Journal University

Management

Journal University Management

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Support the international scientific community in its written production Science, Technology and Innovation in the Field of Social Sciences, in Subdisciplines University school management, management of university academic counseling, elements and conditions for reform in university school management, specific management models for each university context, inclusion as a fundamental tool for attending university diversity.

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The works must be unpublished and refer to topics of University school management, management of university academic counseling, elements and conditions for reform in university school management, specific management models for each university context, inclusion as a fundamental tool for attending university diversityand other topics related to Social Sciences.

Presentation of Content

In the first article we present, *Diagnostic assessment of knowledge in basic sciences and its relation to the teachinglearning process in the university environment* by González-Quezada, Esperanza, Soltero-Sánchez, Alma Luz Angélica, Huerta-Chávez, Irma Alicia and Figueroa-Ochoa, Edgar Benjamín with adscription in the University of Guadalajara, as the following article we present, *Web application for attendance management with QR Technology in a Public Elementary School* by Aguilar-Ortíz, Gabriela, Ramos-Lira, Estefania, Pérez-Cruz, Silver Octavio and Diaz-Sarmiento, Bibiana, with adscription in the Instituto Tecnológico de Oaxaca, as the following article we present, *Comparative study in the progress of the level of English in the BIS generations at the Technological University of Altamira* by González-Barrón, María Teresa, Alvarado-Medellín, Marisela, Barrios-Rodríguez, Lilia Gabriela and Pedraza-Vázquez, Ingryt Karely, with adscription in the N Universidad Tecnológica de Altamira, as the following article we present, *Comparison of ideal vocational profiles against real vocational profiles and their relationship with academic performance at the Technological University of Leon* by Aranda-López, Ariana, González-Arredondo, Liliana, Padilla-Gutiérrez, Luz Aurora and Arredondo-Muñozcano, Ana María, with adscription in the Universidad Tecnológica de León, as the following article we present, *Competencies to be developed by the teacher in distance education* by Fuentes-Favila, Luis Macario, Mendoza-González, Nancy, Ordóñez-Suárez, Teresa and Molina-Vázquez, Gabriel, with adscription in the Escuela Normal de Atlacomulco, as the last article we present, *Effective neurolearning of english in university students through NLP* by Carrillo–Beltrán, Julio César Cuauhtémoc, Ramírez-Jiménez, Armando, Llanos -Ramírez, María del Carmen and Maldonado-Bernal, Mónica del Rocío, with adscription in the Universidad Autónoma de Nayarit.

Content

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iagnostic assessment of knowledge in basic sciences and its relation to the teaching-learning process in the university environment

Evaluación diagnóstica del conocimiento en ciencias básicas y su relación con el proceso de enseñanza-aprendizaje en el entorno universitario

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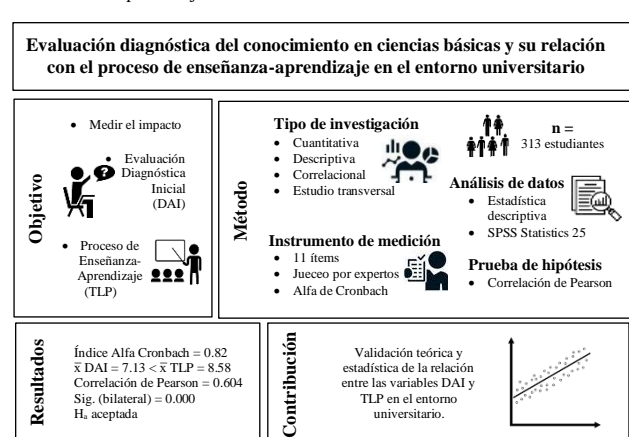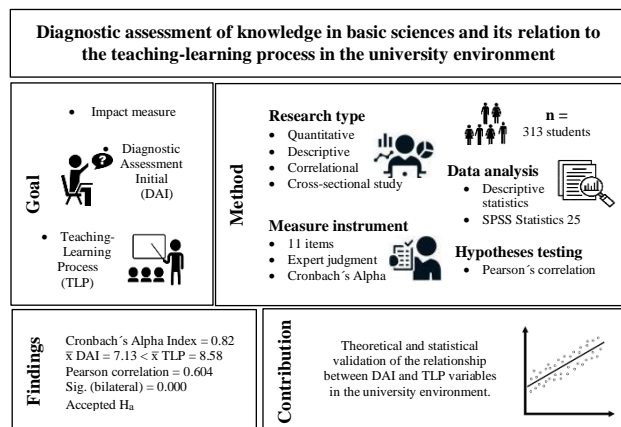
Abstract

Identifying the deficiencies in the learning acquired in undergraduate students allows the design of new methodological strategies in the teaching-learning process. The objective of this research is to measure the implementation of the initial diagnostic assessment of knowledge in basic sciences and differential and integral calculus as part of the Physicochemistry learning unit, and its impact on the implementation of the teaching-learning process. This research is quantitative, descriptive, correlational, and cross-sectional, with convenience sampling of 313 students. The instrument used consisted of 11 items, with validation by expert judgment and Cronbach's Alpha. Data analysis was performed with descriptive statistics and hypothesis testing with Pearson's correlation. The findings corroborate that diagnostic assessment implementation of prior knowledge has an impact on the teaching-learning process in a university environment.

Resumen

Identificar las deficiencias en el aprendizaje adquirido en estudiantes de pregrado, permite el diseño de nuevas estrategias metodológicas en el proceso de enseñanza-aprendizaje. Siendo el objetivo de esta investigación, medir la implementación de la evaluación diagnóstica inicial del conocimiento en ciencias básicas y en cálculo diferencial e integral como parte de la unidad de aprendizaje de Fisicoquímica, y su impacto en la implementación del proceso enseñanza-aprendizaje. Esta investigación es de tipo cuantitativa, descriptiva y correlacional, de corte transversal y con muestreo por conveniencia de 313 estudiantes. El instrumento utilizado consistió en 11 ítems, con validación por jueceo de expertos y Alpha de Cronbach. El análisis de datos se realizó con estadística descriptiva y la prueba de hipótesis con la correlación de Pearson. Los hallazgos corroboran que la implementación de la evaluación diagnóstica del conocimiento previo tiene un impacto en el proceso de enseñanza-aprendizaje en un entorno universitario.

Diagnostic assessment of knowledge in basic sciences and its relation to the teaching-learning process in the university environment

Goal: Impact measure; Diagnostic Assessment Initial (DAI); Teaching-Learning Process (TLP)

Method: Research type — Quantitative, Descriptive, Correlational, Cross-sectional study; Measure instrument — 11 items, Expert judgment, Cronbach's Alpha; n = 313 students; Data analysis — Descriptive statistics, SPSS Statistics 25; Hypotheses testing — Pearson's correlation

Findings: Cronbach's Alpha Index = 0.82; x̄ DAI = 7.13 < x̄ TLP = 8.58; Pearson correlation = 0.604; Sig. (bilateral) = 0.000; Accepted H_a

Contribution: Theoretical and statistical validation of the relationship between DAI and TLP variables in the university environment.

Evaluación diagnóstica del conocimiento en ciencias básicas y su relación con el proceso de enseñanza-aprendizaje en el entorno universitario

Objetivo: Medir el impacto; Evaluación Diagnóstica Inicial (DAI); Proceso de Enseñanza-Aprendizaje (TLP)

Método: Tipo de investigación — Cuantitativa, Descriptiva, Correlacional, Estudio transversal; Instrumento de medición — 11 ítems, Jueceo por expertos, Alfa de Cronbach; n = 313 estudiantes; Análisis de datos — Estadística descriptiva, SPSS Statistics 25; Prueba de hipótesis — Correlación de Pearson

Resultados: Índice Alfa Cronbach = 0.82; x̄ DAI = 7.13 < x̄ TLP = 8.58; Correlación de Pearson = 0.604; Sig. (bilateral) = 0.000; H_a aceptada

Contribución: Validación teórica y estadística de la relación entre las variables DAI y TLP en el entorno universitario.

Correlational study, Deficiencies in knowledge, Implementation teaching-learning process

Estudio correlacional, Deficiencias en los conocimientos, Aplicación del proceso de enseñanza-aprendizaje

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Introduction

The diagnostic assessment of knowledge in basic sciences consists of identifying the level of learning in a given area of knowledge. In this case, this evaluation allows us to have a diagnostic that helps to define the problems faced by the social sciences in terms of education and the exact sciences in the development of new methodologies for the teaching-learning process.

In this regard, talking about the teaching-learning process takes us back to the two main theories that are relevant. The first theory, with a traditional approach, highlights the importance of the teacher as the one directly in charge of transferring knowledge to the student. While the second one, emerges as a theory with a constructivist approach, that is, it puts the student at the center of the learning process, where it makes the student responsible for generating his own knowledge.

For this reason, in the present research, diagnostic assessment is taken up again as a milestone for the development of methodological approaches and the contribution to the teaching-learning theory, as well as the impact it has on the learning achieved in undergraduate students. Due to the above, this type of research is of utmost importance, especially in developing countries where educational levels present deficiencies from the formulation of curricula to the teaching-learning processes.

The technique used in this research is quantitative, which presents an added value with respect to other research techniques, given that it has numerically measurable results, which allows the analysis of variables for the generalization of results in a given population.

Characterizing the impact on student learning, as a result of the teaching-learning process based on previous knowledge evaluations, is a very complicated task for research, since it is necessary to identify the main variables that impede or strengthen this process. For this reason, this research focuses on clarifying the variables studied.

The problem to be solved with this research is formulated from the following question:

- What is the relationship between Diagnostic Assessment Initial (DAI) in basic sciences and differential and integral calculus in the Teaching-Learning Process (TLP) with a traditional and constructivist approach in a university environment?

In this sense, the central hypothesis focuses on:

- H_0: The Diagnostic Assessment Initial (DAI) in basic sciences and differential and integral calculus has no significant relationship with the Teaching-Learning Process (TLP) with traditional and constructivist approach in a university environment.

- H_a: The Diagnostic Assessment Initial (DAI) in basic sciences and differential and integral calculus has a significant relationship with the Teaching-learning Process (TLP) with a traditional and constructivist approach in a university environment.

This research article is composed of nine sections, which are described below, in order to clarify and explain in general terms the contents of each one of them. In the first section, there is an introduction to the research topic, emphasizing the problem to be solved, the central hypothesis, the added value of the technique used and the generalities of the research.

The second section presents a review of the literature and provides an overview of the theory underlying the research, referring to diagnostic evaluation and the teaching-learning process in university environments. The third section details the method used, the type and design of the research, the description of the variables, the measurement instrument, the participants, the procedure and the data analysis.

The fourth section includes the results and discussion, with descriptive statistics, as well as the discussion in the light of the supporting theory. The fifth section contains the conclusions and recommendations, where the main findings, limitations and future work are presented.

González-Quezada, Esperanza, Soltero-Sánchez, Alma Luz Angélica, Huerta-Chávez, Irma Alicia and Figueroa-Ochoa, Edgar Benjamín. [2024]. Diagnostic assessment of knowledge in basic sciences and its relation to the teaching-learning process in the university environment. Journal University Management. 8[19]1-16: e1819116.
https://doi.org/10.35429/JUM.2024.8.19.1.16

The sixth section includes the annexes, which include the instrument used, with the items applied for the development of the research. Now, in section seven on declarations includes conflict of interest, contribution by authors, availability of data and materials, funding of the research work and acknowledgements to the participating teachers and students, as well as to the institution from which they came.

Likewise, the eighth section shows the abbreviations of this article. Finally, the ninth section lists the references of the authors who directly contributed to this study according to the literature review: antecedents, basics, supports, differences, discussions.

State of the art review

Diagnostic evaluation is understood as a tool that helps students to become aware of the possession of certain concepts with which they have to perform correctly during the course. As facilitators, it allows teachers to have a diagnosis to level the students' knowledge and reach the fulfillment of the objectives expected in the course (Gómez et al., 2011).

That is why, at the beginning of the school cycle, diagnostic assessment is applied as a strategic tool to identify inaccuracies in students' knowledge, resulting from the previous teaching-learning process (Cobeña-Álava & Yánez-Rodríguez, 2022). In this sense, it is possible to affirm that students' prior knowledge is the most important factor, given its influence on learning (Ausubel, 1983).

Diagnostic assessment as an evaluation instrument helps to have value judgments, allowing to have the students' learning level and therefore allows teachers to deliver quality products in the teaching-learning process (Martínez & Laurido, 2012). In this regard, it is important to emphasize that each student has his own knowledge, the result of his experience and his own context (Bombelli & Barberis, 2012).

This knowledge will determine their level of competencies in the learning units, reflected in the effective performance in the solution of disciplinary problems (Zavala et al., 2023), i.e., the problems of each of the topics developed during the course, established in the curriculum.

Diagnostic assessment allows teachers to recognize individual differences in the context of learner diversity in the classroom (Kahn-Horwitz, & Goldstein, 2024). Other authors pointed out that the diagnostic evaluation in the first trimester allows the identification of students who know and those who can participate in remedial activities so that at the end of the course, they obtain the expected knowledge (Liemans et al., 2024)

On the other hand, the diagnostic assessment, seen from the pedagogical point of view, is extremely important to be carried out at different moments of the teaching-learning process. This tool allows the identification of students' knowledge and helps teachers to make adaptations in the content of the learning unit to achieve the objectives sought (Vera, 2020).

Therefore, this assessment should be performed at the beginning of the course to detect prior knowledge and make adjustments in the teaching process (Cejas & Alvarez, 2006). A noteworthy aspect of diagnostic assessment is to identify essential learning to achieve quality education (Muñoz et al., 2023). Also, diagnostic assessment is an extremely necessary tool to provide the results expected in the classroom (Acosta & Rodríguez, 2023), at different educational levels, with emphasis on undergraduate studies.

On the other hand, it is worth mentioning that, since the human being is born, his learning system is active, due to this it is extremely important to understand that previous experiences and knowledge are quite necessary, since from these the new knowledge will be constituted. In this context, the learner understands and gives meaning to his new learning, new concepts that regulate mental processes and thinking, such as attention, perception and memory that affect the information that is processed (Machado, et al., 2018).

Ordinarily, the teaching-learning theory mainly comprises two models: the traditional approach and the constructivist approach. First, there is the traditional model, where teaching is the center of this process. Therefore, the teacher is the main responsible for the transmission of knowledge with a merely expository technique, contemplating a master class. The student, on the other hand, only listens to the class.

With this model, knowledge is understood as a construction that comes from the outside, from the scientific knowledge of a subject or discipline, for which the teacher is in charge of organizing the knowledge and preparing it for exposition. The teacher is the expert, the one who understands the subject, and also masters it, explains it and is up to date.

Therefore, learning seen from this model, is the way to acquire or increase knowledge in some subject or area for its subsequent application (Gargallo-López, et al., 2011).

In this teaching model, the students' prior knowledge is not contemplated (Morales et al., 2015). It is reiterative, that the teacher uses exclusively the lecture or expository lesson, only communication is one-way and rarely becomes bidirectional, only in the space dedicated to questions and answers.

It is worth mentioning that the teacher's material is based on books and the evaluation process is focused on assessing whether students learned by repeating what they learned (Gargallo-López, et al., 2011). By way of summary, teaching with this approach focuses on the transmission of knowledge in a certain topic or subject (Cabrera-Medina et al., 2016).

Due to the above, it is important to note that in recent decades the traditional way of learning has been questioned, since students, upon graduating from university, have the responsibility to apply the knowledge acquired in the social reality.

In this context, the graduate must contemplate the social, economic and technological changes to be competitive in the labor market. In this regard, the professional must necessarily migrate from the traditional model to the constructivist model where the teaching-learning process contemplates more options in the generation of knowledge (Ramos & Palacios, 2007).

Consequently, the second model of constructivist approach refers to learning, here learning is the center of the process. Therefore, the learner is primarily responsible for the creation of his or her own knowledge, while the teacher is merely a facilitator of knowledge (Gargallo-López, et al., 2011).

In this sense, the teaching-learning process, now is not conceived as the mere transmission of knowledge, but now knowledge is constructed, including the accumulation of the previous learning process, through experiences and contemplates acquiring knowledge to an already existing one, capable of being modified or reorganized according to the mind of each person (Piaget, 1950).

Therefore, the learning techniques to be used by teachers focus on those with an active cooperative method, as opposed to those used previously, with respect to the traditional passive method. This is due to the Copernican revolution, where the focus of the teaching process is more concentrated on learning and, therefore, the teacher's approach is defined as a guide, tutor or facilitator, while the student acquires his own knowledge (Tünnermann, 2011).

The constructivist theory has five objectives: 1) To understand and express scientific messages with oral and written property; 2) To interpret and represent scientific concepts correctly; 3) To apply strategies for problem solving; 4) To plan and carry out scientific activities in teams; 5) To reason based on their own criteria according to the context (Harré,1986; Osborne,1996; Insausti & Merino, 2000).

With the constructivist approach, the student builds scientific knowledge that involves the development of scientific competencies, therefore, the student is more autonomous and participatory (Espinosa-Ríos et al., 2016). The above, leads universities to create different learning strategies where the teacher is a guide in the solution of problems or the application of knowledge (Fernández & Aguado, 2017). It is emphasized that students responsible for their knowledge should develop critical and creative thinking (Lozano-Ramírez 2020), which will depend on their knowledge, skills, abilities and attitudes to acquire more knowledge (González-Zambrano et al., 2022).

In this sense, innovative environments for learning, motivation and co-instructional strategies should be contemplated in the construction of learning, promoting the memory of previous knowledge in students, for the generation of competencies, with pedagogical and technological material (Salgado, 2022).

Therefore, what is sought with learning supported with the constructivist theory, focuses on the student understanding what he is learning conceptually and individually, through different interactive methods with group techniques (Morales et al., 2015). This leads the student to generate his own knowledge, from the already existing knowledge, therefore, he will achieve true learning.

Thus, learning is the acquisition of knowledge in a critical way (Cabrera-Medina et al., 2016) and to evaluate it, in addition to exams, other methods are applied such as case studies, self-assessments or problem solving (Gargallo-López et al., 2011).

Finally, it is important to highlight that, in university environments, the teaching-learning process has been evolving, the student is the main responsible for his learning, since he is required to be involved so that, from previous knowledge, new knowledge is created, contemplating the context, meeting the new requirements of society in the formation of committed professionals. This inevitably implies that teachers generate new strategies to transfer knowledge (Huerta-Chávez, 2022; Soltero-Sánchez et al., 2021; Soltero-Sánchez et al., 2023).

Therefore, it is important to emphasize that the profile of the university professor must comply with two fundamental aspects, the first is to know the content and the second is to have pedagogical knowledge of the content, i.e., to know the subject and transmit the knowledge (Carreira & Zabalza, 2024). Now, the modern teaching-learning process must be addressed by updating knowledge and skills. In order to reduce the work overload of teachers, an appropriate management system must be introduced (Al Aimun et al., 2024). Finally, the machine learning algorithm can also be used in the evaluation system (Li, 2024).

Method

Type and design of research

This research was developed under a quantitative approach, that is, the data collected were used to test the central hypothesis, according to the numerical measurement made and the descriptive statistical analysis, in order to establish the behavior of the variables studied and to test the theory supporting this research.

This research is also non-experimental, that is, the study was carried out without the intentional manipulation of the variables since they were only observed in their natural environment. The data were collected cross-sectional, i.e., they were collected during the period from 2020 to 2023 (Bernal, 2016; Hernández et al., 2014).

Variables

Diagnostic Assessment Initial (DAI) in basic sciences and differential and integral calculus

It contemplates the initial knowledge that the undergraduate student has in basic sciences and differential and integral calculus, as a basis for the implementation of the teaching-learning process in the learning unit of Physicochemistry I, specifically in the topic of development and calculation of derivatives and integrals.

Teaching-Learning Process variable (TLP) with traditional and constructivist approach

This variable jointly contemplates the teaching-learning process both the traditional and constructivist approaches, both theories are applied after the diagnostic evaluation in the area of knowledge of basic sciences as well as differential and integral calculus. Teaching is based on the traditional approach for the transmission of knowledge whose responsibility lies with the teacher and learning is based on the constructivist approach where the student is directly responsible for generating his own knowledge, in the learning unit of Physicochemistry I in the topic of development and differential and integral calculus.

Measurement instrument

The instrument used for the diagnostic evaluation in basic sciences and differential and integral calculus, as well as the impact on the teaching-learning process with a traditional and constructivist approach in a university environment, consisted of 11 items, on a 10-point Likert scale, with 10 being the maximum score that the students could answer when evaluating the knowledge acquired, both initially in the first 10 items and finally in item 11 by the professor. The instrument was validated by means of the expert judgment technique and Cronbach's Alpha index.

Participants

The sample was non-probabilistic and non-random, that is, not all the subjects of the study population are part of the sample. The above, because, due to the nature of the present research, convenience sampling was chosen because of the ease of access and availability of the subjects of the population to participate in the study (Bernal, 2016; Hernández et al., 2014).

This sample consisted of 313 students of the learning unit Physicochemistry I of the Bachelor's Degree in Pharmaceutical Chemical Biologist, who voluntarily agreed to participate in the two stages of data collection in this research, in the diagnostic stage and in the final stage corresponding to the evaluation of knowledge after the implementation of the teaching-learning process.

Procedure

At the beginning of the 2020B to 2023B semester school year of the Physicochemistry I learning unit of the Bachelor's Degree in Pharmaceutical Chemistry and Biology, the measurement instrument was applied in two parts.

First, they were provided with the instrument in Google Forms to answer exclusively 10 items, in order to detect the level of knowledge on a 10-point scale in basic sciences and differential and integral calculus.

Next, the data obtained from the diagnostic evaluation were analyzed to generate a didactic plan to generate learning. In which we proceeded to apply the traditional teaching method, explaining the topic of derivatives and integrals in a master class. Likewise, based on the knowledge that the students had, they were considered for the creation of learning with the constructivist method.

Subsequently, the second part of the measurement instrument was applied in Google Forms, which consisted of 1 item where the level of learning achieved in the activity of differential and integral calculus was evaluated, with which the impact of the diagnostic evaluation in the teaching-learning process with the traditional and constructivist method in favor of the generation of knowledge in the undergraduate student was measured.

Data analysis

Data were processed with the statistical program SPSS (Statistical Package for the Social Sciences) version 25 and Microsoft Excel spreadsheet software. Descriptive statistics were used for data analysis, measures of central tendency, graphs and hypothesis testing.

Results and discussion

The measurement instrument used in this research, in addition to having been evaluated by expert judgment, and in order to have a valid and reliable scale, the Cronbach's Alpha Index was calculated, from which acceptable values above 0.70 were obtained, as indicated by Nunnally (1978) and Hair et al. (1999).

From this measurement instrument, it is possible to assure that both the design and the validation are supported by the theories of teaching-learning and diagnostic evaluation. In other words, the measurement instrument is reliable when presenting consistent and coherent results, that is, when applied at different times during the period 2020 to 2023, it was possible to obtain accurate results in the behavior of the variables studied.

Likewise, the instrument applied showed validity by accurately measuring the variables described in the research. This was also corroborated by calculating the Cronbach's Alpha index, with which favorable results were obtained that were higher than the parameters established to classify the instrument as a valid and reliable measurement scale (see table 1):

Box 1

Table 1

Calculation of Cronbach's alpha index

Variables	Cronbach's Alpha > .70 (Nunnally, 1978)
MKHS, CKHS, PKHS, DMTS, GCKD, PHKD, CAKD, DICS, SQMD, SQMI, KAADI	0.82

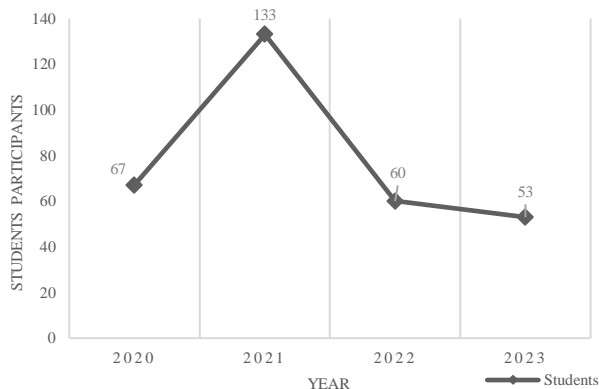*Source: Own elaboration (2024).*

With respect to the categorical variable of sex, 313 students participated in the survey, of which 210 were women and 103 were men, which in percentage terms corresponds to 67% and 33% respectively (see graph 1):

Box 2
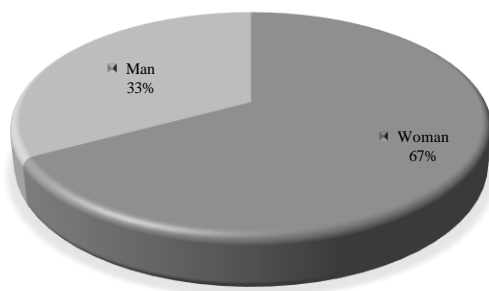
Figure 1

Number of participants by sex.
Source: Own elaboration (2024).

On the other hand, the total number of students participating in the study varied from year to year, considering that student enrollment is not always the same. Given that, even when the semester begins with a number of students registered in the lists of the learning unit, sometimes they drop out and the research only reflects the data of the participants in the two stages of the survey of the measurement instrument, which were: 67 in 2020, 133 in 2021, 60 in 2022 and 53 in 2023 (see graph 2):

Box 3

Figure 2

Number of students participants by year
Source: Own elaboration (2024)

Since this research was longitudinal, it was obtained that the mean of the Diagnostic Assessment Initial (DAI) throughout the three years under study, presented an improvement in the mean obtained after the implementation of the Teaching-Learning Process (TLP). This allowed verifying the importance of the diagnostic evaluation as a strategic tool to identify inaccuracies in prior knowledge, as pointed out by Cobeña-Álava & Yánez-Rodríguez (2022).

This allowed the students to realize the knowledge they had at the beginning of the course and, in the case of the teacher, it allowed him to have an initial diagnosis to design the course and level the knowledge to meet the objectives established in the study plans, in accordance with Gómez et al. (2011).

In this research, in 2020 there was a favorable gap given that the mean of the Diagnostic Assessment Initial (DAI) was 7.15 and of The Teaching-Learning Process (TLP) was 8.46; in 2021 in the DAI variable a mean of 7. 31 and in the TLP variable the mean was 8.64; in 2022 the mean of the DAI variable was 6.95 and in TLP was 8.58; and in 2023 the mean of DAI was 6.87 and in TLP was 8.58 (see graph 3):

Box 4
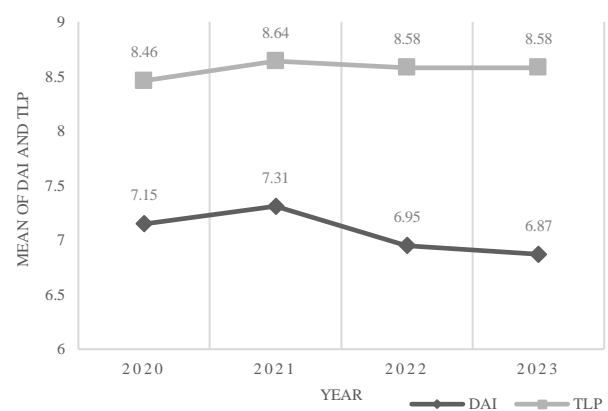
Figure 3

Diagnostic Assessment Initial (DAI) and the Teaching-Learning Process (TLP) over 2020 to 2023

Source: Own elaboration (2024)

These results demonstrate the importance of prior knowledge in students' learning, which also contemplates the experience and context in which they learned, as well as the effective performance in the solution of problems in the different disciplines. This also allows the teacher to have a quality teaching-learning process, by making adjustments or adaptations to achieve the objectives, in accordance with Acosta & Rodríguez (2023); Bombelli & Barberis (2012); Cejas & Alvarez (2006); Martínez & Laurido (2012); Muñoz et al. (2023); Vera (2020); Zavala et al. (2023).

Now, the results obtained in each of the variables of the Diagnostic Assessment Initial (DAI), show the mean values of:

- 7.94 in Mathematics Knowledge in High School (MKHS);
- 7.16 in Chemical Knowledge in High School (CKHS);
- 6.53 in Physics Knowledge in High School (PKHS);
- 8.21 in Diagnostic Mathematics Test Score (DMTS);
- 7.55 in General Chemical 1 Knowledge in Degree (GCKD);
- 6.09 in Physics Knowledge in Degree (PHKD);
- 6.53 in Calculus Knowledge in Degree (CAKD);
- 9.07 in Differential and Integral Calculus Score (DICS);
- 6.74 in Self-Qualification when Making Derivatives (SQMD);
- 5.50 in Self-Qualification when Making Integrals (SQMI).

In this respect, they show the impact of the implementation of the Teaching-Learning Process in relation to the Knowledge Application Activity in Derivatives and Integrals (KAADI), where the mean was 8.58 points on a scale of 1 to 10 (see graph 4):
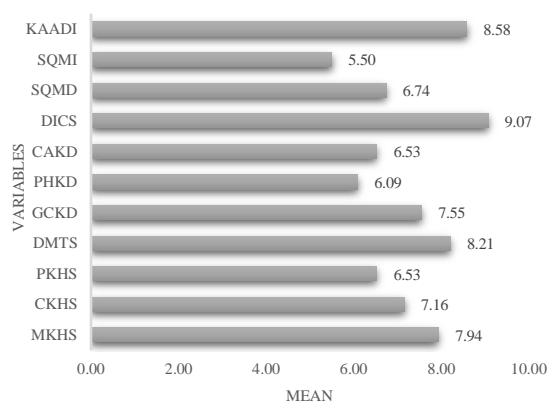
Box 5

Figure 4

Diagnostic assessment variables and their impact on the teaching-learning process
Source: Own elaboration (2024).

The measures of central tendency are shown below exclusively for the variables of the Diagnostic Assessment Initial (DAI), where the minimum values were mostly 1 with the exception of the variables Diagnostic Mathematics Test Score (DMTS) and Differential and Integral Calculus Score (DICS) whose values were 6.

The maximum values for most of the variables were 10, except for the variable Self-Qualification when Making Integrals (SQMI) with a value of 9 (see table 2).

In relation to the mean, the values ranged from 5.50 to 9.07, including values of 6, 7 and 8, in the variables (see graph 4 and table 2). While the standard deviation spanned values from 1.04 to 2.26, reflecting that for the case of $\sigma = 1$ most of the sample data are clustered close to the mean and for the case of $\sigma = 2 > 3$ most of the data are spread over a wider range in relation to the mean. However, the behavior of the data is within a normal distribution (see table 2).

From this it can be asserted that there are deficiencies in the students' knowledge of the basic topics necessary for the development of differential and integral calculus, from the basic subjects in high school and in those at the undergraduate level such as mathematics, physics and chemistry.

Box 6
Table 2

Central tendency measures about Diagnostic Assessment Initial (DAI)

Variable	N	Min	Max	Mean	Standard deviation
MKHS	313	1.00	10.00	7.94	1.65
CKHS	313	1.00	10.00	7.16	2.22
PKHS	313	1.00	10.00	6.53	2.05
DMTS	313	6.00	10.00	8.21	1.13
GCKD	313	1.00	10.00	7.55	1.66
PHKD	313	1.00	10.00	6.09	2.01
CAKD	313	1.00	10.00	6.53	2.01
DICS	313	6.00	10.00	9.07	1.04
SQMD	313	1.00	10.00	6.74	1.94
SQMI	313	1.00	9.00	5.50	2.26

Regarding the variable of the implementation of the teaching-learning process with a traditional and constructivist approach, which was measured by the variable Knowledge Application Activity In Derivatives And Integrals (KAADI), the mean was 8.58 as already mentioned (see graph 4) and the minimum value was 7 and the maximum was 10, while the standard deviation was 0.85 (see table 3). This corroborated that all the data obtained were very close to the mean, which was the expected value. Therefore, the development of new teaching-learning strategies after the application of initial diagnostic assessments highlights their functionality and importance, as well as their theoretical, practical and methodological contribution.

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Box 7

Table 3

Central tendency measures about Teaching-Learning Process (TLP)

Variable	N	Min	Max	Mean	Standard deviation
KAADI	313	7.00	10.00	8.58	0.85

Likewise, the above allows highlighting the importance of both the teaching and learning process, going back to the origins of the human being, that is, from his birth, where the learning system is ready to create new knowledge.

It is for this reason that the change of the values obtained in the diagnostic assessment initial was denoted in comparison with the values obtained in the implementation of the teaching-learning process in relation to the Knowledge Application Activity in Derivatives and Integrals (KAADI), obtaining lower initial values compared to the final values where an increase in the student's learning is clearly marked.

Since, from the previous knowledge is that new learning is generated, for this, the student understands and gives meaning to what is learned, which affects his mental and thought processes including the memory of the new information he processes, thus creating new knowledge, in agreement with Machado, et al. (2018).

However, the calculation of the measures of central tendency for the main variables, the Diagnostic Assessment Initial (DAI) and the implementation of the Teaching-Learning Process (TLP), had mean values of 7.13 and 8.58 respectively, which represents an increase in knowledge. For the case of the DAI variable, the minimum value was 3, which included the mean values of the following 10 variables:

- Mathematics Knowledge in High School (MKHS);
- Chemical Knowledge in High School (CKHS);
- Physics Knowledge in High School (PKHS);
- Diagnostic Mathematics Test Score (DMTS);
- General Chemical 1 Knowledge in Degree (GCKD);
- Physics Knowledge in Degree (PHKD);

- Calculus Knowledge in Degree (CAKD);
- Differential and Integral Calculus Score (DICS);
- Self-Qualification when Making Derivatives (SQMD);
- Self-Qualification when Making Integrals (SQMI).

The maximum value was 9.40, since the averages of the variables mentioned were considered and the standard deviation was 1.12, which represents that all the values are very close to the mean, the expected value (see Table 4). Likewise, in the case of the TLP variable, we considered the values obtained from the variable Knowledge Application Activity In Derivatives and Integrals (KAADI) of the measuring instrument (see table 3 and 4):

Box 8

Table 4

Central tendency measures about Diagnostic Assessment Initial (DAI) and the Teaching-Learning Process (TLP)

Variable	N	Min	Max	Mean	Standard deviation
DAI	313	3.00	9.40	7.13	1.12
TLP	313	7.00	10.00	8.58	0.85

Source: Own elaboration (2024).

It should be noted that the Diagnostic Assessment Initial (DAI) as a tool for identifying the knowledge that students had, had a direct impact until the Teaching-Learning Process (TLP) was applied, which for this research covered both the traditional teaching model where the teacher was directly responsible for teaching the subject with knowledge that the student had to learn, as well as the constructivist model, where the student as the main responsible for generating his own knowledge and the teacher was only a guide in the teaching-learning process, which included problem solving or else the application of knowledge, this in agreement with Cabrera-Medina et al. (2016); Fernández & Aguado (2017); Gargallo-López, et al. (2011); Morales et al. (2015), thus proving the theory described.

Even though the traditional way of learning has been questioned by society itself, demanding graduates who are able to apply the knowledge acquired for the transformation of social reality, according to Ramos & Palacios (2007). This does not detract from the importance of this traditional teaching model.

Article

Therefore, the constructivist theory, comes as a complement to the previous one, where the teaching-learning process, now is not conceived as the mere transmission of knowledge, but now knowledge is constructed, including the accumulation of the previous learning process, through experiences and contemplates acquiring the knowledge to an already existing one, capable of being modified or reorganized according to the mind of each person in accordance with Piaget (1950). This is ratified when testing the central hypothesis of this research.

In this same sense, to test the central hypothesis, Pearson's correlation coefficient was calculated to identify the relationship between the two quantitative variables under study in this research, finding that both are associated, that is, there is a correlation between them.

With this calculation it was found that the Diagnostic Assessment Initial (DAI) in basic sciences and differential and integral calculus has a significant relationship with the Teaching-Learning Process (TLP) with a traditional and constructivist approach in a university environment.

Likewise, the association or correlation that exists between both variables is positive, that is, they move in the same direction; these variables are associated in a direct sense. This means that if the value of the DAI variable changes, it will also change in the TLP variable. Furthermore, the correlation that exists is high, i.e., it has a significant relationship (see table 5):

Box 9

Table 5

Pearson´s correlation calculation

		DAI	TLP
DAI	Pearson´s correlation	1	.604**
	Sig. (bilateral)		0.000
	N	313	313
TLP	Pearson´s correlation	.604**	1
	Sig. (bilateral)	0.000	
	N	313	313

** The correlation is significant at the 0.01 level (bilateral).

Source: Own elaboration (2024).

Thus, the results obtained corroborate the implementation of various teaching techniques included in the active cooperative method, with the direct participation of students in the creation of their own knowledge in an autonomous, participatory, critical and creative way, as well as the ability that students should possess to obtain more knowledge in accordance with Espinosa-Ríos et al. (2016); González-Zambrano et al. (2022); Lozano-Ramírez (2020); Tünnermann (2011), which implies a positive and open attitude to generate their own knowledge.

In this regard, these results corroborate the theoretical contribution regarding the innovative environments that teachers adopt to guide the teaching-learning process, which, when well implemented, are able to promote the recall of the knowledge possessed by students and therefore, contribute to the development of competencies with pedagogical and technological material, also including interactive methods and group techniques, according to Morales et al. (2015) and Salgado (2022).

As well as the fulfillment of the objectives of the constructivist theory according to Harré (1986); Osborne (1996); Insausti & Merino (2000):

1) Understand and express scientific messages with oral and written property;

2) Interpret and represent scientific concepts correctly;

3) Apply strategies for problem solving;

4) Plan and carry out scientific activities in teams;

5) Reason based on their own criteria according to the context.

Finally, when correlating the variables DAI and TLP, the constructivist theory is corroborated, where not only exams are no longer applied to evaluate learning, but now self-evaluations are performed, as was the case of the first variable that was measured by this method, and on the other hand, problem solving to evaluate the second variable, coinciding with Gargallo-López et al. (2011).

Article

Therefore, ineludibly, students as responsible for creating their own knowledge and teachers as guides in the teaching-learning process, the ways of transmitting knowledge are a challenge in teaching that implies the development of new strategies in congruence with Huerta-Chávez et al. (2022); Soltero-Sánchez et al. (2021); Soltero-Sánchez et al. (2023).

Conclusions and recommendations

It is well known that since the human being is born, he is ready to absorb the knowledge that the world offers him and his learning system is uncovered. It is also important to emphasize that the student's attitude towards learning has an influence on this process, because he will have to dedicate his mental structures to retain and apply knowledge, with the purpose of turning knowledge into meaningful learning, creating his own concepts and reflections about the topics he faces daily, from his particular life with daily life to the academic part in the classroom.

The teaching-learning process has evolved from the first theory focused exclusively on teaching, the so-called traditional teaching theory, where the lecture as the main tool of the teacher for the transmission of knowledge had greater relevance and at the same time the responsibility of generating knowledge in the student lay mainly on him. Therefore, the preparation of the material to be shared with avant-garde and updated knowledge was also the responsibility of the teacher, without losing sight of the expository technique as the only option.

However, this teaching-learning process, not only remained in a traditional approach, but has evolved to the constructivist theory, which focuses mainly on learning, where the student takes a fundamental role in the generation of their own knowledge. Hence the importance of having a diagnostic assessment every time a course is started, which will provide an initial overview to identify the knowledge students have and to be able to create or adopt different teaching methods to guide students' learning.

The reinforcement of previous knowledge in the different topics of basic sciences and differential and integral calculus, as well as the technique for students to remember the above, is extremely necessary for the teacher to achieve the learning objectives set out in the courses.

Although each course will have its own scope, we must not lose sight of the fact that the concepts and methodological theoretical applications in the knowledge that a student must have to take a certain course is crucial for him to effectively create knowledge, which is also understood in the constructivist theory as meaningful learning, that is, from a previous concept, new concepts will have to be adhered to and new theories or learning applicable to the course in turn will have to be created.

Now, by means of the scientific method for the development of the present research, which included the quantitative analysis carried out, we have a main finding, with direct contribution to the teaching-learning theory in university environments, as well as practical and methodological applicability in science for teachers who develop in this university context and who wish to replicate the method.

This finding corroborates that the implementation of the initial diagnostic assessment in basic sciences and differential and integral calculus presents a positive correlation with the implementation of the teaching-learning process with a traditional and constructivist approach. This means that the adequate application of an initial evaluation has a direct impact on the teaching-learning process.

Therefore, the choice of a good measurement instrument theoretically supported, duly validated by expert judgment and with the appropriate statistical indexes, is a good start for the development of new theoretical, practical and methodological contributions to the state of the art, as shown in this research.

However, the main limitations faced by this research were, in the first instance, the selection of the sample. Given that it was a non-probabilistic sample, since the period in which the sampling was carried out was non-probabilistic and by convenience, in which the students voluntarily agreed to participate.

Although the results were generalized, this can only be done in the context in which the research was carried out. Due to the above, it is extremely important to carry out the probabilistic and random sampling with the probability that any student from the population studied can be selected in future research, in order to provide greater statistical support.

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Another limitation of this research was that the data analysis focused on descriptive statistics for the description of the behavior of the variables in tables, graphs and even in hypothesis testing.

However, for future research, it is suggested to incorporate new statistical techniques such as the Exploratory Factor Analysis (EFA) that will allow to expand the explanation of the variables, incorporating the necessary factors that clarify the problems studied and allow to have a closer approach to the frontier of knowledge of the state of the art in the teaching-learning theory. Through the creation of innovative models with theoretical, practical and methodological contribution, with a view to subsequent modeling, by means of the use of structural equations and statistically acceptable adjustment indexes.

The last limitation presented in the research refers to the measurement of the variable of the implementation of the teaching-learning process, which was carried out by means of traditional evaluation exclusively, with an exam for the development of the calculation of derivatives and integrals, where the students demonstrated the learning achieved, so it is recommended in future research to implement other techniques that reinforce the knowledge.

In this same sense, it is possible to affirm that the study of the teaching-learning process continues to be a challenge both for scholars in the field and for the educational sector. Since it not only contemplates the traditional teaching techniques, but now new strategies will have to be sought to influence student learning and for this, research is essential, which involves the involvement of the teacher and the student as an inseparable binomial to effectively contribute positively to this process.

In order to continue with the present research, it is recommended to incorporate several variables that allow strengthening the teaching-learning process. In the case of students, we suggest the incorporation of motivational factors, i.e., including intrinsic and extrinsic motivation, which favor or drive learning by finding reasons to learn. Since, on many occasions, the careers chosen by students do not really respond to the expectations they had hoped for, which limits their learning.

Additional variable that can be incorporated on the part of both the student and the professor, is the commitment, as an agreement that is established between both parties to have a learning attitude in order to fulfill the objectives established in the courses that are taught and taken, regardless of whether the subject matter that is taught or studied is to their liking.

Here only the commitment with the teaching-learning process will have to be contemplated, in order to effectively transmit and promote the creation of knowledge. Contemplating, the teaching-learning agreement, where both the student and the teacher do their part for the achievement of the learning objectives set.

In this same sense, the variable of ethics can be incorporated in students in the learning process, from the conceptualization of acting correctly, that is, that students demonstrate their learning without it being the replica of the knowledge of others, avoiding copying tasks, exercises, problem solving, exams and even research projects. This variable can support the explanation of the teaching-learning process, in order to characterize it from a different perspective, which is ethics, understood as the conduct of the human being to do the right thing.

On the other hand, for the teaching process that directly involves the teacher conversely, it is suggested to incorporate the impact of the various innovative instructional techniques in the teaching-learning process. These are more focused on the constructivist theory, which will be able to explain the teaching-learning process from an innovative perspective, which may result in the improvement of the fulfillment of the expected learning objectives.

As a conclusive point, the diagnostic assessment is significantly related to the teaching-learning process; therefore, by applying this tool correctly and interpreting it correctly, it has a significant impact on the teaching-learning process, i.e., the teacher knows the level of knowledge of the students and from there establishes a work plan to level the students' knowledge and thus initiate the teaching of new knowledge established in the course to promote or guide learning.

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Annexes

Below are the items evaluated in the instrument applied, which consists of two central variables, the first variable referring to the Diagnostic Assessment Initial (DAI) in basic sciences and differential and integral calculus, which was measured with 10 internal variables and the second referring to the implementation of the Teaching-Learning Process (TLP) which was measured with only one variable when applying the knowledge acquired in differential and integral calculus (see table 6).

Box 10

Table 6

Items and variables of the instrument applied.

Central Variable	Variable	Item
DAI	MKHS	Mathematics Knowledge in High School
	CKHS	Chemical Knowledge in High School
	PKHS	Physics Knowledge in High School
	DMTS	Diagnostic Mathematics Test Score
	GCKD	General Chemical 1 Knowledge in Degree
	PHKD	Physics Knowledge in Degree
	CAKD	Calculus Knowledge in Degree
	DICS	Differential and Integral Calculus Score
	SQMD	Self-Qualification when Making Derivatives
	SQMI	Self-Qualification when Making Integrals
TLP	KAADI	Knowledge Application Activity in Derivatives and Integrals

Declarations

Conflict of interest

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

Author´s contribution

González-Quezada, Esperanza: Contributed to in the development of the research introduction. She supported with the analysis and review of the state of the art. She supported in the application of the measurement instrument.

She analyzed the results and discussed them. She performed the breakdown of references by type of contribution to the research. She supported in the writing of the article.

Soltero-Sánchez, Alma Luz Angélica: Contributed in the design of the measurement instrument. She supported in the application of the measurement instrument. She analyzed the results and discussed them. She performed the breakdown of references by type of contribution to the research. She supported in the writing of the article.

Huerta-Chávez, Irma Alicia: Contributed to analysis and review of the state of the art. She contributed to the development of the method, type and design of the research. She carried out the statistical data analysis and prepared the tables and graphs. She analyzed the results and discussed them. She developed of conclusions and recommendations. She contributed in the writing of the article.

Figueroa-Ochoa, Edgar Benjamín: Contributed to analysis and review of the state of the art. He contributed to the development of the method, type and design of the research. He carried out the statistical data analysis and prepared the tables and graphs. He analyzed the results and discussed them. He developed of conclusions and recommendations. He contributed in the writing of the article.

Availability of data and materials

The databases and statistical analysis are available upon request via e-mail to the corresponding author of this article.

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Abbreviations

CAKD	Calculus Knowledge in Degree
CKHS	Chemical Knowledge in High School
DAI	Diagnostic Assessment Initial
DICS	Differential and Integral Calculus Score
DMTS	Diagnostic Mathematics Test Score
GCKD	General Chemical 1 Knowledge in Degree
KAADI	Knowledge Application Activity in Derivatives and Integrals
MKHS	Mathematics Knowledge in High School
PHKD	Physics Knowledge in Degree
PKHS	Physics Knowledge in High School
SQMD	Self-Qualification when Making Derivatives
SQMI	Self-Qualification when Making Integrals
TLP	Teacher-Learning Proccess

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Osborne, F.J. (1996). Beyond Constructivism. *Sci. Educ., 80*(1), 53-82.

Article

Web application for attendance management with QR Technology in a Public Elementary School

Aplicación Web para la gestión de asistencia con Tecnología QR en una Escuela Primaria Pública

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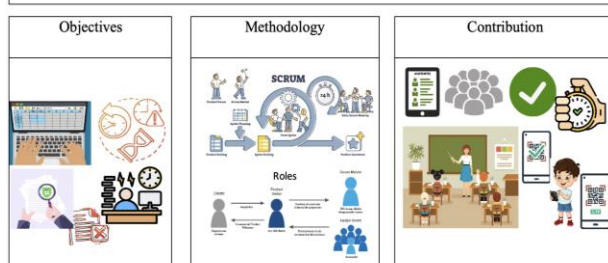d ROR Instituto Tecnológico de Oaxaca • KZU-9558-2024 • 0000-0003-4350-6311 • 820776

Abstract

Educational institutions must constantly update themselves with technological tools to improve the teaching-learning process. Student attendance is crucial, as their non-attendance affects their academic development. Currently, attendance control in the Public Primary School is carried out manually, being inefficient. Implementing technologies such as the QR Code can streamline this process by enabling faster and more accurate registration, instant access to data, early interventions for students with frequent absences, and error reduction. In addition, it facilitates integration with school management systems, promoting a more proactive and student-centered educational environment. For the development of the web application, the SCRUM methodology was used, which will allow agile and collaborative management, ensuring adaptability and continuous improvement of the system. This solution will not only optimize attendance registration, but will facilitate more accurate tracking of students' academic performance.

Resumen

Las instituciones educativas deben actualizarse constantemente con herramientas tecnológicas para mejorar el proceso de enseñanza-aprendizaje. La asistencia de los alumnos es crucial, ya que su inasistencia afecta su desarrollo académico. Actualmente, el control de asistencia en la Escuela Primaria Pública se realiza manualmente, siendo ineficiente. La implementación de tecnologías como el Código QR puede optimizar este proceso al permitir un registro más rápido y preciso, acceso instantáneo a datos, intervenciones tempranas para alumnos con inasistencias frecuentes, y reducción de errores. Además, facilita la integración con sistemas de gestión escolar, promoviendo un ambiente educativo más proactivo y centrado en el alumno. Para el desarrollo de la aplicación web se utilizo la metodología SCRUM, que permite una gestión ágil y colaborativa, asegurando la adaptabilidad y la mejora continua del sistema. Esta solución no solo optimizará el registro de asistencia, sino que facilitará un seguimiento más preciso del rendimiento académico de los alumnos.

Web Application for Attendance Management with QR Technology in a Public Elementary School

Objectives | Methodology | Contribution

Aplicación Web para la gestión de asistencia con Tecnología QR en una Escuela Primaria Pública

Objetivos | Metodología | Contribución

SCRUM, Attendance, QR code
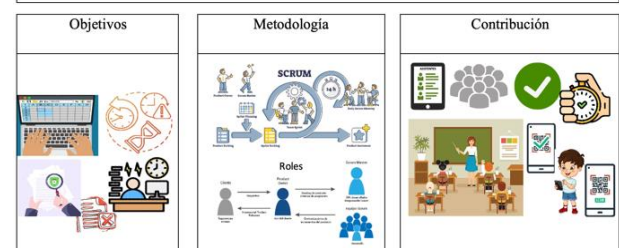
SCRUM, Asistencia, Código QR

Introduction

The control of school attendance is essential in the educational field, as it directly influences the academic performance of students. Regular attendance at a public primary school is a key indicator of parent's and student's commitment to their education, making a significant impact on their long-term academic success.

The importance of efficient attendance management lies not only in data management, but also in creating an educational environment that fosters accountability among students. Regular attendance can be a determining factor in the development of study habits and in the comprehensive education of students. Therefore, it is essential to have technological tools that facilitate the management of this important aspect of education.

The project presents the development of a Web Application for Attendance Management with QR Technology in a Public Elementary School in the city of Oaxaca de Juárez, Oaxaca. Web applications require a development methodology, which can be traditional or agile. The agile methodology used is SCRUM.

Modules for information management were defined:

- Student Management and Control Module
- QR Code Reading Module for attendance registration.
- Assistance Module
- Student Attendance Reports Module
- QR Code Consultation Module
- Access Module for User Management
- Calendar module for the Institute's event management.

This work has the following sections: Problem statement, where the current problems that Primary School is going through are cited. Development methodology, the development of a web application requires a methodology (traditional or agile) where the stages of the application are followed to reach the desired application. Results, these are important once the development methodology has been applied. Conclusions, synthesizing the most relevant points of the research.

Problem statement

In Primary School, attendance control is currently carried out manually, using Excel spreadsheets. Although this method can be functional, it has several limitations, such as the possibility of errors in data capture, the lack of information security and the excessive consumption of time by the administrative staff who capture the information.

There are also student leave, which can be given for two reasons, first because the parent requests it to the school authorities and second because of the number of absences that the student has. If there are thirty absences, the teacher notifies the school director through lists of the group, she communicates with the parents to justify the absences if necessary or to leave the student.

This process is done manually using an Excel file that lacks adequate security levels. Currently, this file is used by the administrator, which poses a significant risk: In case of damage to the computer equipment or the file, crucial information about students could be lost. This lack of protection and support could compromise data integrity and continuity of academic management

Recording and verifying attendance consumes valuable time that could be used in more productive educational activities. This can lead to a decrease in the quality of teaching and an increase in the workload for teachers.

Faced with this situation, the need arises to develop a web application that not only facilitates attendance registration, but also allows teachers and administrators to more effectively track absences and their justifications.

As an important fact, the school has two to three groups from first to sixth grade, with a total of three hundred nine students.

Development Methodology

Software development methodologies are mainly divided into two categories: the traditional methodology and the agile methodology.

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The traditional methodology, commonly known as the waterfall model, is characterized by a sequential and structured approach. In this model, each phase of development must be completed before moving on to the next, which can result in rigorous but often inflexible planning. According to Royce (1970), " the waterfall model is an approach that allows developers to follow a logical and orderly process, although it can be ineffective in the face of unexpected changes" (Royce, W. W. "Managing the Development of Large Software Systems").

On the other hand, agile methodology focuses on flexibility and adaptability. Promotes continuous collaboration between work teams and customers, allowing for quick adjustments in response to changes in requirements or project environment. They intend to promptly deliver operating software to customers, who will then propose new and varied requirements to include in subsequent iterations of the system (Sommerville, 2011).

According to the Agile Manifesto (2001), "the highest priority is to satisfy the customer through early and continuous delivery of valuable software", emphasizing the importance of collaboration and responding to change (Beck et al., "Manifesto for Agile Software Development").

For the development of the application, the agile Scrum methodology was chosen, which allows a flexible and adaptive approach in the development process.

This methodology is based on the realization of sprints, which are short cycles of work focused on the delivery of functional increases of the product.

Scrum is a project management process that simplifies and facilitates product development, promotes teamwork and communication among the members that make up the staff, is essential to obtain more efficient results (Torrado, 2019).

Scrum has roles and these are divided into two: Roles committed to the project: Product Owner, Scrum Team and Scrum Master, other roles involved with the project.

Box 1
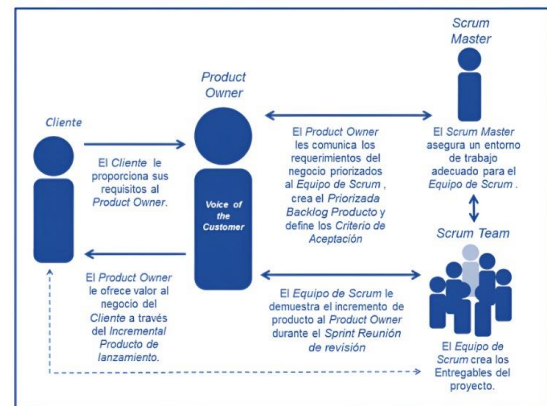
Figure 1
Roles in Scrum

Source: Torrado, 2019

Each sprint is made up of five ceremonies or events:

- Sprint Planning or Initial planning
- Daily Meeting or daily quick meetings
- Sprint Review
- Sprint Retrospective
- Refinement of the Product Backlog

Box 2
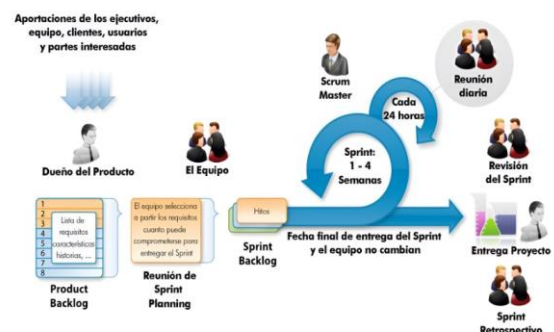
Figure 2
Ceremonies Scrum

Source: Schwaber & Sutherland, 2023

The Scrum methodology has Increments. The Increment is the sum of all Product List items completed during a Sprint and the value of the increments from all previous Sprints. at the end of a Sprint, the new Increment must be "Finished", which means that it is in usable condition and meets the Scrum Team's definition of "Finished". The increment must be usable regardless of whether the Product owner chooses to release it or not. (Schwaber and Sutherland, 2013)

PHP

It is a server-side interpreted language that emerges within the current called open source (open source). It is characterized by its power, versatility, robustness and modularity. As with similar technologies, programs are integrated directly into the code HTML (Beati, 2000).

Compared to ASP, the main advantage of PHP is its cross-platform nature. On the other hand, programs in ASP are slower and heavier, and also less stable (Cobo, 2005).

Box 3

Figure 3

PHP Logo

Source: php.net

Bootstrap

Bootstrap has been characterized as an excellent tool to create clean user interfaces and fully adaptable to any type of device and screen, regardless of size. According to Acens (2016), "Bootstrap it allows developers to design responsive web applications quickly and efficiently, making it easier to create a consistent design across different platforms"

This flexibility and ease of use make it a popular choice among web developers.

Some of its features of Bootstrap are:

- Personalization: Bootstrap is highly customizable. According to Bootstrap (2023), "developers can modify Sass variables to adjust design and components to their specific needs".
- Browser Compatibility: Bootstrap ensures that websites work in all modern browsers. According to MDN Web Docs (2023), "Bootstrap is compatible with all modern browsers, ensuring a consistent user experience ".

- Exhaustive documentation: Bootstrap has clear and detailed documentation.

According to Bootstrap (2023), "Bootstrap's documentation includes examples and guides that make it easy to implement for developers of all skill levels".

Box 4

Figure 4

Bootstrap Logo

Source: https://getbootstrap.com/

My SQL

MySQL is a relational database management system (RDBMS). It is a program capable of storing a huge amount of data of great variety and distributing it to meet the needs of any type of organization, from small commercial establishments to large companies and administrative bodies. MySQL competes with well-known proprietary RDBMS systems, such as Oracle, SQL Server y DB2 (Beati, 2000).

QR code

A QR code (Quick Response) is a type of two-dimensional barcode that allows information to be stored quickly and easily.

Box 5

Figure 5

QR code

Source: unitag.io

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Article

Characteristic:

a.   Storage capacity

It can store up to 7,089 numeric characters or 4,296 alphanumeric characters. This makes it more efficient than traditional barcodes, which are often limited in capacity (ISO/IEC 18004:2015).

b.   Quick Scan

QR codes can be quickly read by scanners and smartphone cameras, allowing immediate access to information. Their design allows them to be scanned from different angles (Denso Wave, 1994).

c.   Versatility

They are used in a variety of applications, including marketing, mobile payments, access to product information, and more. This has led to its adoption in multiple sectors, from commerce to education (Zhang et al., 2020).

d.   Damage resistance

QR codes can be read even if they are partially damaged, they can still be functional even if they have scratches or stains (ISO/IEC 18004:2015).

e.   Ease of creation

Creating a QR code is straightforward and accessible, with numerous online tools available that allow users to generate custom QR codes for different purposes (Cheng et al., 2019).

Results

In the development of the Web application for the management of assistance with QR Technology in a Public Primary School work with the agile development methodology called SCRUM, this methodology has stages:

1.   Plan
2.   Build
3.   Test
4.   Review

These stages are repetitive until the next incremental launch is achieved, ending with multiple launches called sprints. For this project 8 sprints were necessary:

-        Sprint 1: Database Creation
-        Sprint 2: Module for student registration with QR code generation
-        Sprint 3: QR Code Reading Module for Attendance Registration
-        Sprint 4: Module for the registration of student attendance and justification of absences
-        Sprint 5: Student Attendance Reporting Module
-        Sprint 6: Module to consult QR codes of students
-        Sprint 7: User logon and logout module
-        Sprint 8: Permissions module for each type of user
-        Sprint 9: Dashboard showing the students with the highest number of absences
-        Sprint 10: Module to add events of important dates of the institute

In each sprint, the planning is defined: Number of the sprint, duration, objective and activities to be carried out; the meeting plan and the development of the sprint: User stories, use cases, process diagram, interface design, coding and implementation tests.

Registration of students

To enter a new student, you must click on the "New" button, then a form is shown in which the student data must be entered, the fields marked with an asterisk (*) are mandatory, Figure 6.
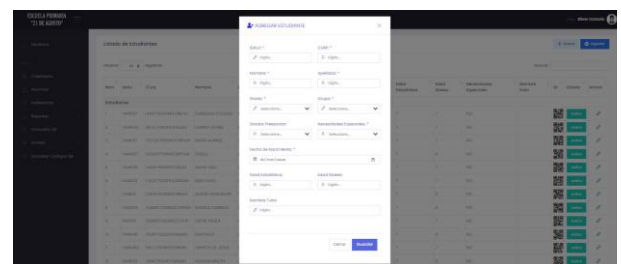
Box 6

Figure 6
Registration of students

Source: Own elaboration

List of students

There are three options to generate the list of students

1° Print the general list of students with all the corresponding data in PDF format.

Article

2º Save the general list of students in Excel format.

3ª Students' credentials are obtained, either by grade and group or solely by their student's IDALU, Figure 7.

Box 7

Figure 7

List of students

Source: Own elaboration

QR Code Reading

To record student attendance, the corresponding QR code must be scanned. Once this is done, the student's data will be displayed along with the time of entry and exit as shown in Figure 8.
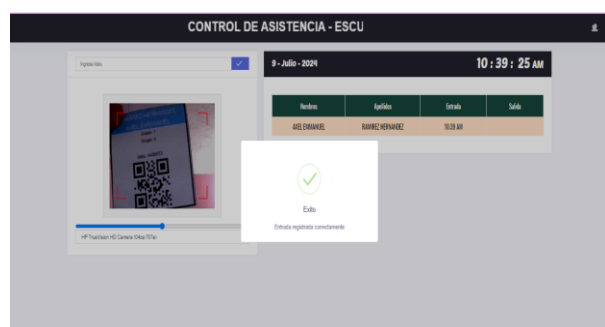
Box 8

Figure 8

QR Code Reading

Source: Own elaboration

In case of scanning an incorrect or non-existent QR Code, the system will display a warning message. This will also apply if the IDALU is incorrect or non-existent.

Check QR

In this section, it is possible to obtain the QR Code of a specific student. To do this, the student's IDALU must be entered and the desired size of the QR code image to be generated must be selected.

Then, click on the "Generate" button and the student's QR code will be displayed. You have the option to download and save the image to your computer. Figure 9.

Box 9
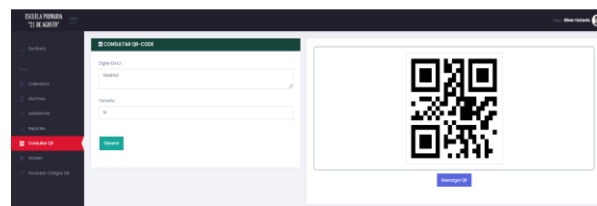
Figure 9

Check QR

Source: Own elaboration

Reports

There are four types of reports:

- The first: General Report
- The second: Group report
- The third: Individual report
- The fourth: Concentrated Report by period

In the group report, you must select the group from which you want to obtain the report. The report displays student attendance information in the form of an individual list of the selected group. The report will mark the days of the week on which the student attended, missed or had a justification. If a student register two entrances and exits on the same day.

Once the group has been selected, you must enter the range of days you want to generate the report (maximum 30 days). After generating the report, it will be shown in PDF format, Figure 10.

Box 10
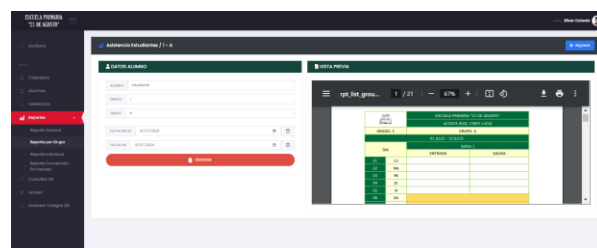
Figure 10

Report by Group

Source: Own elaboration

Aguilar-Ortíz, Gabriela, Ramos-Lira, Estefania, Pérez-Cruz, Silver Octavio and Diaz-Sarmiento, Bibiana. [2024]. Web application for attendance management with QR Technology in a Public Elementary School. Journal University Management. 8[19]1-8: e2819108.
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Conclusions

The implementation of a web application for attendance management and control in a Public Primary School has allowed to optimize administrative processes, improve information security and provide real-time data on student attendance. This project not only benefits the institution, but also contributes to the development of a more effective and organized educational environment.

QR technology has proven to be a viable and practical solution to the challenges facing attendance management, and its implementation can be replicated in other educational institutions looking to improve their administrative processes.

As technology advances, it is critical for educational institutions to adapt to these innovations to ensure quality education and efficient information management.

For future implementations, it is recommended to train teaching and administrative staff on the use of the new application, thus ensuring a smooth and effective transition. In addition, it is crucial to establish a maintenance and update protocol for the system to ensure its optimal operation over time. Constant feedback from users is also essential for making continuous improvements to the app.

Declarations

Conflict of interest

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

Author contribution

Aguilar-Ortíz, Gabriela: Comprehensive support in the development of the project, evaluation and optimization of the development methodology used.

Ramos-Lira, Estefania: Comprehensive analysis of requirements to understand the needs of the Primary School, development of the system with a focus on quality and functionality, implementation of the system, ensuring a smooth transition, and detailed evaluation to measure its performance and effectiveness.

Pérez-Cruz, Silver Octavio: Comprehensive analysis of requirements to understand the needs of the Primary School, development of the system with a focus on quality and functionality, implementation of the system, ensuring a smooth transition, and detailed evaluation to measure its performance and effectiveness.

Díaz-Sarmiento, Bibiana: Initial evaluation of the project, methodology to be used; meetings with the team; Comparative analysis of methodologies, proposals for improvement and documentation of results.

Availability of data and materials

The data handled in the research Web Application for attendance management with QR Technology in a Public Elementary School, are available for consultation

Abbreviations

IDALU – Unique student enrollment number
QR – It is a module for storing information in a data matrix or in a two-dimensional barcode.

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Comparative study in the progress of the level of English in the BIS generations at the Technological University of Altamira

Estudio comparativo en el avance del nivel de inglés de las generaciones BIS de la Universidad Tecnológica de Altamira

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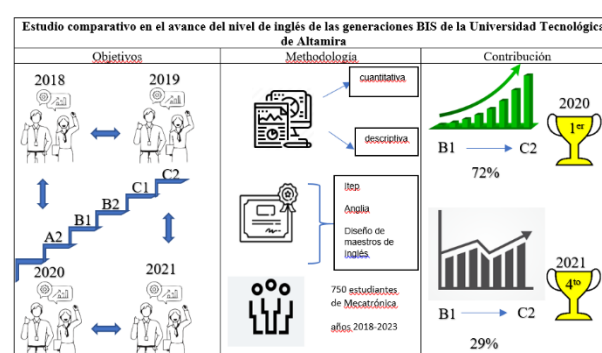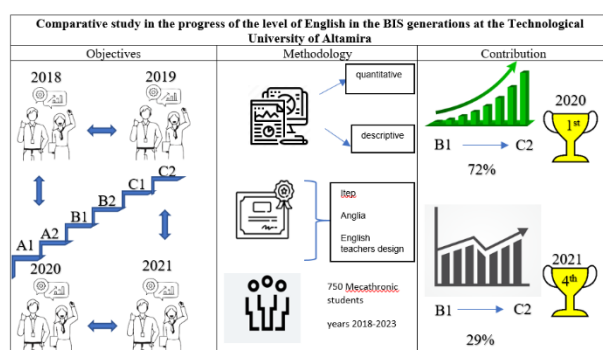[d] ROR Universidad Tecnológica de Altamira • LJM-0713-2024 • 0009-0007-8239-9041 • 1268504

Abstract

The objective of this research work was to determine the BIS generation that has made the most progress in English proficiency to analyze the causes. Progress in English proficiency was compared among all BIS generations, from the beginning of their academic journey until the completion of the Técnico Superior Universitario (TSU) level, with the main difference being the modality in which their classes were taught. The research was quantitative and descriptive. The instruments used to collect data were the iTEP, The Anglia, and another exam designed by English teachers. The study population consisted of 750 individuals who were students of Mechatronics from the years 2018 to 2023. According to the results, it can be concluded that there is greater progress in the third BIS generation. These findings contribute to the study and implementation of future improvement actions for the BIS model, as one of its main challenges is achieving a competent level of English proficiency by the end of the engineering program. Therefore, the more knowledge acquired about the issue, the greater the likelihood of finding solutions.

Resumen

El objetivo de este trabajo de investigación fue determinar la generación BIS que más avance en el nivel de inglés ha alcanzado para analizar las causas. Se comparó entre todas las generaciones BIS el avance en el nivel de inglés alcanzados, desde el inicio de la carrera hasta terminar el Técnico Superior Universitario (TSU), las cuales presentaban como diferencia principal la modalidad en la que se les impartieron sus clases. La investigación fue de tipo cuantitativa, descriptiva. Los instrumentos utilizados para obtener los datos fueron el iTEP, el Anglia y otro examen diseñado por maestros del área de inglés. La población estudiada consistió en 750 personas que fueron estudiantes de la carrera de Mecatrónica, durante los años 2018 hasta el 2023. De acuerdo con los resultados, se puede concluir que existe un mayor progreso en la tercera generación BIS. Estos resultados contribuyen al estudio e implementación de futuras acciones de mejora para el modelo BIS, ya que una de las principales dificultades de este modelo es el reto de alcanzar un nivel de inglés competente al término de la ingeniería. Por lo que mientras más conocimiento se adquiera de la problemática, mayor probabilidad se tendrá de encontrar soluciones.

BIS, English language Learning, iTEP

BIS, Aprendizaje del inglés, iTEP

Introduction

The Technological University, abbreviated as UT, is a decentralized public institution that provides higher education services in careers dedicated to technology and science. It was in September of the year 2018 when the UT of Altamira implemented the Bilingual, International, and Sustainable model, also known as the BIS model by its initials, exclusively in the Mechatronics career (Universidad Tecnológica de Altamira, 2023).

Since then, English proficiency certifications have been conducted periodically to monitor students' progress and achieve the goal of "bilingualism" set by the BIS model, regarding the expected English proficiency upon completion of the degree, which is level C1 (competent user, effective operational command) according to the Common European Framework of Reference for Languages (CGUTyP, 2018).

To carry out the above, new students begin with an additional semester, known as the zero semester. In this semester, they are provided with a 525-hour Introduction to the English Language Course. The course consists of a five-hour English class daily and five two-hour workshops per week (CGUTyP, 2019).

This intensive immersion in the English language during the zero semester improves their English proficiency, as well as helps them to work better with subjects that will be taught in English in the following semesters (Palomares & Domínguez, 2021).

However, a problem identified by all teaching staff was the significant difficulty faced by students who started studying under the BIS model with online classes in understanding and speaking English in their regular classes when the pandemic ended, compared to the generations that started their classes in face-to-face mode.

Understanding this problem is very important because, according to a study by Palomares et al. (2017), the BIS model has had a high rate of failure and dropout since its inception caused mainly by the essential requirement of achieving an intermediate level of English upon completing the degree.

Therefore, a study comparing the progress achieved in English proficiency of all generations from when they enter university until the end of the TSU level, considering especially the modality in which they received their classes, it is of utmost importance as it could assist the educational and administrative staff in identifying the possible causes of this delay, thus preventing or addressing this issue with future generations.

This involves establishing strategies to mitigate the factors involved in online classes and thereby reduce dropout rates or school failure.

Firstly, several concepts related to teaching within the BIS Model are explained, followed by the challenges of teaching English during the pandemic, as well as the presentation of the Methodology, report of results, and conclusions.

BIS Model

Universities face increasingly greater challenges every day due to the constant changes in today's society. One way in which Higher Education Institutions seek to address these challenges is through the BIS (Palomares et al., 2017) modality.

The BIS modality began in the state of Aguascalientes because there was a need for experts within the automotive sector to have a high proficiency in the English language for software development purposes. The first BIS university in the country was the Universidad Tecnológica El Retoño, which began operating in August 2012 (CGUTyP, 2018).

The model retains everything from the previous program to train higher university technicians and then continue with engineering, under professional competencies and practical training (Palomares & Domínguez, 2021).

The BIS model began at UT Altamira in September 2018. The word BIS is composed of the initials of the words Bilingual, International, and Sustainable. This study will focus on the Bilingual axis.

Bilingual

The first axis of the BIS model is the Bilingual aspect, which implies that the school operates using two languages, primarily within the pedagogical area, where didactic material, used bibliography (CGUTyP, 2019), and subjects taught in English are included (Palomares et al., 2017).

However, it also involves administrative staff communicating with BIS students in English and even having signage in English, Spanish, and a third language chosen by the campus (CGUTyP, 2019).

The role of the student within this learning process is of utmost importance, as they should not be passive participants but rather, on the contrary, they should be committed to their education and assume their role as the protagonist of the educational act.

The student becomes the constructor of their knowledge and seeks to maintain intrinsic motivation to learn a second language (CGUTyP, 2018).

The learning of this second language is aimed to be provided simultaneously with the professional development of the student, and this is done under a transitional bilingualism scheme; which means that the English language will be gradually incorporated into the curriculum until it eventually becomes the main language of their education (CGUTyP, 2018).

The goal for the Technological University of Altamira, which was categorized, until September 2018, as a BIS Training University, is that, upon completion of the zero semester, 55% of the students reach at least level A2 according to the CEFR, Common European Framework of Reference for Languages (CGUTyP, 2019), which is a basic level (Suárez, 2022).

The CEFR provides levels of language proficiency, allowing for defining the knowledge that a language student should learn or develop to communicate, as well as enabling the assessment of students' progress throughout their language learning journey. The levels range from basic to mastery or proficient in ascending order as follows: A1, A2, B1, B2, C1, C2 (Ministerio de Educación, Cultura y Deporte, 2002), see annex 1.

After the zero semester, this model indicates that two subjects must be taught in a foreign language (CGUTyP, 2018); in the case of UT Altamira, the subjects taught in English have been Productive Processes and Electricity and Magnetism.

In the second semester, the student receives four subjects in English (CGUTyP, 2018); at UT Altamira, the subjects taught are Chemistry, Electrical Circuits, Motor Control, and Hydraulic and Pneumatic Systems.

Finally, starting from the third semester, all BIS mode teachers must teach their subjects in English (CGUTyP, 2018). With some exceptions considered, such as French and Oral and Written Expression II courses (CGUTyP, 2019). However, UT Altamira has taught all subjects in English from that semester onwards.

Upon completing studies as a Higher University Technician, the established goal regarding English proficiency level is B1, and when the student finishes the engineering program, it is expected that they reach a level of B2 or C1 (CGUTyP, 2019).

This axis has become the one that receives the most effort and attention within the BIS modality because non-compliance with the English proficiency level directly impacts the student's possibility of graduating (CGUTyP, 2018 and 2019).

In fact, in a survey conducted at the Polytechnic University of Santa Rosa Jauregui, it was found that 53% of the graduates from 2022 have not been able to graduate because they did not reach the B2 level of English (Suárez, 2022).

Internationalization

Internationalization arises from creating institutional cooperation networks with the aim to develop educational or research projects, as well as sharing information, and involves the mobility of students, professors, or university staff. Mobility provides BIS students with the opportunity to strengthen their educational and professional formation (CGUTyP, 2018).

Within the internationalization axis, both national mobility between BIS institutions and international mobility are considered.

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Therefore, the university must engage in cultural understanding actions and increase its ties with foreign companies and institutions to belong to the model (CGUTyP, 2019). Some examples of actions that can be taken include organizing cultural fairs, undertaking internships abroad, hosting foreign individuals, international forums and conferences, accreditation of educational programs before international associations, etc. (CGUTyP, 2018).

On its part, the Technological University of Altamira has the MEXPROTEC Mexico-France Cooperation Program, a cooperation program with Centennial College in Canada, the Technical Education Vocational and Training in the United Kingdom, with the German Academic Exchange Service, Community Colleges in the United States of America, and the University of Arizona. It is worth mentioning that, in 2022, 9 students were enrolled in one of these programs (Universidad Tecnológica de Altamira, 2021).

Sustainability

It is the third pillar of the model; a sustainable university seeks to promote a culture of sustainability among its members and stakeholders (Heath et al., 2015), where ecological, social, economic, and institutional balance is gradually achieved. It requires a change in the university lifestyle. The aspects that compose this axis in the BIS model are: Education for sustainability, Sustainable University Management, and Culture of Sustainability (CGUTyP, 2019 and 2018).

Learning English in Virtual Environments

Since the confinement caused by the pandemic, students were forced to carry out their educational process through virtual environments, which presented opportunities but also limitations and challenges. During the pandemic, university students needed to acquire and consolidate new skills that would allow them to be the protagonists of their learning (Trujillo & Martínez, 2021), and in fact, this is particularly important for success in the BIS model (CGUTyP, 2018). According to Carranza et al. (2018) Social networks, videos and videogames are the most useful tools students use when acquiring in an autonomous way a second language, since it influences positively in their motivation.

At UT Altamira, synchronous online classes were conducted in April 2020, using Google Classroom, Google Meet and WhatsApp as the main means of communication. Google Meet offers simultaneous subtitles for online classes, which is an advantage students use a lot.

According to Mendez & Morales (2023), subtitles help students efficiently reach a better and less complicated comprehension of visual authentic and semi-authentic material.

The first difficulty students faced in their online learning was accessing internet services from their homes, as many of them did not have access (Basantes et al., 2021), and if they did, it was of poor quality (Echauri et al., 2021), or they lacked the necessary resources for their virtual classes such as a computer, suitable cell phone, headphones, etc. (Basantes et al., 2021).

However, the most significant difficulty found in a study conducted with a Mexican population was the students' attitude towards the virtual modality, as the majority preferred to obtain their learning through face-to-face classes (Garduza & Toledo, 2021; Trujillo & Martínez, 2021).

Additionally, virtual teaching generates less motivation in them, probably due to concentration problems in their new learning environments (Echauri et al., 2021).

Other difficulties concerning the teacher were mainly the lack of training or technological illiteracy of the teacher (Trujillo & Martínez, 2021), and the fact that a large portion of the teachers taught their classes the same as if they were in face-to-face classes, missing out on and ignoring the opportunities and limitations of the online modality (Basantes et al., 2021).

However, other studies claim that virtual environments allow teachers to implement new tools for education and thus improve language proficiency (Cano et al., 2019 and Llano, 2022).

Nevertheless, it is important to remember that the BIS model not only involves learning English itself but also entails the professional training of the student in English, in which all subjects are taught in the second d language (CGUTyP, 2018).

Therefore, studies or research analyzing the differences in the progress of BIS students' English proficiency and the pandemic's impact on the virtual modality are practically nonexistent.

In February 2022, the Technological University of Altamira returned to its face-to-face modality, presenting a hybrid or mixed modality for practices and workshops in 2021.

Methodology

This research is quantitative and descriptive as it collects numerical quantifiable data on the progress in English level achieved up to the TSU (Technical University Degree) among the BIS (Bilingual, International, and Sustainable) generations, to compare them and to describe in which generation there was greater progress and analyze possible causes for the observed results. For the evaluation, the primary instrument used was the International Test of English Proficiency, or iTEP (Universidad Tecnológica de Altamira, 2020). This test is an online assessment tool developed by the Boston Educational Service. It has the advantage of being easily accessible, affordable, and providing quick results (Suárez, 2022).

It lasts between 50-80 minutes and assesses five skills: grammar, reading, listening, speaking, and writing (International Test of English Proficiency, 2016).

Additionally, the Anglia Placement Test was used.

This is a free online diagnostic test. In this exam, students choose the level at which they would like to start being assessed, ranging from A1 for those who consider their English to be basic, up to C2 for advanced levels.

Depending on the chosen level, students answer between 15 to 35 questions, and the duration of the test also depends on the selected level (Anglia Examinations Syndicate, 2023). Finally, an exam designed in Google Forms by expert members of the English academy was used. The studied population consisted of 750 Mechatronics students who pursued the TSU degree during the period from September to December, from 2018 to 2023. Of the students, 85.7% were male and 14.2% female.

For the first BIS generation, which began its zero semester in 2018, 194 students enrolled and 102 graduated. The diagnostic test was conducted at the university. The completion exam was conducted remotely, which means each student took it at home.

The exams conducted at the university were collectively administered in language laboratories adapted for the BIS model, being the iTEP the only applied test.

The second BIS Generation in 2019 had an initial enrollment of 184 students and 163 graduates. The iTEP exam was administered in the same manner as for the first generation.

For the third BIS Generation in 2020, 136 pupils graduated from the 194 enrolled. This generation was the first to take the zero semester online, so the enrollment exam administered was The Anglia placement test. The completion exam was the iTEP conducted remotely.

Lastly, the fourth Generation in 2021 had an initial enrollment of 178 students and 115 graduates. Both exams were administered remotely since this cohort continued in virtual education. This generation took a placement test used in the CIUT, the Technological University Language Center, created by expert English teachers.

The completion test was the iTEP, administered in person in the university laboratories.

Results

According to the results of the iTEP exam, for the 2018 cohort, the following data were obtained: 61 students at level A1; 67 students at level A2; 40 at B1; 24 at B2; and 2 at C1. Upon completing the TSU program, the following data were obtained: 3 students at level A1; 8 at A2; 41 at B1; 38 at B2; and 12 at C1.

This cohort demonstrated an enrollment mode of level A2, as it appears most frequently according to the number of students who took the diagnostic exam, see Box 1.

González-Barrón, María Teresa, Alvarado-Medellín, Marisela, Barrios-Rodríguez, Lilia Gabriela and Pedraza-Vázquez, Ingryt Karely. [2024]. Comparative study in the progress of the level of English in the BIS generations at the Technological University of Altamira. Journal University Management. 8[19]1-11: e3819111.
https://doi.org/10.35429/JUM.2024.8.19.1.11

Box 1

Simple dispersion test results of the first BIS generation
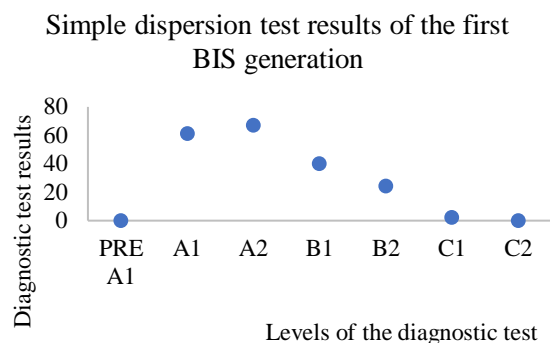
Figure 1

Enrollment levels of the first generation

And the majority graduated with a level of B1. Comparing both graphs, it can be observed that the overall progress was by one level, see Box 2.

Box 2

Simple dispersion of the completion test results of the first Bis generation
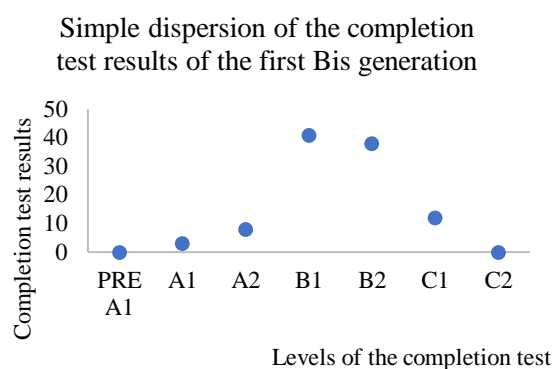
Figure 2

Levels of completion test of the first generation

At the beginning, the rate of students with a satisfactory level, which is from B1 to C2, was 34%; by the end of the TSU program, it increased to 89%. Thus, the difference in the rate of students with this level was 55%, see Box 3.

Box 3

Figure 3

Rate of students with satisfactory level of English in the first generation

In the second cohort, in the first exam administered, the results were as follows: 46 students achieved level A1; 61 got A2; 46 obtained B1, and 31 with B2. The completion test showe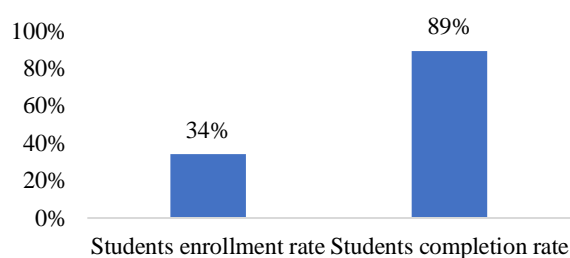d the following results: 7 students achieved level A1; 9 with A2; 44 obtained B1; 42 got B2; 33 resulted with C1; and 13 students concluded with C2.

The enrollment level was on average A2, as it appears most frequently according to the number of students who took the diagnostic exam, see Box 4.

Box 4

Simple dispersion of the diagnostic test results of the second Bis generation

Figure 4

Enrollment levels of the second generation

The graduation level was B1, and comparing both graphs, it can be observed that the overall progress was by one level, see Box 5.

Box 5

Simple dispersion of the completion test results of the second Bis generation

Figure 5

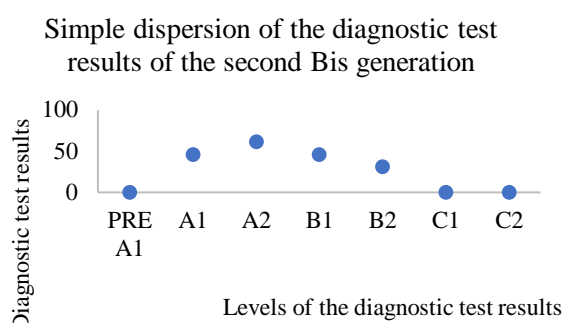Completion levels of the second generation

At the beginning, the rate of students with a satisfactory level, that is, from B1 to C2, was 42%; by the end of the TSU program, it increased to 89%. Thus, the difference in the rate of students with this level was 47%, see Box 6.

González-Barrón, María Teresa, Alvarado-Medellín, Marisela, Barrios-Rodríguez, Lilia Gabriela and Pedraza-Vázquez, Ingryt Karely. [2024]. Comparative study in the progress of the level of English in the BIS generations at the Technological University of Altamira. Journal University Management. 8[19]1-11: e3819111.
https://doi.org/10.35429/JUM.2024.8.19.1.11

Box 6

Figure 6

Rate of students with satisfactory level of English in the second generation

In the third cohort, 62 students achieved Pre-A1 level, 74 got A1, 45 obtained A2, 10 with B1, and 3 resulted with C2 level. At the end of the semester, the results were 15 students at level A1, 13 at A2, 39 at B1, 38 at B2, 30 at C1, and 1 at C2.

The enrollment of this cohort showed a mode of A1 level, as it appears most frequently according to the number of students who took the diagnostic exam, see Box 7.

Box 7

Figure 7

Enrollment levels of the third generation

The mode at graduation was B1, and comparing both graphs, it can be observed that the overall progress was by two levels, see Box 8.

Box 8

Figure 8

Completion levels of the third generation

At the beginning, the rate of students with a satisfactory level, that is, from B1 to C2, was 7%; by the end of the TSU program, it increased to 79%. Thus, the difference in the rate of students with this level was 72%, see Box 9.

Box 9
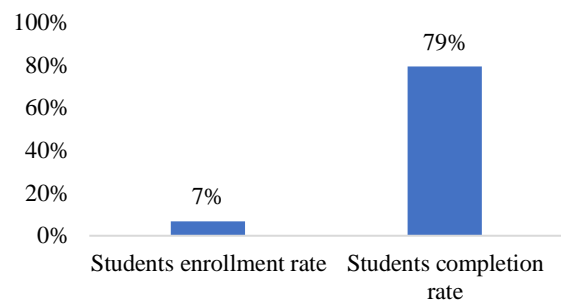
Figure 9

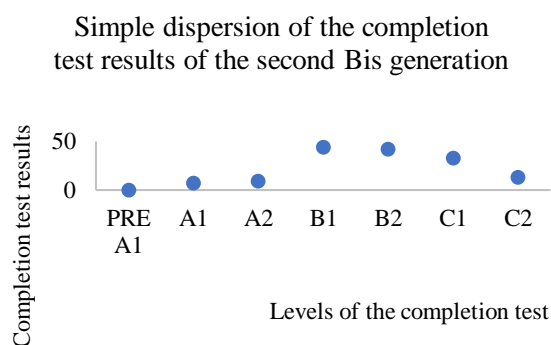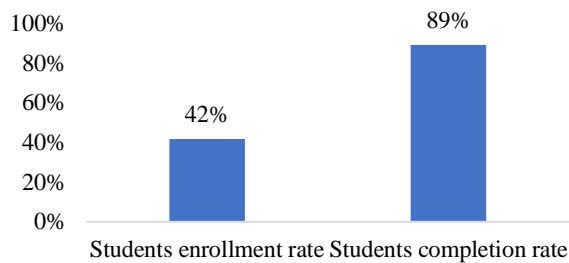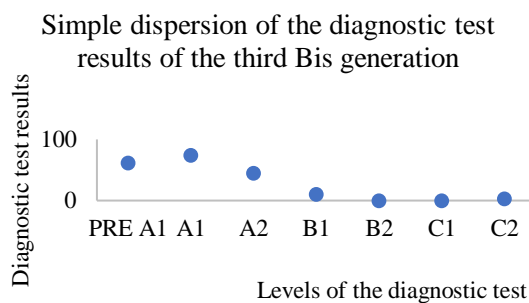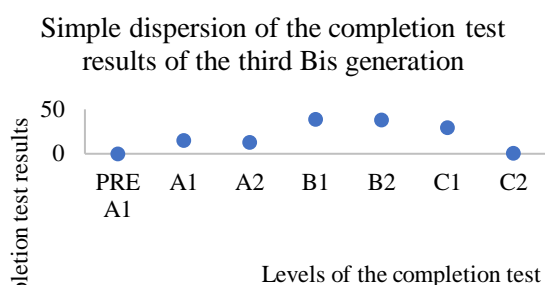Rate of students with satisfactory level of English in the third generation

The last cohort consisted of 50 students at level A1, 60 at A2, 45 at B1, 17 at B2, and 6 students at level C1. On average, the enrollment level was A2, as it appears most frequently according to the number of students who took the diagnostic exam, see Box 10.

Box 10

Figure 10

Enrollment levels of the fourth generation

The completion test shows the following data: 24 students achieved level A1; 14 obtained A2; 38 got B1; 25 with B2, 11 resulted with C1, and 3 led to C2.

The average graduation level was B1, and comparing both graphs, it can be observed that the overall progress was by one level, see Box 11.

González-Barrón, María Teresa, Alvarado-Medellín, Marisela, Barrios-Rodríguez, Lilia Gabriela and Pedraza-Vázquez, Ingryt Karely. [2024]. Comparative study in the progress of the level of English in the BIS generations at the Technological University of Altamira. Journal University Management. 8[19]1-11: e3819111.
https://doi.org/10.35429/JUM.2024.8.19.1.11

Box 11

Simple dispersion of the completion test results of the fourth Bis generation

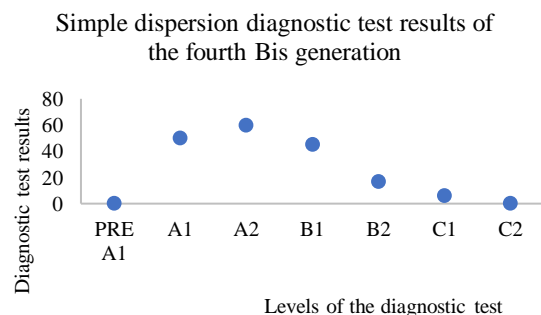**Figure 11**
Completion levels of the fourth generation

At the beginning, the rate of students with a satisfactory level, which is, from B1 to C2, was 38%; by the end of the TSU program, it increased to 67%. Thus, the difference in the rate of students with this level was 29%, see Box 12.

Box 12
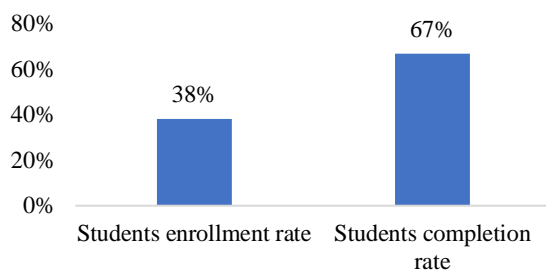
Figure 12
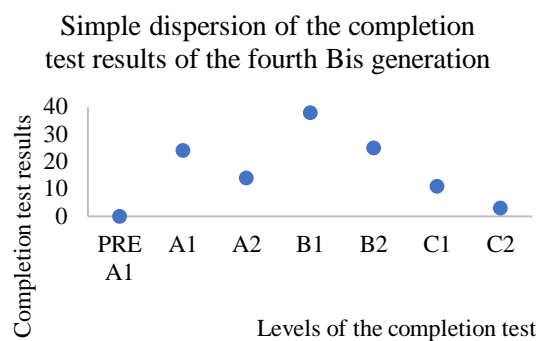Rate of students with satisfactory level of English in the fourth generation

Conclusions

According to the data, the progress made by the 2018, 2019, and 2021 cohorts was of just one level, achieving most of the students a maximum level of B1. In contrast to the 2020 cohort which showed a progress of two levels.

If we analyze the difference in the number of students who reached the acceptable levels of English at the end of the TSU degree which are B1 to C2, the highest rate was achieved by the 2020 cohort (72%).

In contrast to what some authors imply (Basantes et al., 2021; Echauri et al., 2021; Garduza & Toledo, 2021 and Trujillo & Martínez, 2021), the best progress was obtained by the generation whose most of their TSU classes were fully online.

Some of the possible reasons for these results would be that students had more opportunities to simultaneously use digital resources which allow them to be exposed to English materials and apps (Cano et al., 2019 and Llano, 2022).

Furthermore, it was observed that most of them were using subtitles when teachers were explaining their classes fully in English. This way, students benefited from a better comprehension of the second language (Mendez & Morales, 2023).

Another good reason could be that students' free time when confined was dedicated to playing online, even with people of other nationalities using English as their means of communication, provoking a better exposition and acquisition of the language. (Carranza et al., 2018).

In addition to this, during the pandemic, some social networks were highly used to create digital content. This was better monetized if it was in English to better spread all around the world which meant more money. Being this a good motivation for them.

Another possible reason for the obtained results has been mentioned by some authors who state that virtual environments, besides challenging students, provide them with new opportunities to apply tools that allow them to have better communication and practice of the language (Cano et al., 2019 and Llano 2022).

On the other hand, a different diagnostic test called The Anglia placement test was used with this generation, unfortunately its reliability is unknown. Moreover, there was found very atypical data, regarding the rate of new enrolled students with a very low level of English.

Therefore, the validity of these results of the third generation could be a matter of question.

It is recommended to expand the study to search other factors that might be involved, such as the dropout rate, failure, English proficiency level of professors who taught them.

González-Barrón, María Teresa, Alvarado-Medellín, Marisela, Barrios-Rodríguez, Lilia Gabriela and Pedraza-Vázquez, Ingryt Karely. [2024]. Comparative study in the progress of the level of English in the BIS generations at the Technological University of Altamira. Journal University Management. 8[19]1-11: e3819111.
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Annexes

Annex 1. *Common Reference Levels: global scale*

Proficient User	C2	Can understand with ease virtually everything heard or read. Can summarise information from different spoken and written sources, reconstructing arguments and accounts in a coherent presentation. Can express him/herself spontaneously, very fluently and precisely, differentiating finer shades of meaning even in more complex situations.
	C1	Can understand a wide range of demanding, longer texts, and recognize implicit meaning. Can express him/herself fluently and spontaneously without much obvious searching for expressions. Can use language flexibly and effectively for social, academic and professional purposes. Can produce clear, well-structured, detailed text on complex subjects, showing controlled use of organisational patterns, connectors and cohesive devices.
Independent User	B2	Can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialisation. Can interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain for either party. Can produce clear, detailed text on a wide range of subjects and explain a viewpoint on a topical issue giving the advantages and disadvantages of various options.
	B1	Can understand the main points of clear standard input on familiar matters regularly encountered in work, school, leisure, etc. Can deal with most situations likely to arise whilst travelling in an area where the language is spoken. Can produce simple connected text on topics which are familiar or of personal interest. Can describe experiences and events, dreams, hopes and ambitions and briefly give reasons and explanations for opinions and plans.
Basic User	A2	Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g., very basic personal and family information, shopping, local geography, employment). Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.
	A1	Can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type. Can introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has. Can interact in a simple way provided the other person talks slowly and clearly and is prepared to help.

Source: Council of Europe (2001)

Declarations

Conflict of interest

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

Author contribution

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

Alvarado-Medellín, Marisela: investigation, gathering and comparing resources ensuring facts, sharing findings with the whole research team.

Barrios-Rodríguez, Lilia Gabriela: Contributed to conceptualization, review original-draft, sharing findings with the whole research team, provide feedback.

Vazquez-Pedraza, Ingryt Karely: data analysis, translation of original-draft, sharing findings with the whole research team.

Availability of data and materials

The information used in this draft was collected based on the results of the certifications applied to students of the Associate Degree in Mechatronics, in accordance with the guidelines requested by the Coordination of Technological and Polytechnic Universities.

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

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Journal University Management

Article

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Abbreviations

BIS	Bilingual International and Sustainable
CEFR	Common European Framework of Reference for Languages
CGUTyP	General Coordination of Technological and Polytechnic Universities
CIUT	Technological University Language Center
iTEP	International Test of English Proficiency
MEXPROTEC	Mexico-France Cooperation Program
TSU	Technical University Degree
UT	Technological University

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Discussions

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Comparison of ideal vocational profiles against real vocational profiles and their relationship with academic performance at the Technological University of Leon

Comparación de perfiles vocacionales idóneos contra los perfiles vocacionales reales y su relación con el desempeño académico en la Universidad Tecnológica de León

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Abstract

In this research, the relationship between the ideal vocational profile and the real vocational profiles of students in the Virtual Environments and Digital Business (EVN) and Environmental Chemistry (QA) courses, generation 2020-2022, at the Technological University of León, was explored. The results of the vocational preferences of the Single Registration System for Higher Education Applicants (SUREDSU) were used and compared with the qualification of the stay process. The sample consisted of 88 students, 38 from the EVN course and 50 from the QA course. The results allow us to identify that the ideal vocational profile coincides with excellent performance, but there are also combinations with other complementary areas that enable good academic performance. This work invites us to expand the research to identify the additional factors that influenced these results, in order to recognize and enhance them.

Resumen

En la presente investigación se exploró la relación entre el perfil vocacional idóneo y los perfiles vocacionales reales de los estudiantes de las carreras de Entornos Virtuales y Negocios Digitales (EVN) y Química Ambiental (QA), generación 2020-2022, de la Universidad Tecnológica de León. Se utilizaron los resultados de las preferencias vocacionales del Sistema Único de Registro de Aspirantes a la Educación Superior (SUREDSU) y se compararon con la calificación del proceso de estadía. La muestra fue de 88 estudiantes, 38 de la carrera de EVN y 50 de la carrera de QA. Los resultados permiten identificar que el perfil vocacional idóneo coincide con un desempeño de excelencia, pero también existen combinaciones con otras áreas complementarias que posibilitan un buen desempeño académico. Este trabajo invita a ampliar la investigación para identificar los factores adicionales que influyeron en estos resultados, con la finalidad de reconocerlos y potenciarlos.
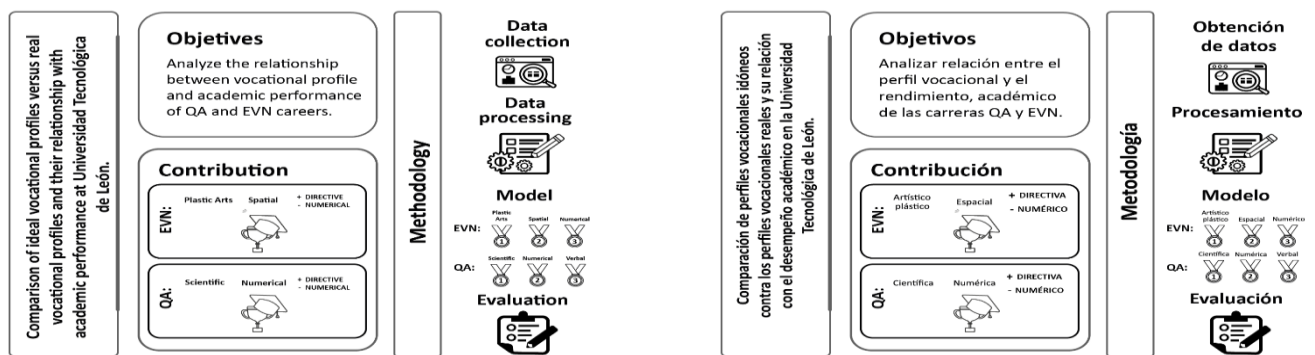
Vocational profile, Terminal efficiency, Academic performance

Perfil vocacional, Eficiencia terminal, Desempeño académico

Article

Introduction

The Technological University of León (UTL), since its beginnings in 1996, recognises the socio-economic and labour changes, seeks to adapt to current demands and integrates into its house of studies the new generations of young people, whose crossroads range from strengthening their knowledge and professional skills, defining a life project in accordance with their values and aspirations, to recognising themselves as part of a social group that allows them to mature in socio-emotional processes important for this stage of life (UTL, 2024). (UTL, 2024).

Currently UTL is one of the largest Technological Universities in the country with a reported enrolment of **7,870 students*,** distributed in two Academic Units, Acámbaro and León, which include the Higher Technical University (TSU) and undergraduate levels. This brings with it great benefits, but also great challenges.

An example of these challenges is that despite the increase in enrolment and the efforts undertaken by the different educational actors, the terminal efficiency of the **TSU generation 2020-2022 is only 43.4%**.**

This is a worrying figure, as it means that less than half of the students who enrol at the University complete their professional training. The main causes of desertion are the following reasons for leaving**:

1. **Academic:** failing grades that do not allow them to continue progressing.
2. **Personal**: family problems, interpersonal conflicts and others.
3. **Vocational:** vocational confusion, dislike of the career or lack of interest in studying.

In the first reason for leaving, several factors converge, on the one hand, the lack of knowledge and skills specific to the chosen career, but also speaks of an educational process that needs to strengthen their academic strategies to develop these skills. The personal motive refers to emotional and social changes or imbalances, which influence the change of perspective on the student's priorities. Family problems are generally the most prevalent.

The third reason is directly related to the phenomenon of 'not feeling called' or interested in the chosen career, losing the purpose of continuing to make an effort.

According to the monitoring of the reasons for dropping out carried out in the psycho-pedagogical department, it has been identified that a large number of students enter UTL without having carried out a process of self-knowledge and reflection on their interests and abilities, having opted for a university degree based on the choices of their group of friends, suggestions from their relatives or occupations that promise greater economic success, but which are not related to tasks or activities that they enjoy doing and learning.

This leads to great frustration when they realise that their lack of vocation and skills makes it difficult for them to achieve the desired academic integration, adding to the list of students at risk of dropping out.

This is why the Technological University of León incorporated a self-diagnostic questionnaire on vocational preferences into its admission process: the Unique System for the Registration of Applicants to Higher Education (SUREDSU).

This tool was created by the now defunct Secretariat of Innovation, Science and Higher Education (SICES) in conjunction with the Guanajuato State's Higher and Higher Education Institutions, to identify and monitor high school students' expectations about university careers (Martínez-López, Vega-Flores and Vega-Chévez, 2018). SUREDSU, being a publicly funded initiative, allows easy and free access for all students interested in knowing their vocational preferences.

The SUREDSU (SEG, 2023) consists of 72 questions with Likert-type answers where the respondent must assign a value of 0-4 according to his or her perception of how much the actions described in the instrument are facilitated.

This survey can be completed virtually through the portal: https://suredsu.guanajuato.gob.mx/ where your answers will profile you to identify your skills and interests across the nine areas of knowledge covered by the instrument.

These areas are: directive, musical, artistic, plastic, scientific, verbal, numerical, mechanical, spatial and social.

Specific combinations of these knowledge areas can help to outline a vocational profile for a career. The student gets a voucher with their results which can be printed out and in case they need to review or reprint them, their results are saved in their user account on the SUREDSU website.

Since 2020, the Universidad Tecnológica de León has sought to take advantage of this information by proposing a combination that is even more in line with the technical careers offered at UTL.

This selection of knowledge areas was carried out with the collaboration of the career managers who, by examining what each knowledge area consisted of and, based on their experience of the skills demanded by their careers, would choose the three main knowledge areas that form the basis for developing the desired technical and professional competences. This combination was called the ideal vocational profile.

Thus, as part of the enrolment process, students complete the SUREDSU survey upon enrolment at UTL. The information obtained from this questionnaire is integrated into a database that is shared with the academic authorities for better analysis and use.

As explained in their study Sánchez et al. (2017), which explains the relationship between dropout and vocational profile in university applicants, academic performance can be classified into two: internal performance, whose indicators are based on the grades that the student obtains throughout their school career, and external performance, which is the result of the implementation of knowledge and skills in a real scenario, where their professional competences are put to the test.

This is why this study considers the evaluation of the internship, which is the period in which students put their skills into practice and put them to use in the solution of a problem or by contributing to the development of a project with benefits for a local company.

In order to make a diagnosis of the current situation related to student drop-out, the case of the Environmental Chemistry and Virtual Environments and Digital Business degree courses is taken, as they are some of the degree courses with the lowest terminal efficiency rates.

The terminal efficiency of QA for the 2020-2022 generation was only 31.5% *** and for the EVN course in the same generation it was 35.1% ***.

In the absence of an analysis showing that these results are in themselves predictors of better academic performance, the relationship between the answers provided by the student and their actual vocational preferences is unknown.

For, there is a margin that lends itself to manipulation by seeking to fit into the career for which he or she has bought a token. Therefore, it is imperative to carry out this research and implement proposals based on a more systematised analysis of this information.

Theoretical framework

Vincent Tinto (1987) mentions that during the first year of university there is a greater risk of dropping out, since students are usually not very involved in university life. For the tasks that the student must undertake in order to integrate into the institution include: detaching from the relationship with the old school (baccalaureate) and adapting to the new intellectual and social requirements.

From this, two problems can be reviewed which may jeopardise their permanence: a) that the student falls into isolation and b) that there is an *incongruence* between his or her ideals and the values offered by the institution.

In this sense, the process of vocational and professional guidance is of great relevance, as it would help to reduce the risk of dropout in early stages, helping the young person to adapt to the new requirements with a greater understanding of himself and the educational model to which he is enrolled, maintaining the greatest possible congruence between his ideals and reality.

The concept of **self-efficacy** studied by Bandura (1986) helps to understand the aforementioned phenomenon, as he explains that a student who knows he is capable of facing an academic problem is a student who is more easily committed to trying to overcome it and, therefore, is more likely to complete his degree.

The key lies in dedicating time to reflection, self-analysis and observation, especially of the positive experiences of achievement that have been had, and in social interaction that recognises the efforts and successes obtained.

Among the factors recognised as a cause of university drop-out, the following is identified among the first places: the wrong choice of career. According to Zambrano, Rodríguez and Guevara (2018) 'The deficient vocational orientation received before entering to select a university career causes students to enrol in professional careers without basing their decision on solid information about them.' (Zambrano, Rodríguez and Guevara, 2018, p.5)

In Mexico, there have been several investigations that have been conducted regarding the importance of Vocational Guidance. In their research work reported in the article 'El efecto de la Orientación Vocacional en la elección de carrera' De León y Rodríguez (2008), emphasise the importance of the vocational guidance process to strengthen the decision-making process in young people at the high school stage, mentioning that: '...the correct selection of the career to study becomes an important tool to preserve or increase the student's motivation and school performance' (De León & Rodríguez, 2008).

According to Bonilla, López, and Juárez (2015), the importance of vocational guidance for upper secondary students lies in providing a space for reflection and self-knowledge, which favours a *'correct professional choice adjusted to their reality...'* (Bonilla, López, and Juárez, 2015).

Key concepts

Vocation: According to the Royal Spanish Academy (2023) the term comes from the Latin *vocatio-onis* 'action of calling'. Vocation is the inclination to a state, a profession or a career.

Vocational Guidance: is a process of vocational and professional guidance to reach the right choice of profession at a higher level; therefore, it must be planned, programmed, executed and evaluated (Barreno, 2016).

Terminal efficiency: indicator that expresses the capacity to ensure that those who start a given level of education graduate satisfactorily from it (Muñoz Izquierdo, 1973).

Dropout: at the Technological University of Leon, dropout is considered to be the interruption of the academic course, whether voluntary or involuntary; temporary (more than 3 years have elapsed since its preparation) or definitive.

Graduation: for the purposes of this study, a graduate is considered to be any student who has satisfactorily completed their studies, fulfilling 100% of the curricular load corresponding to the current study plan in the chosen degree course.

Permanence: a term coined in studies on students who persevere in education, with emphasis on overcoming adversities (González, 2011). This term seems to derive from the translation of the English term used by Tinto and other authors as *persistence*.

Factor: an element or circumstance that contributes, together with other things, to produce a result.

Suitable vocational profile: combination of areas of knowledge based on the SUREDSU survey, previously selected and defined for each career, according to the nature of the essential activities and the graduate profile.

Actual vocational profile: combination of knowledge areas that each student obtains through the SUREDSU survey. The following is a description of each area of the survey in relation to the present study:

Artistic-plastic: Artistic-plastic interest is manifested when we enjoy doing creative work with our hands; drawing, painting, decorating, modelling or sculpting; that is, creating products or expressing ideas and emotions.

It is important for artists and the careers that are related to this type of aptitude are: visual arts, digital arts, performing arts, among others.

Spatial: It is the passion for the use and transformation of materials into drawings, models, posters and other graphic works.

It is thinking in images visualising a future result. It manifests itself as a great imaginative capacity, spatial orientation and skill in representing reality graphically or by means of drawings. It is very noticeable in architects, graphic designers, photographers and others.

Numerical: It is the interest in solving numerical problems, in reasoning and calculating, in thinking logically and systematically. It is very important for economists, actuaries, accountants, aeronautical engineers, computer systems engineers, among others.

Scientific: It is the taste for knowing the cause of natural phenomena, as well as to think logically and systematically. This interest is manifested in the degree to which efforts are made to investigate the reason for the existence of things and events, to discover the causes that produce them and the principles and rules that explain them.

It is important for biologists, physicists, chemists, environmentalists, agricultural engineers, renewable energy engineers, veterinarians, nurses, nutritionists, doctors in general, among others.

Verbal: This is the taste for transmitting ideas, feelings, experiences and emotions orally or in writing in one or more languages. It is important for teachers, lawyers, communicologists, etc. and the careers included in this type of aptitude are philosophy, education, communication sciences, language teaching, among others.

Leadership: It is the satisfaction of leading or guiding the activities of other people, it is the ability to take the initiative, manage, convene, promote, encourage, motivate and evaluate a group or team. This aptitude is related to careers in business administration, business management, business development, among others.

Methodology

The present work is a correlational study analysing both qualitative and quantitative information.

- **Hypothesis 1:** The greater the match with the ideal career profile, the greater the academic performance during the stay process.
- **Hypothesis 2:** The lower the match with the ideal career profile, the lower the academic performance during the internship process.

Suitable vocational profiles determined by the UTL Career Management Offices:

A) TSU in Virtual Environments and Digital Business (EVND): **Artistic Plastic, Spatial and Numerical**.
B) TSU in Chemistry Environmental Technology Area (QA): **Scientific, Numerical and Verbal.**

Sample:

The academic trajectory of 88 students corresponding to the 2020-2022 generation, 38 students from the EVN career and 50 students from the QA career, were compared with the results of the SUREDSU survey.

For the purposes of this study, the population is divided into 3 categories according to the grade they obtained in the last semester of TSU, which corresponds to the stay:

a) STUDENTS OF ACADEMIC EXCELLENCE, who obtained an average of 10.
b) Students of GOOD PERFORMANCE, who obtained an average of 9.
c) SUFFICIENT students, who obtained an average of 8.

Results

Analysis of results of the Virtual Environments and Digital Business (EVN) degree course

1. It should be noted that the students who were part of the study, whose condition was to have graduated favourably from TSU in the Virtual Environments and Digital Business degree, none of them have the expected profile: Artistic Plastic, Spatial and Numerical. They have at most 2 areas that coincide with this profile.

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2. Among the **students who obtained a score of 10** in the process of stay, the areas of vocational interest that predominate are the DIRECTIVE area and the SOCIAL area, being present in 13 of the 18 students of this group equally, that is to say, 72%.

None of these areas is considered to be a preferred area of vocational interest in order to develop successfully in this career. Of the areas that do make up the profile, this group of students obtain the following: the area ARTISTIC PLASTIC, with 8 appearances out of 18 students (44%). The SPACE area appears in 7 out of 18 students (39%). The NUMERICAL area appears in 5 out of 18 students (28%).
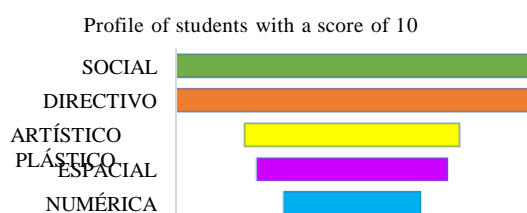
Box 1

Profile of students with a score of 10

Figure 1

Results of predominant area of interest in the group of students with a grade of 10 in stay

3. **Among the students who obtained a score of 9 in the process of the stay,** the areas of vocational interest that predominates is the SOCIAL area, since it is present in 13 of the 15 students who confirm this group (87%), followed by the DIRECTIVE area, with 10 appearances in 15 students (66%). The NUMERICAL area appears in 5 out of 15 students (33%), the ARTISTIC-PLASTIC area appears in 4 out of 15 students (26%) and the SPACE area appears in 4 out of 15 students (26%).
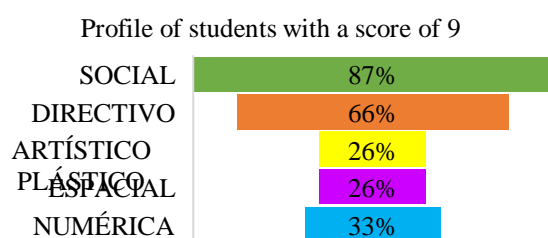
Box 2

Profile of students with a score of 9

Figure 2

Results of predominant area of interest in the group of students with a grade of 9 in stay

4. Among the students who obtained a score of 8 in the process of stay, the areas of vocational interest that predominates is the SOCIAL area, present in 5 of the 5 students that make up this group (100%).

In second place there is a tie between the DIRECTIVE and MUSICAL areas, with 3 appearances out of the 5 students (60%). The ARTISTIC PLASTIC area appears in only 1 student (20%) as does the SPACE area. The NUMERICAL area does not appear in any student in this group.
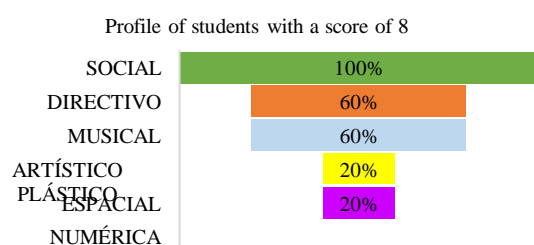
Box 3

Profile of students with a score of 8

Figure 3

Results of predominant area of interest in the group of students with a grade of 8 in stay

1. The area of DIRECTIVE vocational intent is the common factor among students who successfully complete their stay. Making a difference between a performance of SUFFICIENT, GOOD PERFORMANCE or EXCELLENCE, the combination with the areas: NUMERICAL, ARTISTIC/PLASTIC and SPACE; that is, the ideal profile for the EVN career does have a weight in the good performance of the students in the process of stay together with the directive area that is not being contemplated for the profile.

2. There were four students who, despite not having any match with the suitable vocational profile, obtained 10 in their stay grade, i.e. 22% of the total number of excellent students.

These four students had a similar profile between them, where the DIRECTIVE and SOCIAL areas were combined with the VERBAL or MUSICAL. Therefore, these students can represent a good case study to identify which other variables, other than a suitable profile, can contribute to the adaptation to a career as EVN and favour an excellent performance in the stage of stay.

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Analysis of the results of the Environmental Chemistry course (QA)

1. It should be noted that the students who took part in the study, whose condition was to have graduated favourably from TSU in Environmental Chemistry, 4 students have the expected profile: Scientific-numerical-verbal, i.e. 7.7% of the total number of students who participated in this sample. Out of these 4 students, 3 young people have a score of 10 in the process of stay and the fourth one, with a score of 9.

2. It is also important to mention that in this degree course there were 2 students who dropped out of the stay, although they had a general average of 9 during their five semesters, obtaining a temporary academic leave status. Both coincided in at least one area of vocational intention with the predetermined profile. The profiles of these students are: SCIENTIFIC-SOCIAL-DIRECTIVE and VERBAL-SPACIAL-DIRECTIVE.

3. In the profile of the students with a stay grade of 10, the SCIENTIFIC area is the most repeated area, appearing in 20 students out of 26 (77%). The second most repeated attribute is the MANAGEMENT area, with 17 appearances out of 26 students (65%), this area is not included in the profile.

The third attribute is the SOCIAL area with 15 students (57%). The VERBAL area appeared in 10 of the 26 students (38%), occupying fourth place in preferences. The NUMERICAL area only appeared in 6 of the 26 students (23%), occupying 5th place in the preferences.
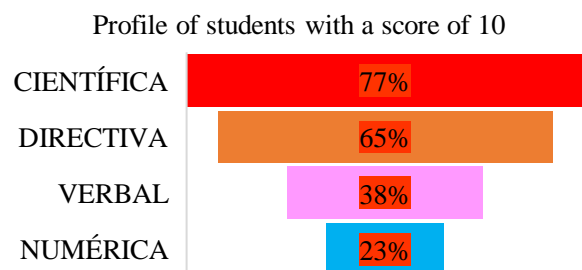
Box 4

Profile of students with a score of 10

Figure 4

Results of predominant area of interest in the group of students with a score of 10 in stay

4. In the profile of students with a stay grade of 9, the SCIENTIFIC area is the most repeated area, appearing in 12 students out of 16 (75%). The second most repeated attribute is the SOCIAL area, with 10 occurrences out of 16 students (62%). The VERBAL area appeared in 6 out of 16 students (37%) and the NUMERICAL area only appeared in 5 out of 16 students (31%).
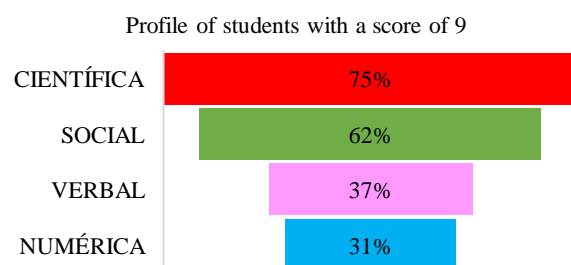
Box 5

Profile of students with a score of 9

Figure 5

Results of predominant area of interest in the group of students with a grade of 9 in stay

5. In the profile of students with exit grades of 8, the area MANAGEMENT is the most repeated area, appearing in 5 students out of 8 (62%).

The second most repeated attribute is the SOCIAL area, with 4 occurrences out of 8 students (50%). NUMERICAL appeared in 3 out of 8 students (37%). The VERBAL area only appeared in 2 out of 8 students (25%).
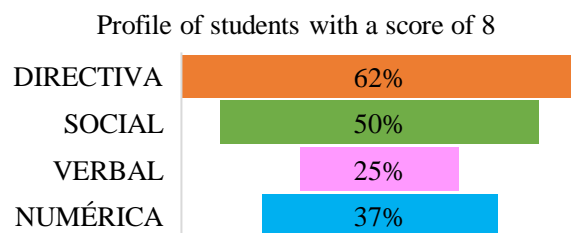
Box 6

Profile of students with a score of 8

Figure 6

Results of predominant area of interest in the group of students with a grade of 8 in stay

6. In this study it is observed that in the Environmental Chemistry degree the common factor among students who successfully complete their stay is to have a balance between the SCIENTIFIC-DIRECTIVE-NUMERICAL AND VERBAL areas.

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Making a difference between a performance of SUFFICIENT, GOOD PERFORMANCE or EXCELLENCE, having or not more matches with the predetermined profile. The SCIENTIFIC area being the predominant one among students with excellence scores.

Conclusions

Although having a real vocational profile in line with the ideal vocational profile has a positive influence on achieving an excellent academic trajectory, it is also observed that it is not the only factor and is not a determining factor for the degree programmes analysed.

In the case of the EVN degree programme, it can be seen that despite the fact that the students do not have a vocational preference (it was the only degree programme with students with 'zero matches' with the ideal vocational profile), it can be observed that there were other internal and external factors that at the end of the day, promoted their academic integration. It is here that a close analysis of the four cases of academic excellence with zero matches in the areas of professional interest could shed light on these other more influential factors. In order to recognise and enhance them.

On the other hand, for the QA course, where the closer to the ideal vocational profile, the better academic results were observed, there is a space for research to analyse what actions can be implemented by the course for those young people with a different profile who choose to enrol in it.

Another case study would be to interview students who, despite having some area of coincidence with the ideal vocational profile and having obtained a good average in their academic career, in the end, decided to drop out during the stay process.

It is worth noting that, for the most part, the areas of *managerial and social* vocational interest were the most prevalent among the actual vocational profiles.

It can be seen that the students of the 2020-2022 generation were interested in leading or guiding the activities of other people, with the capacity for initiative and a taste for relating to and empathising with others.

Therefore, it can be thought that these skills allowed them to adapt to their chosen career in a successful way.

It is therefore essential that the Educational Institution looks at this phenomenon and motivates its future members to pay attention to the vocational profiles that harmonise best with each career, in this way working from early stages in the academic integration of students who enrol at UTL.

To this end, vocational orientation talks can be implemented, making reference to the results obtained in the SUREDSU survey and showing the wide variety of careers that match the results. Or, alternatively, virtual feedback mechanisms could be implemented so that students can compare their results with their chosen career in the first instance.

It is also proposed to identify the cases with the lowest matches with the ideal vocational profiles and to work closely with the tutoring programmes, academic counselling and the psycho-pedagogical department to generate a joint action plan and prevent desertion.

Declarations

Conflict of interest

The authors declare that we have no conflicts of interest. We have no known competing financial interests or personal relationships that could have influenced the article reported in this paper.

Authors' contributions

Aranda-López, Ariana: contributed to the project idea, interpretation and analysis of the data.

González-Arredondo, Liliana: Contributed to data collection, research method and data analysis.

Padilla-Gutiérrez, Luz Aurora: contributed to research development, reviewing and editing.

Arredondo-Muñozcano, Ana María del Carmen: contributed with reviewing and editing.

Availability of data and materials

The data used and analysed in this research are available from the lead author upon formal request.

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Abbreviations

1. DSM — Multi-platform Software Development
2. EVN — Virtual Environments and Digital Business
3. IRD — Digital Network Infrastructure
4. QA — Environmental Chemistry
5. SICES — Secretariat for Innovation, Science and Higher Education
7. SUREDSU — Unique System for the Registration of Applicants to Higher Education
8. UTL — Technological University of León

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Background

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
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
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Competencies to be developed by the teacher in distance education

Competencias para desarrollar por el docente en educación a distancia

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Abstract

Distance education has transformed teaching and learning, requiring teachers to develop specific skills that ensure the effectiveness of the educational process in virtual environments. We would emphasize that the main functions and tasks of the teacher in distance education must change with respect to those of the face-to-face teacher because their activities will be developed in a virtual environment of the teaching-learning process, no longer having the geographical, physical and temporal limitations of traditional methods and incorporating new methodological and communication forms. Likewise, the role of the teacher will no longer be that of transmitter of information but that of facilitator in the formation of critical students, with creative thinking within a collaborative learning environment. The teacher becomes an advisor, an aid to the student when deciding which is the best way to achieve the educational objectives that have been set.
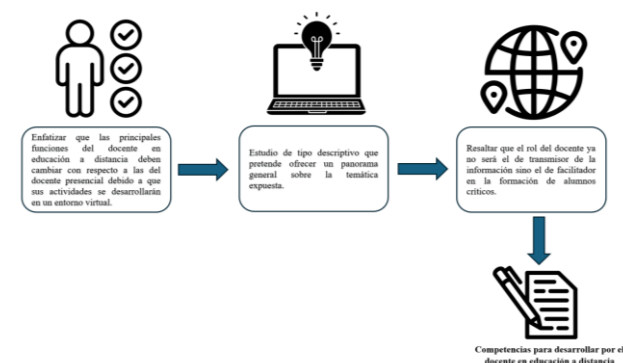

To emphasize that the main functions of the teacher in distance education must change with respect to those of the face-to-face teacher due to the fact that his or her activities will be developed in a virtual environment.

This is a descriptive study that aims to provide a general overview of the subject.

To highlight that the role of the teacher will no longer be that of a transmitter of information but that of a facilitator in the formation of critical students.

Competencies to be developed by the teacher in distance education

Competencies, Distance education, Facilitator

Resumen

La educación a distancia ha transformado la enseñanza y el aprendizaje, exigiendo a los docentes desarrollar competencias específicas que aseguren la efectividad del proceso educativo en entornos virtuales. Enfatizaríamos que las principales funciones y tareas del docente en educación a distancia deben cambiar con respecto a las del docente presencial debido a que sus actividades se desarrollarán en un entorno virtual del proceso de enseñanza-aprendizaje, dejando de tener las limitaciones geográficas, físicas y temporales propios de los métodos tradicionales e incorporando las nuevas formas metodológicas y de comunicación. Asimismo, el rol del docente ya no será el de transmisor de la información sino el de facilitador en la formación de alumnos críticos, con pensamiento creativo dentro de un entorno de aprendizaje colaborativo. El docente se convierte en un consejero, en una ayuda para el alumno a la hora de decidir cuál es el mejor camino para conseguir los objetivos educativos que se ha propuesto.

Enfatizar que las principales funciones del docente en educación a distancia deben cambiar con respecto a las del docente presencial debido a que sus actividades se desarrollarán en un entorno virtual.

Estudio de tipo descriptivo que pretende ofrecer un panorama general sobre la temática expuesta.

Resaltar que el rol del docente ya no será el de transmisor de la información sino el de facilitador en la formación de alumnos críticos.

Competencias para desarrollar por el docente en educación a distancia

Competencias, Educación a distancia, Facilitador

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Introduction

Nowadays, teachers need to be trained in the use of Information and Communication Technologies (ICT) in order to obtain better results in their work or teaching practice. However, there are still teachers who do not do so, and many of them do so due to a lack of knowledge or training in the different tools, either software (the intangible part of the computer) or hardware (the tangible part of the computer). In order to integrate and use ICT efficiently and effectively, teachers need good technical training in the use of these technological tools and also didactic training that provides them with 'good pedagogical know-how' with ICT.

The incorporation and use of Information and Communication Technologies in education has modified teaching-learning practices, both in face-to-face and distance or virtual modalities. In the words of Hernández (Díaz Barriga, Hernández and Rigo, 2009), a techno-pedagogical design is necessary that allows for learning that is 'constructive of meanings and ideas, accompanied by a good dose of cognitive, metacognitive, self-regulatory and reflective-critical strategies as tools for thinking, together with collaborative learning as tools for inter-thinking and constructive dialogue' (p. 20).

Development

Due to the multiple innovative applications it has in all areas of our society, the knowledge and personal and professional use of the services provided by the Internet constitute the most relevant part of the ICT competences that trainers must have, without forgetting the rest of the basic competences that every citizen needs and other competences specific to their professional field, especially the application of these technological instruments for didactic purposes to facilitate students' learning.

To strengthen the competences of teachers in the use of ICT, focusing the work on a training and learning proposal through the reflection of practice with the intention of being a viable study option for the professional and life conditions of teachers. The incorporation of ICT in the classroom with teacher intervention.

The different technological resources, whether software or hardware, which are used as didactic materials, support or as the main tool for a class, have taken on great importance in education, but in order to have an effect in the classroom, it is necessary for the teacher to become involved in the different competences to be developed in the field of ICT. First, the term competence will be defined:

-   The ability to deal effectively with a family of analogous situations by consciously mobilising multiple cognitive resources: knowledge, skills, micro-skills, information, values, attitudes, perception, evaluation and reasoning schemes, in a rapid, relevant and creative manner (Perrenoud, 2004).
-   A complex know-how resulting from the integration, mobilisation and adaptation of knowledge capacities and skills (knowledge, attitudes and abilities), used effectively in situations of a common nature (Lasnier, 2000).

Competences are understood as those capacities made up of a set of knowledge, skills, attitudes and values that enable the performance of certain tasks and functions.

The development of communicative competences through the appropriation of technology should be seen as the capacity for the production, reception and interpretation of messages of different types and through different media, which can promote educational interactions, as opposed to other formative or training processes for the use of media that emphasise the mastery of devices and their potential for the circulation and use of messages produced by others (De la Rosa, 2004).

In short, and in accordance with various studies carried out in this respect (Cabero, 1999; Majó and Marqués, 2002; Tejada, 1999), in the words of Marques (2011), the ICT competences that teachers should have can be summarised as follows:

-   Have a positive attitude towards ICT, an instrument of our culture that should be used and applied in many domestic and work activities.
-   Be familiar with the uses of ICT in the field of education.
-   Know about the use of ICT in the field of their area of knowledge.

- Skillfully use ICT in their activities: text editor, e-mail, Internet browsing.
- Acquire the habit of planning the curriculum integrating ICT (as an instrumental means within the framework of the activities in their area of knowledge, as a didactic means, as a mediator for cognitive development).
- Propose training activities for students that consider the use of ICT.
- Evaluate the use of ICT

These competences must be developed inside and outside the classroom, as teachers are currently facing the fact that students' level of knowledge in the use of different ICT tools is surpassed.

Bernal (2011a) comments that we are living in a society that is characterised by rapid and radical changes in its development. The distance between generations is becoming increasingly closer in age groups. Cultural references and values are changing in shorter periods of time than usual. It should be borne in mind that there are still many teachers who view the use of these resources with suspicion and indifference. The origin of these negative attitudes on the part of a sector of teachers is usually to be found in one of the following circumstances:

- Poor command of ICT, due to a lack of training, which generates: fear, mistrust, helplessness, anxiety.
- Influence of social stereotypes, due to a lack of knowledge about the real contributions of ICT and their importance for society as a whole. Thus, some teachers identify with expressions such as: 'they are expensive, sophisticated and have not proven their usefulness', 'they are a fad', 'they are just another invention to sell', etcetera.
- They are reticent about their educational effects, due to a lack of knowledge of good educational practices that make the most of the advantages that ICT can bring. In this way, and perhaps only considering experiences they may know of in which these materials have been misused, some teachers believe that they dehumanise, are not useful, contribute almost nothing important, have negative effects and make educational work more difficult.

- Prejudices at work: belief that they do not compensate for the time needed for preparation, fear that they may replace teachers, etc.

Therefore, teachers must see the need and usefulness of ICT in their teaching and research work, they must discover their advantages, they must feel supported at all times, otherwise they will see it as unnecessary and not very feasible (Marques, 2011).

It is an unquestionable reality today that the incorporation of ICT in society and especially in the field of education provides a great source of resources and teaching materials that significantly influence the teaching and learning of the student community. A learning system based on Information and Communication Technologies undoubtedly brings added value to the current educational system and opens the door to new educational and training paradigms. The use of ICT in the classroom provides students with a tool that is undoubtedly adapted to their current technological culture and gives them the possibility of taking more responsibility for their education, making them the protagonists of their own learning (Llorens, 2006).

Nowadays, the knowledge and information society requires new educational proposals that allow for synergy between educational and technological processes. Creativity and the use of technologies are combined to produce didactic materials that have evolved in recent years. Distance Education is an example of the methodology, strategies and teaching and learning systems that make use of ICT to manage and build knowledge between people, communities and organisations that are geographically distant and as didactic support in a face-to-face class, since different physical devices have been replaced by logical ones, such as flip charts and cardboards with PowerPoint, a computer and a projector.

Distance education is defined by its vocation to bring institutions and learners closer together. This is how it implies communication, contact and rapprochement in various senses:

- Bringing the school closer to geographically distant populations.

Article

- Bringing the school closer to working environments and their particular training needs.

- Bringing the school closer to the living conditions of populations whose diverse characteristics are not considered in the school as a conventional institution: adults, women, workers, indigenous people, disabled people, professionals in need of updating, migrants, etc.

- Bringing the school closer to contextualised social and professional problems, that is, starting from a vision of the educational institution as the one that is far from communities with specific problems to be solved, and which require training to reach the place. From this approach, it is not the learners who are distant from the school, but the conventional school that is distant.

In distance education, the role of the teacher is of paramount importance because he/she is the one who tutors the student throughout the learning process. There has been much speculation about the possible disappearance of this figure, or at least its disappearance, with the advance and evolution of ICT.

In order to understand why it is impossible for teachers to disappear from the educational scenario, it is necessary to remember, first of all, that education is a human process whose main purposes are the development of the potential of men and women and the incorporation of the cultural patterns of the society in which they live.

Here, the acquisition of information and knowledge is relevant, but by no means exhausts education. Those purposes defined for education are only achieved in social interaction. In this sense, although distance education responds to certain particular demands of today's societies and has evolved rapidly thanks to the development of ICTs, it does not lose its essence as a human process, nor does it move away from the purposes stated above (De la Rosa, 2004).

Therefore, the teacher's profile must respond to basic ICT training and carry out tasks and functions that are not only based on the transmission of knowledge but also on guiding students towards learning to learn, analysis, criticism and constant creativity that will enable them to develop skills and aptitudes in the use of ICT in order to be creative, enterprising and also to be involved in research processes in their field of work.

In terms of communicative competences, the most significant teaching competences for distance education are as follows:

- Communicative competences
- Technological competences
- Design competences
- Management competences

This set of competences is of great importance in the processes, but we cannot forget that there are more tools and strategies, which should help students in their training, and that this training should lead to good and optimal results on a personal and intellectual level of the individuals and to the characterisation of the qualities of educators and teachers.

Communicative competences are very broad, but in general they are those competences with which people can relate to others and to their environment.

The improvement of communication is based on three components of competence which are knowledge, skills and attitudes.

Communicative competences are classified into:

- Linguistic
- Paralinguistic
- Textual
- Kinesics
- Proxemic
- Chronetics

Linguistics is about the acquisition and development of language through a system of open articulated signs, where people relate and understand each other, from this stems the ability to think, to say things, regardless of language, because humans have the ability to communicate.

Linguistics gives rise to the following three competences Paralinguistics, which are all those infinite additional elements that accompany language, whether oral or written, which help to complement communication. The oral elements depend on the tone and context in which the sentences are spoken, and in writing there is everything related to the signs of texts. Pragmatic competence deals with language in order to persuade and convince others, not forgetting that we communicate in order to influence other people's decisions, opinions, knowledge, preferences and attitudes.

Textual competence is the ability to create and understand written texts, where one must have technical ability in writing, communication and knowledge of the meanings of each written symbol.

The fourth competence is the Kinesic competence, which focuses on the body and all its movements, because sometimes without realising it, our gestures, postures, looks, hands, etc. are constantly trying to express something.

They are wanting to express something, then the Proxemic competence which is based on interpersonal distances, i.e. our bodies delimit to which spaces of action or not people can access and others cannot. This happens in different phases of life, both personal and public, and finally the Chronetic competence, which is about expressing the right words at the right time and in the right places, i.e. contextualisation of language (Cabezas, 2009).

In any of the modalities in which teachers work, whether face-to-face or in distance education, it is necessary and essential to train rather than inform; to ensure that students learn to learn rather than to teach them; to promote social interaction - according to circumstances and possibilities - in order to collectivise learning processes.

Technological competences are those skills needed to manage and use all the necessary technological design and development resources from a technical point of view, such as the Internet, web 1.0 and 2.0, communication tools, graphic design, handling of modern audiovisual media (sound and video) and mastery of computer systems.

It also involves knowledge of the training activity, with the aim of being able to adapt it to the type of learner, assessing its suitability in each case.

Design competences are those skills required to apply didactic and pedagogical principles in the instructional design of the sequence that forms part of the planning of the training action, with the aim of creating attractive training proposals that guide students in their learning and respond to their needs. They also refer to the ability to select the most appropriate methodology for monitoring and supervision tasks, thus maintaining up-to-date information and knowledge of the success of the training action.

Management competences are the need to possess knowledge and ability to coordinate work teams, establish priorities, identify training needs, organise and operate the human resources structure around an action (Rojas, 2011).

We would emphasise that the main functions and tasks of teachers in distance education must change with respect to those of face-to-face teachers due to the fact that their activities will be developed in a virtual environment of the teaching-learning process, ceasing to have the geographical, physical and temporal limitations of traditional methods and incorporating new methodological and communication forms.

Likewise, the role of the teacher will no longer be that of a transmitter of information but that of a facilitator in the training of critical students, with creative thinking within a collaborative learning environment, while at the same time possessing a constructivist and formative vision. The teacher becomes an advisor, a help to the student when deciding which is the best way to achieve the educational objectives that have been proposed (Perdomo, 2008).

Bernal, (2011b) comments that a teacher must be able to lead a meeting effectively, but this competence not only requires skills but also knowledge and, above all, attitudes that adequately direct the whole process, where sensitivity to various problems determines different approaches and behaviours.

Thus, in this same line, we may run the risk of forgetting the transversal competences, focusing exclusively on those specific competences that a teacher needs at some point in the development of the profession.

Conclusion

Today's teachers should begin by recognising and understanding the generation gap that separates us from technological and scientific innovations. This perspective will allow us to recognise our fears regarding the use of new technologies, to ascertain our technical knowledge conditions in relation to the technology currently in use and to be able to carry out an in-depth self-assessment analysis in order to accurately review the paradigm in which we find ourselves.

Distance education today represents an excellent educational option as it enables the teacher to be the architect of his own knowledge, since it confronts him first of all with the decision to get rid of various myths in relation to the educational act, this modality requires the ability to make decisions, it also enables him to regulate the times of educational confrontation, It allows better time management and, above all, provides greater academic independence and, contrary to what is thought to be a relationship far removed from the proximity to the tutor or teacher, this modality overcomes it, since, given the impossibility of gestural or behavioural interpretation, the distance academic condition requires greater precision and description but provides greater personalised accompaniment, since the person is drawing his or her interlocutor thanks to the photograph of his or her ideas.

The use of technology to improve educational processes should become a necessity not only for school life, but also for a better management of everyday situations where the individual discovers technology as their best ally to resolve situations of conflict or survival, and not only as an educational possibility but also as a tool for training in one of the most important life competences.

Decision-making, a competence that comes into play from the very moment we decide to start interacting more with the technologies that are at our service to improve our lifestyle.

For this reason, the preparation of teachers in the use of technology has become an imperative necessity in order to be congruent with the current demands of life.

Conflict of interest

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

Authors' contribution

Fuentes-Favila, Luis Macario: Original drafting, revising, data curation.

Mendoza-González, Nancy: Statistical analysis, revision and correction.

Molina-Vázquez, Gabriel: Spelling and editing. Ordóñez-Suárez Teresa: Proofreading and editing

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Abbreviations

ICT   Information   and   Communication Technologies

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Basics

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Article

Effective neurolearning of english in university students through NLP

Neuroaprendizaje eficaz del Inglés en estudiantes universitarios a través de la PNL

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Abstract

The article examines the impact of neurolearning on English language learning in the educational context of the Autonomous University of Nayarit. The research is carried out with 154 undergraduate students in International Business, distributed in morning and afternoon shifts. The main objective is to analyze how neurolearning techniques influence the development of language skills and academic performance of the participants. The methodology uses a survey administered through Google Forms, which includes eight items aimed at evaluating the students' perception of the effectiveness of neurolearning in their language learning process. The results indicate that students highlight the improvement in information retention, personalization of learning and the development of critical problem-solving skills. They also emphasize the importance of continuous feedback, which allows for real-time adjustment of study strategies, thus favoring a deeper understanding of the content. Thus, neurolearning emerges as a valuable approach to optimize English language learning in International Business students. Its integration into academic programs is suggested, with a particular focus on teacher training and the development of methodologies that ensure its effectiveness. This not only contributes to improving language skills but also enriches their preparation to face the challenges of a globalized professional context.

Resumen

El artículo examina el impacto del neuroaprendizaje en el aprendizaje del inglés en el contexto educativo de la Universidad Autónoma de Nayarit. La investigación se lleva a cabo con 154 estudiantes de la licenciatura en Negocios Internacionales, distribuidos en turnos matutino y vespertino. El objetivo principal consiste en analizar cómo las técnicas de neuroaprendizaje influyen en el desarrollo de competencias lingüísticas y en el rendimiento académico de los participantes. La metodología emplea una encuesta administrada mediante Google Forms, que incluye ocho ítems orientados a evaluar la percepción de los estudiantes sobre la efectividad del neuroaprendizaje en su proceso de aprendizaje del idioma. Los resultados indican que los estudiantes destacan la mejora en la retención de información, la personalización del aprendizaje y el desarrollo de habilidades críticas para la resolución de problemas. También enfatizan la importancia de la retroalimentación continua, que permite un ajuste en tiempo real de las estrategias de estudio, favoreciendo así una comprensión más profunda de los contenidos. Así pues, el neuroaprendizaje emerge como un enfoque valioso para optimizar el aprendizaje del inglés en estudiantes de Negocios Internacionales. Se sugiere su integración en los programas académicos, con un enfoque particular en la formación docente y el desarrollo de metodologías que aseguren su efectividad. Esto no solo contribuye a mejorar las habilidades lingüísticas y también enriquece su preparación para enfrentar los retos en un contexto profesional globalizado.

Effective Neurolearning of English in University Students through NLP

Objectives	Methodology	Contribution
ANALIZE NEUROLEARNING	THE METHODOLOGY LEARNING PROCESS	FACE TO THE CHALLENGES THAT ARE IN ALL OVER THE WORLD

Neuroaprendizaje Eficaz del Inglés en Estudiantes Universitarios a través de la PNL

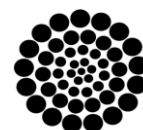| Objetivos	Metodología	Contribución
ANALIZAR NEUROAPRENDIZAJE	LA METODOLOGÍA PROCESO DE APRENDIZAJE	ENFRENTAR TODOS LOS DESAFÍOS QUE HAY EN TODO EL MUNDO

Competencies, Learning, Neurolearning, Performance

Aprendizaje, Competencias, Neuroaprendizaje, Rendimiento

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Introduction

Today, language learning has become an essential skill for students in a globalised world, where effective communication in English is essential in the professional environment. The growing interconnection between countries and cultures has intensified the need to train professionals who are able to function in an international environment. In this context, higher education faces the challenge of implementing methodologies that not only facilitate the acquisition of a second language, but also optimise the educational process. One of the most promising approaches in this regard is neurolearning, which is based on the understanding of the cognitive processes of the brain and their relationship with learning.

Neurolearning is based on neuroscience principles that explore how information is processed, stored and retrieved in the brain. This approach considers not only the cognitive aspects of learning, but also the emotions and motivations that influence the acquisition of knowledge. In education, neurolearning proposes a significant change in the way languages are taught and learned, highlighting the importance of personalising the learning experience to suit the individual needs of learners. This approach aligns with the current demands of education, which require more inclusive and effective methods.

The Universidad Autónoma de Nayarit, aware of the importance of language learning in the integral formation of its students, has begun to explore the application of neurolearning techniques in its academic programmes. In particular, it has focused on the Bachelor's Degree in International Business, where proficiency in English is crucial for students' professional development. This article examines the impact of neurolearning on English language learning, analysing how these techniques influence the development of language skills and students' academic performance. The research is carried out with a sample of 154 students, distributed in morning and afternoon shifts. The selection of the sample allows us to obtain a representative view of the diverse experiences and contexts of the students. Using a quantitative methodology, a survey was administered through Google Forms, which included eight items designed to assess students' perception of the effectiveness of neurolearning in their language learning process.

This strategy allows for the collection of relevant data on how students assess the techniques applied in their training and their impact on language skills acquisition.

Preliminary results of the research indicate that students highlight several advantages of neurolearning in their educational process. Firstly, there is a significant improvement in the retention of information, which is essential for learning a language that requires memorising vocabulary, grammatical structures and idiomatic expressions. In addition, personalisation of learning is crucial, as it allows each student to progress at his or her own pace and according to his or her interests, which in turn fosters greater engagement and motivation to learn.

Another relevant finding is the development of critical problem-solving skills, an essential competence in today's world of work. Students report that neurolearning techniques not only help them acquire the language, but also provide them with cognitive tools that they can apply in practical and challenging situations. This skill is especially important in the context of International Business, where professionals must be able to analyse complex situations and make informed decisions.

The importance of continuous feedback is also underlined in the results, as it allows for real-time adjustment of study strategies. This aspect is fundamental to the learning process, as effective feedback helps students identify their strengths and weaknesses, facilitating a deeper and more conscious approach to their learning. The ability to make immediate adjustments to study techniques contributes to a stronger understanding of content, which in turn improves confidence and communicative competence in English.

As neurolearning becomes established as a valuable approach to language teaching, there is a need to integrate these techniques into academic programmes in a systematic way.

Teacher training is a critical component in this process, as educators must be trained to apply neurolearning strategies to optimise English language teaching.

Article

The implementation of effective methodologies requires an institutional commitment to support the ongoing training of teachers, as well as the creation of an educational environment that favours innovation and experimentation.

The application of neurolearning not only has the potential to improve students' language skills, but also to enrich their preparation to face the challenges of a globalised professional context. In a world where competition is increasingly fierce, graduates who are proficient in English and possess critical skills are highly valued by employers. Therefore, this study not only contributes to the field of education, but also responds to the demands of today's labour market by aligning academic training with professional expectations.

Therefore, this article provides a comprehensive view of the impact of neurolearning on English language learning at the Universidad Autónoma de Nayarit. Through research conducted with undergraduate students in International Business, it shows how this innovative approach can transform language teaching, improving information retention, personalising learning and developing critical skills. It highlights the importance of integrating these techniques into academic programmes and the need for teacher training to ensure the effectiveness of this approach. This opens a path towards a more effective and relevant education that prepares students for the challenges of an interconnected world.

Background

According to Pherez, G., Vargas, S., & Jerez, J. (2018), 'neurolearning involves the application of neuroscience principles to improve teaching-learning processes, transforming the figure of the teacher into a neuroeducator who integrates these strategies in the classroom' (p. 149).

Neurolearning refers to the application of neuroscience principles to understand how human beings learn. In the educational context, this approach allows for the identification of the most effective strategies that favour the acquisition of knowledge. By focusing on how the brain works, teaching methods can be designed to suit the individual needs of students.

This not only improves their academic performance, but also boosts their motivation and confidence. Furthermore, by integrating neurolearning techniques into educational institutions, a more dynamic and effective learning environment is fostered, thus benefiting the holistic development of the learner.

According to Collins (2007), 'understanding the brain mechanisms underlying learning and memory, as well as neural plasticity, is fundamental to improving educational practices. This knowledge offers opportunities to develop more effective teaching strategies, especially in areas such as nursing where information retention is crucial' (p. 306). The evolution of neurolearning has revolutionised our understanding of the human brain and its ability to learn and adapt. As neuroscience research has progressed, it has been recognised that neural plasticity, the brain's ability to reorganise itself and form new connections, plays a crucial role in the learning process.

This phenomenon implies that the brain is not static, but continually evolves in response to new experiences and knowledge. In today's society, where information is generated and shared at an unprecedented rate, this capacity becomes increasingly relevant.

Neurolearning highlights the importance of designing educational strategies that align with brain mechanisms. By understanding how learning works at the neurological level, educators can implement more effective methods that foster lasting retention and meaningful learning. In contexts such as nursing education, where retention of information is vital, applying these neuroscientific principles can enhance student training and preparation.

Thus, the integration of neuroscience in education not only optimises the teaching-learning process, but also contributes to the development of individuals who are better able to face the challenges of a constantly changing society.

This synergy between neuroscience and education promises to transform the way we learn and teach.

Relevance of neurolearning in education

According to Rojas et al. (2021), 'neurolearning offers a motivational approach that enhances English language learning in higher education, facilitating the retention of information and the development of language skills by considering students' cognitive and emotional processes' (p. 810). Thus, neurolearning presents itself as a crucial approach in higher education, especially in the teaching of languages such as English.

By integrating motivational aspects together with an understanding of cognitive and emotional processes, this approach enhances the retention of information and the development of language skills in learners. The relevance of this methodology lies in its ability to adapt the educational process to the individual needs of learners, fostering more meaningful and effective learning. Thus, neurolearning not only improves language skills, but also contributes to the comprehensive training of future professionals in a globalised environment.

According to Goswami (2006), 'there is a considerable gap between scientific research and its direct application in the classroom, leading to the adoption of "brain-based learning" approaches that often lack scientific backing' (p. 408). In higher education institutions, it is crucial to address the gap between neuroscience and its application in the classroom. As new knowledge about the brain develops, educators must be critical of 'brain-based learning' programmes that lack solid evidence. Implementing pedagogical strategies supported by neuroscience research can transform the teaching-learning process, improving retention and understanding of content.

Fostering close collaboration between neuroscientists and educators will allow for the adaptation of teaching practices to the cognitive realities of students, thus optimising the quality of education at the higher education level.

According to Carew and Magsamen (2010), 'neuroeducation combines neuroscience, psychology, cognitive science and education to create more effective teaching methods, enabling the development of evidence-based solutions to guide 21st century learning' (p. 686).

In higher education institutions, the integration of neuroeducation promises to revolutionise learning spaces. By combining neuroscience, psychology and cognitive science, it will be possible to develop more effective teaching methods that respond to the cognitive needs of students.

This approach will enable educators to design evidence-based curricula and educational policies, optimising the learning experience. As these strategies are implemented, students will benefit from a more enriching and adaptive environment, facilitating the development of critical skills needed to meet the challenges of the 21st century and fostering more meaningful learning.

Neurolearning, its relationship to Neurolinguistic Programming and English language learning

According to Ginting and Hartati (2023), 'Neurolinguistic Programming presents itself as a valuable tool in the English classroom as it enhances student motivation and engagement, facilitating information retention through techniques such as emotional anchoring and reframing' (p. 15). This highlights its potential to enrich language teaching. Neuro Linguistic Programming (NLP) has become a valuable tool in education, especially in the teaching of languages such as English. Its focus on the interconnection between language, mind and behaviour offers a framework for improving student motivation and engagement. Through specific techniques such as emotional anchoring and reframing, NLP enables educators to create a more positive and responsive learning environment. These strategies not only facilitate the retention of information, but also encourage more meaningful and effective learning by adapting to the individual needs of each learner.

The human brain, with its remarkable plasticity, has an inherent capacity to adapt and reorganise itself in response to new experiences and knowledge. In today's society, where information is generated and consumed at an accelerated rate, this capacity becomes especially relevant. NLP harnesses this plasticity by focusing on how learners perceive and process information, enabling them to learn more quickly and effectively.

Furthermore, by integrating NLP into the teaching-learning process, educators can address different learning styles, personalising the educational experience and maximising the potential of each student.

The advantages of NLP in the classroom are manifold: it improves communication, reduces anxiety and promotes a collaborative learning environment. This results in more motivated and participative students, able to apply what they learn more effectively. Ultimately, the combination of NLP and neuroscience in education not only optimises the learning process, but also prepares students to face the challenges of an ever-changing world, equipping them with critical skills for their personal and professional development. According to Hedayat, Raissi and Azizzadeh Asl (2020), 'Neuro Linguistic Programming has been recognised as a tool that can help English language learners improve communicative competence, presentation skills and body language effectively' (p. 1142), which underlines its potential to improve educational outcomes and support learners' personal development. Neuro Linguistic Programming (NLP) is an approach that has gained prominence in education, especially in English language teaching. Developed in the 1970s by John Grinder and Richard Bandler, NLP is based on the premise that there is an intrinsic connection between language, behaviour and neurological processes. This relationship allows educators to apply techniques that optimise learning and foster meaningful personal development. The main points covered in the article include a clear definition of NLP and its origins, highlighting its evolution as a tool for improving communication and learning.

The fundamental pillars of NLP, such as rapport building, results-oriented thinking, sensory awareness and behavioural flexibility, are essential for fostering a positive learning environment. Rapport building, for example, allows teachers to establish deeper connections with their students, which facilitates more effective communication. This atmosphere of trust is crucial, as students feel more comfortable participating and expressing their ideas. In addition, results-oriented thinking helps both students and teachers to define clear goals, promoting more focused and effective learning.

NLP also has important implications for students, enabling them to improve their self-esteem and communication skills. Through various techniques, students can develop academic competencies that are not only limited to language learning, but also encompass interpersonal and self-expression skills. This holistic approach results in more meaningful learning, where students not only acquire knowledge, but also learn to apply that knowledge in real-life contexts.

For teachers, applying NLP strategies in the classroom is essential to create a more dynamic learning environment.

This not only improves communication with students, but also allows them to adapt their teaching methods to diverse learning needs. The evidence of effectiveness mentioned in the article supports the ability of NLP to positively impact areas such as vocabulary, reading comprehension and grammatical knowledge.

Neurolearning, which focuses on how the brain processes and retains information, is closely related to NLP. The human brain's ability to adapt and learn has increased in the new society, driven by technology and access to diverse information. This brain plasticity can be harnessed through NLP techniques, optimising the teaching-learning process in the context of learning English. Thus, NLP is presented as a valuable tool that enhances both the cognitive and personal development of students, enabling them to achieve more effective and lasting learning.

Methodology

The present research explores the impact of neurolearning on English language learning in the educational context of the Universidad Autónoma de Nayarit. The research focuses on a sample of 154 undergraduate students in International Business, randomly selected from the morning and afternoon shifts. The participants are between 18 and 21 years old and are in their second, fourth, sixth and eighth semesters. The main objective of this study is to analyse how neurolearning techniques affect students' language skill development and academic performance.

Carrillo–Beltrán, Julio César Cuauhtémoc, Ramírez-Jiménez, Armando, Llanos -Ramírez, María del Carmen and Maldonado-Bernal, Mónica del Rocío. [2024]. Effective neurolearning of english in university students through NLP. Journal University Management. 8[19]1-11: e6819111.
https://doi.org/10.35429/JUM.2024.8.19.6.11

In order to carry out the research, a quantitative approach was adopted, which allows for the collection of structured and accurate data. A survey was designed and administered through Google Forms, which consists of eight items aimed at assessing students' perception of the effectiveness of neurolearning in their English language acquisition process. This methodology ensures the collection of relevant information, providing a clear picture of participants' experiences.

At the same time, the research is exploratory in nature, as during the development of the study, a systematic literature review of various scientific articles on this topic was carried out using the following scientific databases: Direct Science, Emerald, Scopus, Scielo, Redalyc and Google Scholar. For this article, search criteria were applied based on search engines or descriptors, achieving the best results with high impact articles.

The survey was randomly administered to 154 selected students, ensuring an adequate representation of the undergraduate student population. Each item was carefully formulated to capture students' views on various aspects of neurolearning, including information retention, personalisation of learning and the importance of continuous feedback in their education. This survey design allows for an in-depth understanding of students' perceptions and experiences. Data analysis was conducted using descriptive statistical techniques to identify patterns and trends in participants' responses. Statistical software tools were used to process the information, which facilitated the interpretation of the results and the detection of significant correlations between the variables assessed. In addition, the possibility of making comparisons between different semesters and shifts was considered, which made it possible to observe variations in the perception of neurolearning according to the academic context of each group.

The research findings reveal that students positively appreciate the implementation of neurolearning techniques in their training, highlighting improvements in information retention and the development of critical problem-solving skills. Personalisation of learning was also identified as contributing to greater engagement and motivation, which translates into higher academic performance.

Continuous feedback is seen as a key element in the educational process, as it allows students to adjust their study strategies according to their individual needs. This approach is fundamental, as it promotes a deeper understanding of content and fosters autonomy in learning.

This study provides evidence of the effectiveness of neurolearning as a method for optimising English language learning in International Business students. The integration of these techniques into academic programmes is recommended, underlining the importance of teacher training and the development of methodologies to ensure the effectiveness of this approach. The implementation of these strategies in higher education represents a significant advance towards the improvement of educational quality and the integral development of future professionals, preparing them to face the challenges of an increasingly globalised work environment.

The adoption of neurolearning techniques not only improves students' language skills, but also enriches their ability to apply knowledge in real situations, enhancing their professional profile in a competitive labour market.

This research method used a mixed-method approach combining both quantitative and qualitative data collection and analysis.

This strategy facilitated a more comprehensive understanding of the topic by integrating diverse perspectives and generating more complete inferences (Hernández Sampieri, Roberto, 2014).

The results of this study will provide essential information for the design and implementation of innovative pedagogical strategies that favour the continuous improvement of the quality of teaching at the Autonomous University of Nayarit. The importance of neurolearning in the teaching-learning process lies in its ability to optimise the way students acquire and retain information, facilitating more effective and meaningful learning.

It is essential that teachers are updated and trained in this educational approach. Continuing education in neurolearning will enable educators to apply techniques and strategies that are aligned with how the brain works, thus promoting a more dynamic learning environment tailored to the needs of students. By incorporating this knowledge into their teaching practice, educators will not only improve the academic performance of their students, but also contribute to their holistic development, preparing them to face the challenges of the contemporary world.

Student survey

The present research conducted at the Universidad Autónoma de Nayarit analyses the impact of neurolearning on English language learning. The sample included 154 students, 56 per cent of whom were female and 44 per cent male, randomly selected from morning and afternoon shifts, aged between 18 and 21 years old.

A quantitative approach was used and an online survey with eight items was designed to assess students' perception of the effectiveness of neurolearning. The survey ensured adequate representation of the student population and captured views on information retention and personalisation of learning.

Results

The study The study on effective English language neurolearning in university students through Neuro Linguistic Programming (NLP) revealed significant findings. The results indicate that a majority of respondents believe that NLP can improve English language learning among International Business students. 41.6% and 55.8% of the participants agree that the application of NLP is beneficial for language proficiency. Furthermore, 58.4% believe that this methodology plays a crucial role in the learning experience. However, the need for more teacher training to effectively implement these techniques is highlighted.

Despite the challenges, NLP is presented as a valuable strategy to optimise English language learning in the university context. It is suggested that these techniques be integrated into curricula and that teachers be trained to ensure their effectiveness.

Question 1.- Do you think that the application of Neurolinguistic Programming can improve the learning of English for International Business students?
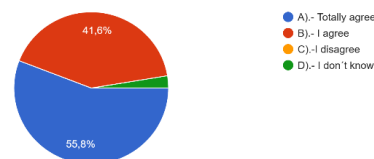

Box 1

Figure 1

Do you think the application of Neurolinguistic Programming can improve English language learning for International Business students?
Source: own elaboration

The results in Figure 1 show that the majority of the students surveyed have a positive perception of the application of Neuro Linguistic Programming (NLP) to improve English language learning in the context of International Business. 55.8% of the participants agree with this statement, while 41.6% strongly agree. These findings suggest that students recognise the potential of NLP as a tool to strengthen their language skills.

Question 2.- Do you think that Neuro Linguistic Programming techniques can support International Business students in the effective mastery of English?
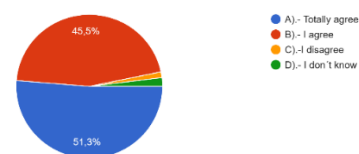

Box 2

Figure 2

Do you think that Neurolinguistic Programming techniques can support International Business students in the effective mastery of English?
Source: own elaboration

The results of the second question show that a majority of students (51.3%) agree that Neuro Linguistic Programming techniques can support International Business students in effective English language proficiency. In addition, 45.5% of the participants strongly agree with this statement.

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https://doi.org/10.35429/JUM.2024.8.19.6.11

These data reflect a positive perception of the potential of NLP to strengthen the language skills of students in this field.
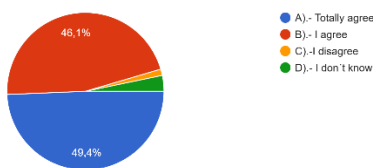
Question 3.- Do you think that Neuro Linguistic Programming is a valuable tool for improving the English language skills of students in the field of International Business?

Box 3

3.- Do you think that Neuro-Linguistic Programming is a valuable tool for improving the English language skills of students in the International Business field?
154 respuestas

46,1%
49,4%

A).- Totally agree
B).- I agree
C).-I disagree
D).- I don´t know

Figure 3

Do you think that Neurolinguistic Programming is a valuable tool for improving the English skills of students in the field of International Business?

Source: own elaboration

The results of the third question reveal that a majority of students (49.4%) consider Neurolinguistic Programming to be a valuable tool for improving students' English skills in the field of International Business. Additionally, 46.1% of participants strongly agree with this perception. These data suggest that students recognise the potential of NLP as an effective resource for strengthening language skills.

Question 4.- Do you agree that Neuro Linguistic Programming can contribute to the successful acquisition of English language competence by International Business students?

Box 4

4.- Do you agree that Neuro-Linguistic Programming can contribute to the successful acquisition of English language proficiency by International Business students?
154 respuestas

50,6%
44,8%

A).- Totally agree
B).- I agree
C).-I disagree
D).- I don't know
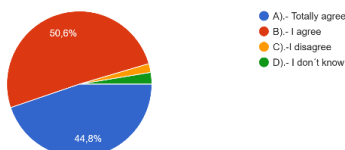
Figure 4

Do you agree that Neuro Linguistic Programming can contribute to the successful acquisition of English language competence by International Business students?

Source: own elaboration

The results of the fourth question show that 44.8% of the students surveyed agree that Neuro Linguistic Programming can contribute to the successful acquisition of English language competence by International Business students. Additionally, 50.6% of the participants strongly agree with this statement.

These data suggest that students perceive NLP as an effective tool for developing their language skills.

Question 5.-In your opinion, does Neuro Linguistic Programming play a significant role in enhancing the learning experience and language acquisition of International Business students studying English?

Box 5

5.- In your view, does Neuro-Linguistic Programming play a significant role in enhancing the learning experience and language acquisition of International Business students studying English?
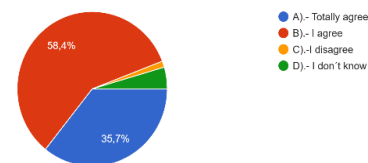154 respuestas

58,4%
35,7%

A).- Totally agree
B).- I agree
C).-I disagree
D).- I don't know

Figure 5

In your opinion, does Neuro Linguistic Programming play a significant role in enhancing the learning experience and language acquisition of International Business students studying English?

Source: own elaboration

The results of the fifth question indicate that a considerable majority of students (58.4%) consider that Neuro Linguistic Programming plays a significant role in improving the learning experience and language acquisition of International Business students.

This data reflects a positive perception of the impact NLP can have in optimising the language teaching-learning process.

Question 6.- Would you agree that incorporating NLP techniques is beneficial for International Business students seeking to improve their fluency in English?

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Box 6

6.- Would you agree that incorporating Neuro-Linguistic Programming techniques is beneficial for International Business students seeking to improve their English language fluency?
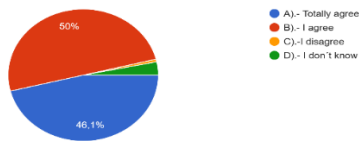154 respuestas

A).- Totally agree
B).- I agree
C).- I disagree
D).- I don't know

Figure 6

Would you agree that incorporating Neurolinguistic Programming techniques is beneficial for International Business students seeking to improve their fluency in English?

Source: own elaboration

The results of the sixth question show that 52.6% of the students agree that incorporating Neurolinguistic Programming techniques is beneficial for those seeking to improve their fluency in English. Furthermore, 42.9% of the participants strongly agree with this statement. These findings suggest that students recognise the value of NLP as an effective resource for enhancing their English communication skills.

Question 7.- Do the International Business students agree with your English language learning objectives?

Box 7

7.- Do you believe that Neuro-Linguistic Programming strategies are effective in assisting International Business students with their English language learning goals?
154 respuestas

A).- Totally agree
B).- I agree
C).- I disagree
D).- I don't know
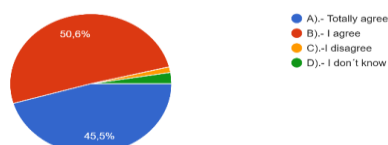
Figure 7

Do International Business students meet their English language learning objectives?

Source: own elaboration

The results of the seventh question indicate that 55.2% of the students consider that Neurolinguistic Programming contributes to the alignment of their English learning objectives. 38.3% of the participants strongly agree with this statement. These data reflect a positive perception of NLP's ability to facilitate the achievement of educational goals in language learning.

Question 8.- In general, do you think that Neuro Linguistic Programming can be a valuable approach to optimise English language learning for students in the field of International Business?

Box 8

8.- Overall, do you think that Neuro-Linguistic Programming can be a valuable approach to optimize English language learning for students in the field of International Business?
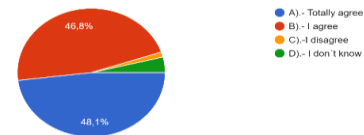154 respuestas

A).- Totally agree
B).- I agree
C).- I disagree
D).- I don't know

Figure 8

Overall, do you think that Neuro Linguistic Programming can be a valuable approach to optimise English language learning for students in the field of International Business?

Source: own elaboration

The results of the eighth question reveal that 54.5% of the students think that Neuro Linguistic Programming can be a valuable approach to optimise English language learning in the context of International Business. Furthermore, 43.5% of the participants strongly agree with this statement. These findings suggest that there is a significant appreciation of the potential of NLP to enhance the language learning process.

Discussion and Conclusions

Research on the impact of neurolearning on English language teaching at the Universidad Autónoma de Nayarit has revealed significant findings that underline the effectiveness of this approach in the development of language skills among International Business students. With a sample of 154 participants, an online survey was used to assess the students' perception of the influence of neurolearning techniques on their learning process.

The data obtained indicate that a considerable percentage of students recognise the improvement in information retention and personalisation of learning, elements that are fundamental for meaningful learning.

One of the highlights of the survey was the appreciation of continuous feedback, which was identified as a key factor that allows for real-time adjustments in study strategies. This type of feedback not only favours the understanding of content, but also promotes a more dynamic learning environment that is adaptable to the individual needs of students. Thus, neurolearning is presented not only as an innovative methodology, but also as an essential resource for optimising the teaching of English in an academic context.

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The results of the analysis reveal that a high percentage of students agree that Neuro Linguistic Programming (NLP) can improve language learning. This perception is reflected in the response to questions about the effectiveness of NLP techniques, where a majority expressed that these tools are valuable for English language proficiency. In particular, 58.4% of respondents believe that NLP plays a crucial role in their educational experience, suggesting that the integration of this methodology into the curriculum could have a positive impact on academic performance.

The study also highlights the need for adequate teacher training in neurolearning. Despite the receptiveness of students to these techniques, a gap in the training of educators is identified that limits the effective implementation of the proposed strategies. Therefore, it is essential that educational institutions invest in the continuous training of their teachers, ensuring that they are equipped with the necessary tools and knowledge to apply neurolearning effectively.

Furthermore, research indicates that neurolearning not only contributes to the development of language skills, but also enriches students' preparation to face challenges in an increasingly globalised professional environment.

By improving fluency and competence in the English language, students are better prepared to participate in the international labour market, where proficiency in English is an essential requirement. According to Rivera Morales and Ornelas Gutiérrez (2024), 'the new 21st century scenarios for university teaching with respect to hybrid environments and emerging pedagogies represent an important contribution to the field of education and university teaching, as it shows different ways of responding to everyday educational problems and presents proposals to face emerging challenges in the field of higher education'.

The proposals highlight the need to adapt teaching practices to a constantly changing environment. The importance of integrating technologies and innovative pedagogical approaches that respond to the current demands of students is emphasised.

This approach not only addresses immediate challenges, but also promotes a long-term vision for higher education, fostering more inclusive and diverse learning. Furthermore, collaboration between teachers, students and communities is highlighted as a key element in creating a more dynamic and effective learning environment.

From the above, it is concluded that neurolearning emerges as a valuable approach that can transform the teaching of English at the Autonomous University of Nayarit. It is suggested that the integration of these techniques into academic programmes, together with robust training for teachers, will not only promote more effective learning, but will also contribute to the continuous improvement of the quality of education at the institution. The review of these findings provides crucial information for the design of innovative pedagogical strategies that will benefit the student community and promote more effective and meaningful learning.

Declarations

Conflict of interest

The authors declare 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.

Authors' Contribution

Carrillo-Beltrán, Julio César Cuauhtémoc: Contributed with the main idea and realisation of the project, as well as the first draft.

Ramírez-Jiménez, Armando: Contributed with the revision in writing and style, as well as the revision and modification of citations and references, and finally the adaptation to the ECORFAN format.

Llanos-Ramírez, María del Carmen: Contributed advice on educational innovation issues in this study.

Maldonado-Bernal, Mónica del Rocío: She contributed with the analysis of the results and the creation of the figures or graphs.

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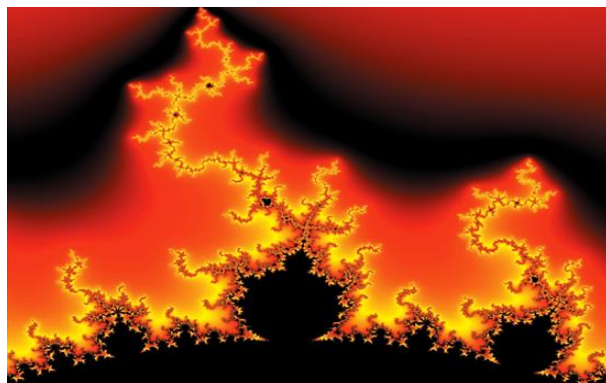[Indicating the title at the bottom with No.10 and Times New Roman Bold]

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