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# ECORFAN Journal - Spain

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The works must be unpublished and refer to topics of education, crowdsourcing, operation of academics' corps, regional development, fiscal, architecture, networks and other topics related to Social Sciences.

## Presentation of the Content

In volume eleven, issue twenty, as the first article we present, *Behavioral addictions in different addictive disorders and their influence on Higher Education*, by Ortiz-Sánchez, Pedro Alfonso Guadal, Sánchez-Iturbe, Patricia Guadalupe, Ortiz-y Ojeda, Pedro Tomás and Clemente-Camacho, Elfer Isaías, with adscription in the Tecnológico Nacional de Mexico-Instituto Tecnológico de Mérida and Tecnológico Nacional de Mexico-Instituto Tecnológico de Tuxtla Gutiérrez, as a second article we present, *Development of a database for managing social service students using MATLAB*, by González-Galindo, Edgar Alfredo, Luna-Alanís, Héctor Nathán, González-Ledesma, Alberto and Castro-Pérez, Joseph Kevin, with adcription in the Universidad Nacional Autónoma de México, as a third article we present, *Reading strategies and their relationship with reading comprehension. Proposal from elementary school*, by Hernández-Gutiérrez, Francisco Javier, Mauricio-Rodríguez, Estrella Jatziri, Lizarde-Flores, Eugenio and Reyes-Camacho, Ana María, with adcription in the Escuela Normal Rural "Gral. Matías Ramos Santos", as fourth article we present, *Teaching styles a look at the academic unit of the north of the state of Nayarit*, by Chávez-Sánchez, Gabriela, with adscription in the Universidad Autónoma de Nayarit.

## Content

**ECORFAN Journal-Spain** December 2024 Vol.11 No.21 1-7
Article

# Behavioral addictions in different addictive disorders and their influence on Higher Education

# Adicciones de comportamiento en diferentes trastornos adictivos y su influencia en la Educación Superior

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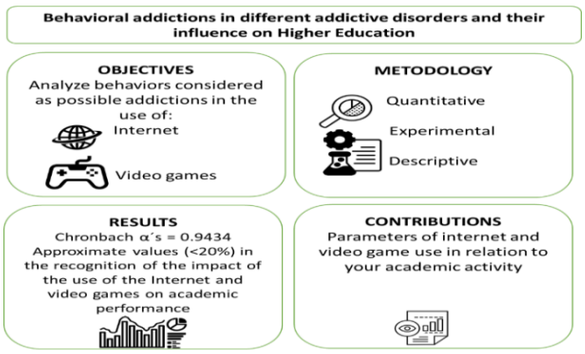
## Abstract

The high use of mass media and video games has strongly attracted the attention of the actors involved in education, questioning the influence that different uses of ICT can present and affect students to the extent of creating a behavioral addiction, if they are aware of its impact and if they negatively influence the learning capacity of students, reflected in the high rate of failure and/or dropout, the objective of this research. After analysis and design, a survey (Cronbach's  0.9434) was applied to undergraduate students of Tecnológico Nacional de México (TecNM), of Engineering: Biochemistry, Computer Systems, Electrical and Industrial, to know their opinions, if there is any addictive behavior of the use of the Internet and the video games and if they consider that they affect their academic performance; The responses indicate a minimal influence that the use of the Internet affects their academic performance and therefore failure and desertion.




**Addictions, disorders, education Resumen**

## Resumen

El elevado uso de los medios masivos de información y los videojuegos, han llamado fuertemente la atención de los actores involucrados en la educación, cuestionándose por conocer la influencia que diferentes usos de las TIC´s puedan presentarse y afectar a los estudiantes al grado de crear una adicción de comportamiento, si están conscientes de su afectación y si influyen negativamente en la capacidad de aprendizaje en los estudiantes, reflejados en el elevado índice de reprobación y/o deserción, objetivo de esta investigación. Previó análisis y diseño se aplicó una encuesta ( de Cronbach 0.9434) a estudiantes de licenciatura del Tecnológico Nacional de México (TecNM), de las Ingenierías: Bioquímica, Sistemas Computacionales, Eléctrica e Industrial, para conocer sus opiniones, si hay algún comportamiento adictivo del uso de internet y los videojuegos, si consideran que afectan su desempeño académico; las respuestas señalan una mínima influencia que el uso del internet afecta su desempeño académico y por lo mismo a la reprobación y la deserción.


**Adicciones, trastornos, educación**

**Citation:** Ortiz-Sánchez, Pedro Alfonso Guadal, Sánchez-Iturbe, Patricia Guadalupe, Ortiz-y Ojeda, Pedro Tomás and Clemente-Camacho, Elfer Isaías. Behavioral addictions in different addictive disorders and their influence on Higher Education. ECORFAN Journal-Spain. 2024. 11-21:1-7.

## Introduction

Behavioural addictions, also known as 'non-substance addictions', are those in which the subject loses control of his or her conduct, behaviour or actions, interfering in different aspects of his or her family, social, work or study life.

There are some routine behaviours that are initially harmless, which, depending on the frequency and intensity with which they are applied and in certain circumstances or contexts, can result in a behavioural addiction.

In 2018, the WHO published its ICD-11 (International Classification of Diseases) including, among others, 'Video Game Disorder' within the category 'Disorders due to addictive behaviours', which emphasises the interest in knowing them and the orientation that behavioural addictions present worldwide.

These have much in common with substance addictions, such as lack of control over behaviour, psychological dependence, the increasing need to increase the time spent on the activity, as well as the loss of interest in different activities that were previously pleasurable, which can lead to family and social isolation of the individual, They differ fundamentally in that in the former there is no intake of addictive substances, it is considered that the two types of addictions are caused by the emotional demand to carry out an activity, behaviours that produce different chemical compounds in the brain that produce emotional pleasure and a feeling of well-being.

According to the American Psychiatric Society, among behavioural addictions, only gambling and video game addiction are considered as diseases (DMS, fifth ed.), although there are other behavioural disorders such as food addictions, compulsive shopping, internet and smart phone addictions (social networks) that are currently under investigation, the last two having the greatest negative impact on educational processes and learning.

According to (INEGI (2021), 78% of those interviewed reported using the internet and 84% of those interviewed reported using a social network.

According to the National Survey on the Availability and Use of Information Technologies in Households (ENDUTIH), of the 35.3 million young people who use the internet, 33.9 million (96.1 %) interacted on social networks (INEGI, 2020).

A social network can be defined as a set of human relationships that have an impact on any person's life.

The formation of social networks appeared in very early stages of the evolution of human societies, and today as then they are widely spread, the tendency to seek the support of other people has always characterised human beings, to share or exchange ideas and needs, particularly in certain stressful situations, in need of rapprochement.

Porrit, quoted by Lobo (1987)**,** has indicated that social bonds can not only act as a social support system, but can even prevent physical or mental disorders in times of intense difficulties.

During the development of a human being many personal and academic activities can represent precisely stressful situations, difficult to overcome, which is probably the reason to look for some activity that allows him/her to evade them, currently being technological applications, the internet, the use of social networks, entertainment in video games.

However, excessive and unlimited use, without control, if the individual does not have the ability to regulate this feeling, can lead to a behavioural addiction which can affect many aspects of their life, their performance at work, at school, with their family and friends.

Thus, this research project seeks to find out the type of addictive or non-addictive behaviour in Engineering students, analysing their answers to a survey on Internet and video game addictions, seeking to find some relationship with the low school performance and high rates of failure and dropout that prevails in them.

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## Methodology

An educational research was conducted working a quantitative methodology, with a descriptive and experimental research design, with the purpose of verifying and gathering information from Engineering students of Higher Education Institutions and taking as a basis the established criteria of a behavioural addiction according to the AMP (American Psychiatric Association), (2013), Beranuy M. et. al. (2009), in order to discern whether this problem exists and if so, how it is affecting their learning in a way that may be influencing or may be the reason for the high failure and dropout rates shown by these students.

We began with a review of the literature and previous studies on behavioural addictions and how they influence the social, personal and academic life of students, which allowed us to pose the research question and delimit the research objectives.

A first version of the information collection instrument was then designed, after which it was piloted and subjected to statistical validation of content using the Kolgomorov index technique and Varimax rotation, after which the questionnaire was modified in the question (number 11 of the original survey) and the suggestions made by the teacher researchers participating in the research were also taken into consideration.

The design of the survey was based on the questions of the DSM-5, section 3, 5th Edition, taking as a basis the questions of the DSM-5, section 3, 5th Edition. Edition, taking, for the purposes of this research, 2 units of competence: video games and use of internet applications, after revision and adaptation to everyday language, grouped into 34 questions.

A total of 264 students were selected from the Bachelor's Degrees in Computer Systems Engineering, Biochemical Engineering, Electrical Engineering and Industrial Engineering, all students of the TecNM, Tuxtla Gutiérrez Campus and Mérida Campus, who were invited to participate in this educational research with the aim of finding out their opinions by freely and voluntarily answering the previously validated survey.

The SPSS v.24 statistical package was used to analyse the data obtained, which allowed the mean and standard deviation of each item to be calculated, as well as the analysis of variance, using a value of $p<0.05$ as a reference. Once the items of the scale were organised according to the theoretical basis, the Cronbach's Alpha statistic ($\alpha = 0.9434$) was used, indicating a high reliability of the survey. For an agile and dynamic analysis of the results obtained, graphs were prepared for each question and frequency tables referring to each of the answers on the Likert scale used in the survey.

## Results

The application of the questionnaire referred to was with the aim of having an approach to find out whether or not there is a behavioural addiction on the part of our students, without a desire to make a study or psychological diagnosis, but rather to have an approach to their opinions on the matter, and above all to find out to what extent they consider that the use of the internet and/or video games is in any way related to or interferes with their academic activity.

The analysis of the data captured in the survey can be seen in graph 1, which shows the behaviour expressed for each question on a Likert scale

**Box 1**

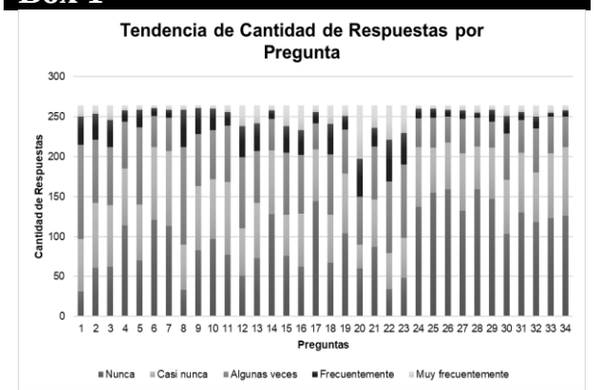


**Figure 1**

Relationship of the answers given

*Source: own elaboration*

The number corresponding to the question is shown on the X axis and the number of students who responded on the Y axis, and the trends in terms of the answers obtained on the Likert scale can be observed. Table 1 below shows the number and frequency of answers given for the questions related to Internet use.

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## Box 2

Table 1

Frequencies of responses obtained on Internet use

| Frequency (%) / Question | Never | rarely | Sometimes | Frequently | Very often |
|---|---|---|---|---|---|
| 1.Do you find it difficult to stop using the internet when you are online? | 31 (11.7) | 66 (25.0) | 118 (44.7) | 35 (13.2) | 14 (5.3) |
| 2.Even if you want to, can't you disconnect from the internet? | 61 (23.1) | 81 (30.68) | 79 (29.92) | 33 (12.5) | 10 (3.78) |
| 3. Do your parents or acquaintances tell you that you should use the internet less? | 62 (23.4) | 77 (29.2) | 73 (27.6) | 34 (12.8) | 18 (6.8) |
| 4. Do you prefer to be on the internet instead of going with your friends? | 114 (43.1) | 71 (26.89) | 59 (22.3) | 14 (5.3) | 6 (2.2) |
| Do you sleep less or too little because you are connected to the internet]? | 70 (26.5) | 70 (26.5) | 94 (35.6) | 22 (8.3) | 5 (1.9) |
| 6. Are you thinking about the internet, even if you are not online? | 121 (45.8) | 91 (34.4) | 39 (14.7) | 10 (3.8) | 3 (1.1) |
| 7. Are you looking forward to your next Internet session? | 113 (42.8) | 94 (35.6) | 42 (15.9) | 10 (3.78) | 5 (1.9) |
| 8. Do you think you should use the Internet less often? | 33 (12.5) | 57 (21.5) | 122 (46.2) | 47 (17.8) | 5 (1.8) |
| 9. Have you tried unsuccessfully to spend less time on the Internet]? | 83 (31.43) | 80 (30.3) | 65 (24.6) | 33 (12.5) | 3 (1.1) |
| 10. Have you rushed to work (at home) to connect to the Internet]? | 97 (36.7) | 75 (28.4) | 61 (23.1) | 27 (10.2) | 4 (1.51) |
| 11. Do you neglect your school or family obligations because you are online? | 77 (29.2) | 91 (34.4) | 71 (26.7) | 17 (6.4) | 8 (3.0) |
| 12. Do you go online when you feel depressed? | 51 (19.3) | 59 (22.3) | 89 (33.7) | 39 (14.7) | 26 (9.8) |
| 13. Do you use the Internet to escape your sorrows or to relieve your negative feelings? | 73 (27.6) | 69 (26.1) | 65 (24.6) | 35 (13.2) | 22 (8.3) |
| 14. Do you feel annoyed, restless, grumpy if you can't use the internet? | 128 (48.5) | 80 (30.3) | 39 (14.77) | 11 (4.2) | 6 (2.2) |

To analyse them, they can be grouped by categories in A) Time issues, questions 2,3,6,7,9,16,18 and 19 apply; B) Interferences with the environment and socially, questions 1, 4,17,20,25,27,28 and 30 apply; C) Relationship with affective problems or time, questions 5,10,12,13,14,21,22,23,26 apply; and D) Academic issues: 11, 31 and 34 apply. The tests of significant differences were applied independently of these categories, since in general all the questions were posed with the same objective in mind.

Concerning the use of the Internet and how it affects them as students (Questions 1 to 14), Fisher's F tests were carried out to see if the differences between the answers obtained in the different aspects evaluated were significant; no significant differences were found between each question and the options on the Likert scale, in questions 3, 4, 7, 10, 12, 13 and 14 in the options ‘never’ and ‘almost never’, in this group the need or sensations that the individual feels when using the Internet were always questioned and the answers indicated that they do not require its use; in questions 5, 8, 9, and 14 the answers to ‘frequently’ and ‘very frequently’ do not show significant differences either.

Analysing the answers in Table 1 and applying the respective analysis to questions 4, 6, 7, 10 and 14 show a significant difference between the answers ‘never’ and ‘very often’, i.e. the ideas referred to by the students that the internet is an imperative need for its use are very clearly defined, only the answer to question 4 applies to 70. 07% of the answers to question 4 showed that they preferred to be with their friends rather than using the Internet (see Table 1 in Box 2), which is interesting because it is a strong indication of an assessment of addictive behaviour.

The other answers indicate that Internet use is not a priority in their activities, in question 6, there were 80.3% of answers, in question 7 there were 78.4%, for question 10 they answered 65.15% and 78.79% answered ‘never’ or ‘almost never’ together.

Of this first block of questions, only question 11 (see table 1) asks about the relationship between internet use and neglecting school or family obligations, in which approximately 27% (71 students) answered ‘sometimes’, and 6.4% (17) and 3. 03% (8) opted for ‘frequently’ and ‘very frequently’, which is questionable because even in a small proportion, there are students who neglect their school activities to use the internet for different reasons; In questions 1, 2, 8 and 9 referring to the frequency of internet use, the answers ranged between 13 and 19% to ‘frequently’ and ‘very frequently’, which can be interpreted that less than a fifth of the students consider that they use the internet in some way to a high degree, but do not recognise this as a factor affecting their school condition.

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## Box 3

Table 2
Frequencies of responses to the use of video games (questions 15 to 30) and responses related to their academic activity (31 to 34)

| Frequency (%) Question | Never | rarely | Some times | Frequently | Very often |
|---|---|---|---|---|---|
| 15. Have you ever thought about playing a video game all day? | 76 (28.7) | 51 (19.3) | 78 (29.5) | 33 (12.5) | 26 (9.8) |
| 16. Have you spent much of your free time playing video games? | 62 (23.4) | 67 (25.3) | 73 (27.6) | 31 (11.7) | 31 (11.7) |
| 17. Have you ever felt dependent on a video game? | 144 (54.5) | 65 (24.6) | 33 (12.5) | 14 (5.3) | 8 (3.0) |
| 18. Did you play longer than planned? | 67 (25.3) | 60 (22.7) | 76 (28.8) | 38 (14.4) | 23 (8.7) |
| 19. Have you increased the amount of time you spend playing video games? | 104 (39.3) | 75 (28.4) | 55 (20.8) | 17 (6.4) | 13 (4.9) |
| 20. Have you been able to suspend once you start playing? | 60 (22.7) | 30 (11.3) | 60 (22.7) | 47 (17.8) | 67 (25.3) |
| 21. Have you ever played games to forget some things in real life? | 87 (32.9) | 59 (22.3) | 67 (25.3) | 23 (8.7) | 28 (10.6) |
| 22. Have you ever played to relieve stress? | 34 (12.8) | 45 (17.04) | 90 (34.1) | 52 (19.7) | 43 (16.3) |
| 23. Have you played to make yourself feel better? | 48 (18.2) | 50 (18.9) | 92 (34.8) | 40 (15.1) | 34 (12.8) |
| 24. Have you ever felt bad when you couldn't play for some reason? | 137 (51.9) | 75 (28.4) | 36 (13.6) | 12 (4.5) | 4 (1.5) |
| 25. Have you ever felt angry when for some reason you have not been able to play? | 155 (58.7) | 56 (21.2) | 38 (14.4) | 11 (4.2) | 4 (1.5) |
| 26. Have you felt stressed when for some reason you have not been able to play? | 159 (60.2) | 59 (22.3) | 32 (12.1) | 9 (3.4) | 5 (1.9) |
| 27. Have you had arguments with any people (e.g. family, friends) about the time you spend playing video games? | 132 (50.0) | 72 (27.2) | 43 (16.3) | 11 (4.2) | 6 (2.3) |
| 28. Have you ever been isolated by others (e.g. family, friends) because you were playing video games? | 159 (60.2) | 54 (20.5) | 36 (13.6) | 6 (2.3) | 9 (3.4) |
| 29. Have you lied about the time spent on games? | 147 (55.7) | 64 (24.2) | 33 (12.5) | 15 (5.7) | 5 (1.9) |
| 30. Has your sleep time been affected by video games? | 103 (39.0) | 68 (25.7) | 58 (21.9) | 22 (8.3) | 13 (4.9) |
| 31. Have you stopped doing any other important activities (e.g. school, work, sport) because you played video games? | 130 (49.2) | 75 (28.4) | 41 (15.5) | 10 (3.8) | 8 (3.0) |
| 32. Have you ever felt bad about playing video games for too long]? | 118 (44.7) | 62 (23.5) | 55 (28.8) | 15 (5.7) | 14 (5.3) |
| 33. Your video game activity interferes with your academic activities (doing homework, meeting for internship reports, etc.). | 123 (46.6) | 81 (30.7) | 46 (17.4) | 5 (1.9) | 9 (3.4) |
| 34. Your video game activity interferes with your educational activity (studying for exams, revising, problem solving, etc.). | 126 (47.7) | 86 (32.6) | 38 (14.4) | 8 (3.0) | 6 (2.3) |

Similarly, some of the representative questions on this topic in the survey are annexed, again not all the graphs were not included for reasons of space; the discussion of results explains the respective answers.

Of the answers obtained in relation to the use of video games, there were no significant differences in the answers to questions 16 and 18 (see Table 2), showing that interest in video games is very varied in terms of frequency of use. In contrast, there were significant differences between the options ‘almost never’ and ‘sometimes’ in answers 20,22,24,25,26,27,28,29,30,31 and 34, (see Table 2 in box 3), which could suggest that there is a certain degree of concern in terms of being able to suspend a game, in showing a certain degree of pleasure when playing video games, in having family conflicts because of this activity, and something important regarding their academic activity, especially because more than 10% declared that ‘sometimes’ they do not fulfil their academic activities, which also applies to the options ‘sometimes’ and ‘frequently’ obtained in 21,24 and 34. There were no significant differences in the options ‘frequently’ and ‘very frequently’ in the responses to items 17, 19, 21, 22, 23, 25, 26, 27, 28, 29, 30 and 31, in most of these responses, the lowest frequencies of the questionnaire were found, the first 3 referring to pleasure or satisfaction when using video games, to which the majority responded with ‘never’, ‘almost never’ or ‘sometimes’, thus expressing that they do not feel a definite satisfaction with the use of video games, and the following 3 about feelings of abstinence from their use; The following 3 were about feelings of abstinence from video games; they also stated that they do not play because they feel stressed, or that they do not get upset or affected when they cannot play them, and finally the last ones about the problems caused by video games.

In the case of the questioning on the use of video games, there were significant differences in the answers given to questions 17, 19 and 24 onwards (see Table 2), marking a relevant disparity between the answer ‘never’ and ‘very frequently’, highlighting the non-dependence on the use of video games; questions 24, 25 and 26 refer to feeling some kind of feeling of anger or irritability at the stress of not being able to use video games, the majority answered never, and less than 2% stated that very frequently. Concern about not being able to meet basic needs can contribute to feelings of anger, and in this case, opinions about not being dependent on video games are further emphasised, with approximately 80% responding ‘never’ and ‘hardly ever’.

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Questions 27 and 28 ask about the problematic relationship or conflict that could exist between the student and his/her family due to excessive video game use, and again a high percentage of students answered in the negative (approx. 80%, more than 200 students).

As a response to the surveys applied, it can be established that 80% of the users consulted gave a score between almost never and never to the questions that relate the use of the Internet and video games with educational activity, i.e. they recognise that the fact that they are frequently using these technologies does not represent a tendency towards behavioural addiction, nor that their academic activities may be affected by these activities, however, more than 21% responded that they frequently or very frequently use these communication systems excessively.

## Conclusions

Technologies are useful if used in moderation, as they allow for interconnection, rapid information, obtaining various products or actions, facilitating tasks, the possibility of expressing oneself, relating to others, etc.

The diagnostic criteria for pathological use of the Internet and video games are very varied (Shapira et al., 2003; Ko et al., 2005; Beranuy et al., 2009) and some show greater consistency in the 8 criteria: 1. 3. Has made repeated unsuccessful efforts to control, decrease or stop Internet use. 4. 4. felt restless, moody, depressed or irritable in attempts to stop or stop using the Internet. 5. You have spent more time on the Internet than you intended to. 6. You have been at risk of losing an important relationship, job or educational opportunity because of the Internet. 7. You have lied to family members, your therapist or others to hide the important relationship with the Internet. 8. Uses the Internet as a way to escape from problems or to alleviate an upset (feelings of helplessness, anxiety, depression or guilt), with some agreeing that, for a diagnosis, the person must meet at least 5 of them, which is not clearly defined in the students interviewed, it is to be considered that in various studies on addictive disorders there is often a denial of dependence.

This is due to the fact that this behaviour demonstrates a pleasure or personal satisfaction that is not compatible with many of the interests of the environment and therefore the user prefers not to express it in order to avoid being reprimanded, when doing so the user does not want to express it, especially when this behaviour gives rise to a qualification or criticism, or does not want to make their opinion known because they may be considered as an addict (Echeburúa and Corral, 2010; Echeburúa and Requesens, 2012). It is important to continue asking these questions in order to make students aware of the need to learn more about how they are affected by the use of these technologies.

The effects of this daily activity should also be known, as it will continue, perhaps increasingly in each person, and it is therefore necessary at the level of each individual to establish protocols of conduct that are appropriate for managing time and daily activities.

For addictions to technologies, the main strategy to avoid them is to obtain a behavioural pattern for their use, not only because the new technologies are harmful in themselves, but also because in today's society it is not appropriate or possible to stop using them, which is why the use of healthy routines is the fundamental form of existing prevention.

## Declarations

### Conflict of interest

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

### Author contributions

*Ortiz-Sánchez, Pedro Alfonso Guadalupe:* Contributed to concept development, questionnaire and data processing, drafting and writing the article.

*Sanchez-Iturbe, Patricia Guadalupe*: Contributed to the generation, drafting and application of the questionnaire, its analysis and the writing of the article.

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*Ortiz-y-Ojeda, Pedro Tomás*: Contributed to the analysis and writing of the article.

*Clemente-Camacho, Elferías Isaías:* Contributed to the processing of the information.

**Availability of data and materials**

The data obtained for this research are available in an electronic repository owned by the academic body Didactics and Application of Basic Sciences.

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**Abbreviations**

| | |
|---|---|
| AMP | American Psychiatric Association |
| CIE | International Classification of Diseases |
| ENDUTIH | National Survey on the Availability and Use of Information Technologies in Households |
| INEGI | National Institute of Statistics and Geography |
| TecNm | Tecnológico Nacional de México |

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Article

# Development of a database for managing social service students using MATLAB

# Desarrollo de una base de datos para gestión de alumnos de servicio social utilizando MATLAB

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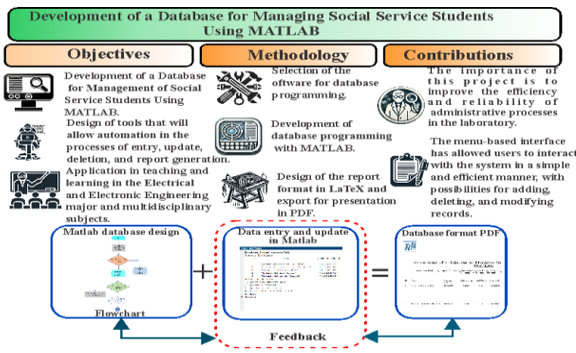
## Abstract

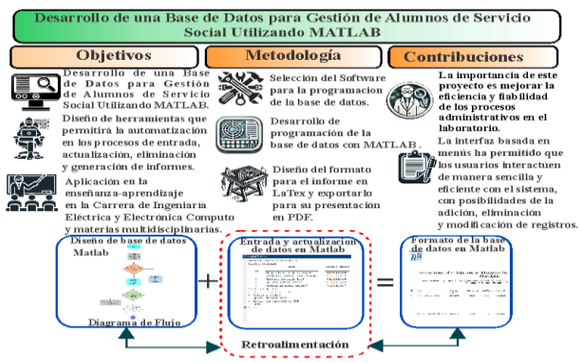
This work presents the development and implementation of a database for managing social service students using MATLAB. The system is designed to optimize and automate the processes of data entry, updating, deletion, and generation of student reports. The database includes essential fields such as student ID, name, account number, initial and final service periods, start and end dates, project title, and completion status. Users interact with the system through a menu-based interface in MATLAB, allowing easy addition, deletion, and modification of records. The system exports the database to a PDF report using MATLAB as a LaTeX editor, executing automatically. This solution reduces administrative workload in the laboratory, improving the efficiency and reliability of managing social service students.




**Database, MATLAB, Latex**

## Resumen

Este trabajo presenta el desarrollo e implementación de una base de datos para la gestión de alumnos de servicio social utilizando MATLAB. El sistema está diseñado para optimizar y automatizar los procesos de entrada de datos, actualización, eliminación y generación de informes de los estudiantes. La base de datos incluye campos esenciales como ID del alumno, nombre, número de cuenta, periodos inicial y final del servicio, fechas de inicio y fin, título del proyecto y estatus de conclusión. Los usuarios interactúan con el sistema a través de una interfaz basada en menús en MATLAB, lo que permite la fácil adición, eliminación y modificación de registros. El sistema exporta la base de datos a un informe en PDF usando MATLAB como editor de LaTeX, ejecutándose automáticamente. Esta solución reduce la carga administrativa dentro del laboratorio, mejorando la eficiencia y fiabilidad en la gestión de alumnos de servicio social.




**Base de Datos, MATLAB, Latex**

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## Introduction

Efficient data management in educational settings is crucial for improving administration and monitoring of both academic and extracurricular activities. In the context of social service, it is essential to have systems that allow proper handling of student information, facilitating both administration and report generation, and storing it in the cloud for tracking student performance.

This project focuses on the development of a database for managing social service students, particularly in the Measurement, Instrumentation, and Control Laboratory at the Centro Tecnológico of the Facultad de Estudios Superiores Aragón of the Universidad Nacional Autónoma de México, using MATLAB as the primary tool. Known for its capabilities in numerical calculation and data visualization, MATLAB also offers functionalities for database management and manipulation, making it a viable option for such applications. According to Goranov (2023), advancements in technology have increased the complexity and size of data sets, necessitating programming tools for rapid data processing and multivariate statistical analysis in environmental research, with data processing capabilities, ease of use, and detailed tutorials.

This enhances research efficiency, and its free availability enables applications in UV-VIS spectroscopy, fluorescence spectroscopy, mass spectrometry, and nuclear magnetic resonance (NMR).

Another application is the Structural Health Monitoring Data Management System (SDMS) presented by Koo (2011), built on the MySQL database management system, an open-source relational database known for its ease of use and rapid deployment.

Koo developed a MATLAB-based interface using mYm that allows researchers to read and write data in the database using simple MATLAB commands, without needing advanced SQL knowledge.

They also developed a web interface with JavaScript and the Google Chart Tools API, allowing real-time data visualization in scatter plots.

This system has been implemented in various structures in the UK, including the Tamar Bridge and the Humber Bridge, demonstrating its ability to manage and analyze large volumes of structural data, providing valuable tools for maintenance and structural integrity research.

The article by MathWorks (2024), "MATLAB in the Cloud," describes how to run MATLAB and Simulink in cloud environments such as AWS (Amazon Web Services) and Azure, the latter being a cloud computing platform created by Microsoft for building, testing, deploying, and managing applications and services using its global infrastructure, allowing access to MATLAB directly from a web browser and facilitating the connection to data and computational resources for long-duration calculations, simulations, and data analysis without the need for powerful local hardware.

The "MATLAB Database Toolbox" resource by MathWorks (2024) explains how to use the MATLAB Database Toolbox to connect to SQL (Structured Query Language) and NoSQL (Not only Structured Query Language) relational databases and in the cloud, enabling import, export, and joining of tables without writing SQL queries.

This toolbox is compatible with popular databases like MySQL (My Structured Query Language), PostgreSQL, a relational database management system, and SQLite, the colloquial term 'Lite' referring to a 'reduced' version, providing native interfaces for greater efficiency. Additionally, the article "Connecting MATLAB to Cloud Databases" on MATLAB Central (MathWorks, 2024) explains how to connect MATLAB to Databricks and other cloud database services like Azure and Google BigQuery, the latter being a managed, serverless data storage product by Google that offers scalable analytics over large data volumes, enabling users to access and query large data sets remotely and run native MATLAB code on a Databricks cluster. Meanwhile, the article by Sandoval (2023) compiles the best articles on database design published in 2023, covering topics from entity-relationship diagrams (ERDs) to best practices for database schema design, providing essential information for professionals and enthusiasts in database design and management.

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On the other hand, the article "Database Management Trends in 2024" (Foote, 2023) explores emerging directions in database management, highlighting the use of cloud-based DBMS, autonomous and augmented databases, analytical, in-memory, and graph databases, and the integration of SQL and NoSQL through new databases like NewSQL, a type of database management system that combines the best of SQL and NoSQL databases, offering both transactional consistency and scalability. With the digitalization of today's society and the rise of IoT, people continuously interact with various user interfaces, which will be designed to be user-friendly, easy to use, and to provide the highest software product performance (Campos and Campos, 2023).

MATLAB is an interactive software for numerical calculation and data visualization, developed by MathWorks Inc. Widely used in fields of science and engineering, MATLAB is compatible with Unix, Macintosh, and Windows environments. The chapter covers how to create, edit, save, run, and debug M files (ASCII files with MATLAB instructions). Additionally, it explores the creation of matrices and vectors, and the use of linear algebra functions like matrix and vector multiplication, dot and cross products, transposition, determinants and inverses, and solving linear equations. MATLAB also allows for the programming of logical structures and loops, the use of subprograms and functions, and the generation of two and three-dimensional graphics. The symbolic math functions of MATLAB are also presented for performing symbolic operations and developing algebraic expressions. MATLAB is known for its highly optimized matrix and vector calculations and its intuitive language for expressing mathematical and visual problems and solutions, not forgetting that it can generate databases within the environment and visualize the information (Dukkipati, 2008).

MATLAB is a numerical computing environment and a scripting programming language. Numerical computing environments like MATLAB enable much more sophisticated and complex mathematical work than simple calculator programs or spreadsheet software packages can achieve. MATLAB stands for "matrix laboratory," and its ability to work with matrices was one of its original strengths, although it is now just one of many features.

Originally intended as a shortcut for students unfamiliar with FORTRAN, it now also interacts with programs written in C, C++, Java, and Python, and allows users to create their own user interfaces. MATLAB is integrated with Simulink, a graphical programming environment that can be driven by MATLAB scripts or used as the interface from which to run MATLAB. Simulink is used to simulate multi-domain dynamic systems. A multi-domain dynamic system is powered by more than one energy domain, including electrical, mechanical, hydraulic, pneumatic, and thermal. Therefore, designing a multi-domain dynamic system is a complex engineering task. Complementary software for Simulink includes software for generating C source code for real-time implementation, real-time testing of models, and formal verification and validation tools, along with graphical block construction libraries (Kte, 2023).

The term "informatics" arises from combining the words information and automatic. Informatics is the science that studies the automatic processing of information within a computer. Moreover, the term "information" is defined as a set of organized data that, collectively, conveys some meaning. Therefore, based on the previous definitions, an informatic system is an information system that enables automatic information processing and consists of a set of interconnected devices. Informatics is prevalent in society, both in personal and professional domains, and is one of the fastest evolving sectors. There are numerous informatic systems; thus, it is imperative that personnel managing these systems are qualified and specialized. Initially, informatic systems were located in a single space, but it is now common to find them distributed across various physical locations. For instance, in a company, not all computer devices are in the same place; several systems are distributed across different rooms or departments, as is the case with other computer devices that are part of an informatic system. This topic addresses the physical structure of an informatic system and its primary functions.

Programming languages have evolved significantly from their origins, as shown in the progression from their inception to the present: first-generation languages in the 1940s, machine code was the representative of this era, with the machine language ENIAC being a pioneer.

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They required encoding instructions using numerical codes. These languages were very difficult to use, and programming was highly complicated. Second-generation languages: In the early 1950s, the second evolution appeared; this was when assembler languages (specific to each machine) emerged, allowing mnemonic rules to be later transformed into machine code. Initially, this process was manual and was later performed by a program called an assembler.

Third-generation languages: In the 1950s, shortly after the appearance of assembler languages, the first compilers emerged, which added block structures and procedure calls, as well as control instructions in a compilable language. These first languages were FORTRAN, COBOL, and LISP. An algorithm is a sequence of necessary steps to solve a problem or perform a task within a finite time. Algorithms are independent of both the programming language in which they are expressed and the computer.

Algorithms can be translated into a programming language and then executed on a machine. The characteristics that an algorithm must have: Precise: it must indicate the order in which the tasks are performed. Defined: if an algorithm is executed twice, it should yield the same result each time. Finite: it must conclude at some point; it must have a finite number of steps (López et al., 2023). The resource "Save a figure as pdf - MATLAB Answers - MATLAB Central" explains how to use the exportgraphics command in MATLAB to create PDF files directly from MATLAB-generated figures. From version R2021b, it is possible to create PDF files containing multiple figures using a for loop (MathWorks, 2023). Furthermore, "PDF Latex file using Matlab - MATLAB Answers - MATLAB Central" describes how to export a LaTeX file to PDF using MATLAB. In the Live Editor, you can select Export to LaTeX, which also creates a LaTeX style file "matlab.sty" in the same folder as the output document (MathWorks, 2020). Another resource, "Convert live script or function to standard format - MATLAB export", provides details on how to convert live MATLAB scripts to standard formats such as PDF, Microsoft Word, and LaTeX. It describes additional options such as including outputs, running code, and hiding code during conversion (MathWorks, 2023).

Additionally, the script "matlabfrag to pdf - File Exchange - MATLAB Central" allows for creating PDF files formatted in LaTeX using matlabfrag to generate .eps and .tex files, then using pdflatex to create the PDF file (Martin, 2024).

Finally, the "Plot2LaTeX - File Exchange - MATLAB Central" tool exports a MATLAB figure as a vector-format PDF file for inclusion in LaTeX, requiring the open-source vector graphics editor Inkscape (Jan de Jong, 2024).

In today's world, the integration of advanced technologies in education is crucial for enhancing the quality and accessibility of learning across various academic contexts.

The incorporation of Big Data tools in business analytics courses, as discussed by Zadeh et al. (2021), highlights the need to develop competencies in handling massive data sets, preparing students to face challenges in data-driven decision-making.

Similarly, the use of open-source platforms like SageMath in teaching operational research in Brazil, presented by Assumpção et al. (2024), demonstrates how economic limitations can be overcome to provide quality education in engineering. Additionally, the application of backpropagation neural networks to personalize learning in open universities, as explored by Wang (2024), underscores the potential of machine learning to transform higher education. In parallel, the Evaluation, Supervision, and Control (ESC) strategies to mitigate student dropout in Islamic higher education, discussed by Agus (2024), reveal the importance of a proactive and collaborative approach to student retention.

Finally, the development of remotely accessible and fully controllable fiber optic systems laboratories, described by Aslan et al. (2024), shows how virtualization and remote control can expand educational opportunities, allowing students to conduct practical experiments without the constraints of time and space.

Collectively, these studies highlight how technological innovation can be a key catalyst in improving education across various fields and contexts.

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**Objetive**

Develop and implement a MATLAB-based database for efficient management and control of students undertaking their social service at the Measurement and Instrumentation Control Laboratory. This tool will enable the automation of data entry, updating, deletion, and report generation processes.

**Hypothesis**

Frequently, administrative tasks involve the submission of reports on students engaged in social service within the laboratory. Implementing a database in MATLAB for managing these social service students will facilitate the automation and optimization of control and administrative processes. Time optimization is pertinent as it enables the automatic generation of PDF reports, thereby minimizing the time spent on repetitive administrative tasks. This will significantly reduce the workload on staff and enhance the accuracy and reliability of the records.

**Methodology and development**

This work was developed at the Faculty of Higher Studies Aragón, within the Technological Center, specifically in the measurement and instrumentation laboratory. It is important to mention that having a database is crucial for maintaining an efficient record of students performing social service. This allows for the immediate presentation of administrative reports in PDF format when required. The file we need to create is named alumnos.mat. This extension describes a database stored in MATLAB format and generates a table where the students' data are stored. It must be loaded at the start of the program to maintain data persistence between sessions; if it does not exist, a new empty table would be created. The database columns include the following fields: ID (unique identifier of the student), Name (student's name), Account_Number (student's account number), Initial_Period (initial period of social service), Final_Period (final period of social service), Start_Date (start date of social service), End_Date (end date of social service), Project_Title (title of the student's project), and Concluded (status of social service completion: Concluded / Not concluded).

The file alumnos.tex is a LaTeX document generated by the program, containing the representation of the student table in LaTeX format and is used as input for the pdflatex compiler to generate a PDF file, including the header, footer, and the table format. The file alumnos.pdf is the result of compiling alumnos.tex using pdflatex, and it is the final version of the report in PDF format, created for viewing and distribution. Additionally, three auxiliary files are generated during the creation of the PDF file: alumnos.aux (an auxiliary file generated by pdflatex during compilation), alumnos.log (a log file containing messages and errors from the pdflatex compilation), and alumnos.out (an additional output file generated by pdflatex).

**1.- Verification and loading of the database from the alumnos.mat file**

Figure 1 shows a block diagram of the procedure for verifying the alumnos.mat file, which is the database, to ensure it loads correctly. If it does not exist, the file alumnos.mat will be created, and the following is the MATLAB code generated.

**Box 1**

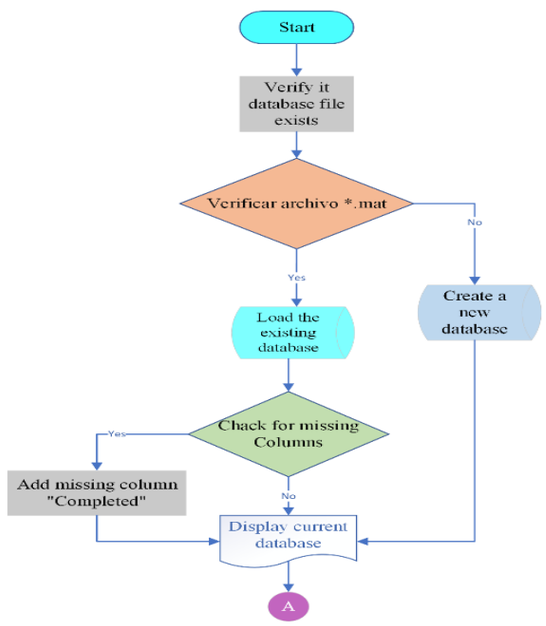


**Figure 1**

Load the database, and if it does not exist, create a new database file

MATLAB code where the student.map file is generated, and the table header is created.

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```
% Verify if the database file exists
if isfile('students.mat')
    % Load the existing database
    load('students.mat', 'students');
    disp('Database loaded successfully.');

    % Check if any column is missing and add it if necessary
    if ~ismember('Completed',
students.Properties.VariableNames)
        students.Completed = strings(height(students), 1);
    end
else
    % Create an empty table with the necessary fields
    students = table('Size', [0 9], 'VariableTypes', {'int32', 'string',
'string', 'string', 'string', 'string', 'string', 'string', 'string'}, ...
                     'VariableNames', {'ID', 'Name', 'Account_Number',
'Initial_Period', 'Final_Period', 'Start_Date', 'End_Date',
'Project_Title', 'Completed'});
    disp('New database created.');
end

% Display the database at the start
disp('Current Database:');
disp(students);
```

## 2.- Function and Operations

Figure 2 shows a flowchart presenting a menu to the user for performing various operations on the database. These operations include entering data, deleting data, updating data, exporting to PDF, and exiting.

**Box 2**

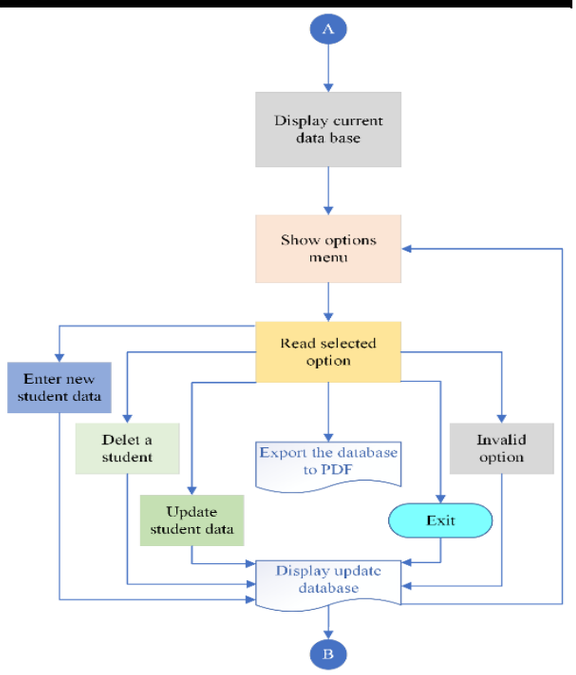


**Figure 2**

Flowchart visualizing the functions of the operators

MATLAB code displays the menu for selecting required actions, whether it is to input information, delete, update, export, or exit the iteration.

```
while true
    disp('Select an option:');
    disp('1. Enter new student data');
    disp('2. Delete a student');
    disp('3. Update student data');
    disp('4. Export the database to PDF');
    disp('5. Exit');
    option = input('Option: ', 's');
    switch option
        case '1'
            % Call the function to enter data
            students = enter_data(students);
            % Save the database
            save('students.mat', 'students');
        case '2'
            % Call the function to delete data
            students = delete_data(students);
            % Save the database
            save('students.mat', 'students');
        case '3'
            % Call the function to update data
            students = update_data(students);
            % Save the database
            save('students.mat', 'students');
        case '4'
            % Export the table to a LaTeX file
            export_to_latex(students, 'students.tex');
            % Compile the LaTeX file to PDF using pdflatex
            if isfile('students.tex')
                disp('Compiling the LaTeX file to PDF...');
                % Set an explicit time limit
                [status, cmdout] = system('pdflatex -
interaction=nonstopmode -halt-on-error students.tex');
                % Check if the compilation was successful
                if status == 0
                    disp('PDF generated successfully.');
                    disp('The PDF file is located in the following
directory:');
                    disp(pwd);
                    % Automatically open the PDF file
                    open_pdf('students.pdf');
                else
                    disp('Error generating the PDF.');
                    disp(cmdout);
                    % Display the contents of the log file
                    if isfile('students.log')
                        fid = fopen('students.log', 'r');
                        while ~feof(fid)
                            tline = fgetl(fid);
                            disp(tline);
                        end
                        fclose(fid);
                    end
                end
                % Delete intermediate files only if they exist
                delete_files({'students.aux', 'students.log',
'students.out', 'students.tex'});
            else
                disp('The file students.tex could not be created.');
            end
        case '5'
            break;
        otherwise
            disp('Invalid option. Please try again.');
    end
    % Display the database after each operation
    disp('Updated Database:');
    disp(students);
end
```

## 3.- Data Entry

Figure 3 displays a flowchart where a menu is presented to the user for entering data of the students.

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https://doi.org/10.35429/EJS.2024.21.11.8.20

**Box 3**

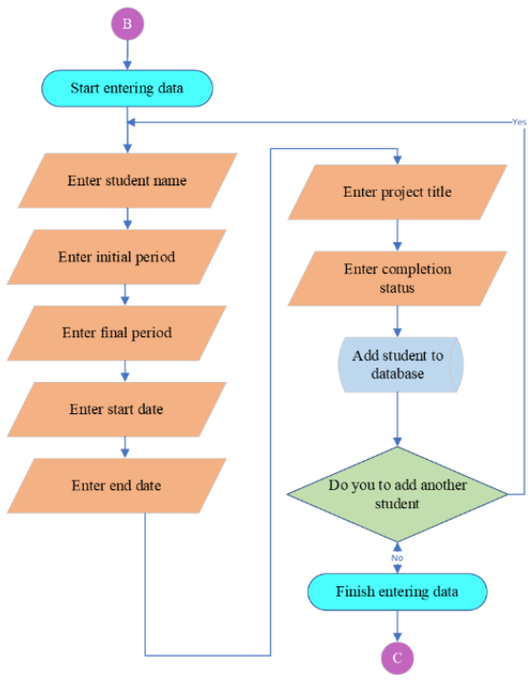


**Figure 3**

Flowchart enabling student data entry

The following code prompts the user to enter the data of a new student and adds it to the table. It allows entering multiple students in a single execution through iterations.

```
while true
      Name = input('Enter the student name: ', 's');
      Account_Number = input('Enter the account number (9 digits): ',
's');
      Initial_Period = input('Enter the initial period (e.g., 2024-1): ', 's');
      Final_Period = input('Enter the final period (e.g., 2024-2): ', 's');
      Start_Date = input('Enter the start date (dd-mm-yyyy): ', 's');
      End_Date = input('Enter the end date (dd-mm-yyyy): ', 's');
      Project_Title = input('Enter the project title: ', 's');
      Completed = input('Enter Yes if completed or No if not completed:
', 's');
      students = add_student(students, Name, Account_Number,
Initial_Period, Final_Period, Start_Date, End_Date, Project_Title,
Completed)
      continue_entry = input('Do you want to add another student? (y/n):
', 's');
      if lower(continue_entry) ~= 'y'
         break;
      end
   end
```

## 4.- Data Deletion

The user can delete data that has already been entered, removing the entire row, as the row contains all the information of the students (see Figure 4).

**Box 4**

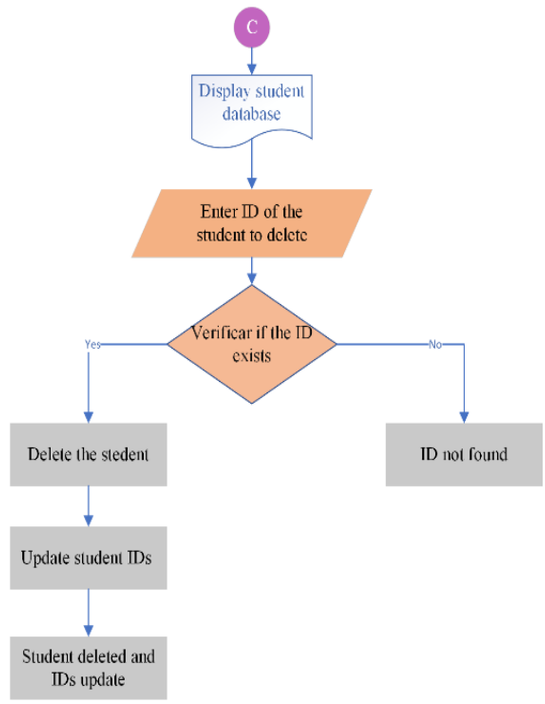


**Figure 4**

Flowchart facilitating the deletion of student data

The subsequent code allows the deletion of a student from the table based on the ID entered by the user and reorganizes the IDs to be consecutive following the deletion of a student.

```
disp(students);
   ID = input('Enter the ID of the student to delete: ');
   if any(students.ID == ID)
      students(students.ID == ID, :) = [];
      % Update IDs
      for i = 1:height(students)
         students.ID(i) = i;
      end
      disp('Student deleted and IDs updated.');
   else
      disp('ID not found.');
   end
```

## 5.-Updating Data:

The menu features a key option that allows modification of student information, presenting a menu to select the information requiring alterations as shown in Figure 5.

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**Box 5**

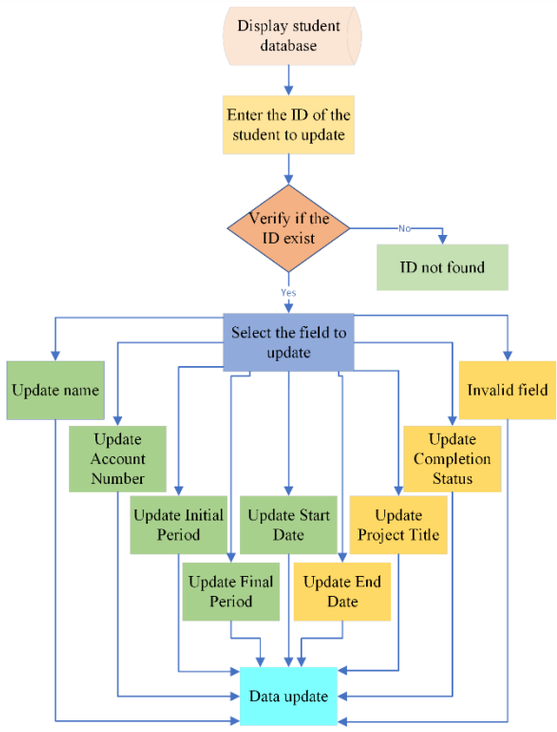


**Figure 5**

Flowchart for updating student data based on their ID

The code displayed below enables the updating of data for a specific student based on their ID.

```
disp(alumnos);
   disp(students);
   ID = input('Enter the ID of the student to update: ');
   if any(students.ID == ID)
      disp('Select the field to update:');
      disp('1. Name');
      disp('2. Account Number');
      disp('3. Initial Period');
      disp('4. Final Period');
      disp('5. Start Date');
      disp('6. End Date');
      disp('7. Project Title');
      disp('8. Completed');
      field = input('Field: ', 's');
      switch field
         case '1'
            students.Name(ID) = string(input('Enter the new name: ', 's'));
         case '2'
            students.Account_Number(ID) = string(input('Enter the new account number: ', 's'));
         case '3'
            students.Initial_Period(ID) = string(input('Enter the new initial period: ', 's'));
         case '4'
            students.Final_Period(ID) = string(input('Enter the new final period: ', 's'));
         case '5'
            students.Start_Date(ID) = string(input('Enter the new start date: ', 's'));
         case '6'
   students.End_Date(ID) = string(input('Enter the new end date: ', 's'));
         case '7'
            students.Project_Title(ID) = string(input('Enter the new project title: ', 's'));
         case '8'
            students.Completed(ID) = string(input('Enter Yes if completed or No if not completed: ', 's'));
         otherwise
            disp('Invalid field.');
      end
      disp('Data updated.');
   else
      disp('ID not found.');
   end
```

## 6.- Exporting to LaTeX and PDF:

This function creates a LaTeX (.tex) file from the alumnus table data, setting up the document class, used packages, and defining the page and table styles. It employs geometry to establish custom margins, fancyhdr to define headers and footers, datetime to include the date and time of update, setspace mainly used to adjust line spacing, and array and graphicx to define the table format and include graphics, respectively. The document title is defined, centered with a 1.5 line spacing, while the student table is formatted with centered columns using the previously defined C column type. Each table row is written using a fprintf within a for loop, open_pdf, this function opens the generated PDF file in the system's default PDF viewer, and delete_files, this function deletes intermediate files generated during LaTeX compilation to keep the directory clean. Figure 6 shows the flowchart of the process for exporting and viewing in PDF.

**Box 6**

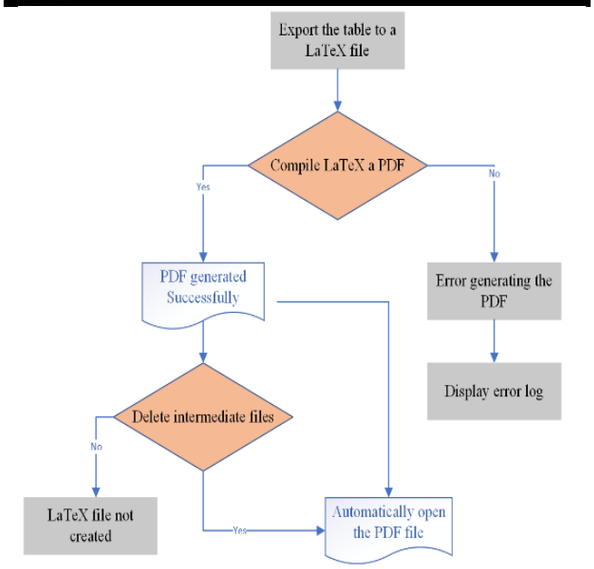


**Figure 6**

Flowchart for exporting the database to LaTeX and viewing in PDF

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The following code demonstrates how the file can be exported to LaTeX and viewed in PDF.

```
    fid = fopen(filename, 'w');
    if fid == -1
        error('Could not create the LaTeX file.');
    end
    fprintf(fid, '\\documentclass{article}\n');
    fprintf(fid, '\\usepackage[landscape, left=0.5in, right=1in, top=1in, bottom=1in]{geometry}\n'); % Adjust margins
    fprintf(fid, '\\usepackage{booktabs}\n');
    fprintf(fid, '\\usepackage{fancyhdr}\n');
    fprintf(fid, '\\usepackage{datetime}\n'); % Package for date and time
    fprintf(fid, '\\usepackage{setspace}\n');
    fprintf(fid, '\\usepackage[english]{babel}\n');
    fprintf(fid, '\\usepackage{array}\n');
    fprintf(fid, '\\usepackage{graphicx}\n');
    fprintf(fid, '\\newcolumntype{P}[1]{>{\\raggedright\\arraybackslash}p{#1}}\n');
    fprintf(fid, '\\pagestyle{fancy}\n');
    fprintf(fid, '\\fancyhead[L]{\\includegraphics[width=2cm]{Aragon.jpg}}\n'); %Author: Edgar Alfredo Gonzalez Galindo
    fprintf(fid, '\\fancyhead[R]{FES Aragón Centro Tecnologico Aragón}\n');
    fprintf(fid, '\\fancyfoot[L]{\\fontsize{8}{12}\\textbf{Responsible: Edgar Alfredo Gonzalez Galindo}}\n');
    fprintf(fid, '\\fancyfoot[C]{\\thepage}\n');
    fprintf(fid, '\\fancyfoot[R]{Update date and time: \\today{} \\currenttime}\n'); % Date and time
    fprintf(fid, '\\renewcommand{\\headrulewidth}{0pt}\n');
    fprintf(fid, '\\renewcommand{\\footrulewidth}{0pt}\n');
    fprintf(fid, '\\setlength{\\headsep}{1.8cm}\n');
    fprintf(fid, '\\begin{document}\n');
    fprintf(fid, '\\begin{center}\n');
    fprintf(fid, '\\vspace*{1cm}\n'); % Space to move the title down
    fprintf(fid, '\\setstretch{1.5}\n');
    fprintf(fid, '\\textbf{\\LARGE Development of a Database for Managing Social Service Students Using MATLAB}\\\\[0.5cm]\n');
    fprintf(fid, '\\setstretch{-1}\n');
    fprintf(fid, '\\fontsize{11}{12}\\textbf{ González-Galindo, Edgar Alfredo *, Luna-Alanís, Héctor Nathán, González-Ledesma, Alberto and Castro-Pérez, Joseph Kevin}\\\\[0.5cm]\n');
    fprintf(fid, '\\setstretch{-1}\n');
    fprintf(fid, '\\end{center}\n');
    fprintf(fid, '\\begin{center}\n');
    fprintf(fid, '\\begin{tabular}{p{0.5cm}p{4.5cm}p{2cm}ccccp{4cm}p{2.7cm}}\n');
    fprintf(fid, '\\toprule\n');
    fprintf(fid, '\\fontsize{7}{12}\\textbf{ID} &
\\fontsize{7}{12}\\textbf{Name} &
\\fontsize{7}{12}\\textbf{Account Number} &
\\fontsize{7}{12}\\textbf{Initial Period} &
\\fontsize{7}{12}\\textbf{Final Period} &
\\fontsize{7}{12}\\textbf{Start Date} &
\\fontsize{7}{12}\\textbf{End Date} &
\\fontsize{7}{12}\\textbf{Project Title} &
\\fontsize{7}{12}\\textbf{Completed} \\\\\n');
    fprintf(fid, '\\midrule\n');
    fprintf(fid, '\\fontsize{7}{12}\\selectfont\n'); % Change the font size of the table
    for i = 1:height(students)
        fprintf(fid, '\\fontsize{7.5}{12}\\textbf{%d} &
\\fontsize{7.5}{12}\\textbf{%s} &
\\fontsize{7.5}{12}\\textbf{%s} &
\\fontsize{7.5}{12}\\textbf{%s} &
\\fontsize{7.5}{12}\\textbf{%s} &
\\fontsize{7.5}{12}\\textbf{%s} &
\\fontsize{7.5}{12}\\textbf{%s} &
\\fontsize{7.5}{12}\\textrm{%s} &
\\fontsize{7.5}{12}\\textbf{%s} \\\\\n',  students.ID(i),
students.Name{i}, students.Account_Number{i},
students.Initial_Period{i}, students.Final_Period{i},
students.Start_Date{i}, students.End_Date{i},
students.Project_Title{i}, students.Completed{i});
        fprintf(fid, '\\hline\n'); % Add horizontal line after each row
        if mod(i, 4) == 0
            fprintf(fid, '\\end{tabular}\n');
            fprintf(fid, '\\newpage\n'); % Insert page break
            fprintf(fid, '\\begin{tabular}{p{0.5cm}p{4.5cm}p{2cm}ccccp{4cm}p{2.7cm}}\n'); % Reopen the table environment
            fprintf(fid, '\\toprule\n');
fprintf(fid, '\\fontsize{7}{12}\\textbf{ID} &
\\fontsize{7}{12}\\textbf{Name} &
\\fontsize{7}{12}\\textbf{Account Number} &
\\fontsize{7}{12}\\textbf{Initial Period} &
\\fontsize{7}{12}\\textbf{Final Period} &
\\fontsize{7}{12}\\textbf{Start Date} &
\\fontsize{7}{12}\\textbf{End Date} &
\\fontsize{7}{12}\\textbf{Project Title} &
\\fontsize{7}{12}\\textbf{Completed} \\\\\n');
            fprintf(fid, '\\midrule\n');
        end
    end
    fprintf(fid, '\\bottomrule\n');
    fprintf(fid, '\\end{tabular}\n');
    fprintf(fid, '\\end{center}\n');
    fprintf(fid, '\\end{document}\n');
    fclose(fid);
```

## Results

Upon running the program for the first time, the existing database is successfully loaded, and the following output is displayed in the Command Window as shown in Figure 7.

**Box 7**

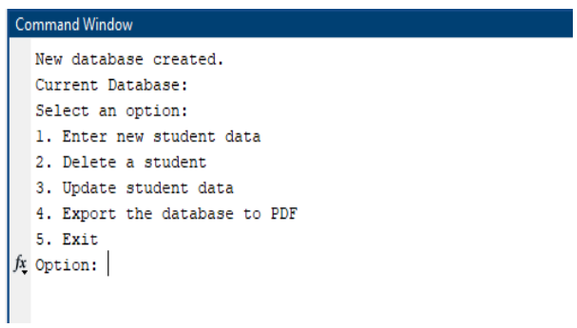


**Figure 7**

The Command Windows displays how a new database is created and requests the 5 options to execute; at the end, an iteration is generated

Figure 8 shows how the student data is entered, and if required, it restarts the menu to enter the next student.

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## Box 8

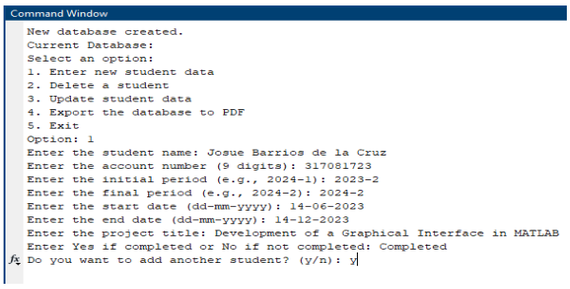


**Figure 8**

At the end of data entry, we can continue entering, giving the option of Y; if N is typed, it exits this iteration and returns to the initial menu.

Figure 9 shows the Command Windows window typing N to finish entering the student data.

## Box 9

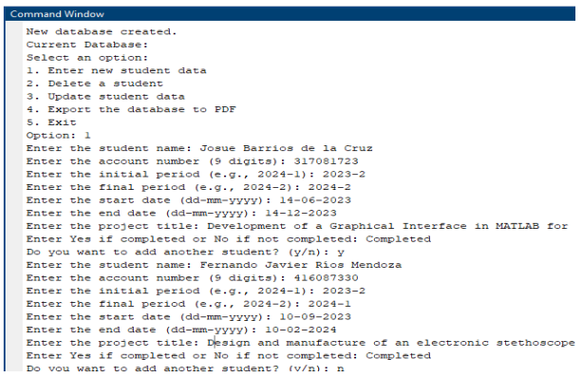


**Figure 9**

N is entered to end the iteration and return to the main menu.

Figure 10 shows the Command Windows waiting to select options, and it can be seen that a table of data for the students generated is displayed.

## Box 10

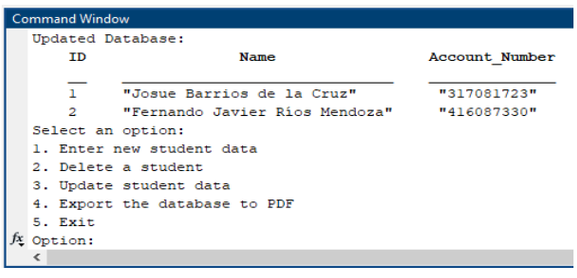


**Figure 10**

The MATLAB Command Windows shows the options for starting and exiting the database where two users are registered

Figure 11 shows the Command Windows as it looks before and after finishing entering the student data; it can continue and displays the list at the top and bottom with the updated data. This output indicates that the database has been updated correctly and presents the current state of the student records, including their identifiers, names, account numbers, service periods, start and end dates, titles of their works, and completion status.

## Box 11

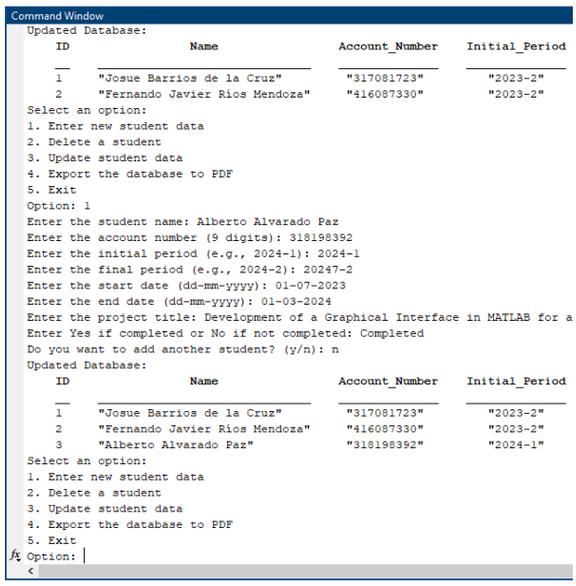


**Figure 11**

Displays the print in the Command Windows of the previous list and the updated list of student information.

## Conclusions

The development and implementation of a database for managing social service students using MATLAB has proven to be an effective tool for improving the efficiency and reliability of administrative processes in the Measurement and Instrumentation Laboratory at the Facultad de Estudios Superiores Aragón. Through the automation of entry, update, deletion, and report generation processes, there has been a significant reduction in the workload of the staff assigned to the Laboratory. The system, by allowing the creation and management of detailed student records, facilitates the immediate generation of reports in PDF format, improving the precision and accessibility of the information.

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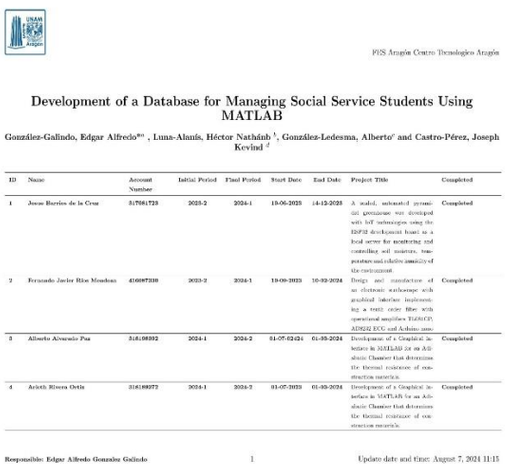
The integration of MATLAB with LaTeX for generating PDF documents has proven to be a powerful combination, leveraging MATLAB's data management capabilities and the flexibility to export the format to LaTeX and view the file in PDF. Additionally, the MATLAB menu-based interface has allowed the responsible person to interact simply and efficiently with the system, enabling the addition, deletion, and modification of records without the need for advanced programming knowledge. This accessibility and ease of use are essential to ensure the adoption and continuous use of the system by the laboratory staff. In summary, the implementation of this database has significantly optimized the administrative processes within the laboratory related to managing social service students, providing a precise and efficient solution that can serve as a model for other laboratories and/or departments requiring similar management and reporting systems.

## Annexes

**Box 12**



FES Aragón Centro Tecnológico Aragón

Development of a Database for Managing Social Service Students Using MATLAB

González-Galindo, Edgar Alfredo[a*] , Luna-Alanís, Héctor Nathán[b], González-Ledesma, Alberto[c] and Castro-Pérez, Joseph Kevind [d]

| ID | Name | Account Number | Initial Period | Final Period | Start Date | End Date | Project Title | Completed |
|---|---|---|---|---|---|---|---|---|
| 1 | Jesus Barrios de la Cruz | 317081723 | 2023-2 | 2024-1 | 19-06-2023 | 14-12-2023 | A scalel, automatid pyanometer was developed with IoT technologies using the ESP32 development board as a local server for monitoring and controlling soil moisture, temperature and relative humidity of the environment. | Completed |
| 2 | Fernando Javier Ríos Mendoza | 416087210 | 2023-2 | 2024-1 | 19-06-2023 | 10-12-2024 | Design and manufacture of an electronic stethoscope with graphical interface implementing a notch order filter with operational amplifier TL081CP, ADS232 ECG and Arduino nano | Completed |
| 3 | Alberto Alvarado Paz | 316108392 | 2024-1 | 2024-2 | 01-07-02-24 | 01-03-2024 | Development of a Graphical Interface in MATLAB for an Adiabatic Chamber that determines the thermal resistance of construction materials. | Completed |
| 4 | Aridth Rivera Ortiz | 316189272 | 2024-1 | 2024-2 | 01-07-2023 | 01-03-2024 | Development of a Graphical Interface in MATLAB for an Adiabatic Chamber that determines the thermal resistance of construction materials. | Completed |

Responsible: Edgar Alfredo González Galindo 1 Update date and time: August 7, 2024 11:15

**Figure 12**

PDF format as shown in the database record of social service students

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## 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 paper.

## Author contribution

*González-Galindo, Edgar Alfredo*: Collaborated in the initial conceptualization of the project, highlighting the need to integrate a menu-based interface in MATLAB to facilitate the entry, update, and deletion of student data. His contribution was crucial in defining the general structure of the system and ensuring that the database covered all essential fields such as student ID, name, and social service details, providing a solid foundation for the development and implementation of the system.

*Luna-Alanís, Héctor Nathán*: Played a key role in the technical part of the project, specifically in the development of the MATLAB code that generates and manages the database. He was responsible for implementing functions that allow dynamic interaction with the database, including adding and deleting records, as well as exporting these data to a PDF format through MATLAB using LaTeX, which significantly increased the efficiency of the administrative process.

*González-Ledesma, Alberto*: Focused on system optimization, working on process automation via MATLAB. His contributions included updating and consequently improving the database and integrating tools to generate automatic reports. These improvements ensured that the system was efficient and capable of minimizing time spent on repetitive tasks, a key goal of the project.

*Castro-Pérez, Joseph Kevin***:** Contributed his expertise in user interface and end-user experience. He designed the MATLAB menu interface, ensuring it was intuitive and accessible to users without advanced programming knowledge. Moreover, he supervised the system integration with LaTeX for report creation, ensuring that the documents generated were both aesthetically pleasing and functionally complete, essential for the presentation of administrative reports.

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**Availability of data and materials**

The data for this research is available according to the sources consulted.

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**Abbreviations**

NMR (Nuclear Magnetic Resonance)
SHM-SDMS (Structural Health Monitoring Data Management System)
MySQL (My Structured Query Language)
ERDs (Entity-Relationship Diagrams)
NoSQL (Not Only SQL)
SQL (Structured Query Language)
PostgreSQL (Relational Database Management System)
SQLite (Lightweight Structured Query Language)
ASCII (American Standard Code for Information Interchange)
ENIAC (Electronic Numerical Integrator and Computer)

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Article

# Reading strategies and their relationship with reading comprehension. Proposal from elementary school

# Estrategias de lectura y su relación con la comprensión lectora. Propuesta desde la educación primaria

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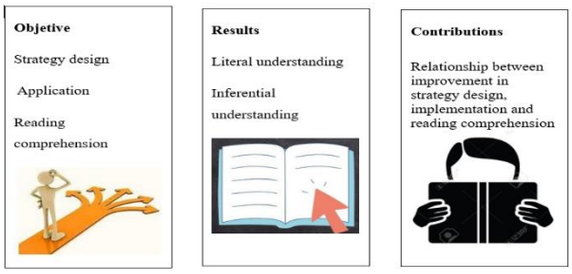
**Abstract**

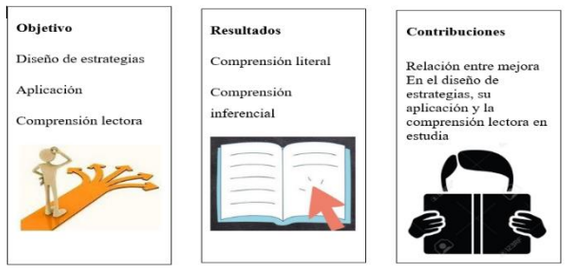
The present research work proposes and designs reading strategies, the aim is to use a qualitative research approach and an action research methodological perspective to intervene and transform the reading comprehension situation of primary school pupils. The results express a relevant and significant relationship between the use of reading strategies and modalities and the improvement of reading comprehension.




**Reading strategies, Reading modalities, Reading comprehension**

**Resumen**

El presente trabajo de investigación propone y diseña estrategias de lectura, la finalidad es que mediante un enfoque de investigación cualitativa y con una perspectiva metodológica de investigación acción se logre intervenir y transformar la situación de comprensión lectora de alumnos de educación primaria. Los resultados expresan una relación pertinente y significativa entre el uso de estrategias y modalidades de lectura y el mejoramiento de la comprensión lectora.




**Estrategias de lectura, Modalidades de lectura, Comprensión lectora**

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## Introduction

Reading comprehension, defined by the OECD (OECD, 2024) as "the ability to understand, evaluate, use and engage with written texts, participate in society, achieve proposed goals and develop the greatest possible knowledge and potential", is a transcendent educational aspect in the expectations of educational improvement in Mexico and the globalised world that seeks, according to the National Reading Strategy of the New Mexican School, to "recover the pleasure of reading, promoting the dissemination and consumption of Mexican and global books. Participate in the construction of peace, creating new spaces for coexistence through the dialogue that reading generates" (GobMex, 2024)

Given the current positions and the importance of reading comprehension in educational systems, this research proposes an intervention proposal that allows for the generation of strategies to achieve a better diagnosis, planning and intervention in primary education groups on reading comprehension.

## Diagnostic

The research was developed in a 3rd grade group of the primary school "María Guadalupe Castorena de Belaunzarán" in the municipality of Ojocaliente, Zacatecas.

One of the important characteristics for the characterisation of an object of study through its delimitation in the approach of a diagnosis and that will result in the design of relevant intervention strategies, is undoubtedly the recognition of learning styles that are defined by (Mejía, 2024) as:

Kinesthetic learning refers to people who learn best through direct experience and active participation [...] Visual learners, as the name suggests, understand information best when it is presented visually [...] Auditory learning refers to those who retain information most effectively when they hear it.

The identification of the different types of learning was carried out by means of a test that consisted of 10 questions focused on tastes based on certain activities or situations. This test was carried out individually, for which they were given a sheet of paper with the 10 questions to be answered in a time limit of 20 minutes.

**Box 1**

**Tabla 1**

Síntesis de los estilos de aprendizaje

| Learning style | Number of pupils presenting the learning style |
|---|---|
| Auditory | 7 |
| Visual | 12 |
| Kinaesthetic | 3 |
| Auditory-Visual | 5 |
| Auditory-Kinesthetic | 1 |
| Visual-Kinaesthetic | 0 |
| Auditory-Visual-Kinaesthetic | 1 |

*Source: Own elaboration*

The above table shows that the predominant learning style in the study group is visual with 12 students and secondly auditory.

## Diagnosis of reading comprehension

Reading is essential in everyday life because it is the key to knowing and interacting with the social world, it is a guideline for the emergence of the imagination. However, for reading to make sense, a fundamental ingredient is required: reading comprehension, which allows access to the construction of concepts through the decoding of texts carried out with a balance between previous knowledge and the information provided by the text.

It is worth noting that the lack of comprehension is one of the most worrying problems in primary schools, because without this competence, it is difficult to acquire new knowledge. In this respect, in order to identify the levels of comprehension in the study group, the analysis of a diagnostic strategy is presented, which rescues information that specifies the level of reading comprehension of the group, and on the other hand, a questionnaire was applied to assess the levels of comprehension, making it possible to identify which are more favoured in the group.

In the reading, the prediction strategy was applied, for which the cover was shown (sampling strategy) where Choco (the main character of the story) was found and questions were asked as shown below:

Ma: Here is this little bird called Choco, how do you think he goes (the dialogue was interrupted).
Ao: Choco

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Ma: Choco like choco milk (laughs) What do you think his family is like?
Raising hand
/A student raised his hand/
Ma: Let's see tell us
Ao: Colourful
Ma: Colourful What colour do you think Choco's family is?
Aos: Yellow
Aos: Colourful
Aos: Yellow with blue
Ao: Like the chicks (Diagnostic session)

In response to the trigger question What colour do you think Choco's family will be? answers were obtained that said it would be yellow through the relationship that the pupils made with the image shown and their prior knowledge, because although it is true that reading comprehension requires the use of what the pupils know, and in this case not only did they show what they know about what birds (in this case Choco's family) may be like, but they also showed that they can use their prior knowledge to make predictions. It should be noted that their predictions are limited to what they observe and not to other things they imagine or want the text to be about. In view of this, it is necessary to further develop the ability to make predictions, because although experts highlight its importance because 'it is to anticipate the contents of the text, to formulate hypotheses about the development and end of what is narrated. The reader is able to make predictions when he/she links the sampling with the information provided by the text'.

Another important thing to highlight is their ability to make analogies with what is in their context, as this was manifested when making a comparison of the colour of Choco's family with the colour of the chicks.

Another reading that was considered for the diagnosis was the story 'Secretos de familia' by the author Isol, so didactic memory was used to ask if they remembered the name of the author, because recovering the name of the author is part of the attention paid to the reading, and although they did not immediately answer the name, when they said the word -puercoespín- (text that was read previously), they demonstrated that they had understood the content of the story.

They showed that they understood the content of the story, although they did not understand the name of the author, with the exception of one student, which shows that most of the students retain more information from the text than from the paratextual data of the text, identifying also that they lack more knowledge about authors of different texts or stories, as was the case in this case.

Ma: The story is called: 'Choco finds a mother', the author is Keiko Kasza. Do you remember the name of the author of the story I read you yesterday?

Aos: No
Ao: 'The Porcupine'.
Ma: The Porcupine
Aa: Isol
Ma: Isol, very good. Yesterday I read you a story by Isol and now I am going to read you a story by Keiko Kasza (Diagnostic session).

Afterwards, we started the reading in shared mode and with dramatisation, which was effective in getting the students' attention, as the focus on dramatisation drew everyone into the story.

During this, another general and interesting aspect appeared in the children, and that is the fact that they empathise with the characters and can discover the feelings in the story, because that is what reading leads us to, to recognise and express emotions. After some pauses in which the prediction strategy was used, the evidence shows that they are limited and focused on their immediate context.

/When reading about how two little animals were not Choco's mummy, the children expressed some emotions/

Ao: Poor thing
Ma: Choco with Mrs. penguin
Ao: It's a good thing that story doesn't exist because I would feel bad.

Almost at the end of the reading, they were shown the image of Mrs. Bear's children and, noticing that they were different from her, they applied the strategy of inference, determining that Choco would be the new son. This strategy is 'by which one infers what is not clearly expressed in a text' (Quiñónez & Echeverría, 2012, p. 13).

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It is true that the text did not mention that Choco would be Mrs. Oso's new son, but, although it is not in the text, the image allowed them to determine it, because they understood that Choco was different from Mrs. Oso, but he does not necessarily have to be the same in order to be mother and son. This identified that the inferential level of reading comprehension is present in the group.

/The pupils inferred that Choco would be the new son by looking at the image of Mrs. Bear's children

Aa: And now Choco is going to be the new son.
Ma: Yes?
Aa: A little bird

Similarly, in the text the word 'adoptive mother' was not specified, so, according to what they understood from the story, they made another inference by mentioning that concept.

Finally, the reading was concluded with the correction and self-correction of their hypotheses, likewise, a space was opened for comments where the critical level was manifested through subjective, deep comments, related to their lives and how families can be different, for this they made analogies about what they observe in their reality, this means that despite the example given in the story referred to the differences for being different animals, some students commented on their experiences regarding their experiences in their context such as differences in skin colour, distinction in hair, etc. The critical level is important because it allows students to relate what they read to their way of thinking about life, because 'the student is immersed in a reality of experiences that, as a person, affects him directly or indirectly'.

Aa: But he found his mum
Ma: He found her
Ao: She was a foster mother
Ma: Not always What can we reflect on this? That not always mothers...
Aa: Are the same
Ma: Or are they?
Ao: No
Aa: Because children can be, some children can be, their mum is like a little brown and the child is white
Ma: That can happen too
Aa: Teacher, for example, my mum is Chinese and I'm straight, straight.
Ma: You see, that can happen, my mum is short and I'm taller than her (diagnostic session).

Write in order the names of the animals that appeared in the story; 2. What was Mrs. Bear doing when she met Choco; 3. How did Choco feel at the beginning of the story; 4. How did Choco feel at the end of the story; 5. What would you have done to get a mother for Choco; 6. Why is Mrs. Bear now Choco's mother? Of these, only one question focused on each level will be analysed using two pieces of evidence to make a comparison of the complexity of the answers.

**Literal Level**

This level is analysed with the answers to question 2 (What was Mrs. Bear doing when she met Choco?). At this level the reader 'has the ability to recognise and remember explicit information and scenes as they appear in the text. This allows him/her to find the main and secondary ideas, [...]'. The secondary idea that the students had to identify was explicit in the text because Mrs. Bear was -picking apples-.

Figure 1 shows that the pupil has the appropriate literal level because she extracted the information exactly as it appears in the text. On the other hand, Figure 2 shows that the learner did not extract the information exactly as it appears in the text.

**Box 2**

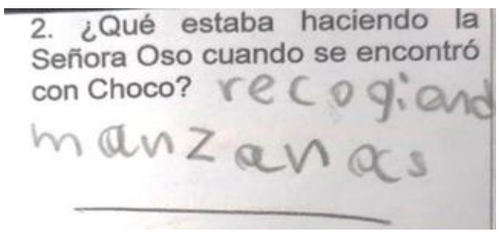


**Figure 1**

Evidence 1. Literal Level

*Source: Own elaboration*

**Box 3**

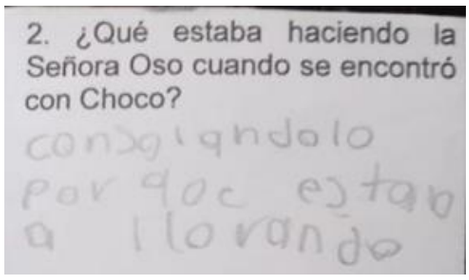


**Figure 2**

Evidence 2. Literal Level

*Source: Own elaboration*

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### Level of reorganisation

The reorganisation of information is analysed by means of prompt 1 (write in order the names of the animals that appeared in the story). Its function is to 'make classifications to categorise people, objects, places and others; sketches to reproduce the text in a schematic way; synthesis to summarise different ideas, facts and others'. In this case, a classification of the characters was requested by the order in which they appeared in the story.

In the following evidences there is a notorious difference both in the amount of characters that appear and in the order; in Figure 3 there is a smaller amount of animals compared to Figure 4, but in spite of this, the pupil who did what is shown in Figure 3 has more developed this level because he placed the characters in the correct order (Choco, giraffe, penguin, walrus, Mrs. bear and Mrs. bear's children). On the other hand, Figure 4 shows that the pupil does have the capacity to retain information, but not to remember the sequence of events, which is why she placed them in the wrong order.

**Box 4**

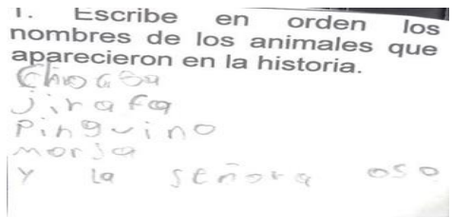


**Figure 3**

Evidence 1. Reorganisation level

*Source: Own elaboration*

**Box 5**

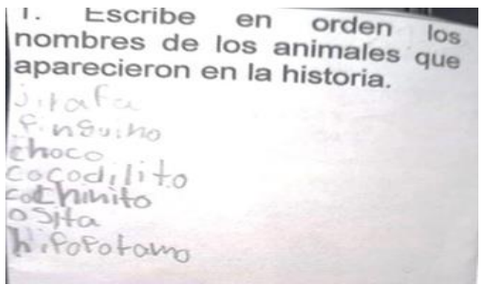


**Figure 4**

Evidence 2. Reorganisation Level

*Source: Own elaboration*

### Inferential Level

When this level is reached, students "reconstruct the meaning of the text by relating it to their personal experiences and previous knowledge, from which they formulate conjectures and hypotheses and draw conclusions" (Guerrero Hernández, 2024). In order to identify how students' inferences are presented, the evidence of question 4 (how did Choco feel at the end of the story?)

**Box 6**

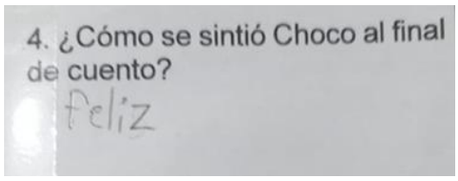


**Figure 5**

Evidence 1. Inferential Level

*Source: Own elaboration*

**Box 7**

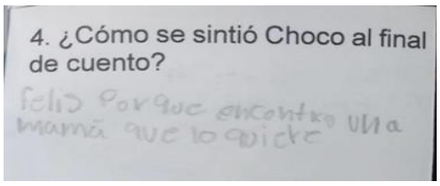


**Figure 6**

Evidence 2. Inferential Level

*Source: Own elaboration*

Here, in both evidences the inferential level was presented because the two students determined Choco's emotional state, although one is more advanced because in Figure 6 the argument of such inference is even presented mentioning that Choco felt happy at the end of the story because he found a mother who loves him, and in evidence 5 not, only the answer "happy" was placed. Both answers are a conclusion of Choco's feelings at the end of the story.

### Critical level

This is one of the most difficult levels to reach because "it acquires an evaluative character, since the reader, in addition to confronting the meaning of the text with his or her experiences and previous information, issues judgments and opinions based on which he or she accepts or rejects what is stated by the author" (Guerrero Hernández, 2024).

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To reflect on what was found in the students, it is necessary to highlight that most of the answers were based only on "helping Choco" in question 5 (what would they have done to get a mother for Choco?) and there was a lack of greater depth in their comments. On the other hand, it is necessary to highlight that within this level there are some ideas that are more complex than others, such as the following two:

**Box 8**

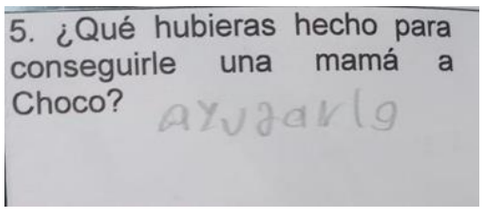


**Figure 7**

Evidence 1. Critical Level

*Source: Own elaboration*

**Box 9**

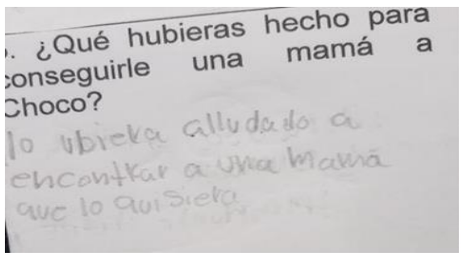


**Figure 8**

Evidence 2. Critical Level

*Source: Own elaboration*

In Figure 8, more critical ideas were presented about what the mother who would have got him with regard to Choco's interests should be like, i.e. she gave him the quality of showing appreciation for Choco by asking in the text for 'a mother who would love him'.

## Theoretical framework

The world revolves between letters, between forms of communication and expression for the satisfaction of needs, because, what reading represents is a way of life, it is a way of seeing the world and acting in it. While it is true that a process is required for the acquisition of reading comprehension that begins at an early age, the teacher's mission is to favour this ability. But the way to achieve this is not simple, because problems arise that require their respective treatment through the implementation of proposals.

The present research is guided by two variables; the first focuses on reading comprehension in third grade students, which means that children who are practically in the middle of primary education present this situation, which can generate barriers for the acquisition of new knowledge. Understanding a text requires a process where different levels are passed to reach the critical level, but what does it refer to, this emphasises the implementation of strategies to discover the message and do something with it. In view of this, a treatment is required to favour the achievement of the learning that remains to be acquired in the following grades, and it is here where the variable of the intervention proposal on the analysis of stories with different modalities (annotated) and with reading strategies (prediction and inference) becomes present.

## Reading comprehension

Looking through the eyes of a child helps us to realise how they see the world and to have the tools to make their learning possible. It should be noted that reading comprehension plays an important role in the acquisition of new knowledge, because it favours the ability to determine ideas, remember, recognise sequences of facts and infer or think with meaning, among other things. The need to get this right in primary schools becomes a situation that afflicts most teachers, because it is the magic of reading, it is the introduction to new worlds through the use of previous knowledge for the acquisition of new ones, adventures through the stories of the texts and above all an enjoyment during the action, understanding new ideas and growing both intellectually and in communication.

According to Solé (1999), cited by (Gamboa, 2017, p. 6) defines it as 'a process of constructing meanings about the text we intend to understand', *in* other words, it is to create a sense of life by constantly decoding texts day by day.

This perspective has also been addressed by (Torres & Granados, 2014) who argue reading comprehension as a process where different levels of information processing arise through the interference of 4 cognitive processes.

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In this sense, the authors explain the attentional cognitive process as the one that allows the selection of useful information, on the other hand, the perceptual ones as producers of visual and auditory discrimination behaviours to gather textual information. As for memory processes, these allow for the temporary manipulation of the necessary information in order to make meaning. And finally, phonological awareness processes help to manipulate speech sounds simultaneously with the recognition and management of phonological units (syllables and phonemes).

The above helps to process information, which is why similarity is found with the subject of this research work, by establishing the analysis of these processes to find out what goes on in the minds of third grade children and how they manifest themselves to determine where to start from. However, when decoding texts, obstacles arise which, according to (Torres & Granados, 2014, p. 454) 'knowledge of the difficulties in reading comprehension at the school stage will allow us to establish the bases so that at this stage the development of the precursors of reading can be favoured'.

In a complementary manner, Catalá (2001) cited by (Ramírez & Fernández, 2022, p. 491) points out that reading comprehension:

It is a process of convergence of assimilative-comprehensive and expressive communicative aspects, which is why the reader is the protagonist in this process, when he/she employs his/her knowledge about the world around him/her, transforms it while interacting with information sources and other people, and, subsequently, is able to communicate his/her experience verbally or in writing.

The inferential 'in addition to the experiences and previous knowledge of the reader, his or her personal abilities to generate hypotheses are manifested' (Ramírez & Fernández, 2022, p. 492) and the critical 'in which the reader is able to make a value judgement about the text read' (Ramírez & Fernández, 2022, p. 492). For the research work being developed, these will be approached with the addition of the reorganisational level, as it allows characterising the ways of reading and distinguishing the students' weaknesses.

**Stories as a strategy for the achievement of reading comprehension**

There are a series of resources used by teachers and researchers to deal with problems based on their needs; among the most widely used in teaching have been strategies that allow students to do something meaningful with the information in the text. Referring to the intervention proposal of this research work, emphasis is placed on the use of strategies and modalities as the main tool to be able to interpret texts and construct meanings, since the former are activities that we carry out while reading, and the latter are the ways of reading to vary in voice and face inflection, readers' voices, etc., depending on the stated purposes.

(Pernía & Méndez, 2018) have observed that in everyday school work, teachers' pedagogical planning lacks reading strategies oriented to the comprehension of texts; the application of reproductive activities such as: dictation, copying the text, memorisation and repetition comes into the picture. [Consequently, teachers show greater interest in teaching the pronunciation of words, intonations, and the construction of meanings is ignored. Given the above approach, it is necessary to emphasize that the work of promoting the construction of meaning falls mainly on teachers, who with only the application of reproductive activities have not achieved effectiveness in reading comprehension, which is why it is necessary to know some of the reasons why the problem arises and build feasible solution strategies, (Pernía & Méndez, 2018) propose to build a sense of reading through strategies, which are conceptualized as 'are actions that are actively performed by the reader, before, during and after reading' (p. 109).

With the implementation of appropriate strategies, it is possible to build a level of comprehension that allows inferences and predictions (Pernía & Méndez, 2018) argue that inference is achieved when the reader is the one who reconstructs the meaning of the text from the data that he/she finds with his/her previous information. On prediction, Solé (1992), cited by (Pernía & Méndez, 2018, p. 110) mention that it is:

Establishing adjusted and reasonable hypotheses about what is going to be found in the text, relying on the interpretation that is being built on what has already been read and on the reader's knowledge and experience.

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For the achievement of the competences of inferring and predicting in reading, prior knowledge is of great relevance, as (Pernía & Méndez, 2018, p. 104) argue with the statement by Solé (1922), who says that the most important thing 'is to know what is necessary to know more from the text'.

With what has been argued so far, the importance of these reading strategies is highlighted, since the proposed solution of the present research is oriented on them, with the addition of sampling, since it is required prior to the prediction with the use of stories as narrative text. Likewise, the activation of previous knowledge during the application of these strategies is contemplated in order to improve the teaching work in the development of reading skills.

On the relevance of the use of stories as a text that allows the development of strategies conducive to the achievement of reading comprehension, (Peña, 2019) mentions that the types of text that children enjoy reading the most are dramatic literary and narrative literary, 'it can be inferred that students are attracted to texts that are more meaningful and functional for their communicative and social needs' (Peña, 2019, pp. 46-47).

## Methodology

The improvement of education is extremely important for the advancement of society, but for those in charge of being a guide in the development of this process, that is, teachers, to carry out an improvement plan, it is required to employ action research, but why, what does this type of research refer to; this refers to the study of a social situation and the use of strategies to broaden the understanding of the different problems of the action. In order to do this, reflection on the action is first required and then a route is taken to modify the practice.

This concept can be synthesised with what is explained by Lomax (1990) cited by (Latorre, 2005), who defines it as 'an intervention in professional practice with the intention of bringing about an improvement' (p. 24). Lewin's triangle (1980) is also cited there, where the link between research, action and training is highlighted, which are materialised in cycles of action and reflection, i.e., as strategies are applied, they are evaluated and evolve to intervene with another cycle of action until improvements are obtained.

With the contribution of different authors, the concept is complemented by defining action research as 'a practical enquiry carried out by teachers, in a collaborative manner, with the aim of improving their educational practice through cycles of action and reflection' (Latorre, 2005, p. 24).

Among the characteristics that define this type of research are those determined by Kemmis and McTaggart (1988) cited by (Latorre, 2005, p. 25).

It is mainly mentioned that it is participatory because the objective is to improve practices and to do so, people who work on it are involved following an introspective spiral, this means that a series of cycles are carried out where what is going to be done is planned, the actions are executed, observed and finally reflected upon, but it should be noted that this is not the end of the research, but the end of a cycle, because from the reflection following the objective of improvement, another cycle is proposed again with the same steps but evolved, thus forming a spiral. Similarly, it is collaborative because self-critical communities are created where the researcher does not carry out his work externally, but rather with and for society, because it is developed in a group of people with the aim of improving reality. It is also necessary to emphasise in the participants a relationship of equals called emancipatory.

It is essential that the process is oriented towards praxis, i.e. reflective and transformative practice, because it allows to induce the construction of theories and for that, it is previously required to carry out a test on practices, ideas or assumptions, which should be recorded in a diary, in evidence and audio recordings; collect and analyse considering not only the data but also our own judgments and impressions of what happens.

Similarly, Zuber-Scerritt (1992) cited by (Latorre, 2005, p. 25) expresses ideas that highlight that practice not only contributes to the theoretical aspect, but also benefits its improvement during and after the process. Regarding what is investigated, it is not based on the right or wrong answers, but on something beyond that, that is, on the solutions from the points of view by emphasising interpretation.

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In terms of analysis, it is made clear that in this research the critical perspective is taken up again, because these are changes that affect people, i.e. society; political processes are determined and progressively the changes will be broader because they start with small cycles of planning, action, observation and reflection, expanding further both in the problem and in the number of collaborators. Likewise, it is necessary to act as critical and self-critical change agents of the given constraints for the improvement of practice.

As the purpose of action research focused on education is the improvement of teaching through the description of activities carried out by the teacher in the classroom, in this case the aim is the use of a proposal to solve the problem of reading comprehension, through reflections made from the interpretations of the data obtained to evaluate the effectiveness of the proposal.

The intervention proposal will be carried out in the Primary School 'María Guadalupe Castorena de Belaunzarán' in the municipality of Ojocaliente, Zacatecas, with 3rd grade students, with the aim of solving the problem, which is manifested in underdeveloped levels. For this reason, the activities proposed are focused on the use of prediction, sampling and inference strategies and modalities of shared and commented reading, using the story as the main resource, due to the fact that this type of narrative text attracts their attention and there is no better way to generate reading comprehension based on their tastes in order to generate a habit of this practice.

## Results

### Reading strategies

Readers use strategies to decode the message and therefore understand the texts, because the strategies allow us to guide the selection of information to find answers to what we are looking for according to the purposes of reading, they also allow us to affirm or correct the mental schemes set out at the beginning; (Solé, 1998, p. 59), conceptualises them as 'procedures of a high character, which imply the presence of objectives to fulfil, the planning of the actions that are triggered to achieve them, as well as their evaluation and possible change'.

The appropriation of reading strategies does not happen immediately, but requires a process to learn and develop them, therefore, it is necessary for children to explore and use them little by little with the help of teacher guidance until they can execute them in an autonomous and effective way.

Prediction consists of anticipating the contents of the text, formulating hypotheses of what will appear in the future in the stories, whether in the development, at the end or even at the beginning (when the strategy is applied before reading). However, it is closely related to sampling, since according to the authors (Quiñónez & Echeverría, 2012, p. 13) 'the reader is able to make predictions when he/she joins sampling with information', that is, if he/she is not provided with information regarding the content of the text, he/she will not be able to formulate hypotheses.

In the development of the intervention in the application of strategies to improve reading comprehension, the context that was given was the case of a girl called Lupita who wanted to have a pet, but did not know which one to choose because she was first interested in knowing what rabbits are like in order to determine her decision. This opened an exploration of prior knowledge in which the pupils were introduced to the characteristics of rabbits. Then a cardboard bunny was presented, from which the sentence 'Hello, I am a rabbit, you will know my name later, now I will tell you my story,' was given, which promoted the act of reading, and so they did it aloud. The implementation of the material allowed the students to get closer to the character, the subject on which the story revolved, and also opened up the application of prediction with the help of sampling, which is demonstrated by the following evidence of a fragment of the class that was applied:

Ma: Now I will tell you the story of this little rabbit. Look, in the story I am going to tell you, there is the word bunny and there is also the word evil, what do you think the story is about?

Ao: About the wicked bunny (Class register)

In this case, the words 'bunny' and 'evil' were used as part of the sampling strategy, since this 'consists of selecting words, images or ideas from the text that function as a clue or signal to predict the content of the text' (Quiñónónez & Echeverría, 2012, p. 13).

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Ma: Yes, let's see Brittany, what do you think it's going to be about?
Aa: About a bunny that plays pranks, because I had a bunny that bit me....
Ma: Did the bunny bite you, look how mean that bunny is, does anyone have any other ideas about anything other than what they think it's going to be about?
Ao: A bunny that has an evil friend.
Ma: That could also be it. No one has thought of that one, have they? You Sofi, what do you think of?
Aa: That an evil rabbit does things to him.
Ma: That an evil rabbit does things to another rabbit, right? That's another idea, we already have three different ideas... (Class record)

The above shows that the students had not had a broad approach to the reading strategies, since at the beginning the prediction was limited, but as other students were questioned specifically, they achieved deeper answers, closer to their reality, context and own experience with the type of pet mentioned; such is the case of the student Brittany, who expanded her opinion by telling the group about how her naughty bunny bit her. However, she changed the adjective 'wicked' to 'naughty', i.e. her ability to make predictions is broader than that of the first student, because she did not extract the information literally (explicitly), on the contrary, her comment was inferential since she deduced an implicit meaning in the word 'wicked'.

Likewise, in register 1, it can be seen that the students highlighted the qualifying adjective 'evil', with which they determined what the events would revolve around, although of course, with different inclinations, because one student focused on the existence of a friend of the bunny whose characteristic is evil and another student imagined that the story would be about two characters, one of whom does bad things to the other.

This initial knowledge is of utmost importance because it also guides the level of comprehension to be achieved, because if students are left with only literal predictions, as the first student did, their level of comprehension may be too, and as mentioned by (Cervantes, Pérez, & Alanís, 2017, p. 3) at the literal level, 'the reader recognises the key phrases and words of the text.

It captures what the text says without a very active intervention of the reader's cognitive and intellectual structure', therefore it is required to advance to other more complex levels, because the intervention in reading is not very active, because, on the other hand, what is expected is that children are involved in it. The notions (acquired from experience) that the students have, which they made known as predictions, are closely related to prior knowledge, because according to (Ausubel, Novak and Hanesian, 1983, p. 1), 'the most important factor that influences learning is what the student already knows'.

This was how the initial exploration allowed the second moment where sampling was applied to be more effective, because when identifying at the beginning of the class characteristics about the colour of the rabbits, this was no longer considered when the image of the cover of the story 'Wicked Bunny' by Jeanne Willis was shown.

Ma: Look, this is the cover of the story (cover shown).
Aos: Wicked Bunny (they read the title)....
Ma: What do you think the rabbit is going to be like? ... now looking at the picture, what do you think he's going to be like?
Ao: Bad
Ma: Malo, let's see, Santi, what do you think the rabbit is going to look like?
Aa: With a sweater
Ma: A little sweater, what else...?
Ao: A pair of little boots like a leprechaun and a pansy.
Ao: A little bunny like he doesn't want to share (Class record)

This shows that the exploration of knowledge gives greater effectiveness to the sampling, because the predictions that the students gave about the characteristics of the character, when asked -what do you think the rabbit is going to be like? -, focused on answers according to what they observed on the cover, where they mainly identified the clothes that the character wears, in this case a waistcoat, pans and boots; in the last characteristic (boots) the student implemented an analogy to describe them.

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## Box 10


**Figure 9**
Cover of the story "Wicked Bunny"
*Source: Willis, J. Ross, T. (2009)*

As shown, the sampling strategy with the implementation of an image (cover), surpassed the initial ideas because it gave way to the presence of broader characteristics of both personality and appearance, with which they were able to identify his way of being as a selfish bunny who does not like to share. Given such effectiveness, the strategy of using words from the story is not left aside, as it gives more scope for the imagination to create an image of the story with the various descriptions of an evil bunny.

Within this process to generate predictions, the fundamental role played by the exploration of prior knowledge stands out, which means that it is important for the improvement of reading comprehension, due to the fact that "before beginning a reading, it is necessary to activate the knowledge that students have of the subject: in this way it is possible to identify how much they know in order to offer clues that help them to understand the text" (Quiñónez & Echeverría, 2012, p. 12). In this case, the clues provided were through sampling with the selection of words and demonstration of the cover.

In addition to the arguments raised up to this point in the research results, the improvement in reading comprehension with the implementation of reading strategies is confirmed by evidence of the children's work carried out during the development of the session. For example, the following images show answers to the questions: "Do you think it is good to cheat adults? why? whose levels of comprehension are diverse due to the complexity with which they presented their arguments.

## Box 11

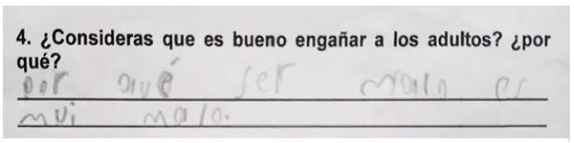


**Figure 10**
Evidence of pupil reading comprehension
*Source: Own elaboration*

## Box 12

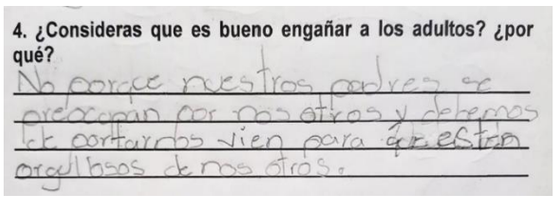


**Figure 11**
Evidence of pupil reading comprehension
*Source: Own elaboration*

The evidence in Figure 10 shows that the written sentence only apparently answers the second question ‘why?’, since there is no ‘no’ textually, but implicitly answers the first question, because it is understood that it does not consider it good to cheat by identifying that this action is bad.

On the other hand, the answer in Figure 11 is more argued, since the concept ‘bad’ appears implicitly when explaining the negative consequences that cheating adults would bring, that is, their critical level is more developed, since it is defined as the ability where ‘the reader is able to make a value judgement about the text read’ (Ramírez & Fernández, 2022, p. 492), which the student did when he/she read the text (Ramírez & Fernández, 2022, p. 492). 492), which the student in Figure 11 did by making a judgement about what Evil did to the bunny by exposing the consequences in general about how the parents worry about this act and even proposes a good behaviour for them to feel proud of, and although he does not specifically mention the character, it is necessary to highlight that this was the one who set an example of deceit.

The development of the critical level in Figure 11 is surprising, as it requires a complex process to reach this level. It should also be noted that the critical level is reflected in both ideas, as they allude to the ‘evil’ characteristic of the bunny in order to respond that deceiving adults as the evil bunny did in the story is bad.

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The above shows that they made use of the predictions to make critical reflections on the reading and what they experienced in their reality by relating it to their context, i.e., it contributed to the advancement of the critical level. Its importance is highlighted because the predictions made before and during the reading allowed them to get to know the character better. However, if these reading strategies were otherwise lacking, answers such as the above would probably not have been obtained because the main qualitative characteristic of the main character would not be highlighted.

In reading, it is necessary to look beyond what is obvious to the eye, because texts conceal meanings that are valuable for comprehension, although, of course, not only written texts but also visual texts such as images. In order to discover the message of written texts, it is essential to apply the inference strategy, whose objective is to favour the ability to establish conclusions from initial ideas, 'reconstruct the meaning of the text relating it to personal experiences and previous knowledge, and from this formulate conjectures and hypotheses and draw conclusions' (Guerrero, 2024, p. 3).

In the application of the proposal to advance reading comprehension, the reading of the story 'How to catch a star' by Oliver Jeffers was carried out, the end of which opened the inference strategy with the guidance of questions and the support of the images of the story. In the first moment where the inference was executed, the image was shown where the character waits seated in different ways, for this the interest of the students was captured by mentioning that in the story there was something that caught their attention in order to generate curiosity. Once the students were interested, we went through the different places to show the image so that everyone could identify aspects that were not explicit in the text.

Below is the excerpt from the class where the students presented aspects they perceived in the image shown, ranging from facial expressions, movement of body parts and even the tones of the Figures.

Ma: Look here, if you notice that the boy has a face (pointing to the page) and here he has changed his face, hasn't he?
AAos: Let's see, teacher
Ma: Here it has a shape, and here it's like it changed.

/The teacher moves to the places to show the image/ Ma: Did he change? It's like something changed

Aa: Yes, his face has changed Aa: No, yes, yes, it has changed Ma: What has changed?
Ao: And his hands, he had them here Ma: What else did he change?
Aaos: The face
Ma: How did it change? Rosário: From happy to sad
Ma: Rosario says it changed him from happy to sad.
Ao: The colours changed a little bit (Classroom register)

With the first questioning, it was expected that they would say how he had changed, but they continued the participations that focused on other aspects that they perceived, therefore, the initial ideas were taken up again and as a consequence an accurate and essential inference was obtained from a student, who identified that the character went from being happy to being sad, that is to say, she identified the emotions of the characters.

Listening to this type of comments like the one made by the pupil, allows all the children to appropriate these ideas, to advance in their observation skills and to achieve a better understanding of the texts by using the visual resources provided, because sometimes, images say more than words, due to the fact that at no time was it mentioned in the story that the boy was sad, but by observing that first he had a smile on his face as a symbol of happiness and then he changed to a sad face, conclusions were drawn that allow for a better understanding of the story.

This highlights the ideas of the authors (Quiñonez & Echeverría, 2012, p. 13) who mention that inference 'is the strategy by which what is not clearly expressed in a text is inferred.

For example: data about characters, objects, values, author's preferences, among other aspects'. In this case, emphasis was placed on the data about the main character, which not only covered his emotions, but also the change in the position of his hands.

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When comparing what the students mentioned and what is shown in the story (Figure 12), the child did indeed move his hands (class record) from being relaxed to tired, and his face was happy and then sad, i.e. some of them did manage to use this strategy and identify important aspects of the character.

## Box 13


**Figure 12**
Image for inference strategy
*Source: Jeffers, O. (2005)*

On the other hand, it should be noted that one pupil mentioned the transformation of the colours, because the landscape changed from light to darker tones. This shows that time has passed, because in the first image the presence of light determining the impact of the sun can be perceived, and in the second Figure on the same page it was possible to hypothesise that it was getting darker. Also, if the image is analysed more closely, it can be seen that the shapes of the shadows are also different, although at first glance they appear to be the same image.

The pupil did not reach these conclusions and only observed the different shades, but the progress he made in identifying this change, which the others did not perceive because they focused only on analysing the character, is highlighted.The small comment made by the child, although it may seem insignificant, has a great impact on his classmates, so that little by little they will analyse the visual resources provided by the texts in greater depth and therefore their level of comprehension will advance. After clarifying the differences between each image, they were asked what the transformation of the character's mood meant to them; it was expected that the pupil would infer that this change was due to the fact that the child was tired of waiting, but what was surprising was that another possible hypothesis arose, believing that perhaps he was hungry, since in the following image the child was happy because he was eating.

## Box 14

**Figure 13**
Evidence of visual hypothesis.
*Source: Jeffers, O. (2005)*

In this way, the visual reference had a great impact, because through inference it allowed the identification of the emotions of the characters, which is fundamental to better understand the events, to find the meaning that the author wants to convey and therefore to advance in the levels of reading comprehension. At another point, the image was presented where the boy in the story tries to catch the star by throwing a lifebelt, and a comparison was made with the act followed on the next page, which represents that the boy was unable to throw the star and therefore, this tool was without its objective.

It was verified that the students arrived at the inference alluding to the impossibility of catching the star with the lifebuoy, whose ideas were strengthened with the arguments given with hypotheses raised about possible reasons why he did not manage to reach his objective. Because on the first page the star appears trapped in the lifebuoy and on the second page it is not in the lifebuoy, this was presented as aspects of the story that are relevant for them to find an answer to the question: why is the star not in the lifebuoy?

The children's answers to the questioning were diverse, i.e. no pupil mentioned agreeing with any of their classmates. In the following excerpt from the class, it is presented textually how the strategy was carried out and ideas are highlighted that show that they reached a level of inferential comprehension, since, with his observation, a student determined that the character could not catch the star because it was far from his reach, that is, he gave a hypothesis according to his knowledge, because according to his reality, the stars are distant.

Ma: If he tried to throw it here (points to the first image), why isn't the star in the lifebuoy (points to the second image)?

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Iker: Because it wasn't enough, the star is too big.
Ma: Why do you think the lifebuoy is like this without the star? Mateo
Mateo: Because it illuminated a lot
Ma: And since it was shining, what happened...?
Sofía: Because maybe the one in the middle was too big and the lifebuoy could have slipped off (Class record).

As mentioned in previous paragraphs, Guerrero (2024) conceptualises the strategy of inference, whose effectiveness requires the reconstruction of meaning from personal experiences. In this situation, the students hypothesised according to what they know both about the stars and the dimensions of the life preserver related to what they observed, since Sofía's idea referred to the possibility that the star had fallen due to the hole in the life preserver, which, being of a large size, could have caused it to slide down until it returned to the child.

The effectiveness of the strategy was enhanced by the use of a counterexample at another point in the application, in which, through the image of the final part of the story, the question was asked as to why the child raised his hands. The students responded to this doubt about what was observed, but was not textually written in the story; among their answers it stood out that the boy raised his hands because he was finally able to get his star.

Although his inference was correct, this was not affirmed, but a counterexample was given, so that they could develop the ability to argue to check the level of understanding achieved. In the following excerpt from the class register, it is evident that the level reached was inferential, because the arguments put forward to validate their answer were based on what they observed, because as they identified that the child's face conveyed happiness and emotion, he could not have raised his hands as a symbol of fear as stated in the counterexample, which gave strength and validity to their hypotheses.

Ma: Here the child raised his hands, look (shows the image), why did he do it, Rosário
Rosario: Because he could get the star
Ma: Yes, I thought he was scared, you can see that when you are scared you do Ahh!
Sofi: But he's smiling Abigail: Excited
Aa: Because he finally got the star....
Ma: So the emotion he's showing isn't one of fear?
Aaos: Noo
Aa: For finding the star (Class register)
The dialogues in the register show how the 3rd grade students made progress in the application of the strategy, because their arguments about their answer are based on inferences made through observation and detailed analysis of the Figure and in this case focused mainly on what it confers on the character.

Reading comprehension and text production are closely related, because according to (Montenegro, 2018, p. 2) 'reading comprehension and text production are processes that go hand in hand and evidence the development of qualities and competences'. This opens the way for the analysis of the texts produced by the children in which they express the level of reading comprehension achieved.

As we know, there is heterogeneity in a classroom, and for this reason the texts are diverse, some more developed than others, as in the case of the pupil in Figure 14, who decided not to use the images for support. On the other hand, there is the production of a pupil who has difficulties in reading and constructing texts, but despite this he was able to make inferences about the images provided to create his story, although this was presented in three lists of some ideas that highlight three events in his story: the first talks about the boy Juan, who went out into the street to see if he could catch the star, then it is mentioned that he looked out of the window and finally reached space in a rocket (Figure 15).

**Box 15**

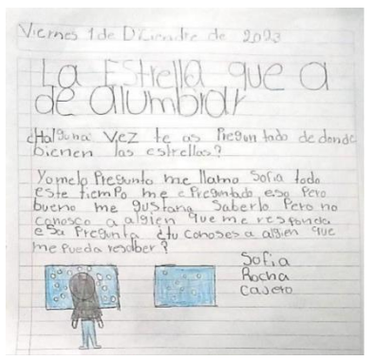


**Figure 14**
Evidence 1 of inference
*Source: Own elaboration*




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**Box 16**

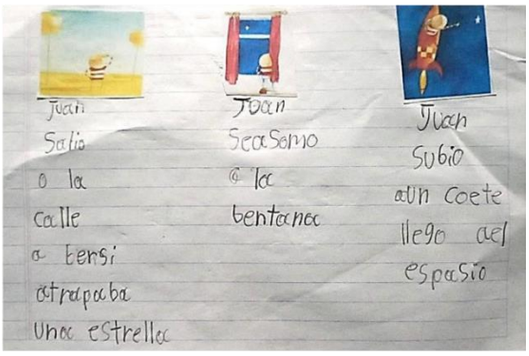


**Figure 15**

Evidence 2 of inference

*Source: Own elaboration*

The implementation of the strategy generated progress in both types of production, as well as motivating those students who find it more difficult to carry out the reading and writing process.

Reading has a different value for each reader, for some it tends to be boring and boring, for others it becomes a way to travel to incomparable adventures, but these differences are found in the way reading is presented to the children. For example, let's suppose that a text, in this case a story, is a dish, and tasting it always in the same way and with the same ingredients tends to take away the desire to continue tasting it, so it is important to vary the way it is presented, for example, from being the main course to being the dessert, and why not, try something new such as changing ingredients. The same happens with reading, it is necessary to change the way in which we read to children, such as varying the inflection of voice and face, that is to say, changing reading modalities.

According to (Castro, 2009), reading modalities are conceptualised as the different ways in which reading can be done. They are used when we want to make reading more varied and interesting. They encourage different types of participation and different reading strategies in children, which makes it possible to encourage, mediate and promote reading.

The shared modality represents the pleasure of reading, because it allows the appearance of a more explicit art, because it is known that reading in itself is art, but with this modality it becomes more present from the tools of orality and musicality, because according to (Jiménez, 2007, pp. 23-24) in shared reading:

The teacher reads the text or explains to the children the theme of the text so that they know beforehand what they are going to read [...] shares with the children by asking questions that allow them to locate the key words and the central theme of the text. The children will intervene by recognising the words they have managed to identify [...] they correct each other, they learn from their classmates, it is sharing knowledge, it is sharing their reading skills, with this same reading, dramatisations can be made and the accompaniment of songs, it brings into play the creativity of the teachers at the moment it is executed.

In the teaching intervention, it is specifically analysed how it was carried out with dramatisation and musical accompaniment, as a way of reading to the pupils and with which they were able to share their reading skills about how they appropriated this modality. We chose to improve reading comprehension in this way, because the main thing that should be generated in children is the interest to perform this act and what better than with this proposal, because with the passage of time develops the need and autonomy to read.

Reading goes beyond putting letters together to find the words of the texts, it is about transmitting a message, opening the sensibility with the emphasis of the stories and allowing the listener to connect in order to improve reading comprehension. One way to create this connection is through dramatised reading, which, according to (Reyzábal, 2023, p. 1)

[...] is one in which all the expressiveness of a text is reproduced with the voice -and with the body language that usually accompanies it-: the emotions, the texture of the words, the cadence with which a story is told or the variations in intensity with which a reflection is expressed, among others.

In the reading of the story Evil Bunny, the modality used was shared with dramatisation, in which voice and facial inflections were performed, and the voice was modulated. The moments where the dramatisation was performed with greater force left an impact on the children that allowed them to better understand the story.

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With intonation appropriate to the expression between exclamation marks - 'Of course they want to know' - voice modulation was applied to the word 'of course'. (Lezman, 2022, p. 2) mentions that it occurs when you control or adjust your voice and conceptualises it as: 'It's when you choose to go louder or softer, faster or slower, dramatic or emotional. Basically, voice modulation means using voice and tone to communicate a message more effectively".

In this case, the speed at which the word was read was modified by saying it slower and lengthening it, so that it went from being heard as 'clear' to 'claaaar'.

On the other hand, voice inflection was used in the sentence -They put rabbit poo in his chocolate cereal-, raising the voice when mentioning the word 'poo', so that the pupils were surprised by such mischief and put themselves in the farmer's place, as rabbit poo can generate disgust, and the intention was also for them to identify this unpleasant emotion. This was carried out in this way, because with respect to what the author mentions (Jiménez, 2022, p. 1) 'inflection is the elevation or attenuation of the voice, in each sentence and allows you to transmit full attention'.

With the application of these strategies mentioned for dramatisation, it favoured the understanding of the story, since at the end of the sentence all the children laughed because of what the evil bunny did. This means that they understood the action and did not judge because they felt identified with it, as children are usually characterised by being naughty. On the other hand, the absence of laughter would call comprehension into question, since one of the functions of reading is the transmission of emotions, and therefore, in such a situation, for obvious reasons, the emotion that the reader can express is joy, laughter or disgust.

(Giraldo & Rojas, 2017, p. 37) mention that with dramatisation 'students are encouraged to deepen their understanding of the content of texts and their comprehension of them'. Thus, within the classroom it generated that the students understood the story and mainly retained the event of the farmer in their memory.

This underlines the importance of dramatisation.

Reading is enriched by the different ideas that arise from the different worlds that can be entered by knowing what is in the mind of the other; this is favoured by the shared modality. In this modality 'students read a literary text which they then comment on through a conversation guided by the teacher' (SEP, 2022, p. s/p). It should be noted that comments can be made during or after reading. As far as the research is concerned, the students did not read the text on their own, but rather it was read by the teacher, and at certain times a space was opened up for commenting on the stories read.

The dynamic for exploring the ideas of the students was through didactic material, since at that moment it was very useful to use two dice, a common one to select the student with respect to the number of points he/she showed after throwing, and another one in which there were the questions that guided the comments, some more superficial and others more profound and critical.

In the class register below regarding the question 'What did Evil Bunny try to hide?', literal answers were obtained, since the information to answer it is explicit because it is found in the story.

Ma: ... What did Evil Bunny try to hide with his story... don't you remember? Let's see Paola, what did he try to hide? let's see tell me
Paola: A report to his parents...
Ma: Anyone else want to comment?
Ao: The report (Class Record)

Asking this type of question did not generate deep comments, but it allowed developing the capacities to retain information, which is important because according to (Silva, 2011, p. p. s/p): To allow attention to the comprehension of a text it is necessary to free up memory and attention resources occupied in inferior processes such as decoding, therefore it will be necessary to automate word recognition and the use of comprehension strategies.

Reading comprehension progressed with the recognition of the word 'report', which they not only remembered as a fundamental part of the story of the bunny, but also related to their experiences, this is because being immersed in an educational environment they felt familiar because the delivery of report cards to their families is part of their daily life.

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This is what gives true meaning to the readings, because comprehension is achieved when the content of the texts become part of the reader.

Comments on a text can be expressed in writing or orally to demonstrate comprehension, but this slogan in the face of profound questions such as ‘if you ever receive a bad grade, how should you act?’ the following excerpt shows what the students thought about the question:

Ma: If you ever get a bad grade, how should you act?
Matthew: By telling my parents.
Ma: Someone else, how would you act?
Aa: We shouldn't act because lying is bad.
Ma: Then you shouldn't lie, you wouldn't lie, would you Abigail? Aa: I would face the consequences
Ma: You would face them, would you Iker?
Ao: Be honest (Class register)

With their oral expressions, the critical level was present, where they reflected their values with their ideas, because in all the comments they identified what is ethically correct, that is, they consider that it is not good to lie, on the contrary, they should be honest and face the consequences of their actions; these ideas show a great level of maturity and the meaning that the reading left in them despite being literary texts where fiction abounds. The implementation of this modality brought great benefits, demonstrating its importance in advancing the levels of reading comprehension; this gives strength to the idea of (Farías, 2023, p. s/p) who mentions that ‘the importance of text commentary lies in the fact that it encourages readers to put their critical sense to the test when they approach a literary work’.

## Colorín Colorado. The Conclusions of the reading journey

Thus, the reading adventure concluded with a significant imprint on the students, since the progress obtained in the problem of reading comprehension was notorious, due to the fact that their literal level was strengthened because they advanced in the recovery of explicit information in a quick way, favouring the development of memory.

On the other hand, in the previous diagnosis it was identified that the most developed level was the inferential level, which advanced with the proposed activities, because their inferences showed greater analysis of the images through observation, related to the events of the story.

Regarding the levels of comprehension, the evolution of the students' critical comments was surprising, as they went from being limited to being fluent, with coherence and critical meaning.

Finally, the way of appropriating the reading modalities proved the taste and learning to broaden the ways of interacting with stories, tales, etc. They also demonstrated that their imagination has no limits, an important factor in understanding the texts and immersing themselves in the adventure in search of reading comprehension.

## Declarations

### 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 paper.

### Authors' Contribution

*Hernández-Gutiérrez, Francisco Javier:* He contributed to the final drafting of the entire article, meaningfully constructed each of the article's sections, checked the writing with the relevant formatting, coherence and cohesion.

*Mauricio-Rodríguez, Estrella Jatziri:* Contributed to the planning and execution of the research project, pre-wrote the general document.

*Lizarde-Flores, Eugenio:* Contributed to the revision of the theoretical framework, as well as making contributions on significant authors related to the topic of study.

*Reyes-Camacho, Ana María:* Contributed to the revision and specification of the methodological route of the research, as well as helping with a general revision of the final document for publication.

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## Availability of data and materials

The images of evidence presented in this research article are the product of the authors' own elaboration, they are images observed and obtained from the research itself, from work, responses and concrete activities of the proposed intervention carried out, as well as from non-profit images and only for research and informative purposes from two children's books: “Wicked Bunny” and “How to catch a star”.

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## Abbreviations

| | |
|---|---|
| Aa | Student |
| Ao | Student |
| Aos | Students |
| Gral. | General |
| Ma | Teacher |
| OCDE | Organization for Economic Co-operation and Development |
| SEP | Ministry of Public Education |

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### Background

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Article

# Teaching styles a look at the academic unit of the north of the state of Nayarit

# Estilos de enseñanza una mirada a la unidad académica del norte del estado de Nayarit

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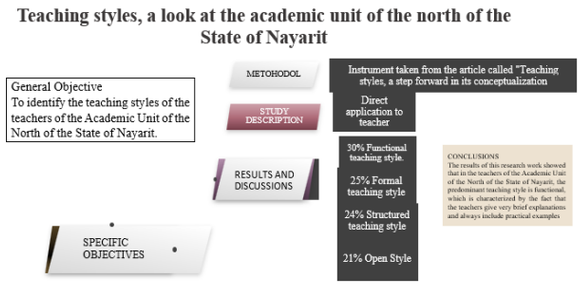
**Abstract**

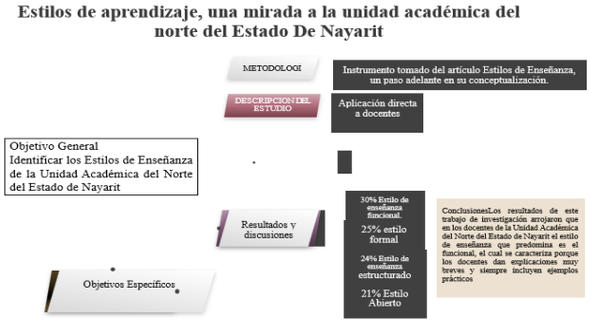
This research paper contains an investigation related to the teaching styles of teachers from the Academic Unit of the North of the State of Nayarit. To develop it, an instrument was used taken from the article called "Teaching Styles: a step forward in its conceptualization and diagnosis by Renes et. Al (2013) which proposes 80 items grouped into 4 dimensions that allow identifying teaching styles, which are classified as: Open, Formal, Structured and Functional. 25 surveys were applied to the 27 teachers of the Academic Unit. The general results showed that the teachers mostly use the functional teaching style, followed by the formal, structured style and finally the open style. Once the data was analyzed, the results were graphed and the information was concentrated, providing general recommendations. Analyze the results of the instruments of teaching styles applied. To identify the teaching style that predominates among the teachers of the Academic Unit of the North of the State of Nayarit. Propose general recommendations.




**Teaching styles, Teachers, University Students**

**Resumen**

Este artículo contiene una investigación relacionada con los estilos de enseñanza de los docentes de la Unidad Académica del Norte del Estado de Nayarit. Para desarrollarla se utilizó un instrumento tomado del artículo denominado "Estilos de Enseñanza: un paso adelante en su conceptualización y diagnóstico de Renes et al. (2013) el cual plantea 80 Items agrupados en 4 dimensiones que identifica los estilos de enseñanza, los cuales son clasificados en: Abierto, Formal, Estructurado y Funcional. Se aplicaron 25 encuestas de los 27 docentes de la Unidad Académica. Los resultados generales arrojaron que los docentes en su mayoría utilizan el estilo de enseñanza funcional, seguido del estilo formal, estructurado y finalmente el estilo abierto. Una vez que se analizaron los datos, se graficaron los resultados y se concentró la información brindando recomendaciones generales. Análizar los resultados de los instrumentos de estilos de enseñanza aplicados. Identificar el estilo de enseñanza que predomina en los docentes de la Unidad Académica del Norte del Estado de Nayarit. Proponer recomendaciones generales que permitan dar respuesta a los estilos de enseñanza identificados de los docentes de la Unidad Académica del Norte del Estado de NAYARIT




**Estilos de enseñanza, Docentes, Estudiantes Universitarios**

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## Introduction

A term that has become very important in the field of education today is teaching styles, emphasising how important it is for educational institutions to provide adequate knowledge to their students so that they can compete with professionals from different universities, both public and private, and allow them to remain at the forefront.

Bravo (2014) states that the basic aim of any educational process is to teach students how to learn through active educational models that focus on their own characteristics and needs. Learning makes it possible to implement educational strategies that focus on raising the quality of all learning with a holistic vision.

The way in which a teacher teaches is directly linked to the way students learn, i.e., depending on the characteristics of the students, the teacher should design educational strategies that allow the acquisition of knowledge appropriate to both the social environment and the educational context in which the student develops.

Ventura and Molocosni (2014) state that in the last ten years, work related to teaching styles and learning styles has incorporated characteristics of the context in which they develop, with the result that the environment in which they live really has an impact on their professional performance.

In this context (Renes and Martínez, 2016) in their article A look at teaching styles in terms of learning styles tell us that in today's society there is cultural heterogeneity and defined social structures. Thus, educational centres must respond not only to traditional academic models but also to the needs of the environment in which the student develops.

They must seek to turn students into responsible citizens, and educational centres into open and inclusive contexts that respect cultural diversity and enhance the skills and aptitudes of each student.

The knowledge of how students learn has been researched on multiple occasions, however it is important to analyse the way teachers teach taking into account learning styles.

## Theoretical framework

Yana et al. (2021) according to their experience states that if the teacher chooses a learning style it can make it easier for him/her to understand why he/she teaches, as well as to identify the easiest way for the learner to process the information.

It is said that nowadays, it has become very difficult to determine a teaching style in university teaching. Due to the great changes that have taken place, there has been a migration from the transmission of information by the teacher to a much more active participation of the students. Faced with these challenges, competences, skills, abilities and independence in their learning must be strengthened and developed. Teachers must guide their students, allowing their learning to respond to the needs of the environment.

In this sense, it is said that the teaching style is a model of beliefs, ways of thinking and behaviours that the teacher develops. These are preferences shown by teachers in their daily work and are related to learning styles.

Renés et al. (2013) propose 4 teaching styles: formal, open, functional and structured.

The formal style is found in teachers who want students to reflect, they plan their teaching in a very detailed way, they do not see other content, they do not like to improvise, however they value analysis and reflection in their students. They are very rational in their teaching and learning process.

The open style is characterised by the fact that teachers are the ones who promote the active participation of their students. They carry out novel activities, motivate, analyse the environment and propose activities that solve current problems. They propose new content even if it is not included in their syllabus.

On the other hand, the structured style is characterised by the fact that teachers encourage their students to learn theoretically. Their classes are taught with a lot of theoretical, systematic content.

For these teachers, planning is very important, their lessons are coherent, very structured and often with a lot of pressure.

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Under this style, teachers are characterised by being pragmatic

.

And the functional style is characterised by the fact that teachers guide students to learn in a practical way, i.e. they give more importance to practice than to theoretical knowledge itself. They favour planning but emphasise functionality.

The presence of teaching styles in teaching activities is important and the participation of both teacher and student is essential for the success of teaching.

## Objectives

### General Objetive

To identify the teaching styles of the teachers of the Academic Unit of the North of the State of Nayarit.

### Specific Objectives

- To analyse the results of the teaching style instruments applied.
- To identify the predominant teaching style of the teachers of the Academic Unit of the North of the State of Nayarit.
- To propose general recommendations to respond to the identified teaching styles of the teachers of the Academic Unit of the North of the State of NAYARIT.

## Methodology

To carry out this research an instrument taken from the article called 'Teaching Styles: a step forward in its conceptualization and diagnosis of (Renes et al 2013) which raises 80 items grouped into 4 dimensions that allows to identify teaching styles, which are classified into: Open, Formal, Structured and Functional.

In this regard, it is important to mention that teaching styles are considered to be a set of behaviours and preferences that the teacher shows during class, based on personal attitudes that are innate in him/her. Some of them have been acquired through their academic and professional experience, taking into account the learning styles of university students.

## Description of the study

The Teaching Styles Questionnaire was designed to delimit the styles, it does not judge, analyse their intelligence, personality, professionalism and less the way of teaching of the teachers.

The dynamics of application consisted of direct application to each of the teachers, and once they had finished, the items were counted in order to identify the predominant teaching style in each of them.

## Results and discussions

As a first point, we show the general results that identify the predominant learning style in its totality.

**Box 1**

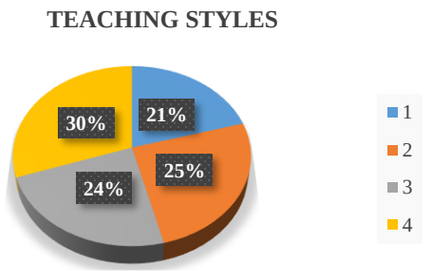


**Figure 1**
Overall Results
*Source: own elaboration*

The results tell us that the functional style showed a percentage of 30% being the predominant style among the teachers of the Academic Unit of the North of the State of Nayarit, in second place the formal style presented a percentage of 25%, likewise the structured style 24% and the open style 21%, As seen in graph number 1, unquestionably the teaching style that predominates in the Academic Unit of the North is the functional one.

According to Yana et al (2021), it is said that this style characterises teachers to teach in a pragmatic way. More importance is given to procedural content than to theory. These teachers agree with planning, but give priority to feasibility, functionality and concreteness.

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## Box 2

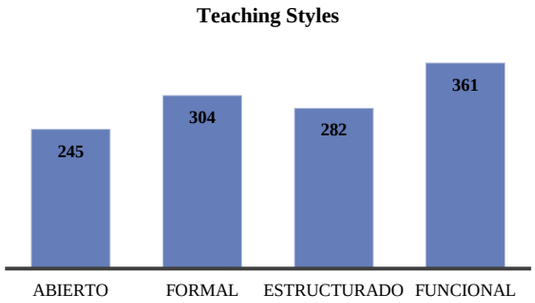


**Figure 2**
General Results
*Source: own elaboration*

In the same way, it can be seen from table 1 that the highest points were given in the functional style with 361, followed by the formal style with 304, the structured style with 282, and the open style with 245. Within this context, the graph shows the results of the Functional Style for each of the Items, as this is the style that predominated among the teachers of the Academic Unit of the North of the State of Nayarit.

The maximum value within this style was concentrated in Items 5, 37 and 63. Item 5 refers to the statement that the teacher always accompanies the explanations of topics with practical and useful examples. Consequently, Item 37 states that the teacher continuously guides the students in solving problems in order to prevent them from making mistakes. And finally, Item 63 says that the teacher feels good among colleagues and students who have ideas applicable in practice. If we analyse these tendencies, it is confirmed that this teaching style predominates among UANEN teachers, since the 3 statements or questions are classified in this style. All this information can be seen in Graph 2 and Table 2.

## Box 3

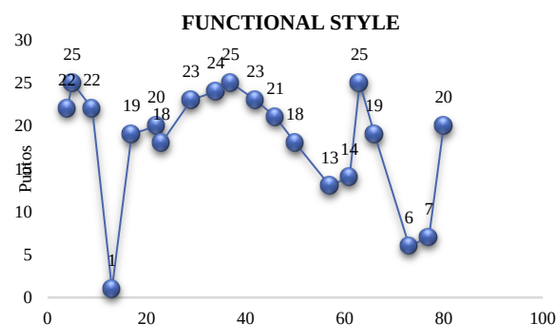


**Figure 3**
Functional Style
*Source: own elaboration*

## Box 4

| Item | Points |
|---|---|
| 4 | 22 |
| 5 | **25** |
| 9 | 22 |
| 13 | 1 |
| 17 | 19 |
| 22 | 20 |
| 23 | 18 |
| 29 | 23 |
| 34 | 24 |
| 37 | **25** |
| 42 | 23 |
| 46 | 21 |
| 50 | 18 |
| 57 | 13 |
| 61 | 14 |
| 63 | **25** |
| 66 | 19 |
| 73 | 6 |
| 77 | 7 |
| 80 | 20 |

**Table 1**
Functional Style
*Source: own elaboration*

On the other hand, the lowest score was found in Item 13, which states that the teacher often brings experts in different subjects to class, as he/she believes that in this way they can learn better.

When teachers have chosen a learning style, it can make it easier for them to understand what they need to teach or how they need to teach and on that basis to choose the teaching style that will enable them to achieve the teaching and learning objectives. It also allows you to identify in which way it is easier for the learner to process the information.

These statements indicate that it is very important for teachers to reflect not only when choosing the teaching style they adopt, but also to decide which strategies they will use to focus on the learning style of the university students they are in charge of.

In this research carried out at the Academic Unit of the North of the State of Nayarit, as mentioned, the functional teaching style is the one that predominated, and is characterised by the style in which teachers guide students to learn.

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The functional style is typical of those teachers whose teaching behaviour guides students to learn by directing them, but placing more emphasis on procedures and practice than on theoretical knowledge.

## Conclusions

Yana et al (2021) state that for university teachers the challenge of choosing a teaching style is more difficult because it requires migrating from a style where information is transmitted to students to a much more active participation. This implies that they must develop skills, competences, aptitudes and be independent in their learning process. Likewise, teachers must guide students in their learning since nowadays there is a demand for higher education to bring about changes that respond to environmental problems.

The results of this research work showed that the predominant teaching style of teachers at the Academic Unit of the North of the State of Nayarit is the functional style, which is characterised by the fact that teachers give very brief explanations and always include practical examples. In the explanations where they include theory, they always include very practical examples, often taken from daily life experiences and problems of everyday life.

Laudadío & Da Dalt (2014), for their part, affirm that studying teaching practices allows for the existence of many valuable experiences that teachers carry out on a daily basis. Didactics analyses the characteristics and conditions of these experiences, subsequently identifying the most significant ones. Analysing teaching practices implies that effective practices are sought.

Taking into account the current results within the Academic Unit of the North of the State of Nayarit, it is recommended to carry out future research on the same topic and compare it with the predominant learning styles of the students of this Academic Unit.

## Declarations

### Conflict of interest

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

### Authors; Contribution

*Chávez-Sánchez, Gabriela*. Sole author of the article, original idea of the project, research itself, information processing and analysis of results

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### Abbreviations

UANEN Academic Unit of the North of the State of Nayarit

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Article

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## Introduction

Text in TNRoman No.12, single space.

General explanation of the subject and explain why it is important.

What is your added value with respect to other techniques?

Clearly focus each of its features.

Clearly explain the problem to be solved and the central hypothesis.

Explanation of sections Article.

## Development of headings and subheadings of the article with subsequent numbers

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## Including figures and tables-Editable

In the article content any table and figure should be editable formats that can change size, type and number of letter, for the purposes of edition, these must be high quality, not pixelated and should be noticeable even reducing image scale.

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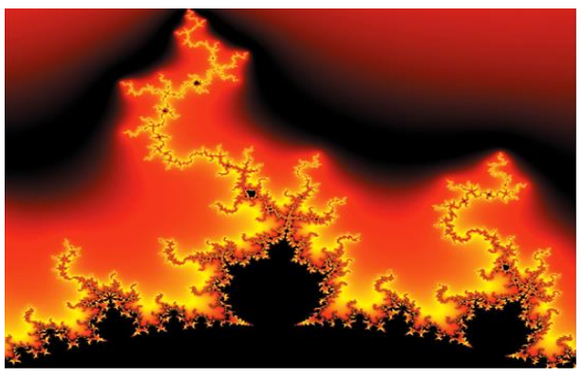

**Figure 1**

Title [Should not be images-everything must be editable]

*Source [in italic]*

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**Table 1**

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| | | | |
|---|---|---|---|
| | | | |

*Source [in italic]*

**The maximum number of Boxes is 10 items**

**For the use of equations, noted as follows:**

$$Y_{ij} = \alpha + \sum_{h=1}^{r} \beta_h X_{hij} + u_j + e_{ij} \quad [1]$$

Must be editable and number aligned on the right side.

## Methodology

Develop give the meaning of the variables in linear writing and important is the comparison of the used criteria.

## Results

The results shall be by section of the article.

## Conclusions

Clearly explain the results and possibilities of improvement.

## Annexes

Tables and adequate sources.

**The international standard is 7 pages minimum and 14 pages maximum.**

## 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.

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**Author contribution**

Specify the contribution of each researcher in each of the points developed in this research.

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*Benoit-Pauleter, Gerard*: Contributed to the project idea, research method and technique.

**Availability of data and materials**

Indicate the availability of the data obtained in this research.

**Funding**

Indicate if the research received some financing.

**Acknowledgements**

Indicate if they were financed by any institution, University or company.

**Abbreviations**

List abbreviations in alphabetical order.

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| | |
|---|---|
| ANN | Artificial Neural Network |

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Use APA system. Should not be numbered, nor with bullets, however if necessary numbering will be because reference or mention is made somewhere in the Article.

Use the Roman alphabet, all references you have used should be in Roman alphabet, even if you have cited an article, book in any of the official languages of the United Nations [English, French, German, Chinese, Russian, Portuguese, Italian, Spanish, Arabic], you should write the reference in Roman alphabet and not in any of the official languages.

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