, which helps us understand the thematic relationships within a field of research. Within this research project, VOSviewer was used to calculate and generate a map of joint citations of authors. The analysis identified a co-citation network of authors comprising 11,152 authors described in the reference lists of the documents in the database. A threshold of no less than nine co-citations per author was set, which produced a co-citation map comprising 63 authors (Figure 2).

Authors such as Johnson, Allen, Lentz, Poteet, and Chao, who have developed in the field of mentoring, academic tutoring, and career development, form the yellow cluster. In turn, authors who have researched leadership priorities, workplace mentoring, and organisational development, such as Ragins, Strauss, Johnsrud, and Dreher, belong to the green cluster.

On the other hand, related authors working in academic networks, mentoring in science, and collaboration in higher education are Scandura, Blackburn, Sullivan, and Baruch in the blue cluster. The red cluster includes Kram, Carnes, O'Meara, and Griffin and their presence in academic mentoring research with an emphasis on gender equity and inclusion in higher education. Finally, the purple cluster is composed of Braun, Jackson, and Bridgestock, who have generated new methodologies for evaluating the impact of mentoring and professional development in education and the labour market.

Johnson and Allen have key connections with other researchers in mentoring and professional development, indicating that they are key references in this field. Kram K.E. is a central author in the red group, suggesting that his work on mentoring and professional networks is fundamental to studies on equity and inclusion.

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Box 3

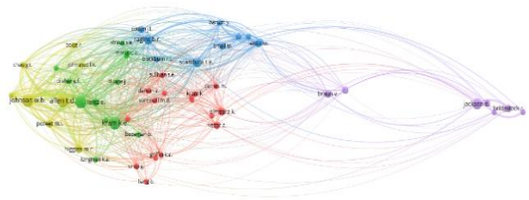

Figure 2

Co-citation of authors on mentoring in access to higher education and professional development

Source: Own elaboration based on SCOPUS using VOSviewer.

Analysis of bibliographic coupling between academic journals

The analysis of bibliographic coupling between sources reveals a structured network of academic journals that share common references, which demonstrates the existence of consolidated thematic communities within the field of study. The International Journal of Mentoring and Coaching in Education is positioned as a central node within the map, highlighting its coordinating role in research on mentoring in educational contexts (Figure 3).

Box 4

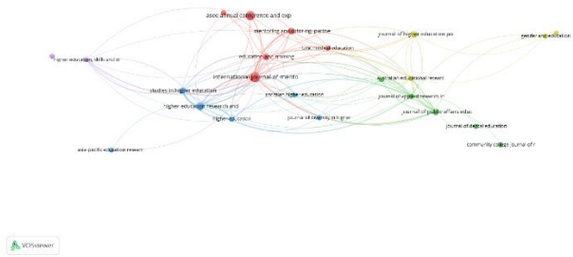

Figure 3

Bibliographic linkage between academic journals on mentoring in access to higher education and professional development.

Source: Prepared internally from SCOPUS based on VOSviewer

Several clearly defined thematic clusters can be seen around it. The first group, made up of journals such as Mentoring and Tutoring: Partnership in Learning, Education and Training, and BMC Medical Education, focuses on professional and medical training, which corroborates the interest in mentoring across all technical-clinical divides.

The second group, comprising publications such as Studies in Higher Education, Higher Education, and Higher Education Research and Development, illustrates scientific output on higher education policies, practices, and descriptive evaluation.

Scientific output by institutional affiliation

The graph below shows the evolution in the number of publications generated by various universities between 2001 and 2025. The trend shows a gradual and, in some cases, accelerated growth in the production of articles related to research on mentoring and higher education (Figure 4).

It can be seen that Vanderbilt University leads as the institution with a recent increase in research output, with a total of 17 publications by 2023, remaining the leader in terms of volume. It is closely followed by Griffith University, which has shown sustained growth since 2012, ranking second from 2024 onwards. Universities such as Southampton, Tasmania, and Texas show consistent participation, especially since 2018. The graph shows that most universities began their production in the last decade, which could indicate a recent surge in interest in research on mentoring, professional development, and training in higher education.

Box 5

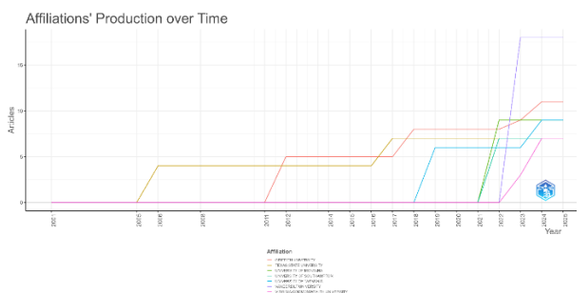

Figure 4

Scientific output by institutional affiliation on mentoring in access to higher education and professional development

Source: Own elaboration based on SCOPUS using Bibliometrix

Annual scientific output

The graph shows a dynamic evolution in the generation of publications over time. From the first records in the 1990s, output was sporadic and low, not exceeding five articles per year until approximately 2014 (Figure 5).

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Box 6

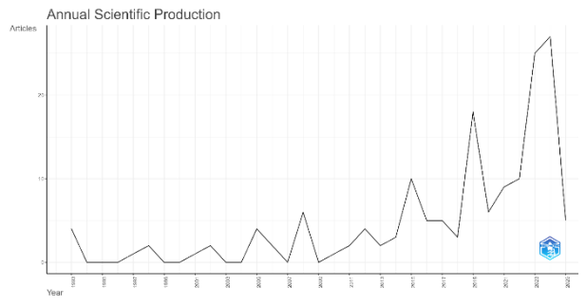

Figure 5

Annual scientific output on mentoring in access to higher education and professional development.

Source: Own elaboration based on SCOPUS using Bibliometrix.

It can be seen that 2015 shows steady growth, with significant peaks in 2018, 2022 and 2024, especially in 2024, when the highest number of publications (more than 25 articles) was reached, reflecting a boom in interest and consolidation of research in this field. The increase is related to the strengthening of academic networks, the consolidation of lines of research on mentoring, equity and professional development, as well as greater visibility of these issues on the global educational agenda. In turn, this trend confirms the growing academic and scientific interest in the topics addressed by this study, as well as the contemporary relevance of mentoring in higher education as a subject of research.

Documents with the highest number of citations

Bibliometric analysis of the most cited documents reveals a set of fundamental works that have shaped the field of research on mentoring, professional development and higher education. In absolute terms, the article by Zellers et al. (2008) ranks as the most cited, with 167 citations and an annual average of 9.28 citations, which denotes its sustained influence over time. However, when considering the citation rate per year and its normalised impact, the work of Zacher et al. (2019) stands out, with a total of 120 citations, an annual average of 17.14 and a normalised citation rate (NCR) of 5.78, indicating high visibility and recent impact in the academic literature (Table 2).

Other reference documents include Girves et al. (2005) and Santos & Reigadas (2002), both with 116 citations, which have been widely used as theoretical references in research on academic mentoring, particularly in underrepresented populations. Also relevant is the contribution of Cross et al. (2019), with 84 citations and an TCn of 4.04, reflecting its growing influence in contemporary studies.

Box 7

Table 2

Documents with the highest number of citations on mentoring in access to higher education and professional development.

Document	Total citations	CT scan per year	Tc Standardised
(Zellers et al., 2008)	167	9.28	3.40
(Zacher et al., 2019)	120	17.14	5.78
(Girves et al., 2005)	116	5.52	2.51
(Santos & Reigadas, 2002)	116	4.83	1.98
(Cross et al., 2019)	84	12	4.04
(Green et al., 2008)	84	4.67	1.71
(Campbell et al., 2012)	62	4.43	2.64
(Okolie et al., 2020)	50	8.33	3.03
(Crawford & Smith, 2005)	50	2.38	1.08

Source: Own Creation

Discussion

This systematic review has consistently shown that mentoring programmes in higher education have a significant and positive impact on the academic, professional and psychosocial development of students and academics, particularly those belonging to historically underrepresented groups. In line with the findings of Girves (2005) and Zellers et al. (2008), it has been confirmed that structured mentoring contributes to greater retention, academic satisfaction and career development, which is especially relevant in contexts of diversity and inclusion.

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One of the most notable contributions is the validation of the ethnically matched mentoring model for Latino students (Santos and Reigadas, 2002), who report higher levels of academic self-efficacy and clarity in their goals when guided by mentors of the same ethnicity. This result coincides with the literature's emphasis on the importance of sociocultural factors in mentoring relationships. Likewise, it was observed that the frequency and quality of mentor-mentee contact directly affects the perception of support and satisfaction with the programmes.

With regard to specific populations, studies such as that by Crawford and Smith (2005) show that the lack of mentoring for African American women in administrative positions generates feelings of isolation and frustration, reinforcing the need for institutional strategies to promote accessible and sustainable mentoring relationships. Along the same lines, Cross et al. (2019) highlight that, for female academics in health, mentoring improves self-confidence, job satisfaction and professional development, but they also point to institutional barriers, such as the lack of formal recognition and the imbalance between workloads and mentoring opportunities.

Another important finding is the link between mentoring and leadership development, as demonstrated by Campbell et al. (2012), who identify that mentors who promote personal development and leadership empowerment favour the formation of socially responsible leadership skills in students. This aspect broadens the traditional view of mentoring beyond academic guidance to a comprehensive training approach.

On the other hand, the review also reveals certain limitations in the current literature. Many studies lack rigorous comparative or longitudinal methodologies that allow clear causal relationships to be established, as pointed out by Zellers et al. (2008). In addition, there remains a gap in the evaluation of mentoring programmes in international contexts and in the later stages of academic careers, as noted by Zacher et al. (2018), who urge the integration of theories such as career development throughout the life cycle.

Finally, innovative proposals were identified, such as the creation of professional training centres with mentoring services (Okolie et al., 2020), which could constitute a replicable model in various institutions to institutionalise mentoring as a systematic practice.

In summary, the results of this review highlight the transformative value of mentoring in higher education, but also draw attention to the need for greater research rigour, contextual inclusion, and programme design that is sensitive to cultural, gender, and career stage differences.

Conclusions

The bibliometric review shows that mentoring in higher education is a fundamental tool for the academic, professional and personal development of students and academics, especially those belonging to historically underrepresented groups. The growing evolution in scientific production and academic interest reflects the consolidation of this field as a relevant subject of study at the global level.

Analyses conducted with tools such as VOSviewer and Biblioshiny identified thematic clusters, influential authors, and collaborative networks between institutions and countries. Topics such as gender equity, inclusion, academic leadership, and professional training stand out as central themes in recent literature. In turn, a strong interconnection between mentoring, career development, and higher education was found, underscoring the comprehensive approach taken by this line of research.

It is concluded that well-structured mentoring programmes have a proven positive impact on student retention, academic satisfaction, and leadership development. However, significant challenges remain, such as a lack of institutional recognition, the need for sustainable and culturally sensitive programmes, and a lack of longitudinal and comparative studies to strengthen the empirical evidence.

Finally, it is suggested that higher education institutions adopt contextualised mentoring models, promote mentor training, and foster organisational structures that support this practice as an integral part of their academic and professional development policies.

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Contribution of the authors

Barradas Arenas, Ulises Daniel: Contributed the conceptual idea for the article. *Vázquez Aragón, Ma-Rosario*. *Pérez Cruz José Alonso*.

Availability of data and materials

The materials are available by contacting any of the authors via email.

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Abbreviations

TCn Standardised citation rate

References

Background

Barner, J., Quiñones-Boex, A., & Warholak, T. (2023). Gender inequity: Enough talk, time for action. *Journal of the American Pharmacists Association*, *63*(1), pp. 39–42.

Chang, C., Hui, J., Justus-Smith, C., & Wang, T. (2024). Navigating STEM careers with AI mentors: a new IDP journey. *Frontiers in Artificial Intelligence*, pp. *7*.

Cullen, D., & Luna, G. (1993). Women Mentoring in Academe: addressing the gender gap in higher education. *Gender and Education*, *5*(2), pp. 125–137.

Fountain, J., & Newcomer, K. (2016). Developing and Sustaining Effective Faculty Mentoring Programs. *Journal of Public Affairs Education*, *22*(4), pp. 483–506.

Misra, J., Smith-Doerr, L., Dasgupta, N., Weaver, G., & Normanly, J. (2017). Collaboration and Gender Equity among Academic Scientists. *Social Sciences*, *6*(1), pp. 25.

Risner, L. E., Morin, X. K., Erenrich, E. S., Clifford, P. S., Franke, J., Hurley, I., & Schwartz, N. B. (2020). Leveraging a collaborative consortium model of mentee/mentor training to foster career progression of underrepresented postdoctoral researchers and promote institutional diversity and inclusion. *PLOS ONE*, *15*(9), e0238518.

Soporte

Campbell, C., Smith, M., Dugan, J., & Komives, S. (2012). Mentors and College Student Leadership Outcomes: The Importance of Position and Process. *The Review of Higher Education*, *35*(4), pp. 595–625.

Carmel, R., & Paul, M. (2015). Mentoring and coaching in academia: Reflections on a mentoring/coaching relationship. *Policy Futures in Education*, *13*(4), 479–491.

Crawford, K., & Smith, D. (2005). The we and the us. *Journal of Black Studies*, *36*(1), pp. 52–67.

Cross, M., Lee, S., Bridgman, H., Thapa, D., Cleary, M., & Kornhaber, R. (2019). Benefits, barriers and enablers of mentoring female health academics: An integrative review. *PLOS ONE*, *14*(4), e0215319.

Eller, L., Lev, E., & Feurer, A. (2014). Key components of an effective mentoring relationship: A qualitative study. *Nurse Education Today*, *34*(5), pp. 815–820.

Ferguson, H., & Wheat, K. (2015). Early career academic mentoring using Twitter: the case of #ECRchat. *Journal of Higher Education Policy and Management*, *37*(1), pp. 3–13.

Girves, J., Zepeda, Y., & Gwathmey, J. (2005). Mentoring in a Post-Affirmative Action World. *Journal of Social Issues*, *61*(3), pp. 449–479.

Green, B., Johansson, I., Rosser, M., Tengnah, C., & Segrott, J. (2008). Studying abroad: A multiple case study of nursing students' international experiences. *Nurse Education Today*, pp. 981–992.

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RENIECYT-SECIHTI: 1702902

Lund, T., Liang, B., Konowitz, L., White, A., & DeSilva Mousseau, A. (2019). Quality over quantity?: Mentoring relationships and purpose development among college students. *Psychology in the Schools*, *56*(9), pp. 1472–1481.

McIlveen, P., & Pensiero, D. (2008). Transition of graduates from backpack-to-briefcase: a case study. *Education + Training*, *50*(6), pp. 489–499.

McMurray, A., Henly, D., Chaboyer, W., Clapton, J., Lizzio, A., & Teml, M. (2012). Leadership succession management in a university health faculty. *Journal of Higher Education Policy and Management*, *34*(4), pp. 365–376.

Obers, N. (2015). Influential structures: understanding the role of the head of department in relation to women academics' research careers. *Higher Education Research & Development*, *34*(6), pp. 1220–1232.

Okolie, U., Nwajiuba, C., Binuomote, M., Ehiobuche, C., Igu, N., & Ajoke, O. (2020). Career training with mentoring programs in higher education. *Education + Training*, *62*(3), pp. 214–234.

O'Meara, K., Nyunt, G., Templeton, L., & Kuvaeva, A. (2019). Meeting to transgress. *Equality, Diversity and Inclusion: An International Journal*, *38*(3), pp. 286–304.

Santos, S., & Reigadas, E. (2002). Latinos in Higher Education: An Evaluation of a University Faculty Mentoring Program. *Journal of Hispanic Higher Education*, *1*(1), pp. 40–50.

Skela-Savič, B., & Kiger, A. (2015). Self-assessment of clinical nurse mentors as dimensions of professional development and the capability of developing ethical values at nursing students: A correlational research study. *Nurse Education Today*, *35*(10), pp. 1044–1051.

Smith-Ruig, T. (2014). Exploring the links between mentoring and work-integrated learning. *Higher Education Research & Development*, *33*(4), pp. 769–782.

Tessens, L., White, K., & Web, C. (2011). Senior women in higher education institutions: perceived development needs and support. *Journal of Higher Education Policy and Management*, *33*(6), pp. 653–665.

Thompson-Tinsley, O., & Li, Y. (2022). Promoting Inclusion Through a Peer Mentoring Program. *Biomedical Engineering Education*, *2*(2), pp. 203–207.

Zacher, H., Rudolph, C., Todorovic, T., & Ammann, D. (2019). Academic career development: A review and research agenda. *Journal of Vocational Behavior*, *110*, pp. 357–373.

Zellers, D., Howard, V., & Barcic, M. (2008). Faculty Mentoring Programs: Reenvisioning Rather Than Reinventing the Wheel. *Review of Educational Research*, *78*(3), pp. 552–588.

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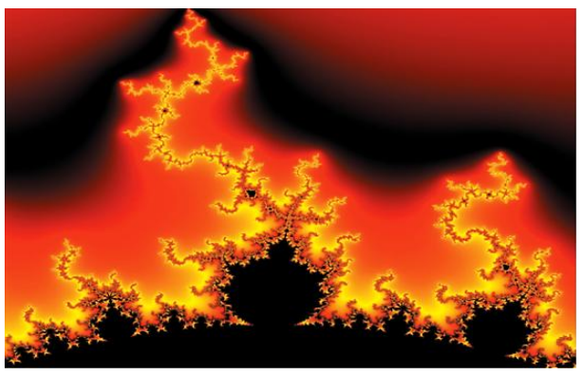

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