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SUMARIO • SUMMARY • RESUMO

INVESTIGACIONES

REFLEXIONES

Editorial

The MLS Inclusion and Society Journal magazine is pleased to present its second issue of the year 2022, corresponding to June. In line with the previous issues, the articles are distributed in research and reflection, with current issues and impact.

This issue has a reflection article sent from Brazil, with philosophical aspects, whose objective is to propose measures in order to introduce some improvements in social and educational life, in the face of the changes that are currently taking place in the social and educational environment. , and whose suggestive title is "The universe without walls: universe, terrestrial societies and their influence on current education".

The block of research articles begins with a very current theme, such as emotional intelligence, investigating its conceptual and neuroeducational bases for inclusion in the 21st century. The role of new skills that base their methodology on emotions is essential for the search for a future society that is more consistent with others. To do this, students must know themselves, the environment and those around them, in addition to respecting, accepting and valuing each of the opinions to which they are exposed. In this study, everything that the term emotional intelligence encompasses is defined, structured and commented, as well as offering a fusion between emotional intelligence and inclusive education.

We continue with another investigation that deals with a key issue in primary education, such as reading. The objective that is intended to be achieved with this work is to know the teaching-learning process of reading and to have an idea about the information that our future teachers and society have about it. It should be noted that this research on reading includes the concepts of educational inclusion, neuroeducation and neurodidactics, which are fundamental in any educational aspect that is considered current.

The third work that we present deals with apps and autism spectrum disorder, from a neuroeducational and inclusive point of view. We are facing a work of great quality and that shows the creation of an ad hoc apps for this work, based, on the other hand, on quantitative research that provides the fundamental neuroeducational and neurodidactic foundations in autism spectrum disorder.

The following research article is a descriptive study on burnout syndrome and its labor impact among speech therapy professionals and other health disciplines. Burnout syndrome is the result of a situation of chronic work stress, which compromises the physical and emotional health of workers, with health professionals being the ones who suffer the most. The objective of this study is to determine the prevalence of burnout syndrome in a sample of health professionals who work in a multidisciplinary team, paying more attention to speech therapists.

We return to the autism spectrum disorder with a theoretical review, with the aim of identifying the studies related to the educational inclusion of students with Autism Spectrum Disorder (ASD) in Early Childhood and Primary Education, paying special attention to the publications generated in the decade 2010 - 2020. For this, a very interesting systematic review was carried out in the Web Of Science (WoS) database.

The purpose of the following article is the identification and evaluation of results using the PhET simulator on gravitation (specifically on the law of universal gravitation), this topic is part of the academic curriculum at the level of secondary education and first year university, in disciplinary careers or applied as in technological training and

engineering. For this purpose, a class practice is carried out with students using two of the simulators that address the topics and that can complement the work, before, during and after the class sessions at each level.

We end this issue of ISJ for June 2022 with an investigation that studies the impact of experimentation as a strategy that allows strengthening the acquisition of significant learning related to the area of Natural Sciences.

In general terms, this number provides different lines of research and reflection that demonstrate scientific activity in emotional intelligence, autism spectrum disorder and reading in primary education, among others.

Chief Editors
Claudia De Barros Camargo
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RESEARCH

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EMOTIONAL INTELLIGENCE: CONCEPTUAL FOUNDATIONS AND NEUROEDUCATION FOR 21ST CENTURY INCLUSION

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Abastract. Currently, emotional intelligence is undervalued in education; for this reason, the main objective of this work is to provide it with visualization and knowledge for future teachers, as well as to serve as a guide towards a more emotionally intelligent education. Today's education needs a paradigm shift that should be encouraged from childhood to university, and who better to start this change than future teachers. The role of new competencies that base their methodology on emotions is essential in the search for a future society that is more consistent with others. To this end, students must know themselves, their environment and their surroundings, as well as respect, accept and value each of the opinions to which they are exposed. In the study, the term emotional intelligence is defined, structured and commented on, in addition to offering a fusion between emotional intelligence and inclusive education. Also, sustainability will be questioned in connection with emotional intelligence in the education of the 21st century, at different levels; economic, environmental and social. In addition, the terms neuroeducation and emotional intelligence will be related, and finally, the results obtained will be observed through a likert scale where the lack of information on these areas by teachers can be seen.

Keywords: emotional intelligence, inclusive education, sustainability, neuroeducation, teacher.

INTELIGENCIA EMOCIONAL: BASES CONCEPTUALES Y NEUROEDUCACIÓN PARA UNA INCLUSIÓN DEL SIGLO XXI

Resumen. Actualmente, la inteligencia emocional se encuentra poco valorada en la educación; por este motivo, el principal objetivo de este trabajo es otorgarle visualización y conocimiento para futuros docentes, así como servir de guía hacia una educación más inteligente emocionalmente. La educación en nuestros días necesita un cambio de paradigma que debe fomentarse desde la etapa infantil hasta la universitaria, y quien mejor para comenzar este cambio que los futuros docentes. El rol de nuevas competencias que basen su metodología en las emociones es primordial para la búsqueda de una futura sociedad más consecuente con el prójimo. Para ello, el alumnado debe conocerse así mismo, al medio y a quien lo rodea, además de respetar, aceptar y valorar cada una de las opiniones a las que se expone. En el estudio, se define, se estructura y se comenta todo lo que contrae el

término inteligencia emocional, además de ofrecer una fusión entre la inteligencia emocional y la educación inclusiva. También, se cuestionará la sostenibilidad en conexión con la inteligencia emocional en la educación del s.XXI, a diferentes niveles; económico, ambiental y social. Además, se pondrán en relación los términos neuroeducación e inteligencia emocional. Finalmente, se observaran los resultados obtenidos a través de una escala likert donde se puede ver la falta de información sobre dichos ámbitos por parte los docentes.

Palabras clave: inteligencia emocional, educación inclusiva, sostenibilidad, neuroeducación, docente.

Introduction

The realization of this research not only entails a more than relevant diffusion for this concept. From a teacher's point of view, it is considered that emotional intelligence is very important from an early age and even more so nowadays. The new generations need a change of routine and a solution to the constant exposure they have with the network and other digital media, which is why interpersonal relationships between students are increasingly scarce. Here the main objective we have with emotional intelligence. There can be two types of emotional intelligence in the eyes of the educator, it all depends on the methodology that the teacher carries out.

In the first place, we can speak of emotional intelligence from a traditional point of view, that is, teaching the 'typical' values in a general way in which the teacher comments on values such as companionship, empathy, or honesty but without practicing a constructivist methodology in which they are encouraged; in this way, the teacher does not put this teaching into practice and does not take it to a real situation. On the other hand, there is the teaching of emotional intelligence from an innovative point of view, which is currently instilled in future teachers and which will bring about the first great change in education in the 21st century. In addition, continuing with the aforementioned change, special relevance must be given to the term neuroeducation. The study of the functioning of the brain while it is in the learning or teaching phase makes it possible to take advantage of all those moves that one wants to make. For example, once you know how the student learns best to do a sum (thanks to neuroeducation), the teacher is spared all the time searching for the perfect explanation. Knowledge of neuroeducation is essential for any teacher who wants to teach by extracting from each student the best way to work. In addition, as far as the part of this research is concerned, it has been possible to observe the large number of authors who have been involved in it. In addition, the respondents make us reflect thanks to their answers leading us to find a solution to all this research in which we can develop solutions for our future in the educational field.

The following is a brief reference to the term emotional intelligence according to different authors.

Emotional Intelligence Concept

Salovey and Mayer (1990) qualify this intelligence as a part of social intelligence. Years later, in the Handbook of Intelligence (Mayer, Salovey, and Caruso, 2000), they defined it as "The ability to perceive and express emotions, assimilate emotions into thought, understand and reason through emotions, and regulate emotions in oneself and others" (p. 396). In contrast, Goleman (1995), says that it is "the ability to recognize and manage our own feelings, motivate ourselves, and monitor our relationships" (p. 3).

Years later, Robbins and Judge (2017) highlighted emotional intelligence as the ability to locate and use emotional cues and/or information.

Inclusive education in relation to emotional intelligence

Bisquerra (2011) proposes that the important thing would be to find where education has to advance in order to be able to meet the students and attend them equitably. Therefore, the concern for inclusion, social intervention, and/or attention to diversity, causes the educational system to refer to strategies for the comprehensive development of the individual from a perspective where integration involves the intervention of the school, family, and community. LOE (2006) refers to the purpose of education as the training that seeks to promote the development of subjects in social and affective-cognitive aspects. However, the education of emotions to develop as people has had little relevance.

Sustainability in relation to emotional intelligence

According to Sterling (2004), sustainability is represented by three dimensions, economic, social, and environmental; there are traditional theoretical models that restrict sustainable development to these dimensions as they are insufficient to carry out the subject with all its difficulty. University management and teaching models, in order to adapt to the European Higher Education Area (EHEA) and the needs of the present, require a change in the educational system based on certain competencies necessary for citizens and for their possible personal and professional growth. In addition, academic curricula must include environmental contents and new general changes in the conceptualization of the educational process. We would be talking about a change of educational paradigm that would try to avoid the traditional to methods that exclusively develop reason-cognition, carrying out tasks disconnected from the reality in which we live and from global and local difficulties. In this sense, it is necessary to give value to emotions and the full development of emotional intelligence to achieve a fully sustainable society.

Neuroeducation in relation to Emotional Intelligence

Neuroeducation is considered a current discipline that merges neuroscience. The one that assumes responsibility for the analysis of the brain together with the sciences of education. Following Guillén (2018), "Neuroeducation aims to improve teaching and learning processes based on what we know about how the brain works. Learning from, in, and for life." (p. 72). Finally, Emotional Intelligence focuses on specific brain centers, which accept the interrelation between the limbic system and the neocortex. Such neuroanatomical components grant human beings different abilities. Following Bueno (2019), certain cognitive or cerebral processes are also named by neuroeducation as constructs that have a certain direct influence on learning and education.

Method

Design

The method carried out in the elaboration of this study is based on information collected from a Likert scale questionnaire, an additive scale model which belongs to an ordinal level of measurement; it is composed of certain items by way of confirmation in which the person's opinion is requested (Bedoya, 2017). This scale was elaborated and passed to primary education students and current primary school teachers. By means of the information obtained, non-experimental research is proposed, characterized by the non-adulteration of the independent variable, that is, the groups are not randomly distributed. Only the changes that occur in the data are observed through quantitative techniques, variables that have a reference model, specifically, a criterion; allowing the explanatory design which tries to clarify the reasons for the consequences studied, i.e., not only the phenomenon, situation, characteristics, etc., are detailed, according to Salinas (2008); descriptive, which is defined by Glass & Hopkins (1984) as the selection of antecedents that clarify what happens and then structures, tabulates, and figures the data obtained; and correlational, whose objective is to measure the concordance between several variables in a given environment (Cazau, 2006). All this will be shown later, based on the data extracted on the results obtained. Therefore, future teachers and those who are already in educational centers, as the theoretical framework developed above indicates, are responsible for working with emotional intelligence at school.

Population and sample

The population and the sample that make up this research are a group of future teachers of the fourth year of the degree in primary education and a group of current teachers.

The problem according to Arias (2012), the general and specific objective of this research according to Marín and Lafuente (2008) will be indicated below.

Problem, general objective, and specific objective

According to Arias (2012), a problem is an issue that requests to be solved with a solution. Research problems are issues of reality that have not been known. Thus, the unknown is an inconvenience for the researcher, who suggests questions about the unknown and will have to seek a solution through research; the answer obtained will form the solution to the problem. Does the current situation on emotional intelligence have a conceptual basis for quality education in the educational field?

According to Quisbert and Ramírez (2011), the research objective arranges and specifies tasks to be performed by the researcher; the objective refers to the variables involved in the research task. By means of the research objective, we manage to give an answer to the problem posed; this objective is proposed for the resolution of some unknown subject. Likewise, two types of objectives can be distinguished according to Marín and Lafuente (2008); the general objective, which should reflect the nature of the problem to be investigated. For this research, the general objective is to analyze the current situation on emotional intelligence, which would consist of creating a conceptual basis of emotional intelligence in teachers for a warm education in the educational environment.

On the other hand, the specific objectives, movements carried out in order to achieve the general objective, are detected. The specific objectives to be mentioned are the following:

- Show the current situation in the field of emotional intelligence.
- Identify the relationship between self-management, self-knowledge, social knowledge, and emotion management.
- Expose the most relevant aspects of emotional intelligence.
- Explain emotional intelligence in the current context.
- Present emotional intelligence in the current educational system.

Consequently, the specific objectives must not only hinder the main objective but must also accept or govern the research in the direction of its end.

The hypothesis is the next point developed in this research where it will be reflected whether it is positive or negative.

Hypothesis

As a result of the collection of samples for the database, hypotheses have been obtained with numerical estimates for the values of the population studied. For this purpose, statistical analyses have been performed with the researcher being the extractor of the different conclusions on the results presented by the population (Creswell, 2008).

H0, specifically negative, refers to the current situation on emotional intelligence as not consisting in creating a conceptual basis of emotional intelligence in teachers for a warm education in the educational environment.

H1, positive, reflects the current situation on emotional intelligence, as it does not consist of creating a conceptual basis of emotional intelligence in teachers for a warm education in the educational environment.

This is followed by a description of the variables according to Murillo (2011).

Variables

An independent variable is the quality inferred as the cause of the phenomenon under investigation, and this is the concept used to refer to the variable manipulated by the researcher. However, the dependent variable brings together the changes that occur in the independent variable when it is manipulated. Therefore, what we must abide by will be what we measure, and this will provide us with the information to be considered (Murillo, 2011). In addition, within the independent variables, we find inclusive education, educational sustainability, and neuroeducation; and, in the dependent variables, we find emotional intelligence; these should be moderated separately. Such action strengthens the cause-and-effect logic of an investigation.

Once the variables have been mentioned, we will move on to the instrument where we will also include the operationalization table with its respective items, which can be found in the instrument.

Participants

The population and the sample that make up this research are a group of future teachers of the fourth year of the degree in primary education and a group of current teachers.

Instruments

According to Salinas (2008), research instruments refer to templates, questionnaires, and/or scales where the information needed to achieve the results that lead us to reach the objectives set is obtained. For the construction of the instrument, an operationalization table was used where, based on the specific objectives and dimensions, the corresponding items were elaborated.

Table 1

Operationalization table

Operationalization Table		
SPECIFIC OBJECTIVES	**DIMENSIONS**	**LIKERT**
1. Identify the relationship between self-management,	A (Emotional Intelligence)	A1. -Elementary education teachers have knowledge of self-awareness of Emotional Intelligence (EI).

	self-knowledge, social knowledge, and emotion management.	Base authors: Goleman (2001) Bisquerra (2007) Bar-On (2006)	A2. -Elementary education teachers are aware of the social awareness of Emotional Intelligence (EI). A3. -Elementary education teachers have knowledge of self-management of Emotional Intelligence (EI). A4. -Elementary education teachers have knowledge of Emotional Intelligence (EI), emotion management/control. A5. -In primary education emotions influence learning.
2.	Show the current situation in the field of emotional intelligence.	B (Inclusive Education in Relation to Emotional Intelligence) Base authors: Aranda (2002) Bisquerra (2011)	B6. -Educational integration is equivalent to educational inclusion. B7. -Educational inclusion involves fostering inclusive values and attitudes. B8. -Educational inclusion is facilitated by emotional intelligence. B9. -Educational inclusion needs the basis of emotional intelligence. B10. -Neurodidactics is key to educational inclusion.
3.	Introduce emotional intelligence in today's educational system.	C (Sustainability in Relation with Emotional Intelligence) Base authors: Colás Bravo (2021)	C11. -Neuroeducation is the study of the brain and its application to the educational context. C12. -Emotional intelligence with neuroeducational basis acquires scientific character. C13. -Teachers have knowledge of the brain areas involved in emotional intelligence. C14. -Teachers are aware of the influence of neurons on emotional intelligence. C15. -Teachers have knowledge of the neurotransmitters of emotional intelligence.
4.	Expose the most relevant aspects of emotional intelligence.	D (Neuroeducation in Relation to Emotional Intelligence) Base authors: Guillén (2018) Mora (2020)	D16. -Emotional intelligence is sustainable at the social level D17. -Emotional intelligence is economically sustainable D18. -Emotional intelligence is environmentally sustainable. D19. -Emotional intelligence is sustainable in the educational system.

Note: Own elaboration

Content validity

According to Chiner (2011), "the validity of a test indicates the degree of accuracy with which it measures the theoretical construct it is intended to measure and whether it can be used for its intended purpose. That is, a test is valid if it "measures what it claims to measure"; it is the most important quality of a measuring instrument" (p.2). At the same time, Chiner (2011) contributes that "validity has three components: content validity, criterion validity, and construct validity. In the first place, the first of these, content validity, is the one used in this research and refers to "the degree to which the test presents an adequate sample of the content to which it refers, without commissions and without content imbalances" (p.2). In this research, an expert judgment was chosen, selecting nine experts with doctoral degrees who are specialists in the field. The result was optimal, with several variations of ambiguous words and expressions with difficulty of concordance. In conclusion, once the expert judgment was completed, a pilot test was carried out, for which a small group of the sample was taken and the scale was ordered, observing that there were no problems in the scale; with all this, the scale is considered validated.

Reliability (Alpha)

The use of Cronbach's Alpha coefficient evaluates the reliability of the adapted questionnaire (Junior, 2009); Hora, Monteiro, and Arica (2010), on Cronbach's Alpha coefficient, "a way of estimating the reliability of a questionnaire applied in a survey" (p.5). Examining Cronbach's Alpha, it is observed that its purpose is to verify the consistency of the variables surveyed as firmness with respect to the survey carried out in conjunction only with the individuals surveyed. Hora, Monteiro, and Arica (2010, p. 6), perfecting comment, "The great use and acceptance of my academic degree by Cronbach's alpha coefficient is a determining factor in its adherence to fermentation for reliability evaluation." Concluding, Cronbach's Alpha, whose reliability of the scale is .951, which is following George and Mallery (2003), is excellent. Therefore, the result obtained through the Likert scale is analyzed.

The following is the analysis of the data carried out in this research.

Data analysis

Descriptive analysis

The results obtained through descriptive analysis using the likert scale, thanks to the collaboration of future and current teachers, are presented below.

Dimension A, Emotional Intelligence.

Analyzing Figure 1, it is observed that it has a negative value -0.57; therefore, the asymmetry is negative, meaning that the data are not grouped around the mean. As for its kurtosis, it turns out to be platykurtic since its value is negative -0.813, and its data are not

clustered at a specific point in the mean. Emphasizing the result shown in the graph, it is interpreted that the teachers surveyed do not know the social awareness obtained from emotional intelligence; the lack of knowledge of this area represents a backwardness in education due to the fact that nowadays an individualized education is pursued contemplating the emotions of each student and trying to work promoting values such as cooperation and teamwork. These values increase empathy, individualized motivation to achieve a group objective and enthusiasm, relevant aspects in emotional intelligence.

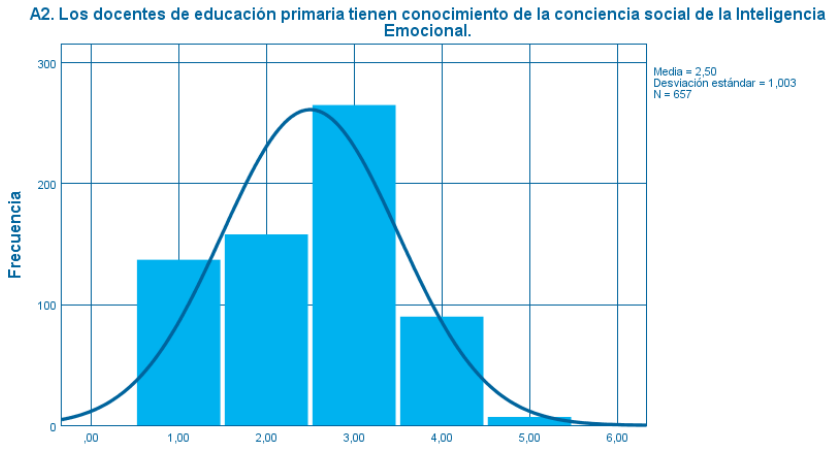

Figure 1. A2. Primary school teachers' knowledge of social awareness of emotional intelligence.

Note: Own elaboration

As can be seen, in this graph the skewness contains positive value ,064 so the skewness is positive, meaning that the data are grouped around the mean. On the other hand, a negative value is found -0,395 on kurtosis, so it is platykurtic and the data are not grouped around a point, to the mean; these are distributed and it is not relatively good. Analyzing Figure 3, it is shown that most of the respondents answer 'indifferent.' It is forgotten that in addition to being teachers, we are also educators, so it is essential to teach both conceptual and attitudinal content. The most important subject that a student learns in education is to know himself, to know how to shuffle the feelings that run through his head from the time he is five years old until he is eleven, and it is reflected that currently there are very few teachers who are trained to teach this competence because even they themselves do not know it. Teachers who are not part of traditional teaching should encourage this 'relationship' between student and teacher.

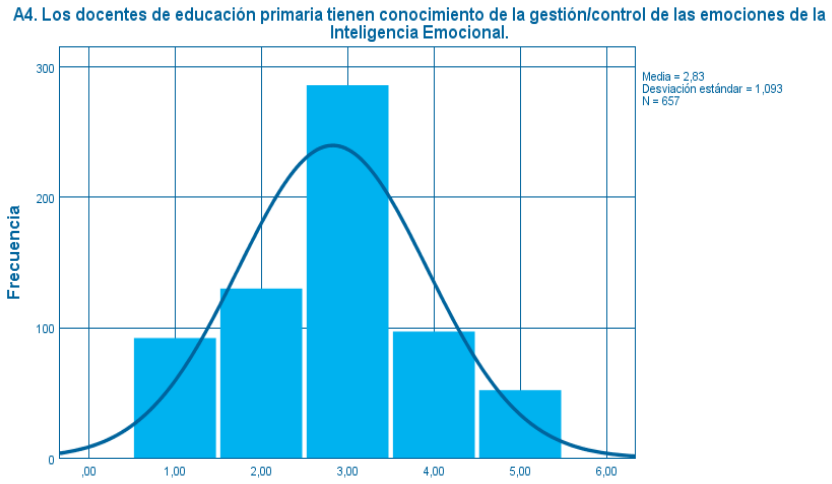

*Figure 2***.** A4. Primary school teachers' knowledge of emotional intelligence of emotion management/control.

Note: Own elaboration

With respect to Figure 3, its asymmetry is positive, 615, grouping the data around the mean; it also shows kurtosis of negative value - 1.180. Therefore, it is platykurtic and the data are not grouped around a point, around the mean, they are distributed and it is not favorable. In this case, as well demonstrated by the teachers interviewed, there are differences between educational integration and educational inclusion. The main difference between them is summarized in that the term integration is defined as the invitation to a person to participate in a subject by adapting to the community he/she is already in. While, on the other hand, the concept of inclusion is defined as an egalitarian model for all in which cooperation and solidarity predominate.

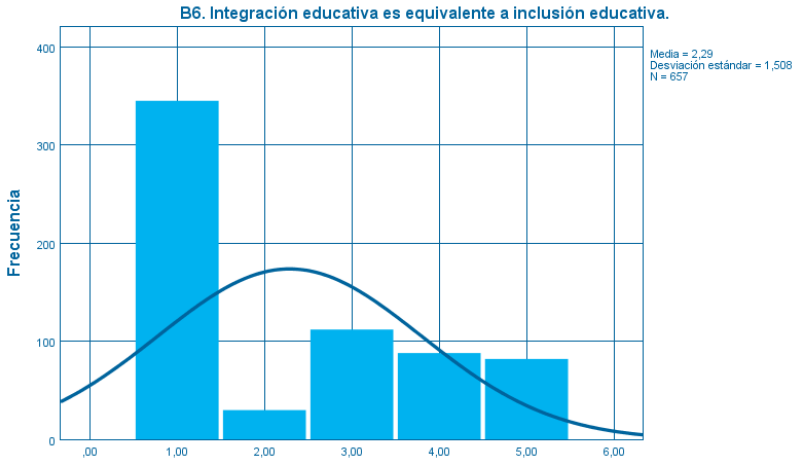

*Figure 3***.** Dimension B. Educational Inclusion.

Note: Own elaboration

Next, negative skewness -1.479 can be seen, causing the data not to be grouped around the mean; the kurtosis value is positive 0.967, being leptokurtic, that is, the data are grouped at a specific point, at the mean. Therefore, as shown in the figure to be discussed, it is verified that teachers certainly know that emotional intelligence promotes educational inclusion. However, this is not the only advantage obtained from emotional intelligence; it also improves self-knowledge and decision making, helps to combat stress and, above all, is a precautionary method for stress, increases personal relationships, and favors personal progress, among other advantages.

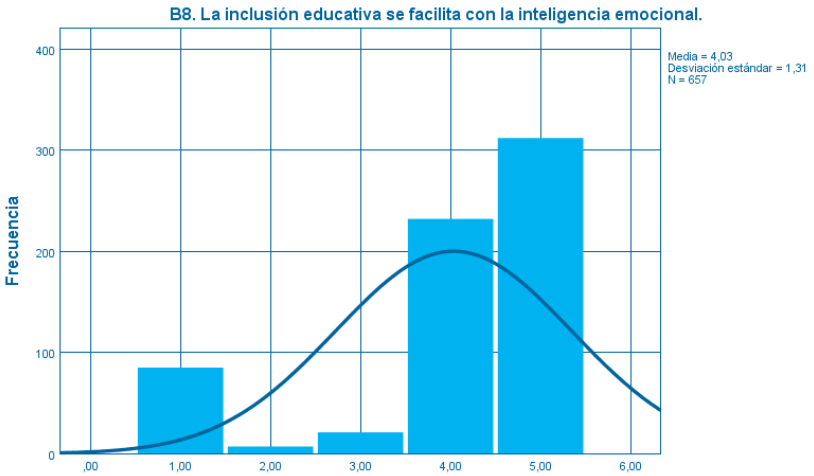

Figure 4. B8. Educational inclusion is facilitated by emotional intelligence.

Note: Own elaboration

Next, in this figure we observe asymmetry of positive value ,068, and its data are grouped around the mean. Negative, the value of its kurtosis - 0.985 being platicurtic, and its data not clustered around the mean if not distributed. This case is not positive. By analyzing the graph, it is perceived that most of the subjects have responded with 'indifferent.' Supporting emotional intelligence through scholarships and grants would benefit education to foster such competence and also teachers who would profit from such scholarship to learn more about emotional intelligence. These scholarships and grants are important to continue the training of teachers in this area of education due to the fact that after the surveys conducted most of them still do not know about emotional intelligence.

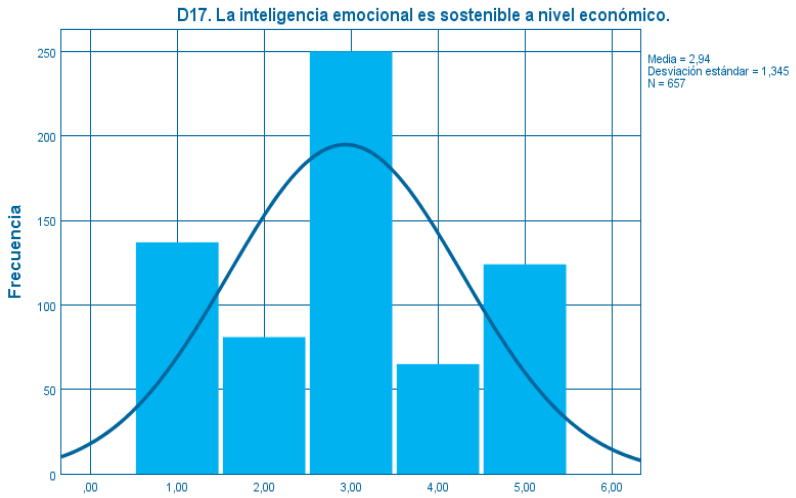

Figure 5. D17. Emotional intelligence is economically sustainable.

Note: Own elaboration

Finally, the asymmetry of this graph is found to be negative -0,522, indicating that its data are not grouped around the mean; kurtosis is negative -1,056, so it is platykurtic and the data do not gather around the mean, they are distributed and it is unfavorable. In addition, it can be observed that most of the respondents answer 'indifferent' to the question asked. Emotional intelligence is presented as a problem in today's education by three parameters: economic, social, and environmental. The balance of these three mentioned above would lead to the solution of this unsustainability, and, therefore, to an education where emotional intelligence is one more competence in the curriculum.

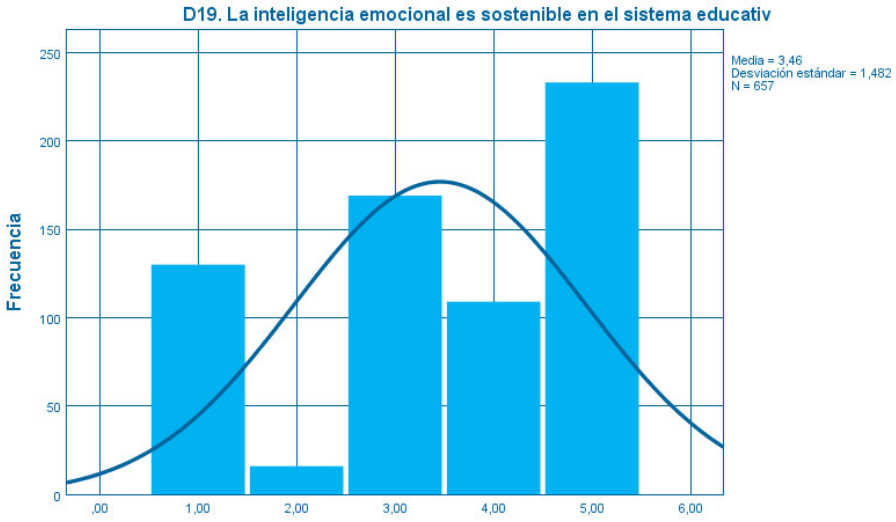

Figure 6. D19. Emotional intelligence is sustainable in the educational system.

Note: Own elaboration

In Figure 7, whose value, ,324, shows positive skewness, meaning that the data are clustered around the mean. On the other hand, its kurtosis obtains a negative value of -0,616, meaning that it is platykurtic, and the data are not grouped around a point, i.e., the mean but are distributed; this being unfavorable. In this case, it can be seen that most of the respondents answer that they disagree with what is asked. Emotional intelligence is located in the cortex of the brain known as prefrontal neocortex, and through neurons it is connected to the limbic system, the place where all human emotions are concentrated.

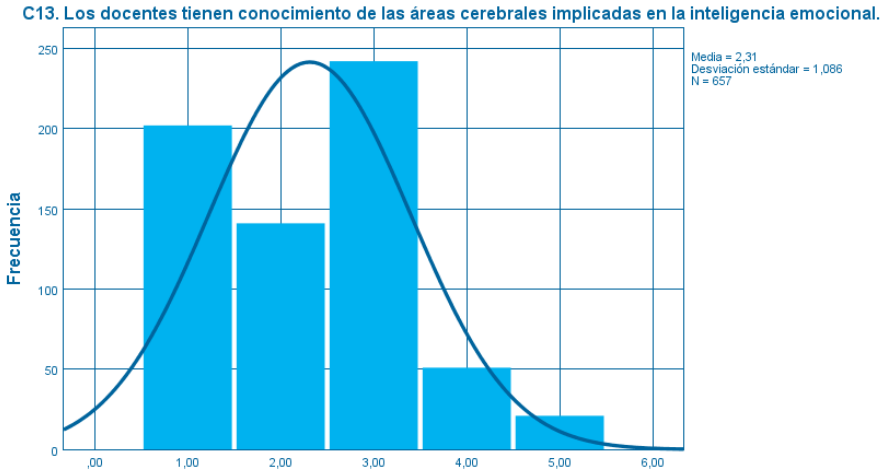

Figure 7. C13. Teachers have knowledge of the brain areas involved in emotional intelligence.

Note: Own elaboration

Regarding figure 8, positive value ,173 of asymmetry, the data are grouped around the mean; the value in its kurtosis is negative - 0.703, so its kurtosis is platykurtic, and the data are not grouped around a point, they are distributed and it is unfavorable. Addressing now the question posed in the questionnaire, the interviewees are again unaware of the usefulness of neurons in the field of emotional intelligence. Neurons have the primary purpose in this area of acting as a system that enables the understanding of actions and, therefore, imagination, empathy, and theory of mind.

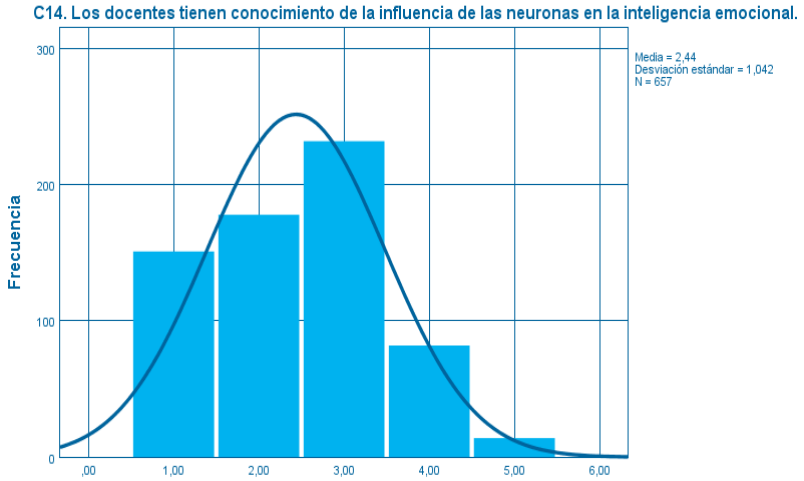

Figure 8. C14. Teachers have knowledge of the influence of neurons on emotional intelligence.

Note: Own elaboration

Non-Parametric Analysis

The non-parametric evaluation analysis is based on Farrell's study (1957), where the properties of the set of production processes (SPP) that are likely to be carried out are taught:

- Convexity: the set of productive processes, formed by the productive processes studied and by the convex group that limits it.
- Constant returns to scale (REC): the set of production processes characterized by being composed of linear combinations of the observed production processes.
- Free elimination of inputs and outputs: it implies a productive unit (PU) capable of creating the same amount of output with a higher degree of inputs or a lower degree of output with the same proportion of inputs.

In this research, the null hypothesis is retained; i.e., the data are not normal. In turn, this research has been developed with the use of two samples (future teachers and current teachers), so we will apply a technique used to identify the differences of isolated groups in quantitative variables without a specific distribution, namely the *Mann-Whitney U* technique. The basis is the rank differencing and *t Student's* counterpart in which quantitative variables with normal distribution are defined (Rivas-Ruiz, Moreno-Palacios, Talavera, 2018).

To conclude with the methodological framework, the correlation will be mentioned, specifically the Rho Spearman correlation, exposing the most significant figures in each of the dimensions of this work.

Correlation

The most striking early research on the teaching of this idea is shown in psychology through the pioneering study of Inhelder and Piaget (1955); on correlation, the authors determine that knowledge of the subject of correlation leads to knowledge of the ideas of probability and proportion, as well as combinatorial ability. Rod Spearman correlation table (Annex 2).

Rho Spearman correlation

Spearman's Correlation analysis is a non-parametric statistical method that attempts to analyze the power between two quantitative variables (Mondragón, 2014).

Dimension A

A1: The most significant correlation is found in item A1 with A4 with a Spearman coefficient of ,849. Primary education teachers who have knowledge of EQ self-knowledge (A1) are also of the opinion that primary education teachers have knowledge of EQ emotion management/control (A4). The least significant correlation is found in item A1 with D17 with a Spearman coefficient of ,195. Primary school teachers who have knowledge of EQ self-knowledge (A1) also believe that emotional intelligence is economically sustainable (D17).

A5: Consequently, in dimension A, the most significant correlation is found in item A5 with B9 with a Spearman coefficient of .911. Teachers who say that in primary education emotions influence learning (A5) also say that educational inclusion needs the basis of emotional intelligence (B9). In addition, the least significant correlation is found in item A5 with B6 with a Spearman coefficient of .327. In primary education, emotions influence learning (A5); they are also of the opinion that educational integration is equivalent to educational inclusion (B6).

Dimension B

B8: The most significant correlation is found in item B8 with A5 and B9, with a Spearman coefficient of .894. Teachers who are of the opinion that educational inclusion is facilitated by emotional intelligence (B8) affirm that in primary education emotions influence learning (A5), in addition to the fact that educational inclusion needs the basis of emotional intelligence (B9). The least significant correlation is found in item B8 with B6, with a Spearman coefficient of .353. Teachers who affirm that educational inclusion is facilitated by emotional intelligence (B8) in turn affirm that educational integration is equivalent to educational inclusion (B6).

B10: The most significant correlation is found in item B10 with B8, with a Spearman coefficient of .865. Teachers who indicate that neurodidactics is key to educational inclusion (B10) also indicate that educational inclusion is facilitated by emotional intelligence (B8). The least significant correlation is found in item B10 with B6, with a Spearman coefficient of .382. Teachers who point out that neurodidactics is key to educational inclusion (B10) also point out that educational integration is equivalent to educational inclusion (B6).

Dimension C

C11: The most significant correlation is found in item C11 with C12, with a Spearman coefficient of .802. Teachers who think that neuroeducation is the study of the brain and its application to the educational context (C11) also believe that emotional intelligence with a neuroeducational basis acquires a scientific character (C12). The least significant correlation is found in item C11 with C15, with a Spearman coefficient of .194. Teachers who think that neuroeducation is the study of the brain and its application to the educational context (C11) also think that teachers have knowledge of the neurotransmitters of emotional intelligence (C15).

C13: The most significant correlation is found in item C13 with C15, with a Spearman coefficient of .743. Teachers who have knowledge of the brain areas involved in emotional intelligence (C13) also ensure that teachers have knowledge of the neurotransmitters of emotional intelligence (C15). The least significant correlation is found in item C13 with B6, with a Spearman's coefficient of .045. Teachers have knowledge of the brain areas involved in emotional intelligence (C13), likewise they state that educational integration is equivalent to educational inclusion (B6).

Dimension D

D18: The most significant correlation is found in item D18 with D17, with a Spearman coefficient of .764. Teachers who say that emotional intelligence is environmentally sustainable (D18) in turn say that emotional intelligence is economically sustainable (D17). The least significant correlation is found in item D18 with C14 with a Spearman coefficient of .060. Teachers who say that emotional intelligence is sustainable at the environmental level (D18) also say that teachers have knowledge of the influence of neurons on emotional intelligence (C14).

D19: The most significant correlation is found in item D19 with D16, with a Spearman coefficient of .903. Teachers who support that emotional intelligence is sustainable in the educational system (D19) think that emotional intelligence is sustainable at the social level (D17). The least significant correlation is found in item D19 with D17 with a Spearman coefficient of .226. Teachers who support that emotional intelligence is sustainable in the educational system (D19) also support that emotional intelligence is sustainable at the economic level (D17).

Results

Next, the results can be visualized based on the function achieved in the collection of the Likert scale sent to teachers and future teachers who are finishing their training. The representation of the results will be by means of a descriptive analysis of the items considered and the most salient information provided by the data. After this, the descriptive analysis will be exposed with the development of the most striking graphs regarding the research. In addition, as for the descriptive analysis and its correlation, it is observed that the answers of the respondents agree with each other since such knowledge is unconsciously related, producing a significant correlation.

Discussion and conclusions

To conclude, after carrying out this research and visualizing the answers in the questionnaire, it can be perceived that the process of integration of emotional intelligence in education is slow, but that little by little it is being achieved. Today's teachers have an idea of the concept of emotional intelligence, but they are not yet able to put it into practice with total clarity. In my opinion, the focus of university studies on this concept should be even greater in order to capture the attention of future teachers, so that they are the ones who pursue this education based on it. "Until emotional intelligence is implemented in the classrooms of our country, there will not be the real transformation that the educational system needs," said Punset (2010, p. 23).

On the other hand, inclusive education and emotional intelligence are two concepts that are slightly linked, and, in my opinion, we cannot emphasize one without the other being positively affected, which is why both concepts are growing at the same time. Every teacher who pursues an inclusive education is promoting emotional intelligence and vice versa. We are facing two concepts that will be key in the education of the future, where I hope to find a few

hours a week dedicated to emotional intelligence, and where feelings are worked on in a natural and realistic way.

Finally, neuroeducation cannot be forgotten in this research, focusing it as a main topic addressed in this research; it is concluded that most teachers are unaware of this discipline. However, I am confident that the terms neuroeducation, emotional intelligence, inclusive education, and sustainability will continue to evolve in education and eventually be introduced in education.

The first conclusion is that, in most cases, teachers have a vague knowledge of all the items mentioned in this research. It should be noted that the answers obtained agree with each other, thus producing an interrelation between each of them.

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READING IN PRIMARY EDUCATION

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Abastract. This article will present the research on five dimensions addressed to carry out a more exhaustive research on the concept of reading, the difficulties that children may have when learning it, the concept of educational inclusion, neuroeducation and neurodidactics. The aim of this work is to learn about the teaching-learning process of reading and to have an idea about the information that our future teachers and society have about it. A simple of 300 students who are currently studying the Primaria Education Degree has been chosen. They will be given a scale that they must answer, from which the results to be discussedwill be obtained through a descriptive analysis of the ítem considered in it. Some of the ítems analyzed are also presented graphically to understand them clearly. We will end with a conclusión and personal assessment related to the information obtained on the aforementioned questionnaire (Likert sacale) to hace a clear idea of what our future teachers know about learning to read, if they have knowledge about the new teaching methodologies, anda if future education remains in good hands.

Keywords: reading, reading difficulties, educational inclusion, neuroeducation, neurodidactics.

LA LECTURA EN EDUCACIÓN PRIMARIA

Resumen. En el presente artículo se va a presentar la investigación sobre cinco dimensiones abordadas para poder hacer un estudio más exhaustivo sobre el concepto de lectura, las dificultades que se pueden presentar en los niños y niñas a la hora de aprenderla, el concepto de inclusión educativa, neuroeducación y neurodidáctica. El objetivo que se pretende alcanzar con este trabajo es conocer el proceso de enseñanza- aprendizaje de la lectura y tener una idea sobre la información que tienen nuestros futuros docentes y la sociedad sobre ello. Se ha elegido una muestra de 300 alumnos que actualmente están cursando el Grado de Educación Primaria. Se les pasará una escala que deberán responder, de la cual se obtendrán los resultados a discutir a través de un análisis descriptivo de los ítems considerados en la misma. También se presenta de forma gráfica algunos de los ítem analizados para entenderlo de forma clara y finalizaremos con una conclusión y valoración personal relacionada con la información obtenida sobre el cuestionario mencionado anteriormente (escala Likert) para tener una clara idea sobre lo que saben

nuestros futuros docentes a cerca del aprendizaje de la lectura, si tienen conocimiento sobre las nuevas metodologías de enseñanza y si la educación futura queda en buenas manos.

Palabras clave: lectura, dificultades de la lectura, inclusión educativa, neuroeducación, neurodidáctica.

Introduction

We will begin by talking about written language in its general aspect. As a concept, it is an essential tool in social and personal development so that society can achieve its integration with the maximum possible benefit, since communication in all its aspects is important in order to understand the world we live in and to socialize with peers. This requires the development of multiple linguistic, cognitive and metacognitive skills. According to Solé (2002), reading is the process in which a reader interacts with a text in order to interpret or understand a given message. On the other hand, Marchesi (2005) explains that reading is one of the main activities to be encouraged in the classroom due to its integrity. In this way, he adds that reading allows development not only at an intellectual level through the enrichment of knowledge but also at an emotional, psychological or personal level, therefore, attending to the integral development of schoolchildren. Navarro (2008) states that in order to get students to read for pleasure, it is necessary to implement a series of strategies and techniques that encourage reading in the classroom, as well as in other primary socialization agents such as the family. In this way, according to the same author, it will be possible for students not only to practice reading in order to solve problems, seek information out of necessity or understand messages that may be important, but also as a pleasure and as a source of autonomous knowledge. Navarro (2008) proposes a series of strategies that encourage the use of reading, such as active repetition, establishing mnemonic rules, repeating aloud, highlighting, taking notes, summarizing a text, concept mapping, among others. However, all these strategies must be practiced from a methodology that encourages students to implement them, otherwise, they would fall into a traditional methodological technique, based on the passivity of students, in the absence of autonomous decision making or memorization of these. In this way, some of the active methodologies that can be present for the encouragement, practice and learning of reading are the following:

- Gardner's multiple intelligences. It consists of conceiving learning from several dimensions, so that, according to Gardner (2012), students can enhance their own performance at a cognitive and integral level. In this way, reading would be framed in the linguistic intelligence that could develop communicative skills in the student.

- Cooperative learning: Through this methodological technique, students in small groups interact autonomously, seek solutions and information and establish roles to achieve common goals, leaving aside competitiveness and individualism (Benito, 2007). Reading would be present, in this way, in a motivating and innovative environment for students and, consequently, the pleasurable practice of reading, too.

- Gamification: Gaitán (2013) mentions that from techniques that involve the mechanics of video games and the playful character that this presents, it is possible for students to practice reading in a pleasant way, so its application in the primary classroom can be beneficial.

On the other hand, Padgett (1998), focusing on the typology of learning difficulties, speaks of language and reading, pointing out aspects centered on the following characteristics that appear:

- General abilities of the student body.
- Fundamental symptoms.
- Processing deficits.
- Secondary symptoms.

Educational inclusion, according to Patterson (1995), consists of the participation of students in an educational system that takes into account their possibilities and offers solutions to their limitations, and must be linked to concepts such as equity, equality, non-discrimination or justice, as pointed out by Bolívar (2012), who also states that the presence of these terms is sometimes difficult to achieve in the educational system for different reasons, including teacher training or the resources available to the school center. Currently, the education system is based on Organic Law 3/2020, of December 29th , which amends Organic Law 2/2006, of May 3rd , on Education (LOMLOE, 2020). This organic law includes a series of pedagogical principles that seek educational inclusion and attention to diversity, such as:

- Personalization of teaching.
- Principle of respect and non-discrimination.
- Principle of equity and equal opportunities.
- Principle of individualization.

In addition to the state level, in the autonomous community of Andalusia, educational inclusion is also taken into account through Law 17/2007, of December 10, 2007, on Education in Andalusia (LEA, 2007). This law develops a series of methodological strategies or forms of educational response for students, as described in the following section. Table 1 below shows some of the strategies or aspects to be taken into account in Primary Education in order to promote inclusion.

Table 1.

Strategies and aspects to promote inclusion in primary school.

Strategies and aspects that facilitate inclusion in primary education.	
Strategies or aspects	Description
Value systems	Parra (2008) considers that establishing a system of values in the classroom is necessary in order to achieve

	their transmission, the development of skills and abilities, as well as the awareness of the need for everyone to have the same rights to life in general and to the particularities of the students in particular. For this system of values to be present in the classroom, it will also be necessary, according to García and Dolan (1997), to attend to psychological, economic and ethical dimensions since, in the curriculum, they are present in a cross-cutting manner.
Values of the teaching staff	Serna and Luna (2011) consider that teachers at all times are models for the student body, so it is necessary to show themselves as such through exemplary behavior, based on the presence of values, a democratic, inclusive, communicative attitude, and knowledge of different techniques for peaceful conflict resolution, such as assertive dialogue. When all this is present in the classroom, according to López (2006) it is possible to build an environment in which students can internalize these values and acquire them in a meaningful way.
Curricular adaptation	The LOMLOE (2020) establishes a series of curricular adaptations such as significant adaptations and reinforcement programs in which some of the curricular elements can be adapted in order to achieve the most inclusive teaching and learning process possible. Within this type of adaptation, values must be present and not only contribute to the cognitive improvement of the learner but also to his or her integral development.
Specific programs	Specific programs have been in place since Organic Law 8/2013, of December 9, 2013, for the improvement of educational quality (LOMCE, 2013). They consist of the design of a teaching and learning process aimed at students to improve some aspect that is not included in the curriculum and that may be important for the shaping of the student's personality or for the development of the competences established by the regulations. Some specific programs may be for the development of social skills, to improve empathy, to improve personal aspects such as self-esteem, to learn

	techniques for peaceful conflict resolution, among others.

Note: Own elaboration.

Understanding educational inclusion from the importance of its application in education in general and for the attention to the diversity of students, neuroeducation, and later, neurodidactics, can be considered as possible ways from which students can find tools to develop the learning of reading, as well as to attend to their difficulties in practice.

According to García (2017), neuroeducation is a paradigm that focuses on teaching strategies based on the brain's own functioning, sometimes using information and communication technologies. Through neuroeducation, educational and psychological aspects are combined in order to achieve a teaching and learning process that favors all students at an integral level.

With the incorporation of ICT in the educational system, the student has more information available through the learning that takes place in the classroom. Thus, Jensen (2004) states that the main goal of neuroeducation is to take advantage of learning in order to be executed in a way that allows an improvement in the quality of teaching and learning. It should be noted that neuroeducation, in spite of being now a more current and more worked topic, has antecedents that warned about the importance of this from early ages in the educational system. Montessori (1986) states that by working with the mind it is possible to achieve integral development from the first years of life, since children are able to pay much more attention than in any other period of their lives.

Gardner (1993), through the theory of multiple intelligences, states that through the presence of different intelligences, the child can achieve greater understanding and the development of skills and abilities, having as a starting point the brain and the absorption of knowledge and content, in this case, according to the theory, intelligences. From neuroeducation, according to Gardner (1993), all the intelligences that are proposed in the theory of multiple intelligences could be developed. On the other hand, Mora (2017) exposes the need to take into account attention as a basis on which to carry out learning because, through attention itself it is possible to obtain the development of people not only at the academic level but also in other aspects. Therefore, from the educational system, it is necessary to contribute, from the perspective of neuroeducation to achieve a series of benefits in children such as:

- The activities must be presented from a motivating perspective and must be interesting for the students, because if they are too ordinary they could become unmotivated.

- Encourage students' interest and curiosity for learning through questions.

- Develop aspects such as imagination or creativity through activities like stories, games or other types of tasks that move away from the traditional methodology based on memorization and passivity of students.

- Allowing the manipulation of resources available in the classroom, as well as taking more into account the procedural aspects in the classroom, since learning in an autonomous way allows contributing to a perspective based on neuroeducation.

Finally, before moving on to neurodidactics, Mora (2017) makes a classification of the different types of attention that may be present from a neuroeducation-based perspective. They are the following listed below in Table 2.

Table 2.
Types of attention

Types of attention	
Tipo	Descripción
Attention base	This type of care is the one that allows us to know what is happening around people in a more general way than other types of attention.
Absorbing attention	Through absorbed attention it is possible to maintain constancy and a fixed level of alertness.
Orientational attention	The objective of the orientative attention is to detect the most important points within a group of information. It should be noted that, in this case, the orientational attention is not permanent, but is subject to constant modification depending on the context.
Executive attention	Through executive attention, sustained attention can be achieved, which allows the development of critical thinking after obtaining information, as well as being able to reason.
Unconscious attention	This type of attention is involuntary. It is, together with base attention, a type of

	attention that does not require the student's perception since it is very basic.

Note: Own elaboration.

Next, we will delve into neurodidactics in its different applications from the primary classroom, as well as taking into account emotions as vehicles that allow well-being in the classroom and in other contexts in order to facilitate educational development. Neurodidactics, according to Fernández (2017) is a term that has been given since 1988 and tries to find a field based on research that allows knowing a way of being able to teach through neuroscience from a more effective vision for the students, as well as to promote their educational performance. Neurodidactics also combines brain, attention, memory and emotions in such a way that the student's potential is improved, as well as the level of significant learning acquired. Some of the educational applications related to neurodidactics in the primary classroom are the following:

Table 3.

Applications related to neurodidactics in primary school.

Applications related to neurodidactics in Primary Education	
Application	Description
Sleep	According to Van Dongen et al. (2003), sleep has not always been conceived as an important factor in learning. However, there are several studies that currently explain that lack of sleep can have negative effects on the work of aspects related to neurodidactics such as memory, attention, reasoning, motor skills or the emotional sphere. To prevent this from happening, Mora (2013), states that increasing the hours of sleep in children may be appropriate for the performance of students, as well as delaying the school schedule according to Willingham (2012).
Physical exercise	According to Codina (2014) physical exercise has always been considered a practice that promotes cognitive performance in people. Therefore, it is necessary to increase it in educational attention. Through this, students can see their own personal wellbeing favored and it can even help to promote social skills or a more participatory, active, inclusive education based on the principle of respect and non-discrimination.
The game	The game, according to Guillén (2012) also offers a benefit to students because through it it is possible to

	awaken curiosity or interest in the student. In addition, this allows a number of benefits for students such as improving their well-being at school, developing creativity or personal aspects such as self-esteem or socialization. Therefore, the same author points out that the game should be considered as a resource or tool in primary school classrooms, since the playful nature of the game can help them in critical thinking, companionship, imagination, among other aspects. Thus, Drobnic and García (2013) consider that a game that is related to neuroeducation is chess because it develops attention, memory, concentration, creativity or reasoning through the actions carried out in its practice.
Nutrition	Blakemore and Frith (2007) mention nutrition as a possible improvement for student brain functioning. Through proper nutrition, concentration and memory are favored. This happens because the brain, in four-fifths, is water so not being hydrated makes it difficult to be concentrated or pay attention and, consequently, their learning. For this reason, Pozo (2012) points out the importance of increasing omega 3 as well as improving diet and habits from an early age for the academic performance and wellbeing of children.
Memory	According to Howard (2011), learning is synonymous with memory, so the relationship between memory and recall must be present at all times in education. Codina (2014), in this way, explains that working memory must be encouraged in the classroom so that previous knowledge can be related to the new knowledge acquired. To this end, he mentions a series of techniques or strategies such as: - Working on similarities and differences. - Brainstorming. - Establishing debates. - Relating learning to the sensory aspect to achieve significant learning, - Using visual resources that promote the understanding of the contents, among others.

Attention	Through attention, students can receive stimuli, so fostering it in the classroom helps to create new knowledge. Taylor et al. (1999) consider that the presence of attention in the classroom depends mainly on the interest and motivation that learning can cause in students, so the teaching task, in this case, is very important and is defined: to try to teach through a methodological technique that causes students to pay attention to the explanation. Codina (2014) points out a series of strategies that facilitate the students' attention, such as the following: - Working through active methodologies or experiential learning. - Relating new knowledge to previous knowledge. - Encourage learning in movement. - Establish groups for cooperative work in the classroom.
Art	According to Wright (2006) those students who use music, writing or painting to communicate, cooperate, express their thoughts or resolve conflicts that may occur in the classroom, have a lower level of anxiety or stress so that their emotional problems are also diminished. In addition, Mora (2013) points out that the benefits of art in the classroom for students, among others, are: - Improved imagination. - Development of critical thinking. - Emotional activation. - Free expression of ideas.
Emotions	Jensen (2004) states that emotions are present throughout people's lives, so contributing to the development of skills related to emotional intelligence in the classroom, from an early age, should be positive for the student body. The identification of emotions or their control, as well as the expression of feelings, help students in their personal well-being and, consequently, the predisposition to learning is greater. In the classroom, emotions are increasingly being taken into account because, in addition to the fact that at a learning level it helps students, it also improves their integral development, which is one of the goals of the educational system today.

Note: Own elaboration.

Method

The methodology used in the elaboration of this study is based on the information gathered from the scale (Annex 1) passed to students in the fourth year of the Primary Education degree. Through the information collected, it is suggested to analyze the data obtained through quantitative techniques and statistical analysis, which allowed the design of descriptive analysis, all based on the information extracted from the results obtained. Therefore, the research intends to make a descriptive correlational analysis on the information obtained from the future teachers in order to have an approximate knowledge about the knowledge that future teachers have at the end of their career, who are mainly responsible for providing our society with certain values and knowledge to understand the world that surrounds them today.

Instruments and procedures

In order to carry out this work, we used a scale for the collection of information. Once created, based on an operationalization table, according to the research objectives, we proceeded to a content validity, with expert judgment and pilot test, which was positive.

Results

Through a descriptive analysis of the items considered and the most relevant information provided, the results are presented below. First, as shown in Table 4, it can be seen that a high percentage of the sample strongly agrees with this item, that is, they are of the opinion that future teachers have knowledge of the concept of reading.

Table 4.
Ítem A1.

A1.- Primary school teachers are aware of the concept of reading.				
	Frequency	Percentage	Valid percentage	Cumulative percentage

Valid	,00	9	3,0	3,0	3,0
	Disagreement	15	5,1	5,1	8,1
	Indifferent	55	18,6	18,6	26,7
	Agree	169	57,1	57,1	83,8
	Strongly agree	48	16,2	16,2	100,0
	Total	296	100,0	100,0	

Note: Own elaboration.

As Table 4 ratifies, most of the future teachers are in the histogram curve in the central part, thus attributing that the concept of reading is related to the knowledge that the teachers have. As can be seen, 57.1% agree with the statement, while 5.1% disagree. It is also important to note that 18.6% of the sample is indifferent to the proposed question, which could give rise to two currents, the first being their disagreement with the formulation of the statement or, on the other hand, their lack of knowledge about the term or its relation to their profession.

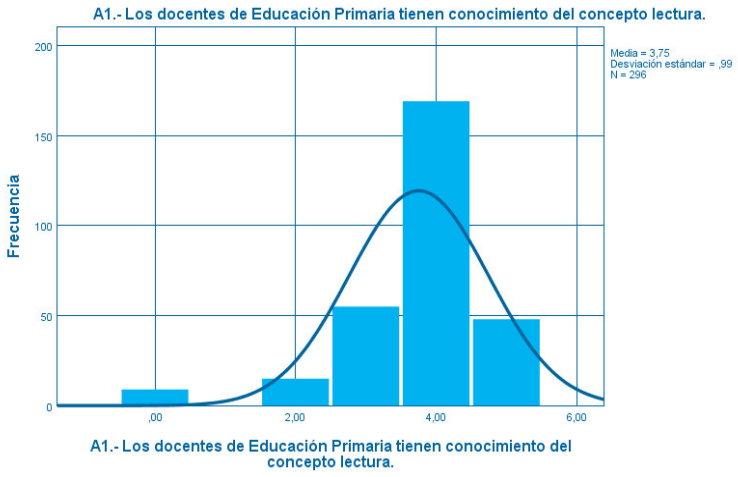

Figure 1. Item A1.

Note: Own elaboration

As can be seen in Table 5, the percentage of people who disagree and are indifferent to this item is similar, we have 41.9% of the sample that considers this item indifferent, so it can be deduced that the vast majority do not know how to differentiate between reading delay and dyslexia, and on the contrary we see 41.2% who totally disagree, implying that they do know how to differentiate between these needs.

Table 5.

Item B8.

B8.- Primary school teachers differentiate reading delay from dyslexia.					
		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	,00	9	3,0	3,0	3,0
	Strongly disagree	15	5,1	5,1	8,1
	Disagree	122	41,2	41,2	49,3
	Indifferent	124	41,9	41,9	91,2
	Agreed	26	8,8	8,8	100,0
	Total	296	100,0	100,0	

Note: Own elaboration.

Figure 2, corresponding to Table 5, shows quite clearly what has been explained above. In the central area we find a great similarity between the percentages, since most of the responses are concentrated in the central part of the histogram, drawing a large inverted U, leaving the extremes with very low scores, which can be said that in this case an item has been raised with great relevance, taking into account that future teachers should have knowledge about it so that in the classrooms of current educational centers they can find this reality, know how to detect it in time and warn the professional.

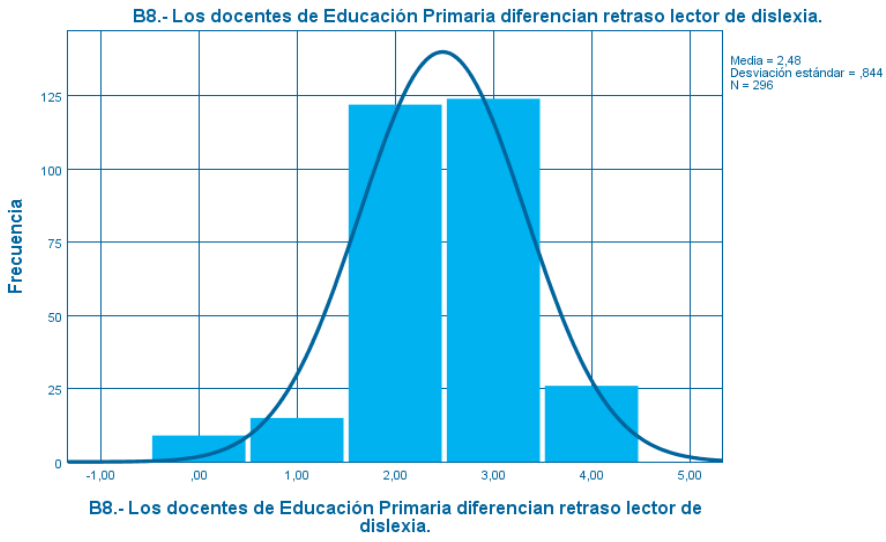

Figure 2. Item B8.

Note: Own elaboration

Continuing with the proposed items, Table 6 shows a great reality in our society, which is trying to evolve in a more favorable way towards coexistence among equals (school and daily), so that all people feel educated and treated equally, whether or not they present functional diversity or any special educational need, since integration does not mean the same as educational inclusion. Observing the table, it can be seen that the highest percentage is concentrated in the disagreement option, corresponding to 37.2%, it can be concluded that the way of seeing and living education is changing and is being transmitted from the universities, which have a great influence on the future teachers who will be arriving at our schools.

Table 6.
Iem C12.

C12.- Integration is equivalent to educational inclusion.					
		Frecuencia	Porcentaje	Porcentaje válido	Porcentaje acumulado
Valid	,00	9	3,0	3,0	3,0
	Strongly disagree	45	15,2	15,2	18,2
	Disagreement	110	37,2	37,2	55,4
	Indifferent	73	24,7	24,7	80,1
	Agreed	37	12,5	12,5	92,6
	Strongly agree	22	7,4	7,4	100,0
	Total	296	100,0	100,0	

Note: Own elaboration.

To complete the information offered by table 6, the histogram corresponding to figure 3 is shown, where the response obtained by students who are finishing Primary Education, who know how to differentiate between these two terms, can be better appreciated. The option of disagreement (37.2%) stands out considerably in comparison with the rest of the responses, thus highlighting the work of university teachers who are bringing about the change that the great majority of current schools are carrying out.

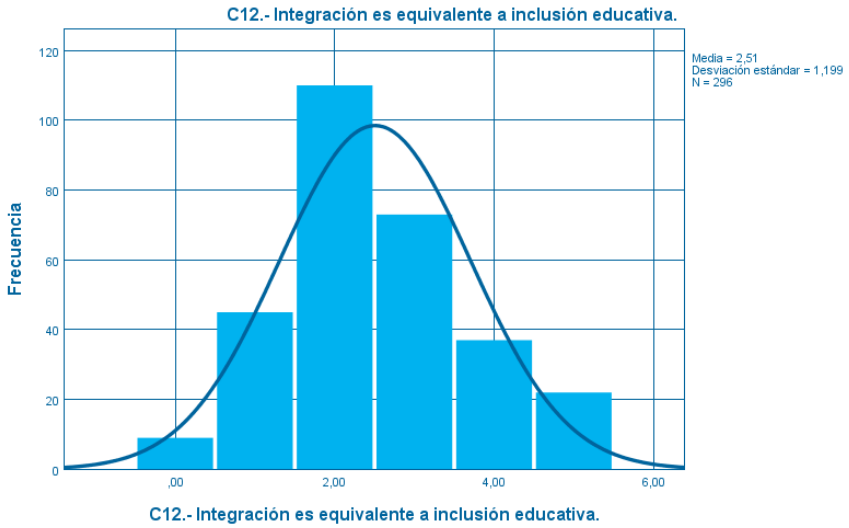

Figure 3. Item C12.

Note: Own elaboration

As can be seen in Table 7, approximately 43% of the sample strongly agrees with this item, so they consider that neuroeducation is the study of the brain and its application to the educational context contributes positively to the teaching and learning process in the classroom, since, through neuroeducation, educational and psychological aspects are combined in order to achieve a teaching and learning process that favors the entire student body at an integral level.

Table 7.
Item D17.

D17.- Neuroeducation is the study of the brain and its application to the educational context.

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	,00	9	3,0	3,0	3,0
	Strongly disagree	11	3,7	3,7	6,8
	Indifferent	95	32,1	32,1	38,9
	Agreed	55	18,6	18,6	57,4

Strongly agree	126	42,6	42,6	100,0
Total	296	100,0	100,0	

Note. Own elaboration.

Next, with respect to Figure 4 corresponding in this case to another item analyzed in the scale where it is stated that Primary Education teachers have knowledge of the brain areas involved in reading, the highest percentage observed in the answers corresponds to disagree and is 40%, therefore we conclude that throughout the four years that make up the studies of this grade they do not end up knowing which are the functions of the brain areas involved in reading. As can be seen, the bell-shaped histogram in Figure 4 is accentuated from the central area of the histogram, where the great majority disagrees.

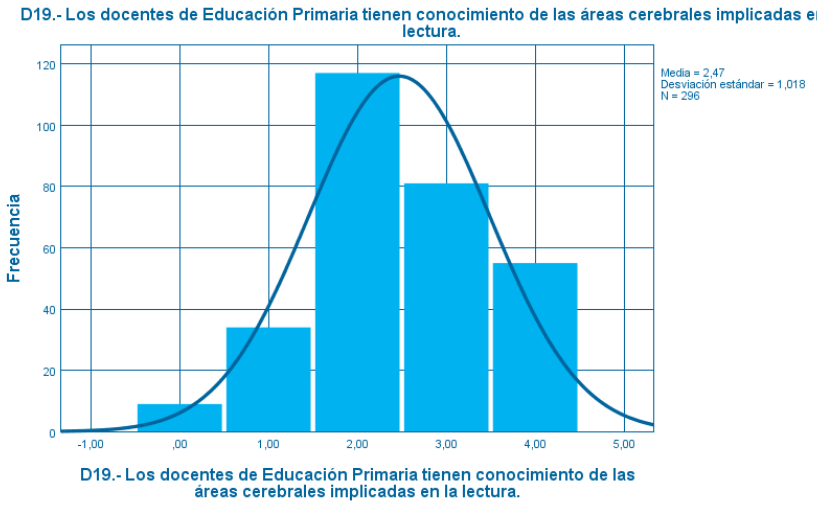

Figure 4. Item D 19.

Note: Own elaboration

Neurodidactics tries to find a field based on research that allows to know a way to teach through neuroscience from a more effective vision for students, as well as to promote their educational performance. In addition, through neurodidactics, brain, attention, memory and emotions are combined in such a way that the potential of the student is improved, as well as the level of significant learning acquired. Observing the results of Table 8 and taking into account the above definition, we see that the students have a slight knowledge of this dimension, 37.2% of the sample agreeing with the proposed statement, although on the contrary we can highlight that the response of indifferent also has a high percentage with 32.1%, which shows that another part of the students do not know well how to work with neurodidactics in their classrooms and the benefits that can be obtained from it.

Table 8.

Item E22.

E22.- La neurodidáctica es la aplicación de las bases neurológicas en los procesos de enseñanza aprendizaje.		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	,00	9	3,0	3,0	3,0
	Disagreement	11	3,7	3,7	6,8
	Indifferent	95	32,1	32,1	38,9
	Agreed	110	37,2	37,2	76,0
	Strongly agree	71	24,0	24,0	100,0
	Total	296	100,0	100,0	

Note. Own elaboration.

Continuing, with respect to Figure 5, we can see how the majority of the sample considers that reading teaching methods should be based on neurodidactic elements, with a clear distribution of the data on the right side of the histogram. This result offers hope, since it can be assumed that future teachers will be more prepared or more predisposed to training in different areas in order to provide quality teaching in the classroom. We see specifically how the mean is high and a very low standard deviation considering that the great majority understands this statement as positive.

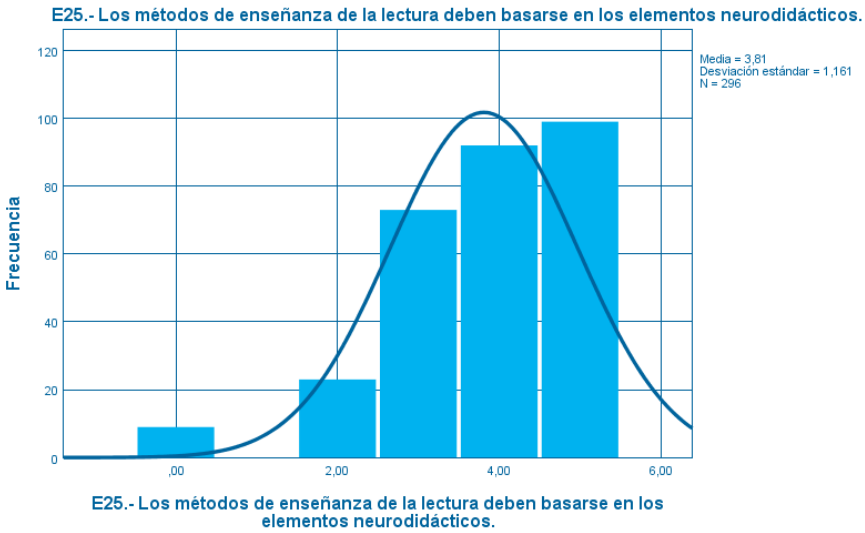

Figure 5. Item E25.

Note: Own elaboration.

To conclude, it has been considered convenient to show the results obtained with respect to the non-parametric analysis that has been elaborated with respect to the dimensions that have been dealt with throughout the research (reading, reading difficulties, educational inclusion, neurodidactics and neuroeducation).

Parametric test

This is a hypothesis test that does not require that the distribution of the population be characterized by certain parameters. For example, many hypothesis tests assume that the population is normally distributed using the parameters μ y. Non-normative tests do not make this assumption, so they are useful when the data are significantly out of the ordinary and are robust to variability. In this case the kolmogorov-Smirnov test has been used, which highlights that for this sample the null hypothesis must be rejected, so the distribution of the data is not normal, and therefore the correlation below is Spearman's Rho correlation.

Table 9.
Non-parametric correlations

Correlations

			A.-READING	B.-READING DIFFICULTIES	C.--EDUCATIONAL INCLUSION	D.-NEUROEDUCATION	E.-NEURODIDACTICS
Spearman's Rho	A.-READING	Correlation coefficient	1,000	,206**	,023	,143*	,017
		Sig. (bilateral)	.	,000	,695	,014	,765
		N	296	296	296	296	296
	B.-READING DIFFICULTIES	Correlation coefficient	,206**	1,000	,609**	,607**	,596**

		Sig. (bilateral)	,000	.	,000	,000	,000
		N	296	296	296	296	296
	C.- EDUCATIONAL INCLUSION	Correlation coefficient	,023	,609**	1,000	,610**	,738**
		Sig. (bilateral)	,695	,000	.	,000	,000
		N	296	296	296	296	296
	D.- NEUROEDUCATION	Correlation coefficient	,143*	,607**	,610**	1,000	,655**
		Sig. (bilateral)	,014	,000	,000	.	,000
		N	296	296	296	296	296
	E.- NEURODIDACTICS	Correlation coefficient	,017	,596**	,738**	,655**	1,000
		Sig. (bilateral)	,765	,000	,000	,000	.
		N	296	296	296	296	296

**. Correlation is significant at the 0.01 level (bilateral).
*. The correlation is significant at the 0.05 level (bilateral).
Note. Table used for the correlation study. Own elaboration.

The correlations that exist between the five dimensions investigated will be presented below, specifying the correlation coefficient between them.

- Dimension A correlates with B: with respect to dimension A which corresponds to reading and dimension B which corresponds to reading difficulties, we can see that Spearman's coefficient gives a result of 0.206.

- Dimension B correlates with C: taking into account the dimensions corresponding to B (reading difficulties) and C (educational inclusion) we observe a Spearman coefficient of 0.609, which indicates a positive range.
- Dimension C correlates with E: the dimensions concerned in this correlation are C (educational inclusion) and E (neurodidactics) where a Spearman coefficient of 0.738 is observed.
- Dimension D correlates with E: these two dimensions present a correlation with a Spearman coefficient of 0.655, which means a very positive and strong correlation, since it is very close to the value 1.
- Dimension E correlates with C: among the correlations that exist between these two dimensions, as in the previous correlation, it can be seen that the value presented (0.738) is very strong and positive.

Discussion and conclusions

To conclude this document, it is necessary to write this section in order to offer a more complete and general view of the research carried out with respect to the Likert scale and Spearman's correlation, as well as the dimensions chosen to shape and articulate this final thesis. Continuing, it is possible to observe some more general conclusions that make a review of the main points of the present work. In the first place, regarding the conceptualization and theoretical frameworks that have made up the present work, it has been made clear how a concept as standardized as reading can give a 360º turn if we apply neuroeducation and neurodidactics when teaching it to our students, being supported by different authors mentioned in each of the theoretical frameworks carried out. On the other hand, during the documentation it was possible to appreciate how the terms as a whole are on the one hand known and worked on as is the example of reading, reading difficulties and educational inclusion, but at the same time a little invisible or little researched as far as the field of neuroeducation and neurodidactics is concerned. Therefore, it was interesting to propose a scale to be answered by the future teachers and to observe the knowledge they had on the different issues raised throughout their entire training. Secondly, the results obtained show how certain teachers have knowledge and a great predisposition to make a great effort to change the current educational system, which will bring a revolution in the coming generations, providing society with more culture, values and education in general. Therefore, we know that teachers who are being prepared receive this type of information, but some questions that underlie this would be, do they know how to apply or use this information? So, this is a small beginning that summarizes a point of view about the training that our teachers receive. Finally and thirdly to add that teaching is a very sacrificial job if one wants to influence in a positive way the coming generations, making them reach a more inclusive, respectful and generous way of life with the people who share the society. We also want to make teachers aware of the need to keep on training themselves, since society is constantly changing and there is a growing need for competent people who know how to approach any problem from different perspectives and get the maximum performance and benefit both from their work and from the development of the people they work with. In addition, neurodidactics combines brain, attention, memory and reading in Primary Education.

For his part, Ocampo (2019) states that through the presence of neurodidactics and thanks to the brain plasticity of students, it is possible, through a dynamic didactic intervention, to focus learning to various educational branches where emotions. According to Ibarrola (2013), would have a great importance in terms of the learning climate, the mood with which both students and teachers face their work or the motivation for teaching.

In conclusion, all educational networks are connected to each other and it would be wonderful to create a work environment where all this information is taken into account, put into practice and create together a more understandable world.

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ANNEX I

READING DIFFICULTIES IN PRIMARY EDUCATION.

SEX: **AGE:** **COURSE:**

The dimensions to be evaluated are the following: A) Reading; B) Reading difficulties; C) Educational Inclusion; D) Neuroeducation; E) Neurodidactics.

Mark with a cross the alternative that most closely matches your personal criteria.

Thank you.

	Strongly disagree	Disagree	Indifferent	Agreed	Strongly agree
A1.- Are primary school teachers aware of the concept of reading?	1	2	3	4	5
A2.- Do primary school teachers know the types of reading (visual, syllabic...)?	1	2	3	4	5
A3.- The reading didactic methodology used in educational centers has a scientific basis.	1	2	3	4	5
A4.- Reading in Primary Education is an inclusive element.	1	2	3	4	5
A5.-The primary education teacher must have neuroeducational training for the teaching of reading.	1	2	3	4	5
B6.- Primary education teachers are knowledgeable about reading delay.	1	2	3	4	5
B7.- Primary Education teachers have knowledge about Dyslexia.	1	2	3	4	5
B8.- Do primary school teachers differentiate reading delay from dyslexia?	1	2	3	4	5
B9.- Reading difficulties affect educational inclusion.	1	2	3	4	5
B10.- Reading difficulties are solved with neuroeducational training.	1	2	3	4	5
B11.- The solution to reading difficulties lies in neurodidactics.	1	2	3	4	5

C12.-Integration is equivalent to educational inclusion.	1	2	3	4	5
C13.- Educational inclusion involves fostering inclusive values and attitudes. .	1	2	3	4	5
C14.- Educational inclusion is facilitated by reading.	1	2	3	4	5
C15.- Educational inclusion needs a neuroeducational basis.	1	2	3	4	5
C16.- Neurodidactics is the key to educational inclusion.	1	2	3	4	5
D17.- Neuroeducation is the study of the brain and its application to the educational context.	1	2	3	4	5
D18.- Neuroeducational-based reading acquires a scientific character.	1	2	3	4	5
D19.- Primary school teachers are aware of the brain areas involved in reading.	1	2	3	4	5
D20.- Primary school teachers have knowledge of neurotransmitters in reading.	1	2	3	4	5
D21.- Primary school teachers are aware of the influence of mirror neurons in reading..	1	2	3	4	5
E22.- Neurodidactics is the application of neurological bases in teaching and learning processes.	1	2	3	4	5
E23.- Primary school teachers are familiar with the neural network of learning to read.	1	2	3	4	5
E24.- The didactic methodology of reading must have a neural basis.	1	2	3	4	5
E25.- Reading teaching methods should be based on neurodidactic elements.	1	2	3	4	5

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APPS AND ASD: NEUROEDUCATIONAL CONCEPTUAL BASES FOR QUALITY INCLUSION

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Abastract. This article aims to create neuroeducational conceptual bases in the applications that exist for ASD, thus promoting quality inclusion. To do this, a theoretical tour is carried out through the bibliographic review of articles related to ASD and focussed on the different neurosciences of education, such as Neuroeducation, Neuropedagogy and Neurodidactics. Applications of both educational and general interest useful for people with Autism Spectrum Disorder are also provided as they help develop skills in a playful way, which perhaps in a more traditional way would not be as effective. In this research, the collection of information has been used, mainly in students of the University of Jaén, through the Likert scale. With the help of the collection of these data, an analysis of the information obtained is carried out, through quantitative techniques and statistical analysis, which facilitated the descriptive explanatory design shown later, based on the data extracted from the results obtained. By thoroughly analysing these data, we can conclude that the majority of respondents believe that teachers should base, both education and the applications created for the educational field and for inclusion, on neuroscience to impart more significantly the contents established in the curriculum.

Key words: Autism Spectrum Disorder, APP, inclusion, neuroeducation, neurodidactics.

APPS Y TEA: BASES CONCEPTUALES NEUROEDUCATIVAS PARA UNA INCLUSIÓN DE CALIDAD

Resumen. Con este artículo se pretende crear unas bases conceptuales neuroeducativas en las aplicaciones que existen para TEA, fomentando así una inclusión de calidad. Para ello se lleva a cabo un recorrido teórico por la revisión bibliográfica tanto de artículos relacionados con el TEA como enfocados en las diferentes neurociencias de la educación, tales como la Neuroeducación, Neuropedagogía y la Neurodidáctica. También se proporcionan aplicaciones de interés tanto educativo como general útiles para personas con el Trastorno del Espectro Autista ya que ayudan a desarrollar habilidades de manera lúdica, que quizás de una manera más tradicional no sería tan efectivo. En esta investigación se ha utilizado la recogida de información, principalmente en alumnos de la

Universidad de Jaén, a través de la escala Likert. Con la ayuda de la recopilación de estos datos se procede a realizar un análisis de la información obtenida, por medio de técnicas cuantitativas y análisis estadístico, la cual facilitó el diseño explicativo descriptivo que se muestra posteriormente, basándose en los datos extraídos a partir de los resultados obtenidos. Al analizar exhaustivamente estos datos, podemos llegar a la conclusión, que la mayoría de encuestados opinan que los docentes deben basar, tanto la educación como las aplicaciones creadas para el ámbito educativo y para la inclusión, en la neurociencia para impartir de manera más significativa los contenidos establecidos en el currículum.

Palabras clave: Trastorno del Espectro Autista, APP, inclusión, neuroeducación, neurodidáctica.

Introduction

The creation of this article has the purpose of creating a neurological conceptual basis, considering that, in the educational field, especially in ASD and in the applications for this, there is a lack of research of this type. The main objective of the research is to analyze the current situation of the Autism Spectrum Disorder and the applications that exist for it, focusing on showing the current situation in the field of ASD, identifying the relationship between applications and ASD, outlining the most relevant aspects of educational inclusion, explaining neuroeducation in the current context and presenting neurodidactics in the current educational system, having as final product of the TFG the construction of an APP for ASD with neuroeducational and neurodidactic basis.
In regard to the theoretical justification, this research has five chapters. The first chapter, ASD, the second chapter, APP and ASD, the third chapter, Inclusion and the fourth, Neuroeducation and the fifth and last chapter, Neurodidactics.

ASD

Nowadays, in order to understand the Autism Spectrum Disorder and the people person with autism it as we know it, many investigations and researchers have taken place so that it can be considered a disorder and not a mental illness like schizophrenia. The best known authors in this field are Kanner and Asperger, but there are many other authors who have researched Autism much earlier. These authors did not know that the research they were doing was about this disorder, such as Johanes Mathesius who described what appeared to be an autistic child with a very serious diagnosis in the 15th century and Dr. Jean Itard with the controversial case of Victor of Aveyron, although it is not known for sure if these cases were of autistic boys and girls (Quiroz et al., 2018).

Until 1911, with Paul Eugen, the word autism was not formalized in medical science, but it was in 1943 with Kanner and his writing "Autistic disturbances of affective contact", when the basis of what we currently consider to be Autism Spectrum Disorder was established. Kanner established the first key characteristics to distinguish autistic children from other diseases and disorders, such as a great lack of communication with their environment and the people who compose it, an inability of language, which could be mutism and lack of

communicative intention, but the most important was the strong obsession to maintain their environment in an established and routine way, without suffering any change. But Kanner's greatest contribution to autism, which was alleged in later research, was the claim that it was not a mental illness like schizophrenia, but a neurodevelopmental disorder (Artigas & Paula, 2017).

In accordance with Kanner's advances, Asperger began to investigate this disorder, conferring the following characteristics that he could observe in patients with an autistic diagnosis: low empathy, naivety, limited ability to have and make friends among their peers, pedantic and repetitive speech, lack of verbal and non-verbal communicative gestures, great inclination for issues and topics of interest to the subject, and poor motor coordination. However, his studies were not very successful, considering that his articles and research were written in the German language, so Asperger's contributions and research to the field of autism spectrum disorder were not considered until Lorna Wing translated them into English, considering that it was already a very common language at that time and that most researchers had access to it (Herrera, 2021).

To centralize, collect and organize the different existing disorders, the WHO created a manual, which has been modified according to the new contributions that were published, known as DSM (Diagnostic and Statistical Manual of Mental Disorders). In Autism Spectrum Disorder, the most radical change since the DSM-I, was that in the DSM-IV the different categories that compose it were specified: Autistic Disorder, Pervasive Developmental Disorder Not Otherwise Specified, Rett syndrome, Childhood Disintegrative Disorder and Asperger's Syndrome. Another major change was the reduction of the criteria that diagnose autism from sixteen to six criteria, grouping the characteristics for a better diagnosis. The last and current modification was in the DSM-V in which it was renamed as we know it now, Autism Spectrum Disorder or ASD and the removal of Rett Disorder from this group because it is a genetic disease that has characteristics similar to those of ASD, but is not part of it (Artigas & Paula 2012).

The characteristics that make us deduce that the person with Autism Spectrum Disorder are focused on two branches, the subject has problems with language both expressive and communicative that significantly influences their social interactions and their preferences and activities are very limited, so it also significantly affects their actions. Some more concrete behaviors that we can quickly and clearly identify are; the child does not have satisfactory expressions from six months of age, does not respond to these from nine months and from twelve months is not able to perform or respond to social behaviors such as indicating or saying hello with the hand. The child is unable to babble in the first year of age, from sixteen months of age does not say simple words and is unable to elaborate and pronounce short and spontaneous sentences by the time he reaches two years of age. In general, any action that leads to a loss of language or social skills is a sign of a possible ASD diagnosis (Bonilla & Chaskel, 2016).

In 2013, with the DSM-V, the current types or categories that constitute the Autism Spectrum Disorder were established, which are; Autistic Disorder, Asperger's Disorder, Childhood Disintegrative Disorder and Pervasive Developmental Disorder Not Otherwise Specified (Garcia et al, 2019). According to Fernandez (2016) autism spectrum disorder can also be distinguished and diagnosed by these grades:

- Autistic Disorder - first degree, is the most severe degree that we can find within this classification and its most outstanding characteristics are the absence in the progress of language, limited social skills leading the subject to isolate himself, repetitive and stereotyped actions and inability to maintain eye contact with other people (Fernandez, 2016).

- Regressive Autism - second degree, it is called regressive due to the deprivation of skills already acquired by the subject, it is the most common at the moment and its most outstanding characteristics are deprivation of language, play, verbal and nonverbal communication, social interaction and manifestation of reiterative attitudes and isolation (Fernandez, 2016).

- High Functioning Autism - third grade, in this grade the first characteristics are confused with another type of disorder such as attention deficit as a result of the fact that in the beginning of autism they do not appear in a serious way and its most significant characteristics are a great complication to interact with their environment despite acquiring a common language, established attitudes and behaviors that lead to obsessive behaviors, they have an almost common learning although with motor difficulties and mental inflexibility but great memory skills and inconvenient to externalize their emotions (Fernandez, 2016).

- High Functioning Autism - third grade, in this grade the first characteristics are confused with another type of disorder such as attention deficit. This occurs because the first characteristics of this autism are more subtle. The most significant signs are a great complication in the interaction with their environment in spite of handling a common language, and established attitudes and behaviors that lead to obsessive behaviors. They have an almost common learning although with motor difficulties and mental inflexibility, great memoristic skills and difficulty in externalizing their emotions (Fernández, 2016).

APP and ASD

For people with ASD, the development of efficient applications is a key aid to develop competencies such as social interactions with the environment and people around them, cognitive and communicative skills, and to stimulate an adequate physical and emotional development. In ICTs generated for people with any type of autistic disorder, there are different types of applications aimed at promoting, developing or facilitating different skills or situations, whether communication, leisure or planning (Cuestan and Abella, 2012). Some of them are:

- TIC-TAC: It is an application for electronic devices intended to facilitate the understanding and use of the abstraction of the meaning of time in those people who have perceptual and/or sensory problems (Pensosi and Villamía, 2012).
- Personal Guide: It is an application for electronic devices aimed at facilitating the communication of individuals with ASD (Cuestan and Abella, 2012).
- Virtual reality: It is a resource that subjects the person to a simulation of an everyday activity, in this case the buying and selling in a supermarket (Sebastian, 2004).
- ARASAAC: It is a website that has a wide range of augmentative and alternative systems of communication both in graphic symbol systems (photographs, drawings, pictograms, words or letters) and gestural (mimicry, gestures or manual signs) (Martín and Teruel, 2017).

In the educational field, applications have also been implemented to improve the social and school development of individuals with ASD. For these applications to be functional and useful in the field of ASD, they must have a series of factors that help to understand and manage them. According to Sanromá, Lázaro and Gisbert (2017) they should be easy and intuitive to use, avoiding factors that lead to distractions, as well as incorporating visual reinforcement. The sections or activities should be well defined and have a wide range of customization to adapt as much as possible to each person and optimize the use of the application. Motivational factors can also be used in case of errors and successes to maintain the user's interest.

Educational applications for education can be divided depending on the skills or abilities we want to improve; vocabulary, communication and language, body self-awareness, emotional education and imagination and/or social skills. This range of applications can be worked in synchronization or individually, since we can use the applications depending on the skills we want to develop in the subject. Some of the most used applications, according to Bonilla and Galván, (2019) are:

- "Iba planet pro" and "I-lexis hd ml" to work on vocabulary expansion and improvement.
- "Peapo" and "Vizzle" to work on language and communication improvement.
- "Somantics" and "Discovering my body" to improve self-concept and body awareness.
- "Expressive Face" to develop and improve imagination and emotional intelligence.
- "FaceTime" and "Osmo" to develop and improve social skills we could use.

Neuroeducation

To better understand what neuroeducation is, we must first understand what neuroscience is and what it studies. Neuroscience is a set of sciences whose subject of study is the nervous system and the brain, focusing mainly on how brain activity is connected to behavior and learning. Neuroscience aims to understand how the brain produces the individuality of human action (Kandel, Schwartz & Jessell, 1997).

Another of the most relevant concepts in neuroscience is learning, which could be defined, according to Meza (2014) as a constructive cognitive process, which focuses its activities on achieving the main objective, learning. Neurons are responsible for the learning process, since brain cells are permanently connected. This is sustained by the connectivity of different areas of the brain, creating new connections between brain cells and then reinforcing them through repetition (Yucra, 2016).

Although the anatomy and function of the brain is the same for all individuals, they are all different, since each person's brain is unique and incomparable. The brain is capable of learning from different learning styles, such as visual, auditory, linguistic or logical; and from different methods, since the brain can develop different types of intelligences because, according to Gardner (1983), there are different types and intelligences that are interrelated but do not affect each other.

The brain is capable of learning through patterns and, at the same time, teaches itself thanks to its plasticity. For this process to be more effective, the right genetic and environmental conditions must be in place to facilitate learning. The brain has an indeterminate and flexible capacity to retain the data and knowledge it acquires through the subject's experiences. Because the brain learns gradually, it is important that knowledge is presented from the simplest to the most complex so that the data are stored in a meaningful way and last longer (Campos, 2010).

With these definitions and characteristics clear, it is congruent to say that neuroscience research can contribute to a better understanding of the processes and mechanisms that students use to learn knowledge and, therefore, help teachers to teach more effectively, adaptively and meaningfully (Geake 2002).

Some of the elements that are part of the learning processes according to Martin, et al (2021) are; awareness, where we work with skills such as success-oriented motivation, attitudes of formation, maintenance and change, control of emotions, attention, where global attention, divided attention, sustained attention, selective attention and meta-attention are reinforced, acquisition of information, where we work with skills such as selection, repetition, organization and elaboration, personalization where skills such as creativity, critical thinking and self-regulation are developed, information recovery through directed search, random search, trace and selection or evocation system, high level transfer and low level transfer, and initial, final, normative, criterial, product or process evaluation.

Neuroeducation studies how to improve the teaching-learning process so that students acquire knowledge in a meaningful way, how students communicate with their peers and teachers and interact socially in the educational environment, based on the processes and knowledge provided by neuroscience (Mora, 2014).

In any pedagogical framework, the teaching-learning process involves a series of cognitive, social, emotional, moral and physical competencies that the subject's brain learns and

improves as it develops. Bearing in mind that this development takes place mainly at school, it is essential for teachers to know what the brain is like, how it learns, processes, registers, retains and remembers information, in order to create didactic units in accordance with the needs of the students, so that they learn knowledge in a simpler and more meaningful way. It is also important to highlight the plasticity of the brain to learn and adapt to different situations. The effect that the teacher has on the students' brains when developing activities, talking and acting with the students is key in the development of these competencies (Campos, 2010).

One of the most relevant characteristics of the brain is its plasticity, which according to Pascual (1996), is the ability of the brain to adapt its neural networks to reduce disturbances caused by external or internal circumstances. Another characteristic of brain plasticity (Larbán, 2012) is to understand how the environment affects and transforms the constitution of the brain. The brain has greater plasticity when the subject is developing, thanks to the effectiveness of the dual sensory and motor pathways and the continuous new experiences faced in their daily life, which forces the neural networks to learn and adapt to them (Aguilar, 2003).

Among the brain capacities we find mirror neurons. Larbán (2012) comments that these are visuomotor neurons that are activated when the person does some activity or movement or sees another individual carrying out such movement or activity regardless of whether or not the subject develops a motor reaction, in other words, these neurons are not only activated by his own movements, but also when perceiving the actions of others. These mirror neurons are closely related to imitation, empathy and theory of mind and imitation, which are key to the development of a subject's communicative and social abilities with other individuals in a community. Neural systems also have a key and conclusive quality for the human being to produce the ability to imitate others, that is, thanks to the ability to encrypt the movements carried out while performing an activity (Sanchez, 2021).

Empathy allows us to understand the emotional actions of others, but for this we need to be aware that other people have experiences, which makes empathy cognitive as well as experiential and affective. This is linked not only to verbal language, but also to non-verbal language, body movements, facial features, past experiences, experiences with the person and the context in which they are in that situation, etc. (Piemontesi, 2010).

The theory of mind is the ability of a subject to understand the people with whom he/she shares a society, for this the individual needs to identify that both the person himself/herself and those around him/her have a mind and with it they think and feel, as opposed to immaterial things. Once this process is completed, the brain of the subject must be able to understand or assume something about the actions, thoughts and feelings of others in various experiences and situations. The person will act, assume and feel in the face of various situations and problems. The theory of mind develops in children in the age range between three, four and five years, depending on each one (Piemontesi, 2010).

Electroencephalographic research has confirmed that individuals with ASD have their mirror neurons activated when they perform their own movements or actions, but these neurons do not react when other people perform these movements and actions. This dysfunction creates deficits in other skills related to theory of mind, mirror neurons, empathy and imitation, which consequently creates difficulties in the progress of basic skills such as cognitive, social and communicative skills (Larbán, 2012).

Neurodidactics

Neuroeducation and neurodidactics are related, as both are based on brain studies provided by neuroscience research to improve teaching-learning processes, although there are differences. As we have already mentioned, neuroeducation helps teachers to know what the brain is like and how it works in order to improve the uptake of new knowledge by students (Mora, 2013). And neurodidactics relates neurosciences with didactics, which according to Barriga (2009), is a group of practices dedicated to improving the action of teachers in teaching-learning processes and understanding educational reform projects in order to optimize them.

Neurodidactics is a discipline that is within neuropedagogy, which is a science that is dedicated like other neurosciences to the study of the brain, this is understood as an organ both biological and social, which has the ability to be altered by the teaching-learning processes in a practical, experiential and playful components, not mechanized. Neuropedagogy is one of the neurosciences that not only studies the language and learning of the brain, but also communicates its findings to make the necessary modifications for neurodidactics to carry out a teaching process adapted to the abilities and skills of each subject (Tomar, Franco & Zapata, 2019).

It is consistent to define neurodidactics as a multimodal science, which studies how to enhance learning through the capacities and processes of the brain. It uses Activity Theory to explain the importance of active student practice in the teaching and learning process, since, for this to happen, changes in neural networks must arise. Active, practical and reiterative participation facilitates the production of synapses, which have the function of linking and transmitting information between neurons, causing this information to remain longer than the neurons that are not so used by the subject, which end up being reduced or eliminated, and, therefore, the information that was in these (Morales, 2018).

Campusano (2006) attributes that thanks to the new active and ludic learning programs provided by neurodidactics, teachers can learn more about the capacities and faculties in which each of their students develop better and, therefore, use them for a more meaningful and individualized learning. Neurodidactics tries to prevent teachers from teaching through continuous repetition, abusing learning by mechanized memory, since, when acquiring knowledge without understanding it before, neurons reinforce precisely that incomplete information by being activated repeatedly each time the data is repeated, due to which it is

increasingly complex to direct those neural networks that have been consolidated through repetition. This exchange of knowledge in which it is the professional who has the information, either of a specific topic or more extensive topics, which the receiver lacks, is called the teaching-learning process (Chuca, 2017).

As we have already mentioned above, neuropedagogy and, therefore, neurodidactics are influenced by both cognitive and social bases, which is why a determining factor in the teaching-learning process, are emotions. Emotions are physiological responses that occur adaptively for the survival of the person to different situations or stimuli experienced by a subject when he/she notices objects, people, places or moments and essential memories that prevent them to carry out a reaction provoked by that impulse. Emotions are controlled by the limbic system, in which the amygdala is located, in charge of examining the stimuli received, if those are positive the information is stored in the brain and, therefore, learning occurs, but, on the contrary, if they are negative or there are threatening situations or feelings the amygdala blocks that information, consequently, it eliminates the possibility of learning (Benavidez & Flores 2019).

The objective of neurodidactics is to facilitate proposals, including different ways that adapt to the specific needs of students such as music, art, technology, etc., applying knowledge about the brain and learning processes, through the theory of activity, that is, creating quality synapses through interactions between neuronal interconnections that help the acquired knowledge to be significantly established in the brain of the subject, favoring an inclusive education in classrooms and educational centers (Paniagua, 2013).

Neurodidactics is useful in the adaptation of its didactic teaching-learning proposals based on the knowledge of the brain and the emotions of the subject according to the specific attention needed by the students and through this facilitate an inclusive development (Fernández, 2017).

To carry out these methodologies, the teacher needs neurodidactic tools to replace the traditional and mechanized memory tools. These are defined as those pedagogical means and tools used by a teacher to transmit meaningful knowledge and help with the teaching-learning process. Teaching tools have increased in recent times, due to the different learning styles used by teachers and new research on the multiple intelligences of students. It does not matter what type of tool it is as long as the teacher knows how to use it with the correct planning, execution, orientation, instructions and approach to capture the attention, motivate and promote the aptitudes and abilities of the subject, taking into account the specific needs, the objective set and the knowledge that the teacher wants the students to acquire. Some positive factors of using neurodidactic tools in the classroom are; the development of creative and critical thinking to face the problems presented, solve problems, promote communication, collaboration and search, management, selection and elimination of information and facilitate the process of learning to learn and decision making by students, among others (Vera, 2021).

Method

Design

The methodology used to carry out this study was through the collection of information, mainly from students of the University of Jaén, using the Likert scale. With the help of this data collection, an investigation of the information obtained was carried out by means of quantitative techniques and statistical analysis, which facilitated the descriptive explanatory design shown below, based on the data extracted from the results obtained.

Results

Descriptive analysis

The results obtained from a descriptive analysis of the most relevant information obtained in the tests will be presented below.

Most graphs have a negative asymmetry, which means that the data are clustered on the left side of the histogram curve with respect to the mean. We are also faced with a platykurtic kurtosis, since the pointing of the frequency distribution, with respect to the normal distribution curve, has coefficient less than 0, that is, they are not clustered around the mean. Some graphs are:

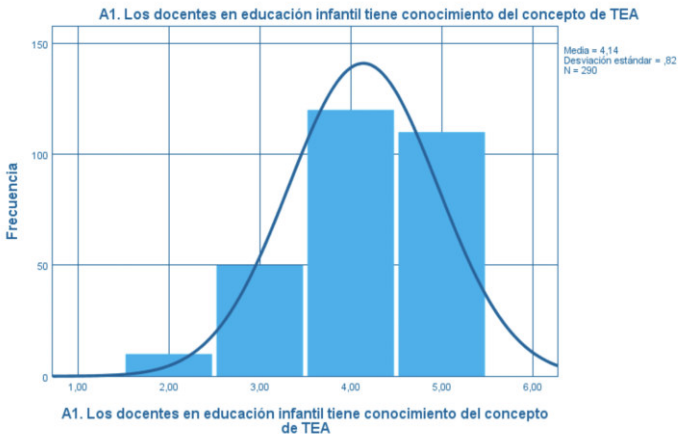

Figure 1. A1 of emotional intelligence.
Note: Own elaboration

In Figure 2, we can observe that the majority of subjects agree that early childhood education teachers know about autistic disorder, since the mean is 4.20. We would be faced with a negative asymmetric graph, considering that the data are grouped on the left side of the histogram curve with respect to the mean. We are also faced with a platykurtic kurtosis, since

the pointing of the frequency distribution, with respect to the normal distribution curve, has a coefficient less than 0, i.e., it is not grouped around the mean.

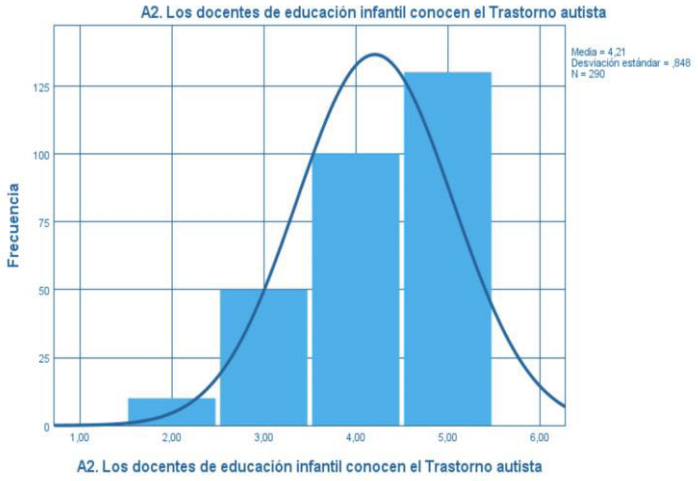

Figure 2. A2.
Note: Own elaboration

We can see in Figure 3 that the majority of subjects agree that teachers in early childhood education know about Asperger's Disorder, since the mean is 3.86. It is a negative asymmetry graph, due to the fact that the mean is on the left side of the histogram curve, and a leptokurtic kurtosis, considering that the pointing of the frequency distribution, with respect to the normal distribution curve, has coefficient greater than 0, that is, they are grouped around the mean.

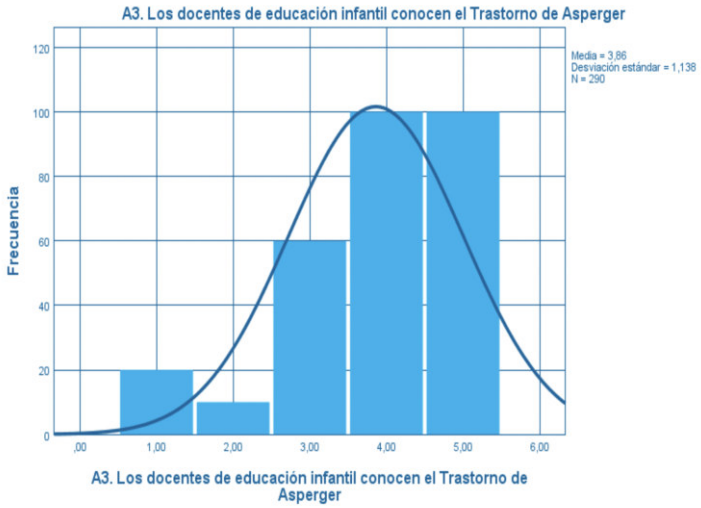

Figure 3. A3.
Note: Own elaboration

We find in Figure 4, that the majority of subjects show indifference to the knowledge of early childhood education teachers about Childhood Disintegrative Disorder, since the mean is 2.72. The graph is positively asymmetric, the data are clustered on the right side of the histogram curve with respect to the mean. We also have a platykurtic kurtosis, taking into

account that the pointing of the frequency distribution, with respect to the normal distribution curve, has a coefficient of less than 0, that is, it is not grouped around the mean.

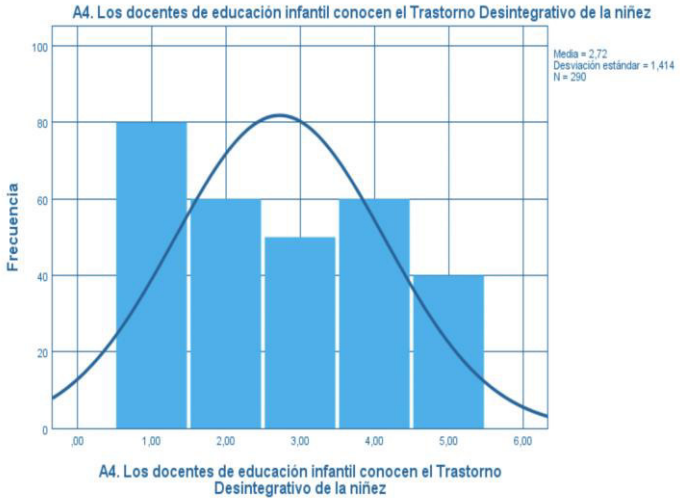

Figure 4. A4.
Note: Own elaboration

In Figure 5, we can see that it is a negative asymmetric plot, considering that the data are grouped on the left side of the histogram curve with respect to the mean. A platykurtic kurtosis is also observed, since the pointing of the frequency distribution, with respect to the normal distribution curve, has coefficient less than 0, that is, they are not grouped around the mean. The majority of subjects show indifference to the knowledge of early childhood education teachers about Pervasive Developmental Disorder Not Otherwise Specified, since the mean is 2.97.

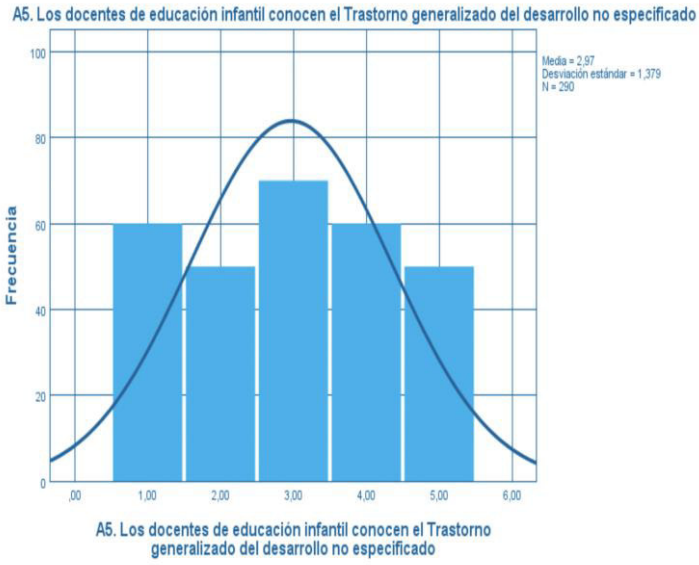

Figure 5. A5.
Note: Own elaboration

Non-parametric analysis

In this research we have used a single sample, so we will apply Kolmogorov-Smirnov, which has a significance of 0.50. The result shows that we should reject the null hypothesis, so the data distribution is not normal, and we will adopt Spearman's Rho correlation.

P/Rho correlation analysis

We can observe some of these correlations have a double correlation, for example, B7 correlates with B8 and B8 correlates in turn with B7, this also happens with the correlations B10>B11 and B11>B10; D17>D18 and D18>D17 and D19>D20 and D20>D19.

- B7>B8 (.934), this means that those who think that teachers in early childhood education are aware of PPPs for Autism Spectrum Disorder also think that early childhood education teachers are aware of the types of APPs that exist for Autism Spectrum Disorder (ASD).
- B8>B7 (.934), this means that those who are of the opinion that teachers in early childhood education are aware of the types of APPs required for Autism Spectrum Disorder (ASD) are also of the opinion that teachers in early childhood education are aware of the APPs for Autism Spectrum Disorder.
- B10>B11 (.795) this means that those who believe that the APPs we have in early childhood education have an inclusive element in the classroom also believe that the APPs in autism have neuroeducational components.
- B11>B10 (.795) this means that those who believe that APPs in autism have neuroeducational components also believe that the APPs we have in early childhood education have an inclusive element in the classroom.
- D17>D18 (.598) this means that those who believe that neuroeducation is the study of the brain and its application in the educational context also believe that APPs with a neuroeducational basis acquire a scientific character.
- D18>D17 (.598) meaning that those who believe that neuroeducationally based APPs are scientifically based also believe that neuroeducation is the study of the brain and its application in the educational context.
- D19>D20 (.890) this means that those who are of the opinion that teachers have knowledge of the brain areas involved in APPs are also of the opinion that teachers have knowledge of the influence of neurotransmitters in APPs.
- D20>D19 (.890) means that those who think that teachers have knowledge of the influence of neurotransmitters on APPs also think that teachers have knowledge of the brain areas involved in APPs.

Discussion and conclusions

To finalize and conclude this article on the conceptual neuroeducational bases for a quality inclusion in applications and Autism Spectrum Disorder, it is necessary to give a personal and general point of view of this including all the points that have been approached, the theoretical framework, where the necessary information is found to be able to carry out the subsequent research, and the methodological framework where the results of this research are found.

Regarding the theoretical framework, the main objective was to define and conceptualize the importance of the neurosciences of education such as neuroeducation, neuropedagogy and neurodidactics, as a basis to be used by both teachers and institutions when implementing the educational curriculum. In addition, the importance of neuroscience in educational inclusion, in this case, in students with Autism Spectrum Disorder, is proven, considering that thanks to these data we know how the brain of these children is and therefore, we can adapt learning to their specific needs both in the classroom and at home.

In the methodological framework we have proceeded to explain the design of this research and the specific and general objectives, which in this case we can say have been met, since we have analyzed the historical and current situation of ASD, identified the relationship between APP and ASD, we have exposed the most relevant aspects of inclusion, explained neuroeducation in the current context and neurodidactics in the current education system and as a final product we have built an App for ASD with neuroeducational and neurodidactic basis. When analyzing the results, the graphs in the appendix were examined in detail, studying their symmetry, kurtosis and the mean of each one of them. The results obtained show that the majority of respondents are of the opinion that neuroscience in education is of vital importance both for inclusive APPs and for teaching the contents established in the curriculum.

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THE BURNOUT SYNDROME AND ITS EMPLOYMENT IMPACT AMONG PROFESSIONALS IN SPEECH THERAPY AND OTHER HEALTH DISCIPLINES: A DESCRIPTIVE STUDY

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Abastract. Burnout syndrome is the result of a situation of chronic work stress, which occurs over a long period of time and compromises the physical and emotional health of workers. Health professionals are the group that suffers the greatest risk from these conditions. The objective of the present study was based on knowing the prevalence of burnout syndrome in a sample made up of health professionals who are working in a multidisciplinary team, although with greater attention to speech therapy language. Methos: A descriptive cross-sectional methodology is proposed, carried out by a group of 60 health professionals, who are working in the Autonomous Community of Madrid and Castilla-La Mancha. As measurement instruments, the Maslach Burnout Inventory (MBI) questionnaire and an ad-hoc. Results: Show the prevalence of burnout was low, although they presented changes in mood and stress at work. In addition, some significant relationships were discovered between the subscales of emotional exhaustion and personal fulfillment through the MBI questionnaire, when professionals suffer changes in mood and work stress. There were significant differences between the speech therapists in support and labor protection and in the performance of tasks. On the other hand, the non-speech therapists showed significant differences in that the work situation with their team caused them stress, in active listening and the therapeutic bond with the patient. Discussion: We have found the prevalence of burnout was low and significant differences between the speech therapists and non-speech therapists.

Keywords: Burnout syndrome, health professionals, speech therapist, stress.

SÍNDROME DE BURNOUT Y SU IMPACTO LABORAL ENTRE LOS PROFESIONALES DE LA LOGOPEDIA Y OTRAS DISCIPLINAS SANITARIAS: UN ESTUDIO DESCRIPTIVO

Resumen. El síndrome de burnout es el resultado de una situación de estrés laboral crónico, que compromete la salud física y emocional de los trabajadores siendo los profesionales sanitarios quienes más lo sufren. El objetivo del presente estudio es conocer la prevalencia del síndrome de burnout en una muestra de profesionales sanitarios que trabajan en un equipo multidisciplinar, prestando mayor atención a los logopedas. Método: Se propone una metodología descriptiva de corte transversal, realizada en un grupo de 60 profesionales sanitarios, de la Comunidad Autónoma de Madrid y de Castilla-La Mancha. Se utilizó el cuestionario Maslach Burnout Inventory (MBI) y un cuestionario elaborado ad-hoc. Resultados: Los resultados muestran que la prevalencia de burnout fue escasa, si bien, aparecen cambios en el estado de ánimo y estrés en el trabajo con diferencias estadísticamente significativas en las subescalas de cansancio emocional y realización personal a través del MBI, cuando los profesionales sufren cambios en el estado de ánimo y estrés laboral. En cuanto al tipo de profesional los logopedas mostraron puntuaciones elevadas en apoyo y protección laboral y en la organización del tiempo. En cambio, los no logopedas, mostraron mejores puntuaciones en estrés en el trabajo, en la escucha activa y el vínculo terapéutico con el paciente. Discusión: Encontramos escaso burnout con importantes diferencias entre logopedas y no logopedas.

Palabras clave: Síndrome de burnout, profesionales sanitarios, logopedas, estrés.

Introduction

Burnout syndrome, also called "professional burnout" or "burnout syndrome", has been described as a set of medical-biological and psychosocial symptoms in the person after having used a large amount of energy in the work area causing chronic stress that leads the professional to a negative attitude towards those with whom he or she works (García-Campayo et al, 2016; Maslach & Jackson, 1982).

Burnout syndrome is originated by multiple causes, although most studies classify three types of variables that develop this condition: personal, social or environmental and organizational factors (Ademir et al., 2019; García-Campayo et al., 2016; Párraga et al., 2018).

Burnout syndrome presents certain symptoms in the person who suffers from it and in the organization where he/she performs his/her work, such as physical-biological (cardiovascular alterations, sleep disturbances, muscle pain, chronic fatigue, etc), emotional and cognitive (irascible attitudes, behavioral changes, etc) and effects in the workplace (increased absenteeism, higher costs, lack of energy, social conflicts, etc) (García-Campayo et al., 2016; Maslach and Leiter, 2016; Párraga et al., 2018).

Among all these symptoms, those that appear with a higher frequency are those associated with inattention (45%), effects developed by tiredness or fatigue (17.8%), and with a higher prevalence of feelings of stress (51%) (European Agency for Safety and Health at Work, 2013; Gil-Monte, 2009). Likewise, large percentages appear in manifestations related to muscular pain, behavioral changes and addictions in the consumption of toxic substances or psychotropic drugs (Gil-Monte, 2009).

These severe consequences have led to an increase in the rate of absenteeism and sick leave (7.5%), costing companies up to 8 billion euros (Alba, 2009). For this reason, the World Health Organization has come to consider it as an occupational risk (WHO, 2000), as it has detrimental effects on mental health and quality of life of people.

In relation to prevalence, it affects between 4% and 30.5% of the population in the European Union (García-Campayo et al., 2016). These large statistics point to those people who contain high social demands, belong to care or helping occupations and present direct contact with other people, being the jobs that tend to show a higher risk of burnout those related to human services, education, public administrations (Lastovkova, et al., 2018) and health professionals, the latter being the group considered as one of the most susceptible to suffer from this syndrome (Barragán et al., 2015 García-Campayo et al., 2016).

In Spain, the prevalence of burnout is 15% (Grau et al., 2009), which has led to a greater interest in studying this type of contingency (Regal, 2016). In this sense, different risk groups have been investigated, where health professionals such as doctors and nurses and especially primary care professionals have been considered as one of the most susceptible to suffer this syndrome (Bakhamis et al., 2019; Barragán et al., 2015 García-Campayo et al., 2016; Vilà-Falgueras et al., 2014). However, other health specialists also show prevalence of this syndrome, such as physiotherapists (González-Sánchez et al., 2017; Rogan et al., 2019; Serrano, Garcés, & Hidalgo, 2008), psychologists (Berjot et al., 2017), occupational therapists (Brown & Pshniak, 2018; Poulsen et al., 2012) and speech therapists (Bruschini et al., 2018; Kasbi et al., 2018; Ewen et al., 2020), among other groups. Specifically in the last group, among speech therapy professionals, the data suggest that they present a mild-moderate level of burnout (Bruschini et al., 2018; Kasbi et al., 2018), finding that the trigger of burnout was correlated with work demands, lack of control at work and less professional support (Ewen et al., 2020).

As a result, numerous instruments have emerged to analyze the prevalence of burnout syndrome, the most recognized and used being the Maslach Burnout Inventory (MBI) by Maslach & Jackson (1986), which is based on a three-dimensional model characterized by emotional exhaustion (EQ), depersonalization (PD) and reduced personal fulfillment (PR).

Therefore, the aim of this study is to determine the prevalence of burnout syndrome in a sample of health professionals working in a multidisciplinary team with special attention to the figure of speech therapists based on the Maslach Burnout Inventory (Maslach & Jackson, 1986).

Method

Design

The present research study on the prevalence of burnout syndrome among healthcare professionals was designed as a cross-sectional, descriptive and observational epidemiological study.

Participants

The participants were chosen by non-probabilistic sampling from the Autonomous Community of Madrid and Castilla-La Mancha. The following inclusion criteria were taken into account: health care workers who are working in a multidisciplinary team and are currently working.

This study included a total of 60 professionals out of all those to whom the questionnaire was sent, who were about 80 people from a total of 6 clinical centers. Of these, 76.7% (N=46) were women and 23.3% (N=14) were men, ranging in age from 23 to 63 years (M=30.33 and SD= 8.10 years). Regarding their marital status, 50 % (N=30) were single, 31.7 % (N=19) had a partner and 18.4 % (N=11) were married, divorced or separated. In addition, 18.3% (N=11) reported having a child/children, compared to 81.7% (N=49) who did not, and it was analyzed that most of the participants live with their family, more specifically 48.3% (N=29); 36.7% (N=22) with their partner and 15% (N=9) alone or in another situation.

The characteristics of the sample according to level of studies, university centers attended, year of graduation and payment for their studies are summarized in Table 1.

Finally, of this group of participants, 71.6% (N=43) worked in private entities, 13.3% (N=8) in associations, 11.7% (N=7) in hospitals and 3.3% (N=2) in nursing homes.

Table 1.

Frequency distribution of the sample by level of studies, university centers attended, year of graduation and the cost of their studies.

	N= 60	
	N	**%**
Level of studies		
Speech Therapy Degree	46	76,7
Other Degrees (Physiotherapists, Nurses, Doctors, Psychologists, Occupational Therapists)	14	23,3
University teaching centers		
University of Castilla-La Mancha	44	73,3
Other university teaching centers	16	26,7
Year of graduation		
1980-2009	12	20
2010-2019	48	80
Were you able to pay for your studies?		
Yes	24	40
No	36	60

Instruments

The present research work on the prevalence of burnout syndrome among professionals.

Two instruments were used to collect information. First, an ad hoc questionnaire made up of 70 open and closed multiple-choice or dichotomous questions, which assesses sociodemographic characteristics and different work-related factors. Specifically, the items are made up of several questions, each of which can be classified into seven categories. The first of these is to find out the sociodemographic characteristics of the participants with 13 questions; the second is about the worker's health with 8 questions; the third about his or her work situation with 3 questions; the fourth about the worker's degree of satisfaction by means of 12 numerical scales (1 being not at all or a little and 10 quite a lot or a lot); the fifth has 15 questions on the characteristics of the current job and economic level; the sixth category has 11 Likert-type questions on the quality of the worker's well-being at work (1 being disagree and 4 totally agree); and the seventh presents 8 numerical scales on the evaluation of the characteristics of a service center (1 being a little or not at all important and 10 being very or quite important).

Secondly, the Maslach Burnout Inventory (MBI) questionnaire by Maslach & Jackson (1986) was used in its validated version in Spanish (Seisdedos, 1987). It is designed to assess burnout syndrome by evaluating the frequency with which each of the situations described in the items occurs. The items are divided into three dimensions or subscales: emotional exhaustion, depersonalization and personal fulfillment. It consists of 22 items made up of affirmative statements about the emotions and attitudes felt by the worker towards his/her work situation. The answers are given on a Likert-type scale with scores from 0 (never) to 6 (every day). Each construct or subscale is composed of a number of items:

- The emotional exhaustion/tiredness subscale is composed of 9 items (1, 2, 3, 6, 8, 13, 14, 16 and 20) that measure feelings of emotional overload (which may expose physical or psychological consequences). The maximum score is 54 points.
- The depersonalization subscale is designed by 5 items (5, 10, 11, 15 and 22) and values those negative feelings or behaviors towards the patient. The maximum score is 30 points.
- The self-realization subscale is composed of 8 items (4, 7, 9, 12, 17, 18, 19 and 21) and measures feelings of competence and achievement (related to negative aspects that a person has about himself/herself, such as depression, low commitment, lack of motivation, lack of work relationships, among others). The maximum score is 48 points.

For the analysis of the items and to determine burnout levels, the normative criteria of Gil-Monte and Peiró (2000) were used. High scores on the subscale of emotional exhaustion/personal exhaustion and depersonalization, and low scores on personal accomplishment would indicate the presence of this syndrome. Specifically, the total score of this standardized questionnaire is divided into three thirds, the high level meaning a diagnosis

of burnout, the intermediate level meaning a tendency to burnout and the low level meaning no risk of suffering from this syndrome.

- When scores equal to or higher than 25 are obtained in emotional exhaustion, a high level is determined, between 16-24 an intermediate level and less than 15 a low level.
- In depersonalization, when scores equal to or higher than 9 are obtained, it is a high level, between 4-8 an intermediate level and less than 3 a low level.
- When scores of 0-35 are determined in personal realization, it would be a low level, between 36-39 an intermediate level and more than 40 a high level.

Procedure

This study obtained ethical approval and supervision (Code: 19/2020) by the Ethics and Clinical Research Committee (CEIC) of the Gerencia de Atención Integrada de Talavera de la Reina (Toledo).

The design of the "ad hoc" questionnaire was evaluated by a panel of experts (Cabero and Llorente, 2013) composed of health professionals and university teachers of the Speech Therapy Degree. Taking into account the suggestions for improvement made by the expert committee, various changes were made to the formulation, order and the admission of new questions, as well as eliminating other questions.

In addition, a pilot test was carried out with a group of 12 people, some of whom were teaching, others were studying speech therapy and the rest were not involved in this discipline. The objective of this procedure was based on the assessment that each of the definitive items of the questionnaire were understood, to estimate the average time for answering them and to determine the feasibility of the data analysis.

Once the "ad hoc" questionnaire was completed, it was designed online, using the Google Forms format. This platform is a free Google application for any user, where all kinds of information can be collected and structured, each of the answers can be received in an ephemeral way, and, in addition, it offers the opportunity for the interviewer to formulate or modify the questions of the questionnaire through different designs (check boxes, multiple choice, short answer, linear scale, detachable lists, etc.). The system even ensures that responses can be made from any type of electronic device, organized and analyzed using different graphs, and saved in an online spreadsheet.

All participants had to agree to the study by means of an informed consent form included in the cover letter. This showed the reason for the study and the objectives to be achieved along with the Organic Law 3/2018, on the protection of personal data and guarantee of digital rights.

With regard to its diffusion, email was used in order to contact those centers that were located in the Autonomous Community of Madrid and Castilla-La Mancha. In order to get in touch with this type of centers, a search was carried out through Internet browsing, as well as taking into account those entities known by people in the environment. In this way, an e-mail message was sent explaining the reason for the present investigation together with the link generated by the Google questionnaire platform to a total of 6 speech therapy clinics and/or

multidisciplinary centers, reaching a total of 80 people who were working in one of the speech therapy centers or in a multidisciplinary center. However, the final sample was 60 people. The link generated by the Google questionnaire platform was open and active on the on-line platform from April 27 to May 9, 2020.

Statistical analysis

After data collection, analysis was performed using IBM® SPSS® Statistics 22.0 software. Thus, simple frequency parameters, measures of central tendency (mean and median) and standard deviations were used for the analysis. Likewise, the nonparametric Mann-Whitney test, which is the nonparametric test parallel to the t-test for independent samples, was performed for this analysis. The confidence level of .05 was taken into account for all statistical analyses. In addition, descriptive and frequency distribution (mainly means and standard deviations) and Chi-square tests of independence were used.

Results

Worker health

The results obtained in relation to worker health can be found in Table 2. One of the most relevant data indicates that 71.7% (N=43) have manifested changes in their mood in recent years.

Table 2.

Distribution of frequencies in the questions on worker health.

		N=60	
		N	**%**
Sleeping hours	5 a 7 hours	29	48,3
	8 a 9 hours	31	51,7
Good eating habits	Yes	38	63,3
	No	4	6,7
	Maybe	18	30
Physical/sports activity	Yes	39	65
	No	21	35
Presence of illness	Yes	11	18,3
	No	49	81,7
Medical treatment	Yes	14	23,3
	No	46	76,7
What type of treatment?			
	Hormonal	5	8,3
	Anxiety	1	1,7
	Cholesterol	2	3,3
		4	6,7

	Headache and migraines	1	1,7
	Intestinal inflammations	1	1,7
	Covid-19		
Psychological/psychiatric treatment	Sí	4	6,7
	No	56	93,3
Changes in mood in recent years	Sí	43	71,7
	No	17	28,3

Work situation

With respect to the 3 questions in this category, it was found that 51.7% (N=31) of the population felt that they were subjected to a lot of stress in the workplace, compared to 48.3% (N=29) who did not experience stress. It is also found that they have suffered few incidents at work, since 11.7% (N=7) have or have suffered them and 88.3% (N=53) responded that they have not. And, in their workplace, they are generally offered medical check-ups for occupational hazards (65% (N=39) compared to 35% (N=21) who are not.

Degree of worker satisfaction

Table 3 below shows the degree of satisfaction of the workers in their work and the development of their job performance, as well as the statistically significant differences according to the type of professional (speech therapist vs. non- speech therapist)..

Table 3.

Distribution of descriptive statistics in the questions on the degree of worker satisfaction. Statistically significant relationships and mean ranges.

	Max. Val	Min Val	Median	SD	*p*	Speech therapist (mid-range)	Non speech therapist (mid-range)
Your Job	2	10	6,45	2,58	* 0,032	31,90	21,29
Remuneration	1	10	5,07	2,73	* 0,033	31,90	21,29
Commitment	1	10	6,95	2,83	* 0,014	32,24	19,00
Involvement	1	10	7,23	2,81	* 0,010	32,36	18,54
Autonomy	2	10	6,85	2,60			
Stability	1	10	6,35	2,89	* 0,033	31,90	21,19
Physical well-being	2	10	6,35	2,89			
Mental well-being	1	10	5,65	2,63			

Work condition	1	10	5,62	2,73	* 0,014	32,25	18,95
Relationship with the team	2	10	7,15	2,73	* 0,010	32,37	18,50
Communication	2	10	6,67	2,6	* 0,050	31,70	21,08
Coordination	2	10	6,32	2,65			

Characteristics of the current job and economic level

The results of the fifth category of the ad hoc questionnaire on the characteristics of the current job and economic level are shown in the following tables (Tables 4 and 5).

Table 4.

Distribution of frequencies in the questions on the characteristics of the job position.

		N=60	
		N	**%**
Socioeconomic status	Bad	3	5
	Regular	26	43,3
	Good	31	51,7
Shift	Morning	9	15
	Afternoon	25	41,7
	Evening	0	0
	Split	26	43,3
Type of attendance	Hospital	7	11,7
	Clinic	43	71,7
	Home Care	7	11,7
	Other	3	5
Your working day	Weekly/Daily/Continuous	39	65
	Split	18	30
	Shifts	3	5
Type of contract	Indefinite	33	55
	Service/Training	15	25
	Interim/Partial	7	11,7
	Temporary/Relay	5	8,3
Do you combine this job with any other job?	Yes	24	40
	No	36	60
Please specify:	Clinic/Home care	9	15
	Teaching/Research	4	6,7
	Hospital	1	1,7
	Associations/School support	10	16,7
Patients you work with	Adults	7	11,7
	Children	21	35
	Both	32	53,3
Time from graduation to first contract or current contract	Days	8	13,3
	Months	34	56,7

	Years	18	30
How many hours is the facility where you work open?	5 to 11 hours	37	61,6
	12 to 24 hours	23	38,5
Vacations	Yes	57	95
	No	3	5

Table 5.

Distribution of descriptive statistics in the questions on job characteristics.

	Min. Val	**Max. Val**	**Median**	**SD**
Number of years working in your discipline	1	40	6,55	7,22
Years working in this center	1	36	4,37	5,44
Years you have been working	1	40	7,50	7,88
Number of hours the establishment is open	5	24	10,92	4,95

Table 6.

Distribution of descriptive statistics in the questions on the quality of employee well-being at work.

	Min. Val	**Max. Val**	**Median**	**SD**
Material Resources	1	4	2,63	0,893
- Facilities			2,58	0,869
- Materials			2,52	0,983
- Prevention			2,67	0,896
- Collaborators			2,78	0,825
Social environment	1	4	3	0,835
- Help			2,97	0,901
- Comfort			3	0,844
- Respect			3,12	0,761
- Appreciation			3,02	0,813
- Recognition			2,90	0,858

Professional and personal organization	1	4	2,33	1,084
- Organization			2,38	1,151
- Rhythm			2,65	1,071
- Form			2,58	1,109
- Monotonous			1,92	1,124
- Remuneration			2,03	1,104
- Conditions			2,47	0,947
Workplace demands	1	4	3,01	0,74
- Policy			3,08	0,743
- Ethics			3,03	0,780
- Approve			2,63	0,843
- Internalize standards			3,10	0,706
- Changes			3,03	0,663
- Protocol			3,13	0,769
- Tyme and rhythms			3,13	0,676
Labor practice	1	4	2,62	0,931
- Decision making			2,35	1,005
- Dialogue			2,13	0,982
- Updating			2,70	0,908
- Support/protection			2,80	0,860
- Participate			2,83	0,994
- Contact			2,85	0,880
- Management support			2,70	0,889
Perception of the workload	1	4	2,27	0,984
- End of workday			2,33	2
- Enough time			2,25	2
- Several tasks			2,82	3
- Excessive work			2,45	2
- Disrupt			2,03	2
- Irregular and unplanned			1,92	2
- Do not accumulate			2,22	2
- Home			1,88	1,50
- Overdue tasks			2,53	2,50
Professional's job perception	1	4	2,61	0,846
- Adequate			2,55	0,852
- Distributed			2,42	0,962
- Success			2,97	0,736
- Information			2,50	0,834
Worker psychosocial factors	1	4	2,86	0,856
- Satisfied				
- Secure			3,05	0,769
- Simple functions			3,03	0,736
- Confidence			2,17	0,785
- Comfortable and motivated			3,03	0,736
- Stimulating challenge			3	0,883
- Positive aspects			2,95	0,852
- Physical effects				

- Effects of wear and tear			3,25	0,751
- Mood			2,72	1,010
- Difficult situations			2,85	0,899
			2,62	1,043
			2,88	0,958
Communication and working relationship	1	4	2,86	0,792
- Correct			3,37	0,712
- Adequate treatment			3,28	0,585
- Team member			3,32	0,725
- Positive and comfortable			3,17	0,763
- Expressing opinions			2,92	0,907
- Stressful situation			1,85	0,899
- Collaboration			2,13	0,892
- Coordination			2,85	0,860
Professional rest	1	4	2,72	0,924
- Personal life/work			2,68	0,983
- Taking care of business			2,88	0,761
- Days off			3,30	0,962
- Family/friends/acquaintances			2,85	1,022
- Non-work issues			1,90	0,896
Bonding and therapeutic relationship	1	4	3,04	0,739
- Offering help			3,50	0,701
- Not going to work			2,07	0,972
- Appropriate attitude			2,95	0,790
- Trust is success			3,58	0,591
- No proper bonding			2,05	1,016
- Relationship is critical			3,70	0,591
- Not talking			2,70	0,944
- Proper treatment			3,57	0,563
- Family attitude			2,32	0,813
- Progress			3,10	0,630
- Therapeutic relationship			3,57	0,533
- Fulfillment of objectives			3,40	0,718
- Technical resources			2,63	0,901
- Responsibility			2,47	0,747
- Emotional bonding			2,65	0,899
- Active listening			3,65	0,577
- Express and be assertive			2,83	0,763
- Humble and authentic			3,33	0,729
- Attitudes and resources			3,47	0,623
- Limitations and referral			3,47	0,676

Assessment of the characteristics of a service center

The results obtained in the seventh category, regarding the characteristics that a service center should have, are shown in Table 7.

Table 7.
Distribution of descriptive statistics in the questions given on the characteristics of a service center.

	Min. Val	Max. Val	Median	SD
Quality of service	3	10	8,13	2,46
Economic profitability	2	10	7,13	2,418
Common good	3	10	7,88	2,38
Competitiveness	1	10	6,17	2,744
Labor quality	2	10	8	2,491
Productivity	3	10	7,57	2,324
Efficiency	3	10	7,90	2,334
Satisfaction of the people served	3	10	8,30	2,486

Maslach Burnout Inventory (MBI) Variables

To measure the prevalence of burnout syndrome in the sample, we offer, on the one hand, the descriptive results of the MBI questionnaire, and, on the other hand, the results according to the established cut-off scores (low, medium and high in each dimension).

The estimated reliability of this questionnaire was calculated according to Cronbach's alpha coefficient, being 0.71 for the entire scale (see Table 8).

Table 8.
Descriptive and reliability statistics of the MBI dimensions (CE, DP and RP) in the study sample.

Dimension	Min. Val	Max. Val	Median	SD	Cronbach's alpha
Emotional Fatigue (CE)	0	44	17,60	11, 84	0,883
Depersonalization (DP)	0	18	6,43	5,20	0,547
Personal Realization (RP)	0	48	36,05	9,50	0,846

Figure 1 shows the percentages of the sample in each of the dimensions of the questionnaire classified into three levels (low, medium and high), as well as the number of subjects in each of the percentages.

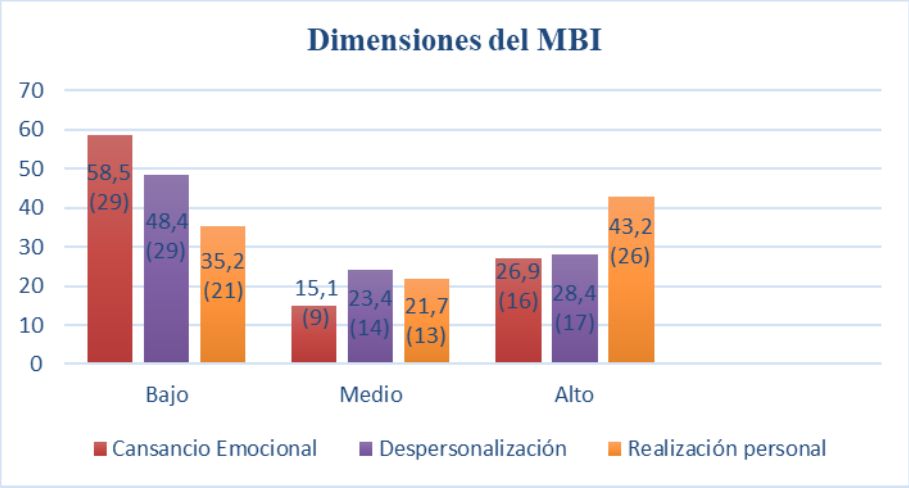

Figure 1. Percentage of professionals with low, medium and high levels of emotional exhaustion, depersonalization and personal fulfillment.

Note: Own elaboration

Therefore, if we take into account the recommendation that only high scores in the domains of fatigue and depersonalization and low scores in personal accomplishment allow us to consider the presence of Burnout Syndrome, we observe a low presence of this disorder. Likewise, as a whole, the results show that Burnout Syndrome exists in 15% (N= 9) as opposed to 85% (N= 51) who do not have it, as shown in Figure 2.

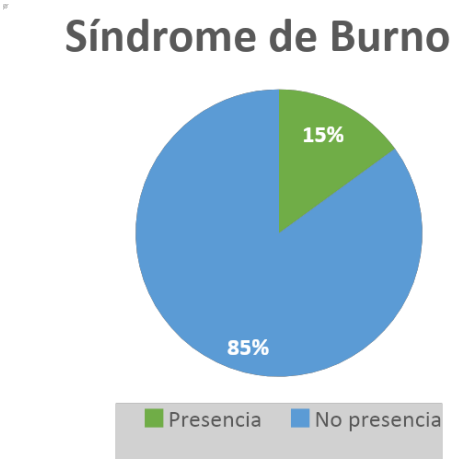

Figure 1. Burnout Syndrome

Note: Own elaboration.

Relationship between variables

Different statistical analyses were carried out between the variables studied in this work to find out the main sociodemographic and occupational factors that facilitate the appearance of Burnout Syndrome. Thus, it was found that statistically significant differences were found in the variable having suffered changes in mood in recent years, with mental well-being (χ^2 (2) =6.56; p≤0.037), with the MBI inventory score in emotional exhaustion (χ^2 (2) =14.47; p≤0.01), and in personal fulfillment (χ^2 (2) =6.04; p≤0.049). Thus, people who have undergone mood changes in recent years have higher mean ranks in emotional exhaustion and lower mean ranks in personal accomplishment and mental well-being compared to people who have not undergone mood changes in recent years.

The variable being subjected to stress at work, also showed statistically significant differences with mental well-being (Z: -2.173; p≤0.030), job status (Z: -2.096; p≤0.031) and the emotional exhaustion dimension of the MBI questionnaire (Z: -3.293; p≤0.001). Therefore, people under stress at work have lower scores in mental well-being and working conditions, and high scores in the emotional exhaustion category of the MBI questionnaire.

In the variable level of education of the participants (speech therapists vs. other professionals), statistically significant differences were found with some variables. For example, with having suffered changes in mood in recent years (Z: -2.159; p≤0.031), where professionals who are not speech therapists (physicians, nurses, physiotherapists, psychologists and occupational therapists) have suffered more changes in mood in recent years compared to speech therapists.

Also, being a speech therapist showed statistically significant differences with all the items of job satisfaction as shown in Table 3, so that speech therapists feel better satisfaction in all items compared to health workers from other disciplines (doctors, nurses, physiotherapists, psychologists and occupational therapists).

In addition, statistically significant differences occurred in some items on the perception that health care workers have of the quality of well-being at work. On the one hand, speech-language professionals versus the rest of the non-language professionals manifested higher mean ranks in "job support and protection" (Z: -2.482; p≤0.013) and in "not performing late tasks during weekends or vacations" (Z: -2.988; p≤0.003). On the other hand, non-language professionals (physicians, nurses, physiotherapists, psychologists and occupational therapists) compared to speech therapists had higher mean ranks in "working situation with equipment causes stress" (Z:-2.054; p≤0. 04), in "feeling that the patient's attitude is appropriate" (Z:-1988; p≤0.047), in "the importance of active listening during sessions" (Z:-1,910; p≤0.05), and in considering that "the therapeutic bond is an essential requirement for meeting therapy goals" (Z:-1,914; p≤0.05).

Finally, the sex variable only showed a statistically significant difference with having suffered "an occupational incident or occupational disease in the last year with subsequent sick leave" (Z: -2.231; $p \leq 0.026$), being more frequent among women compared to men.

Discussion and conclusions.

Starting with the results of our study, it is observed that, in the sociodemographic variables, there is a predominance of the female sex with respect to the male, data in line with other studies that reflect a growth in the female population among healthcare professionals (Gil-Monte et al., 2017; Instituto Nacional de Estadística, 2018, Liu et al., 2020; Masiero et al., 2018; Párraga et al., 2018; Portoghese et al., 2017). In addition, it is these, women compared to men, who have suffered more frequently some incident or occupational disease, which is similar to previous studies where differences by gender are shown, with greater serious accidents appearing in women as a result of displacements, temporary contracts, physical agents, etc., (Corrales-Herrero et al., 2015; García et al., 2016).

Regarding age, there is a large number of participants with ages ranging from 20 to 30 years, presenting a young population in the research, as noted in the report established by the National Institute of Statistics (2019), when referring to some health disciplines. The variable number of children and marital status, revealed a high percentage of subjects without children and who are single, a result similar to the statistics provided by the National Institute of Statistics (2018), reflecting that the population does not have children until at least 30-40 years old.

As for the type of professionals working in the centers studied, there is a greater number of speech therapists because they are centers with this profile, although there are also professionals who are performing their work in other health disciplines, such as Nursing, Medicine, Occupational Therapy, Psychology and Physiotherapy. This data highlights how interdisciplinarity is present in this study (Brown & Pashniak, 2018; Bruschini et al., 2018; Liu et al., 2020; Slocum et al., 2019), which would highlight the importance within the field of Speech Therapy of sharing knowledge with other professionals and carrying out a unified perspective in order to improve the quality of work, reach consensus on decisions from different points of view and better understand the patient's evolution (García-Campayo et al., 2016; Maestre et al., 2013).

The analysis of the data related to the worker's health reflects a good state of health, since there are good habits of sleep, food, physical exercise, however, 71.7% have revealed changes in their mood in recent years. These emotional variations, can have repercussions on the professional's work performance (Callaghan & Coldwell, 2014), even leading to the development of burnout syndrome (Beehr et al. 2010; Schonfeld et al., 2018). In this line, our data reflected how having suffered changes in mood in recent years was related to greater emotional exhaustion and lower scores in personal accomplishment measured with the MBI

questionnaire and even lower mental well-being. This data has been reported by García-Rivera et al. (2014), where it is confirmed that emotional affective states (depression, anxiety, stress, lack of motivation, etc.), apply directly to work, ensuring the appearance of work stress or affecting some of the dimensions defined in the MBI questionnaire. Moreover, it is the health professionals in this study (doctors, nurses, psychologists, physiotherapists and occupational therapists), compared to speech therapy professionals, who have experienced more changes in mood in recent years. Thus, this data reinforces that of other studies that show that professionals in Nursing, Medicine or other related disciplines, are those who suffer or have suffered more problems associated with emotional impacts that affect their mental health (Barragán et al., 2015 García-Campayo et al., 2016).

Regarding the situation at work, our data reflect that 51.7% present stress, so we can say that although the prevalence of this is medium, data similar to that of other authors (Bernaldo and Labrador, 2008), our figures are very different from those of research that suggest the high prevalence of work stress among healthcare workers in general (Bruschini et al., 2018; García-Rodríguez et al., 2015; Lastovkova et al., 2018). However, our data found how being subjected to stress at work appeared significantly related to lower mental well-being and working condition, as well as, higher percentages in the emotional exhaustion subscale of the MBI questionnaire. Thus, our results would support how the presence of stress at work has an impact on the appearance of greater emotional fatigue measured with the MBI scale, and lower scores in mental well-being and working conditions (Bernaldo and Labrador, 2008; García-Campayo et al., 2016).

Therefore, we can conclude that healthcare professionals who have suffered changes in mood in recent years or who suffer stress at work are more likely to suffer fatigue or emotional discomfort, which implies a major challenge for healthcare staff, as they suffer a greater psychological impact or burnout and this indiscreetly affects their quality of care (Ademir et al., 2019; González-Sánchez et al., 2017; Rogan et al., 2019). Therefore, it would be essential and desirable that organizations and workplaces help their workers to promote a set of coping strategies and/or personal, emotional and social support skills or even that entities offer prevention services to workers in order to safeguard their health and manage work-related stress by promoting suitable environments in which worker fatigue and mental discomfort are reduced (Gil-Monte, 2012).

Regarding the degree of employee satisfaction, our results show average scores for remuneration and working conditions, being these results similar to those obtained in other studies, since the participants state that the appreciation they have about their remuneration or socioeconomic situation and working conditions are not comparable with their performance and involvement (Yslado et al., 2019). However, on the contrary, notable scores are obtained in the items of involvement, relationship with the team and commitment. Thus, our data may reflect the importance of cooperative bonding, teamwork, social support, etc. These elements are key in increasing productivity, communication and commitment to work (Vilà-Falgueras et al., 2015). In addition, many of these items were significantly related among speech-language pathologists, so it seems that speech-language pathologists, feel more satisfied in their job

compared to the rest of the health professionals in this study. Similar results were found by Ewen et al. (2020) with speech therapy professionals.

Regarding the characteristics of the job, the diversity of contract types stands out, with a predominance of permanent contracts (Vilà-Falgueras et al., 2015); a high percentage of work performed in clinics (Brown & Pashniak, 2018); and generally good working conditions in terms of remuneration, vacation time, type of working day, etc. Some elements of the job, have been related to burnout syndrome and worker dissatisfaction, such as overwork due to the combination of several jobs, shiftiness (Barker & Nussbaum, 2011; Oliveira & Pereira, 2012), years of professional experience (Voltmer et al., 2013), type of workday (Matheson et al., 2014; Stimpfel, Brewer & Kovner, 2015) and time working in the same job (Sagripanti et al., 2012). However, our results found no significant relationships between job characteristics and the presence of burnout.

As for the quality of the worker's well-being at work, in general terms, high scores were found in quite a few sections. Thus, with respect to the bond and therapeutic relationship, the demands of the workplace, the social environment, psychosocial factors and communication, and the work relationship, the scores were high, which may lead us to think that the professionals present a quality relationship based on support, trust, satisfaction and security, these being important elements in the prevention of stress and in their well-being at work (De Lima et al., 2010). In addition, it can come to be considered an indicator of quality care when we refer to patients or relatives, and implies a good communicative development, bonding and where professionalism and ethics are very present (Leal-Costa et al., 2015). Likewise, high scores were found in the section on professional rest, so that among the participants in this research this aspect is well cared for, being again an indicator of protection, which favors work performance and even helps to manage stress (Chacón and Grau, 2014; García-Campayo et al., 2016). In addition, we highlight how in material resources, professionals determine their physical environment, facilities and material resources as adequate to provide quality services (Ghavidel et al., 2019).

Taking into account the type of health professional, it has been seen that speech-language pathologists have higher scores in the items "support and protection at work" and in "no need to take back work tasks in their vacation or weekend time" in comparison with the rest of the health professionals in the study. This result may suggest that speech-language pathologists feel supported in their workplaces and have better routines or habits for using free time as a break. So they manage to maintain a work organization in their day-to-day work and manage to achieve a work-life balance (Ewen et al., 2020; Bruschini et al., 2018). With these results, it could be considered that there are fewer situations that generate job burnout (García-Campayo et al., 2016), although future research is needed to further investigate this aspect. On the contrary, the healthcare professionals (nurses, physicians, psychologists, physiotherapists and occupational therapists) in our sample in comparison to the speech-language professionals have expressed high scores in the items "the work situation with my team causes me stress", interesting data since again it is observed how these workers in Nursing or Medicine are the ones who feel more job stress (Ademir et al., 2019; Barragán et al., 2015; Bakhamis et al., 2019; García-Campayo et al., 2016; Párraga et al., 2018; Vilà-Falgueras et al., 2014), although job

stress has also been seen in physiotherapists (González-Sánchez et al., 2017; Pavlakis et al., 2010; Rogan et al., 2019), occupational therapists (Edwards & Dirette, 2010; Brown & Pshniak, 2018; Poulsen et al., 2012) and psychologists (Berjot et al., 2017). Also, high scores have appeared among healthcare professionals (nurses, physicians, psychologists, physiotherapists and occupational therapists) in comparison with speech therapists on some elements associated with the bonding relationship such as "feeling that the patient's attitude is appropriate", "the importance of active listening during sessions" and "therapeutic bonding is an essential requirement to meet therapy goals". This difference may reflect the tradition of this collective regarding the therapist-patient relationship, as well as the importance that this issue has or has had in the good health care process and in the good practices associated with therapeutic actions (Floyd and Dago, 2014). This difference between non-language professionals and speech therapists is interesting, since in the function and professional work of speech therapists it is not enough just to have specific knowledge about language disorders, communication, voice, the development of an assessment and intervention, but it is also necessary to put into practice a set of skills and abilities that strengthen the therapeutic alliance (Fernández-Zuñiga and de León, 2008).

With respect to the evaluation of the characteristics of a service center, it was seen that all the participants gave great importance to the satisfaction of the persons attended, the quality of the service, the quality of the work and the efficiency. It can be seen that these characteristics are related, firstly, to the satisfaction and quality offered to the people who diagnose, treat and prevent ailments, and, secondly, to the quality both within the work center and among the professionals who make it up. Therefore, for the future, it is important to take care and implement in the work centers these or other similar elements that delve into a good management of the centers, in order to increase work, personal, emotional efficiency and thus reduce work discomfort and stress (Durán et al., 2018).

In relation to the presence of burnout syndrome, as we have seen in the introduction, many studies have shown the relevance and presence of this syndrome in health professionals in general. However, our results show that there is no burnout or that it is a minority, since only 15% (9 participants) present it. Likewise, we found low values for emotional fatigue and depersonalization and high values for personal fulfillment. Therefore, we can say that the health professionals in this study did not report scores that would suggest the development of this syndrome, with the absence of emotional fatigue or burnout, when the individual finishes his or her working day; with the absence of depersonalization, which would mean that the worker is not unmovable with the users he or she attends to and pays attention to their well-being; and, finally, with the presence of personal fulfillment meaning high levels of personal competence. Therefore, in light of these results, we can say that our study has not found a prevalence of burnout in the healthcare personnel studied. This result is in line with other studies conducted that also did not find burnout (Berjot et al., 2017; Bruschini et al., 2018; Pavlakis et al., 2010; Serrano et al., 2008). Furthermore, in our study, no statistically significant differences were found between burnout syndrome and the variables of this research. Only, significant differences were found in the subscale emotional exhaustion and personal accomplishment for professionals who in recent years have suffered changes in mood and in the subscale emotional

exhaustion in professionals who feel stress at work as previously explained (Bernaldo and Labrador, 2008; García-Rivera et al., 2014; García-Campayo et al., 2016).

With respect to the limitations of the study, firstly, it should be noted that the number of the sample chosen for the research and the geographical location can be considered very small, and may not be very representative or generalizable. In this line, it is true that the significant relationships may be biased by the asymmetry of the sample size in the variables analyzed. For future research, it would be important to increase the number of participants to obtain much more representative results. Secondly, it is noteworthy that the design of the ad hoc questionnaire is very extensive, which could affect the results obtained. Finally, the lack of studies on this field of knowledge in speech therapy may initiate new research projects in the country to provide greater attention to the occupational and psychosocial well-being of the healthcare team where the speech therapist is the target population in burnout treatment and prevention programs.

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CURRENT TRENDS ON STRATEGIES FOR THE EDUCATIONAL INCLUSION OF STUDENTS WITH AUTISM SPECTRUM DISORDER (ASD)

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Abastract. The main objective of this work is to identify studies related to the educational inclusion of students with Autism Spectrum Disorder (ASD) in Childhood and Primary Education, paying special attention to the publications generated in the last decade (2010 - 2020). To do this, a systematic review was carried out in the Web Of Science (WoS) database, with the following descriptors: "autism, inclusion and education". A total of 309 references were obtained, of which only 24 fit the selection criteria. The results obtained are structured around the following five categories: Analysis of interventions with students with ASD; Good practices aimed at teachers with students with ASD; Curricular adaptation processes of students with ASD; Analysis of the training needs of professorship; Generic processes of educational inclusion. Most of the investigations conclude that it is important to work based on the interests of the students and verify the lack of teacher training in terms of inclusive practices and knowledge about ASD.

Keywords: early childhood education, Primary Education, educational inclusion, ASD, Autism Spectrum Disorder, systematic review.

TENDENCIAS ACTUALES SOBRE ESTRATEGIAS PARA LA INCLUSIÓN EDUCATIVA DE ALUMNADO CON TRASTORNO DEL ESPECTRO AUTISTA (TEA)

Resumen. El presente trabajo tiene como objetivo principal, identificar los estudios relacionados con la inclusión educativa del alumnado con Trastorno del Espectro del Autismo (TEA) en Educación Infantil y Primaria, prestando especial atención a las publicaciones generadas en la década 2010 - 2020. Para ello, se realizó una revisión sistemática en la base de datos Web Of Science (WoS), con los siguientes descriptores: "autismo, inclusión y educación". Se obtuvieron un total de 309 referencias, de las cuales solamente 24 se adaptan a los criterios de selección. Los resultados obtenidos se estructuran en torno a las siguientes cinco categorías: Análisis de intervenciones con alumnado con TEA; Buenas prácticas dirigidas a docentes con alumnado con TEA; Procesos de adaptación curricular del alumnado con TEA; Análisis de las necesidades formativas del profesorado; Procesos genéricos de inclusión educativa. La mayor parte de las investigaciones concluyen que es importante trabajar a partir de los intereses del alumnado y constatan la falta de formación docente en cuanto a prácticas inclusivas y conocimiento sobre el TEA.

Palabras clave: educación Infantil, Educación Primaria, inclusión educativa, TEA, Trastorno del Espectro del Autismo, revisión sistemática.

Introduction

Autism Spectrum Disorder (ASD) is one of the most challenging categories, both for diagnosis and intervention, within the so-called "Neurodevelopmental Disorders" (APA, 2013). ASD is included in this category, according to the DSM-5, along with intellectual development disorders, learning disorders, motor disorders, communication disorders and attention deficit hyperactivity disorder. Specifically, the current criteria defining ASD are:

- Persistent deficits in communication and social interaction manifested by difficulties in social-emotional reciprocity; deficits in nonverbal communicative behaviors used in social interaction; and difficulties in developing, maintaining and understanding social relationships.
- Repetitive and restricted patterns of behavior, activities and interests, manifested by at least two of the following symptoms: stereotyped or repetitive movements, use of objects and speech; excessive adherence to routines, ritualized verbal and nonverbal behavior patterns or excessive resistance to change; highly restricted and fixed interests that are abnormal in intensity or focus of interest; or hyper- or hypo-reactivity to sensory stimuli or unusual interest in sensory aspects of the environment.
- Symptoms must be present in early childhood, limit and disrupt daily functioning and are not best explained by intellectual disability or global developmental delay.

As stated by Villalba (2015), the prevalence of ASD is around 15-20 cases per 10,000 inhabitants, which means that of the 4,675,716 students expected to be enrolled in the 2019-2020 school year in Early Childhood and Primary Education (Ministry of Education and

Vocational Training, 2019), more than 9,000 had ASD. In addition, these percentages have increased significantly in recent years; therefore, it is essential to provide these students with quality inclusive educational attention that enables their presence, participation and learning in regular classrooms and that, in addition, values their differences as a source of enrichment.

At a conceptual level, educational inclusion, according to Echeita (2013), should be considered as the balance between learning and quality performance that adjusts to the capacities and abilities of the student body and ensures meaningful learning for all. In contrast to integration, it is a model that modifies the educational system so that it adapts to the needs of the students, and it is not the students who must change to fit into it. As Blanco (2006) summarizes; "teaching adapts to the students and not the students to the teaching" (p. 6), which will contribute to the development of fairer, more democratic and supportive societies (Echeita, 2008), but will require ensuring that all girls and boys have access to quality education with equal opportunities. To achieve this, it is first necessary to reduce or eliminate all barriers of different kinds that limit or prevent access, presence and participation in learning for all, paying special attention to the most vulnerable students (Sandoval, Simón and Márquez, 2019).

According to Gallego (2012), the current measures proposed by the Spanish educational system to attend to students with ASD according to their level of impairment include, from the lowest to the highest level of inclusion, the following schooling modalities:

- Specific center for autism: In which students with ASD only are included. Specific for people who need extremely individualized learning conditions.
- Specific center: In this center, students can interact with other students who do not only have ASD, increasing their relationship possibilities.
- Special education classrooms located in regular centers: These classrooms enable students with ASD to be close to the inclusive environment and, therefore, the advantage of benefiting from social interactions with neurotypical children, while still receiving an adapted and individualized intervention.
- Combined schooling: Students who receive this type of attention attend simultaneously the regular and the specific center (or specific classroom), and in both the curriculum is developed jointly. This requires the coordination of all professionals involved.
- Regular center: This is the most inclusive option since students with ASD are included in a regular classroom with the necessary adaptations and specific support to optimize their educational response.

Among all these options, ordinary measures tend to prevail, and the adaptations that are developed must take as a reference the general evaluation criteria established in the didactic programs. When these are not sufficient, after a psycho-pedagogical evaluation, other specific measures of Significant Individualized Curricular Adaptation (abbreviated to ACIS in Spanish) will be implemented, which will affect the mandatory elements of the curriculum: objectives, content and evaluation criteria (Moreno et al., 2005).

However, currently, the educational inclusion of students with ASD is limited, in most cases, to their attendance in a regular center equipped, to a greater or lesser extent, with a series of human or material resources. In this variation of the model, closer to integration than to inclusion, the student feels obliged to survive in an environment in which hostility oscillates according to the child's abilities to adapt to the context which, taking into account the limitations in terms of social and communication skills, are usually limited. For this reason "given the confusion and uncertainty present, progress towards the implementation of inclusive education is far from easy" (Ainscow, 2012, p. 40).

Given this situation, we propose the present research, with the intention of contributing to some extent to the imminent need to find organizational and pedagogical resources that allow teachers to reach informed agreements on what strategies to use, what didactic, material and personal resources are more relevant or what content is a priority in the teaching and learning process of people with ASD. Therefore, the main objective will be to analyze the state of the art of the organizational and didactic strategies used in the national and international educational context to face the educational challenges involved in the inclusion of students with ASD in kindergarten and primary school.

Method

A systematic review of the literature was carried out in December 2020, using articles indexed in the Web Of Science (WoS) databases, with the main objective of identifying research on educational inclusion of students with ASD. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol for systematic reviews was also taken into account.

In this bibliographic search, there was no language restriction, and the following descriptors were used: "autism", "inclusion" and "education". The search was adapted to the Boolean operator of WoS and Abstract was used as the field label. A total of 356 references were obtained. However, publications not included between 2010 and 2020 were discarded, leaving a total of 309 records.

For the final selection, through an inter-judge screening, a first reading of their titles and abstracts was made, selecting those considered relevant for full-text review, excluding studies not related to the Early Childhood or Primary Education stages. As can be seen in Figure 1, the selection process, which consisted of three distinct phases, concluded with the selection of a total of 24 papers.

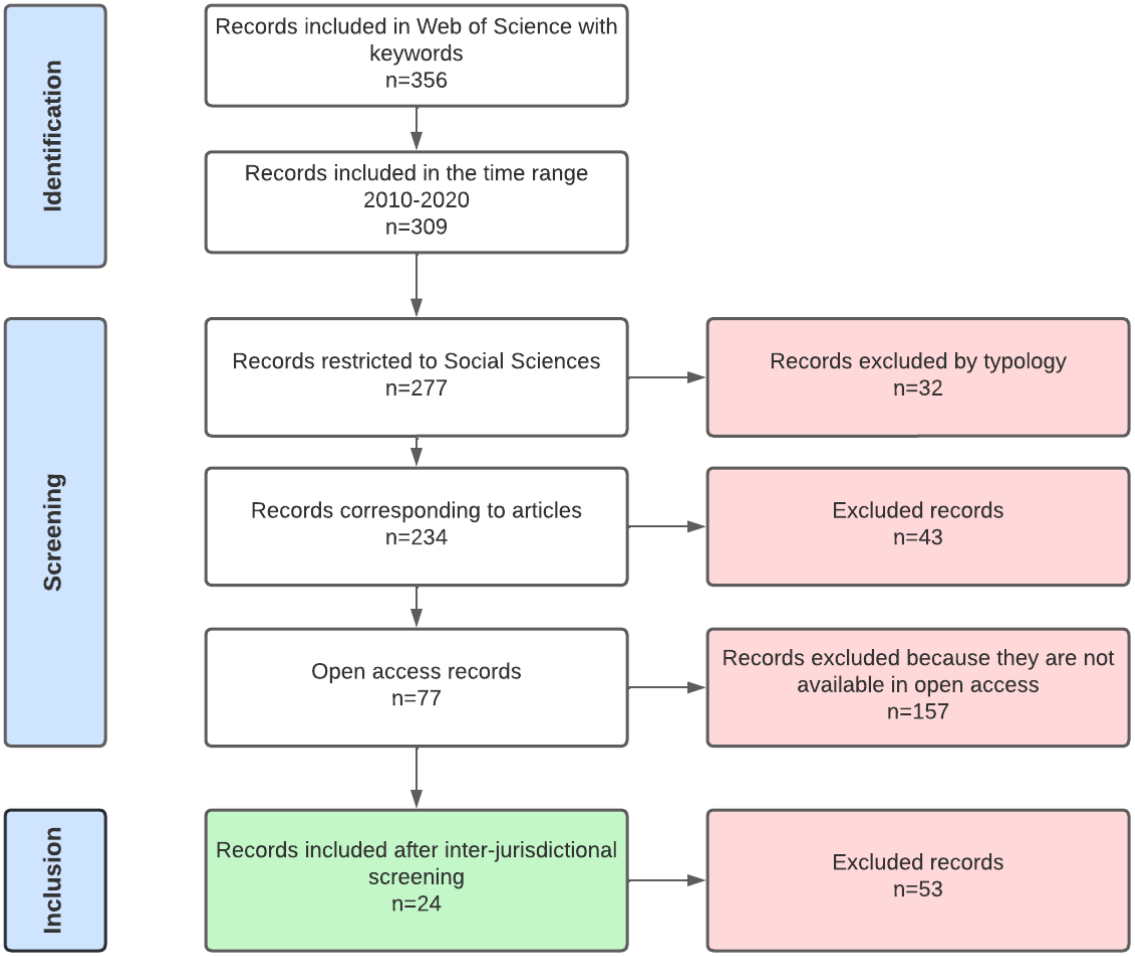

Figure 1. Flow diagram.

Note: Own elaboration.

For the organization and study of the information contained in each article, an analysis matrix was prepared considering authorship, year, objectives, sample and results.

Results

After analyzing the content of the selected documents, according to the topic that has the greatest weight within each article, a categorical classification was elaborated with the intention of structuring these works related to the educational inclusion of students with ASD. The following five categories were identified:

- Analysis of interventions with students with ASD.
- Good practices aimed at teachers with students with ASD.
- Curricular adaptation processes for students with ASD.
- Analysis of teacher training needs.

- Generic processes of educational inclusion.

The results found in the different studies are presented below.

Analysis of interventions with students with ASD

This category includes studies that either compare methodological strategies or evaluate the effects of certain interventions.

In the first case, we find the study by Guasch & Sanahuja (2020) carried out in Catalonia, which identifies which methodological strategies are used with students with ASD in the regular classroom, and whether they differ from those used in the SIEI classroom (intensive support service for inclusive schooling,abbreviated to SIEI in Spanish). The results presented show that when there is a SIEI classroom, it is common to place the student with ASD outside the regular classroom, where the support teacher maintains the role of tutor. However, within the regular classroom, the support teacher dedicates his/her time to the student with low-functioning ASD, while the student with high-functioning ASD receives support from the tutor.

ASD receive support from their peers.

In line with peer support systems, Haas et al. (2019) show step-by-step how peer tutoring strategies, namely CWPT (Classwide Peer Tutoring) and PALS (Peer-Assisted Learning Strategies), could be implemented. To exemplify the implementation of both strategies, they use a hypothetical student diagnosed with ASD. However, in the work of Koegel, et al. (2013), also related to interventions with peers, three real children of 9, 10 and 12 years old diagnosed with ASD, with communication difficulties and schooled in regular public elementary schools did participate. In this study, it is tested whether the implementation of an intervention with peers with activities and workshops that include the students' centers of interest improves socialization and interaction, as well as the motivation to remain in the activity. The results show that the development of activities that incorporate the interests of the child with ASD leads to an increase in social engagement.

Improvements were obtained in all three cases in terms of the amount of time engaged and actively participating with peers in activities. In addition, their non-directed verbal initiations improved significantly so much that they often approached those of students without ASD.

In Locke, et al. (2019) two implementation strategies for improving the use of a social engagement intervention for children with autism in public schools are compared. And in Brignell, et al. (2018) the effects of two communication interventions on children with ASD are evaluated, specifically: FPI (Focused Playtime Intervention) and PECS (Picture Exchange Communication System). Overall, it is concluded that neither intervention improved oral or nonverbal communication in the majority of children.

Regarding studies that evaluate the effects of certain interventions, there is the work of Reichow, et al. (2018), which systematically reviews the effectiveness of EIBI (Early intensive behavioral intervention) for the improvement of behaviors and functional, intelligence and

communication skills for young children with ASD, confirming its effectiveness. In Santarosa & Conforto (2015) the relationship between students with ASD and mobile devices is studied, confirming to be favorable since the socialization of the analyzed students increased, favoring cognition, motor skills, communication, among other skills.

Positive results were also obtained in Barba & Minatel (2013), with an inclusive intervention through occupational therapy involving two children diagnosed with ASD aged 3 and 5 years, their mothers and the teaching team of the two centers. This study shows that myths stigmatize the attitude of people in the environment and represent a barrier to inclusion, so it is proposed to work on concepts such as respect for difference, tolerance and cooperation. As for these children, it is indicated that, thanks to this intervention, they were initiated in oral communication, expanded their circle of relationships, and experienced collective and group situations that facilitated their socialization.

Best practices for teachers of students with ASD

This group of publications offers advice for the care of students with ASD. Some of these studies provide practices to effectively carry out some method, as in the case of Ozel Erenand Nik Asilah Nik Ali (2017) with the EBP (evidence-based practice) method, and Togashi & Walter (2016) to introduce the use of the Adapted-PECS system. Other publications focus on specific subjects, such as the proposal by Aguiar et al. (2018) on the textual comprehension of students with ASD within the subject of Spanish Language.

In Corona et al. (2019), generic suggestions are offered, such as those summarized below:

- The teaching and learning process for students with ASD should be developed in natural contexts of intervention.
- The pace of performance of students with ASD should be respected, maintaining a patient and reassuring, but also directive and respectful attitude.
- The space in which the teaching and learning process takes place should have a fixed and predictable structure, avoiding chaos or lack of definition. The space should have natural light, with little visual stimulation, ventilated and clean. Ideally, noisy environments should be avoided.
- It is recommended to place students with ASD in the group, close to peers with whom they have empathy or support. They should also be close to the teacher and the blackboard, in order to favor their attention. It is better not to place it next to a corridor, window or in places with potential distractions.
- If an unexpected situation arises in the classroom, such as an unforeseen behavior of the child with ASD, the moment should be used to explain to the rest of the group what is going on with his or her classmate.
- As for the material, it is suggested to use videos, illustrations, drawings, finished models, etc. It is important to provide them with resources that allow them to understand the temporal nature of events, in which emotions are identified, that help them to

organize actions following logical sequences or that graphically describe certain activities in a sequential manner.

- Better to plan the teaching and learning process based on the knowledge possessed by students with ASD. Special importance should be given to the achievement of skills related to communication, social interaction and behavior.

Likewise, it is worth highlighting the work of Hersh & Elley (2019) in which evidence-based recommendations are offered, in this case the good practices provided arise after conducting a survey carried out to 120 teachers, as well as other professionals working with children and young people with autism in Poland. Some of the practical recommendations are:

- It is necessary for each student with ASD to have an individual teaching assistant or support teacher, but without limiting access to the teacher or other students.
- Small group teaching and individual planning, including individual motivation systems and transition support.
- Positive but realistic attitude toward each student's academic and social potential.
- Minimize sensory disturbance and overstimulation in activities.
- Inclusive climate where all students with ASD feel safe and respected by all.
- Contact or visits to adult ASD schools that act as role models.
- Adequately funded schools with high quality resources to fully support quality instruction for students with ASD and/or disabilities.
- Measures to promote inclusion: active participation of students without disabilities, inclusive social events, opportunities for students with ASD to take on roles and responsibilities.
- Training and information for professionals on ASD.

Curricular adaptation processes for students with ASD

Processes carried out with specific cases are presented. For instance, in Aporta & Lacerda (2018), the activities carried out with a Brazilian student with ASD are presented, the materials used and the impressions of the teacher in charge are analyzed, who at the beginning of teaching indicates suffering anxiety and insecurity for having a student with Autism Spectrum Disorder. In the conclusions, it is emphasized that the work of this teacher evidences the importance of the teacher's performance with these cases, and made it possible to identify the teacher's fragility in the face of unknown demands. The need for further studies to expand knowledge about ASD and to obtain successful practices is emphasized.

In the same line, the study by Fiorini & Manzini (2016) identifies situations of difficulty and success of two Physical Education teachers during classes with students with disabilities and autism. It is highlighted that both teachers found it difficult to include these students in their classes, due to teaching strategies, pedagogical resources, content selection or the presence of the classroom teacher. Among the results of this study, three aspects that supported the development of the classes also stand out: the profile and previous experiences of each teacher,

the type of disability or disorder and knowledge about them, and teacher empathy. It was positive that the teacher's gaze focused on the students' possibilities and abilities, instead of focusing on their limitations.

Roberts, et al. (2017) documents the trajectories of Australian students with autism during their education and examines the personal (e.g., student abilities) and environmental (e.g., school environment) factors associated with different trajectories and outcomes. While this paper explains the research process, the final conclusions are not recounted, although it initially concludes with negative outcomes for adults with autism in domains such as employment and independent living.

Analysis of teacher training needs

These works are mainly focused on studying teacher competencies and training in the face of Autism Spectrum Disorder.

Razali, et al. (2013) investigated the perceptions of teachers on the inclusion of children with autism at the preschool stage in Malaysia. The results show that the three teachers interviewed were not prepared to teach children with autism in their classes because they lacked knowledge of the characteristics of this student body. They did not understand why inclusive education is important.

The need for the educational administration to have a clear understanding of the true concept of inclusive education is emphasized. In addition, it is emphasized that the parents of all students should be informed of the presence of students with autism so that they can cooperate. But, above all, this study highlights the importance of teachers receiving orientation through workshops or continuing education courses so that they can better understand autism. The research shows that most government schools do not offer inclusive programs, and those that do are implemented by people who lack experience in early childhood education or early childhood special education.

In the research by Caicedo & Amén (2016), contextualized in Ecuador and reaffirming theater as a method of inclusion for infants with autism, it was found that 67% of the 15 teachers interviewed were unaware of inclusion methods for children with autism and that 60% did not receive specific training to be able to work with these students.

The lack of teacher training in terms of inclusive practices and knowledge about ASD is also found in the study by Marques & Giroto (2016), which analyzes the teaching performance of a kindergarten teacher when faced with the school inclusion of children with ASD. Similarly, in Lourenço & Leite (2015), training needs are detected both related to the understanding of the problems of children with autism spectrum disorders, as well as classroom planning and curriculum management.

Generic process of educational inclusion

These are international studies that analyze how to process of educational inclusion of students with ASD is or could be carried out in their respective countries, such as the work of Majoko (2017) in Zimbabwe; Vieira-Rodrigues & Sanches-Ferreira (2017) in Portugal; Lima & Laplane (2016) in Brazil; and León (2018) focused on Ecuador.

In Majoko (2017), 18 teachers were interviewed. Documentary analysis and non-participant observations were conducted to explore supportive practices for including students with autism in regular Early Childhood Development classes. It is explained that teachers need to look beyond the label of ASD, to overcome stereotypes and maintain expectations about the abilities of students with autism. Focus on potentialities rather than limitations. It is considered that adaptations should not be made only with students with ASD, but concern the whole educational community.

Vieira-Rodrigues & Sanches-Ferreira (2017) describe the opinion of teachers on the inclusion of students with special needs, exploring the factors that justify their opinion after six years of the implementation of the Portuguese Decree that aimed to promote equal opportunities, value education and promote improvement in the quality of teaching. The results emphasize that educational inclusion is beneficial for students with needs, but also for the socio-moral development of typically developing students. Another important fact is that more than half of the 244 teachers who participated in the study considered that they did not have sufficient training to deal with certain students with special educational needs.

In Lima & Laplane (2016) it is concluded that the schooling process of students with autism is not completed, since few reach secondary school, not guaranteeing educational inclusion.

Finally, León (2018) summarizes a series of conditioning factors to facilitate the educational inclusion of students with ASD in the Ecuadorian context, including the following:

- Early initiation of children with ASD in the educational process. For their development, the same educational objectives that are taken into account for the rest of the students should be considered.
- To carry out the necessary adaptations in the objectives, contents, methodology, didactic materials and evaluation, in order to provide the fulfillment of the planned goals in line with what is considered for the students in general.
- Work in a structured way with specific objectives and by specific areas.
- If necessary, initiate students in the use of alternative systems, as well as in the use of different communicative functions.
- Provide interdisciplinary and specialized care: professionals in psychology, medicine, rehabilitation, nutrition, speech and occupational therapists, etc.
- Work with the family, the community and other educational agents from the very beginning. Also from the beginning of educational care, it is considered necessary to develop the socialization processes of these students.

- Structuring the educational intervention based on the achievements attained.

Regarding the years of publication, most of these papers have been published between 2016 and 2019 (75% of the total), in addition, three publications from 2013, two from 2015 and one from 2020 have been selected.

Discussion and conclusions

This systematic review has allowed us to learn more about the process of educational inclusion of students with ASD and to evaluate the situation of these students within the educational system. It should be noted that the research analyzed is quite recent, since although the search covered the years 2010 to 2020, the first experiences collected belong to 2013. Likewise, most of the productions are international studies and come from countries such as Ecuador, Portugal and Brazil.

Regarding the methodological strategies carried out in infant and primary classrooms, most of the researches highlight the importance of working on the basis of the students' interests. This improves their motivation and involvement in the activity, and encourages socialization and interaction among peers. This is confirmed by the results of the research by Da Silva, Oliveira, Campos and Oliveira (2019), which conducted a review of studies that used play mechanics for the inclusion of students with educational needs, and in which they concluded that working from the interests of students increases their commitment and involvement in the task, while promoting adequate cognitive, social and human development.

Another aspect to reflect on the results obtained is that most of the studies were aimed at working on some of the most affected areas of students with ASD: communication, social interaction or behavioral inflexibility. These deficits cause them serious difficulties in understanding the society in which they live, which has led to a recent increase in interventions that focus on the development of these skills in students with ASD (March-Miguez et al., 2018).

To achieve this purpose, most of the experiences proposed the use of cooperative and inclusive strategies and discarded interventions of a more individual nature. Of all of them, the positive results obtained from the use of the peer tutoring strategy are cited, such as with: CWPT (Classwide Peer Tutoring) and PALS (Peer-Assisted Learning Strategies). And it is that in the research conducted by Liesa, Latorre and Vázquez (2016) peer work stands out for increasing the maintenance of communicative and social interactions in inclusive school environments. Offering empirical evidence that validates the effectiveness of this type of support systems for students in kindergarten and primary education, in diverse school contexts ranging from classrooms to the playground.

On the other hand, there was also a consensus among the different investigations that interventions should be based on classroom learning principles and had to be delivered in a spatially and temporally structured way. This is also pointed out in their work Arróniz-Pérez and Bencomo-Pérez (2018), in which they emphasize that the intervention should be characterized by an early start, intensive character, high structuring and, finally, by a specific

action on language. From that point on, the choice of one or another resource, space or content will depend on the idiosyncrasies of the student in question, since much emphasis is placed on the individuality of each case.

It is worth highlighting the role played by ICT in some of the educational experiences analyzed. All of them had favorable findings, as they managed to improve, among other aspects, student socialization, motor skills or communication. In line with these results, the intervention program mediated by ICT and implemented by Suárez, Mata and Peralbo (2015), which increased student motivation and reinforced each of the activities, is mentioned.

Concerning the teachers, a large number of those who had to carry out the inclusion of students with ASD said that they were not prepared for this task, as they felt insecure due to their lack of knowledge about ASD, educational inclusion and classroom curriculum management. In some cases, they did not even understand the need to include these students. For all these reasons, and according to Patiño's research (2018), the need for training of all teachers in strategies that allow them to solve the problems that may arise from these inclusive educational situations arises, as well as maintaining continuous communication and coordination with other teachers, specialists and families.

Finally, it is necessary to highlight families as essential agents in the educational intervention of their sons and daughters (Arróniz-Pérez & Bencomo-Pérez, 2018). As Lozano-Segura, Manzano-León, Casiano & Aguilera-Ruíz (2018) state, a child with ASD who perceives from home a positive environment favorable to inclusion, will generalize his or her learning and will develop it correctly in the relationships he or she establishes at school. However, in a large number of the studies analyzed, the involvement of families is not as good as teachers would like for multiple reasons. This aspect is also picked up by García-Cuevas and Hernández (2016), since in their study the collaboration of families and external professionals was very limited, negatively influencing the effectiveness of the inclusive activities carried out in the center.

We conclude this section by pointing out that, although the different methodological and organizational strategies used in the different documents lead to varied conclusions, it is still a reality that the inclusion of students with ASD is complicated due to various aspects such as: teaching strategies, pedagogical resources, content selection or the presence of the classroom teacher. This causes that the trajectory of students with these characteristics is not as satisfactory as expected and that, sometimes, they do not finish the mandatory education. For this reason, research and experiences should continue to be carried out to systematize good practices that ensure inclusive and quality education for all students with ASD.

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EVALUATION OF THE PhET SIMULATOR AS A STRATEGY FOR THE LEARNING OF GRAVITATION IN PHYSICS IN MIDDLE AND UNIVERSITY EDUCATION

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Abastract. The purpose of this article is to identify and evaluate results using the PhET simulator on gravitation (specifically on universal gravitation law), this topic is part of the academic curriculum at the level of secondary education and first year university, in disciplinary careers or applied as in technological and engineering training. To this end, a class practice is carried out with students using two of the simulators that address the topics and that can complement the work, before, during and after the class sessions at each level. The results obtained with the use of the simulators in the different academic practices are measured with the evaluation instruments that are destined for each session, such as laboratory guides, explanations, practice logs, work guides, etc., considering the use of the same as an important part of the activities, which alternate their use with explanations, with questions, with application problems and laboratories, in order to strengthen the concepts addressed in each of the practices carried out and finally put to try simulators, as a resource to contextualize, to reinforce, to represent another alternative for class work with students.

Keywords: graphic simulators, simulator evaluation, simulators in education.

EVALUACIÓN DEL SIMULADOR PHET COMO ESTRATEGIA PARA EL APRENDIZAJE DE LA GRAVITACIÓN EN FÍSICA EN LA EDUCACIÓN MEDIA Y UNIVERSITARIA

Resumen. El presente artículo tiene como finalidad, la identificación y evaluación de resultados usando el simulador de PhET sobre gravitación (específicamente sobre ley de gravitación universal), este tema hace parte del currículo académico a nivel de educación media y de primer curso universitario, en carreras disciplinares o aplicadas como en formación tecnológica e ingeniería. Para dicho fin, se realiza con estudiantes una práctica en clase utilizando dos de los simuladores que abordan las temáticas y que puedan complementar el trabajo, antes, durante y después de las sesiones de clase en cada nivel. Los resultados obtenidos con el uso de los simuladores en las diferentes prácticas académicas se miden con los instrumentos de evaluación que se destinen para cada sesión, tales como guías de laboratorio, explicaciones, bitácoras de práctica, guías de trabajo, etc., considerando el uso de los mismos como parte importante de las actividades, los que se va alternando su uso con las explicaciones, con preguntas, con problemas de aplicación y laboratorios, con el propósito de fortalecer los conceptos abordados en cada una de las practicas realizadas y finalmente poner a prueba los simuladores, como recurso para contextualizar, de reforzar, de representar otra alternativa para el trabajo en clase con los estudiantes.

Palabras clave: simuladores gráficos, evaluación de simuladores, simuladores en educación.

Introduction

Nowadays, the use of new technologies, which are considered emerging or alternative in science education, is still considered a wide field to be explored in the educational sector and has not yet been studied in depth, due to its recent history. It is very usual to see countless tools that have been developed from different platforms, networks, programming languages and specialized software, specifically in the development of simulators, as a tool that complements educational practice (Lucero, 2015).

These tools have not had a very wide reception in an educational environment yet, therefore, it is of great interest to be able to explore them and know their scope (Albarracín, 2017) According to the different uses given from an educational relevance, there is a wide variety of possible adaptations, which, in the case of scientific work, can be fully exploited when creating material corresponding to a wide variety of experiences that are derived from the reality of each concept addressed from the scientific work.

New technologies have had a significant impact on the change of the educational paradigm, for example, the use of computers for academic purposes, which has allowed strengthening communication and knowledge of work worldwide with the Internet (Amaya, 2011). Also with the generation of software and applications for different multimedia devices that today are part of the pedagogical work in the classroom.

Currently, classes centered on augmented reality tools allow understanding the phenomenologies of nature in other ways, making their explanation attractive and striking for students. It is a novel technology that has made it possible to innovate the different ways in which animations, virtual objects, are combined with real objects (Hernández, 2016). It is of vital importance to bring students closer to scientific concepts through didactic tools close to

their social, cultural and technological reality, hence the need to contribute from education to their use, to their continuous training.

The proposed work consists of elaborating, applying and evaluating activities (workshops and laboratories) through the use of PHET Interactive simulations, developed by the University of Colorado, in the regular curriculum of natural sciences in secondary education and Basic Sciences at the higher education level, specifically Physics. These activities would be developed taking into account the curricular contents of the subject and would be adapted to the different simulators to complement laboratory practices or to perform virtual laboratory practices in a direct way.

The execution of the activities would be carried out during regular classes without interrupting the calendar and the academic curriculum of the subject at different levels, laboratories and workshops would be scheduled to reinforce what has been seen and then evaluated based on the indicators of achievement of the various topics to be addressed. The topics would be specified during the course, the idea would be to address physics concepts for students in grades 10 and 11 of middle school, in their regular classes, as a complement to what is being worked, we would proceed to work on common geometry topics such as perimeters, areas and volumes, magnitudes and units, which are transversal to physics, reinforcing mathematical concepts applied to physics, as well as common astronomy concepts of position and astrophysics in the same way.

At the university level, virtual laboratories are also programmed using simulators in the Physics that are addressed in the engineering programs (Physics I or Mechanical Physics, Physics II or Electromagnetic Physics and Physics III or Wave Physics and Thermodynamics). For each academic semester, there are three cuts, and in each one of them, a minimum of one laboratory practice must be done, and it is there where the corresponding guides are proposed, either where the virtual resource is taken as a complement to the practice in the classroom laboratory, or it is done completely virtual.

The learning results obtained by using the simulators and performing the usual physical laboratory practices are intended to be equated, in order to establish parameters of functionality and relevance according to the particular subject matter addressed (Rodríguez-Hernández, 2010). Said relevance depends on the objectives and evaluation indicators at the time of performing the laboratories, this allows visualizing which practice and in which modality is more relevant for each subject, and whether it is convenient to do it virtually or in person.

Method

It consists of the study of the different results obtained with the development of the activities in which the simulators are used, in this case, the PhET simulators about gravitation. The activities have already been proposed and carried out, these correspond to the usual ones of the physics curriculum in grade 10 at school (Colegio Moralba Suroriental IED) and the first academic semester at the university in the telecommunications engineering career (Corporación Universitaria UNITEC). See annex. The first consisted of a virtual laboratory session with tenth grade students, where a work guide is previously programmed, the explanatory session of the topic is carried out and then the laboratory practice using the simulators. Then, the development of the activity is reviewed and the results are evaluated, taking into account what was developed by the students through the evaluation rubric. On the other hand, at the university, an on-site laboratory session is previously scheduled (for each academic term only one on-site class session is scheduled, corresponding to the laboratory practices, due to the pandemic situation), this session is complemented with a laboratory guide, which is previously socialized, and also complemented with the simulators. The students of each level participate in the elaboration of the activities, then they are graded and the results obtained are analyzed by means of a form, by which the statistical study is made by recording the data, finding measures such as the mean, the location of values by means of quartiles, and according to the evaluation rubrics in each case. The evaluation instruments used consist of forms, which take into account very specific questions of each topic and its relation with the use of each simulator. For each activity developed, a single-answer multiple-choice evaluation is carried out, with questions specific to each topic worked on.

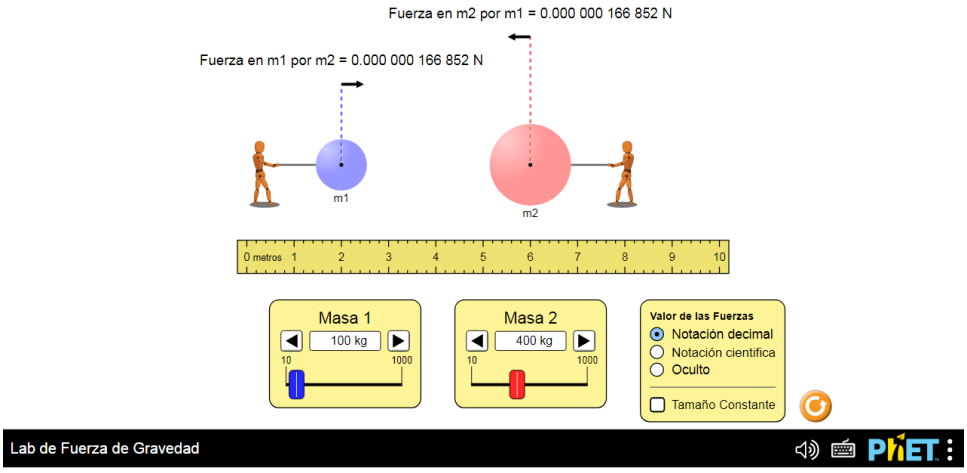

Figure 1. PhET Simulator. Gravity Force Lab.

Note: Source: https://phet.colorado.edu/sims/html/gravity-force-lab/latest/gravity-force-lab_es.html

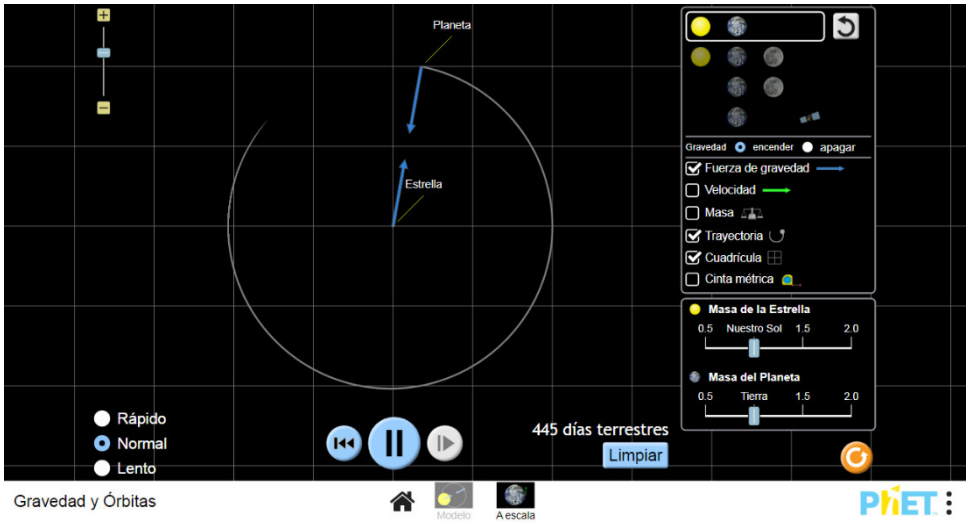

Figure 2. PhET simulator. Gravity and orbits..

Note: Source: https://phet.colorado.edu/sims/html/gravity-and-orbits/latest/gravity-and-orbits_es.html

In the implementation of the simulator, three moments are taken into account, as described below:

Moment 1: Previous explanation of the topic.

The teacher explains the subject of gravitation, starting with some questions that are developed during the explanation:

- What is gravity, is it a force at a distance or a field force? Explain.
- How does gravitational force manifest itself between bodies?
- Is the gravitational force a conservative force? What is the gravitational field? Explain.

After the explanation, each student writes his or her version answering each question, which is then complemented as the experience with the simulator is carried out.

Moment 2: Application of the simulator

The practice is carried out, starting from a work guide assigned by the teacher. The guide consists of a virtual laboratory mediated by the PhET simulators "Gravitation and orbits" and "Gravitational force", which will be approached in two stages, explained below:

The first simulator to be worked on is "Gravitation and orbits", with the described guide (see annex 1) estimated for half an hour. Subsequently, the simulator "Lab Gravity Force" and its respective guide (see annex 2), which is also allocated for half an hour. During the development of the application, the teacher is constantly giving feedback on the topics in each practice.

After the practice, the final test is solved, which consists of a test-type document (annex 3), in which the initial questions will be taken into account.

Results

Posterior a la aplicación de los instrumentos de evaluación, se evaluarán los resultados de acuerdo a los diferentes rangos de acuerdo a cada institución (1.0 a 5.0 en el colegio, siendo 3.5 la nota mínima y de 0.0 a 5.0 en la universidad, siendo 3.0 la nota mínima). Al aplicar los instrumentos de evaluación, en las tres diferentes etapas, se obtienen los siguientes resultados:

STAGE 1

The results of the first stage of the activity are presented below:

Results with the students of the school (course 1002 morning session).

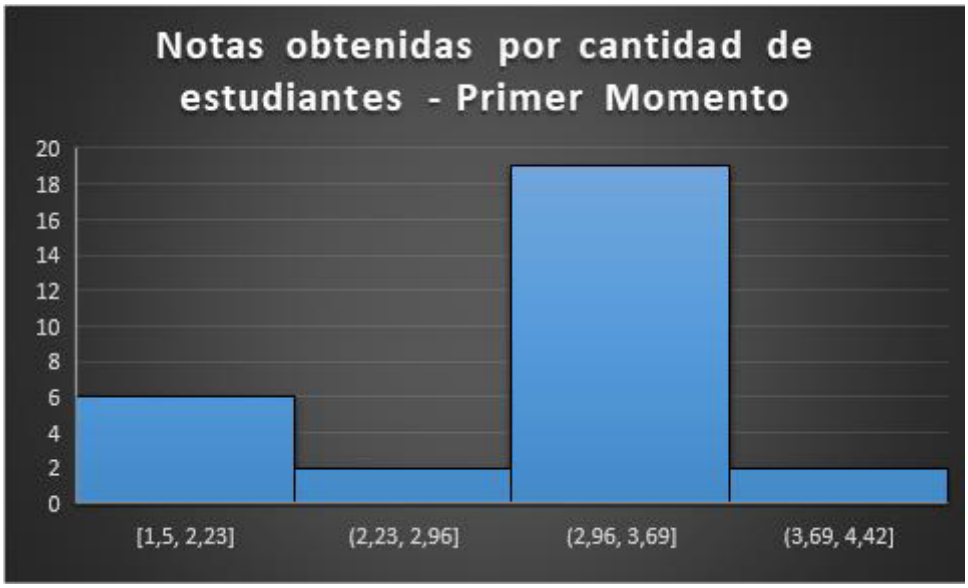

Figure 3. Grades obtained.

Note: Own elaboration.

During the first activity after the explanation, a very basic appropriation of the concepts is observed. With the teacher's guidance, the students' concerns about the concepts and the different observations considered in the first activity are clarified.

Results with university students (Physics I and lab, Telecommunications Engineering program)

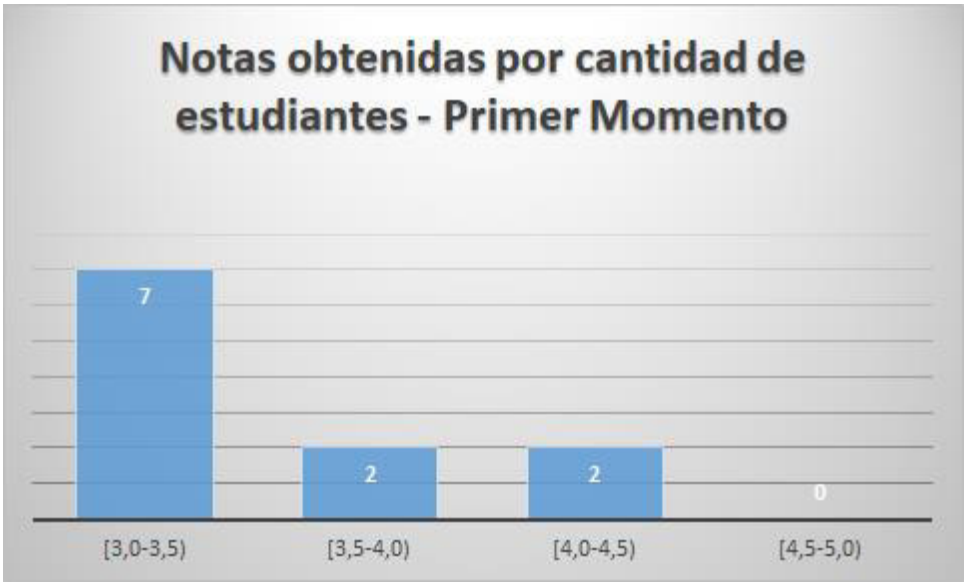

Figure 4. Grades.

Note: Own elaboration.

When applying the initial activity after the explanation, the students obtain grades at a basic level as initially expected, where the apprehension of concepts and their subsequent application is the most important thing, and where the use of the simulators would be focused.

STAGE 2

The results of the second stage of the activity are presented below:

Results with the students of the school (course 1002 morning session).

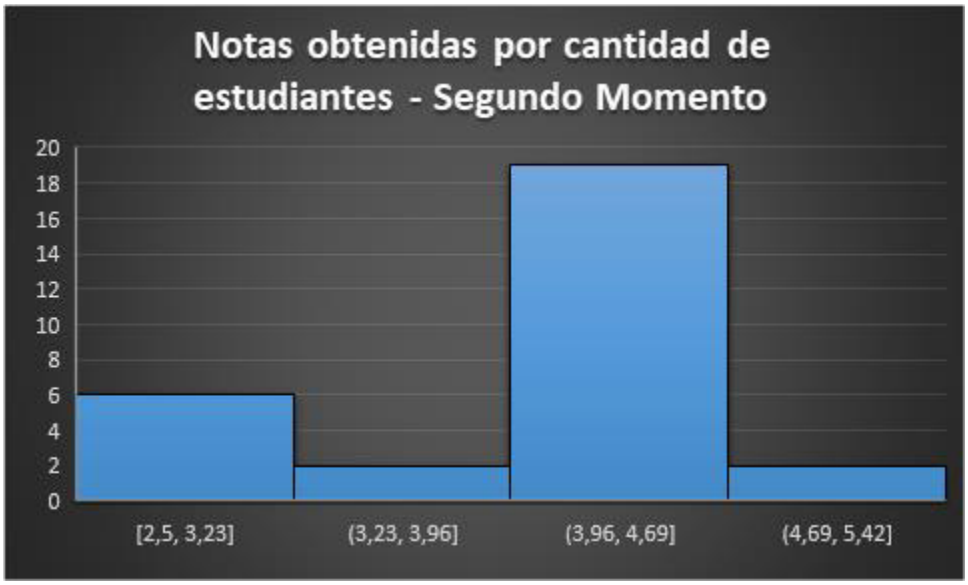

Figure 5. Grades.

Note: Own elaboration.

After the application of the second activity following the use of the simulator, more favorable results are obtained, which is the expected purpose according to the grades observed in the graph. The grades have risen significantly from three to five tenths on average for each student, improving even the conceptual appropriation and its interpretation.

Results with university students (Physics I and laboratory, Telecommunications Engineering program)

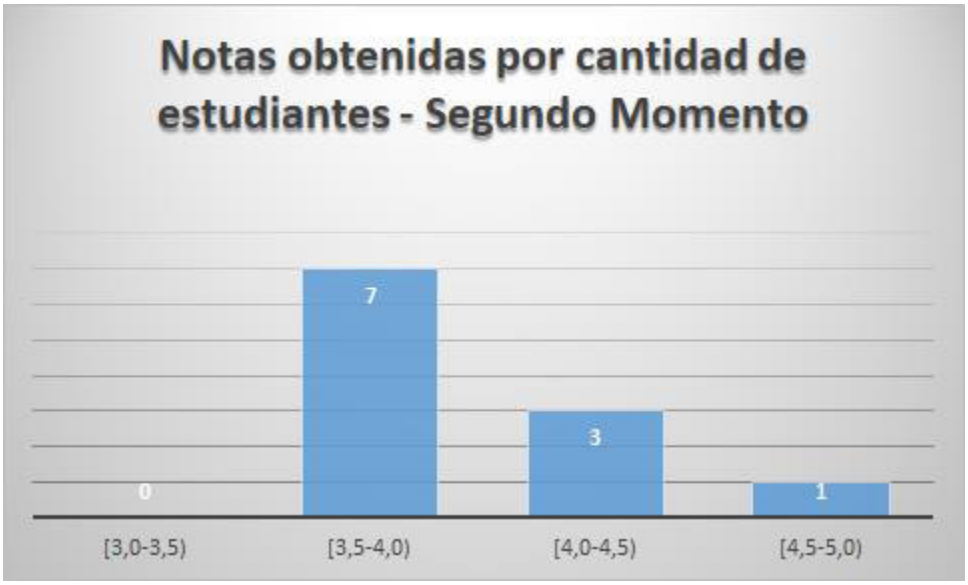

Figure 6. Grades.

Note: Own elaboration.

Discussion and conclusions

With the results obtained, we hope to achieve the initial task of verifying the viability of the use of simulators or, failing that, to discover new evidence that will provide insight into the complexity of this subject. If the hypotheses could be tested, then we would have evidence of improvement in the development of activities through the use of simulators as a didactic tool. This would be the first step of many that would have to be taken in this process, which would aim at demonstrating that simulators really are a tool that complement and reinforce the concepts addressed in classroom practice. It is a work that continues to evaluate the results obtained and developed in different stages in order to have a wide veracity and relevance of the results.

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ANNEX I

		Tema: Gravitación y leyes de Kepler			Rango calificación 1-5	
	Curso 1002	Resultados prueba final			Mín aprobación 3,5	
					1er momento	2do Momento (prueba final)
1	BERNAL	FUENTES	JUAN	CAMILO	3	4
2	CAGUA	TORRES	KAROL	JULIETH	2,5	3,5
3	DUEÑAS	DIAZ	FELIPE		3	4
4	FIRIGUA	LUGO	MICHAEL	STEBAN	3,5	4,5
5	GUERRERO	MESA	HEIDY	NATALY	3	4
6	HOYOS	ZULUAGA	LUISA	FERNANDA	2,5	3,5
7	MARTINEZ	SUAREZ	ALISON	YEANNET	3	4
8	MONTIEL	BUSTAMAN	YAIR	ELIAN	2	3
9	MOSQUERA	HERNANDEZ	LAURA	CAMILA	2	3
10	NOVOA	RODRIGUEZ	JUAN	DIEGO	3,5	4,5
11	OSORIO	QUINTERO	JESHUA	DAVID	3,5	4,5
12	OSORIO	QUINTERO	JOSHUE	DANIEL	2	3
13	PERDOMO	GOMEZ	SANTIAGO		1,5	2,5
14	PERDOMO	SANDOVAL	MARIANA		3	4
15	PIMENTEL	LUGO	FRAURYMA	ALECXANDRA	3,5	4,5
16	POVEDA	PAEZ	JOEL	MATEO	4	5
17	QUINTERO	ROSERO	PAULA	XIMENA	3	4
18	RODRIGUEZ	BENAVIDES	LUNA	SOFIA	3,5	4,5
19	RODRIGUEZ	HERNANDEZ	AMMY	KARIME	3	4
20	RODRIGUEZ	SANDOVAL	JEIMMY	SOFIA	3	4
21	ROLDAN	MARTINEZ	KAROLL	JOUZETHWO	4	5
22	SATOBA	PIÑEROS	JOHAN	SEBASTIAN	3	4
23	SEPULVEDA	MONTAÑA	CATALINA		2	3
24	SIERRA	RODRIGUEZ	SERGIO	IVAN	3,5	4,5
25	TELLEZ	GUEVARA	LUISA	FERNANDA	3	4
26	VELASQUEZ	IPUZ	BRAHIAM	STIVEN	3	4
27	VICTORIA	PRADA	KELI	TATIANA	3	4
28	VIDES	ROMERO	LUISA	FERNANDA	2	3
29	ZAPATA	GRANADOS	ARIANA	SOFIA	3,5	4,5

		Tema: Dinámica Rotacional, Gravitación	Rango calificación 0-5	
	Física I y laboratorio	Resultados prueba final	Mín aprobación 3,0	
N° est	NOMBRES		1er momento	2do Momento (prueba final)
1	BARRERA RAMIREZ NICOLAS		3	3.5
2	BARRETO GARZON ANGIE VALENTINA		3	3.6
3	CUEVAS GONZALEZ WILLIAM FERNEY		3.2	3.6
4	GIL TOVAR MIGUEL ANGEL		3.2	3.7
5	HERNANDEZ RIVERA DANIEL FELIPE		3.3	3.8
6	MATIZ CÁRDENAS CESAR MAURICIO		3	4
7	OROZCO GIRALDO JUAN ESTEBAN		3.5	3.9
8	PARRADO ALFONSO CAMILO EDUARDO		3.5	3.9
9	RAMIREZ MANRIQUE SANTIAGO NICOLAS		4	4.2
10	REYES APONZA CAMILO ANDRES		3	4.2
11	VASQUEZ BRIJALDO OMAR ENRIQUE		4.2	4.5

ANNEX II

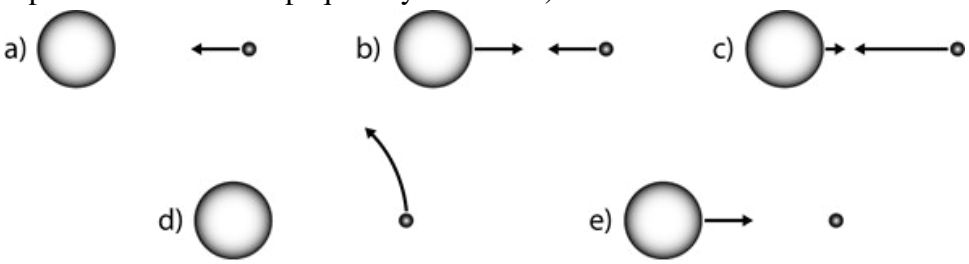
Nombre: _____

Grado: _____

Gravedad y Órbitas

Post-lab. Selecciona la respuesta correcta:

1.- Elige la imagen que crees que muestra la fuerza de gravedad de la Tierra y el Sol (El tamaño de la flecha esta asociada con la intensidad de la fuerza, una flecha pequeña representa una fuerza pequeña y viceversa).



2. ¿Cómo cambiarían estas fuerzas de gravedad si el Sol se hiciera mucho más grande?

Aumenta Permanece igual Disminuye

3. ¿Cómo cambiarían estas fuerzas de gravedad si la Tierra estuviera mucho más cerca del Sol?

Aumenta Permanece igual Disminuye

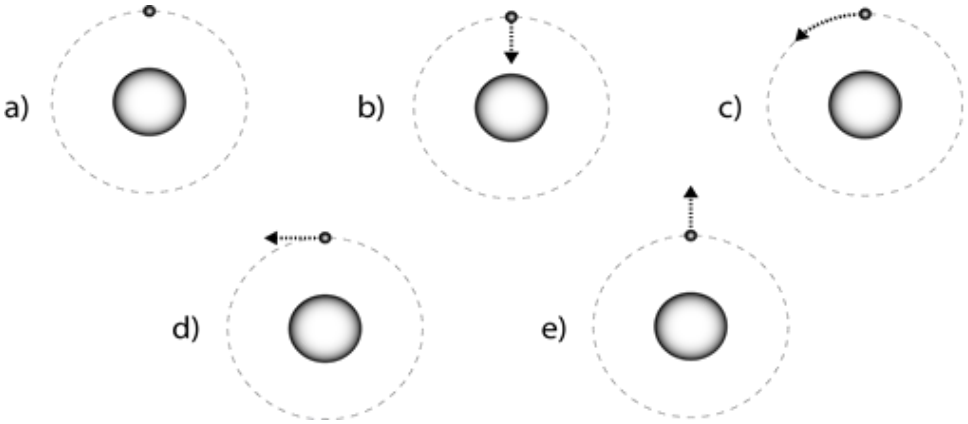
4. ¿Cómo cambiarían estas fuerzas de gravedad si la Tierra se volviera mucho más pequeña?

Aumenta Permanece igual Disminuye

5. ¿Cómo cambiarían estas fuerzas de gravedad si la Tierra y el Sol se alejaran mucho?

Aumenta Permanece igual Disminuye

6. Elige la imagen de cómo se movería la Tierra si se "apaga" las fuerzas de gravedad



ANNEX III

Explorando la Gravedad

PRE PLANEAC	CONOCIMIENTO PREVIO	
	• Saber que una fuerza es un empujón o un tirón (simulación PhET "Fuerza y movimiento: Intro")	
	OBJETIVOS DE APRENDIZAJE	
	• Comprender que la gravedad es una fuerza • Comprender que la fuerza de gravedad depende de la masa y la distancia entre dos objetos	
	Normas Básicas Comunes	Prácticas Básicas Comunes
	Construir y presentar argumentos utilizando evidencia para respaldar la afirmación de que las interacciones gravitacionales son atractivas y dependen de las masas de los objetos que interactúan	1. Dar sentido a los problemas y perseverar en su solución 2. Razonar de forma abstracta y cuantitativa 5. Utilizar las herramientas adecuadas de forma estratégica 7. Buscar una estructura de uso
	MATERIALES	

<table>
<tr><td>I
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Simulación PhET Lab de Fuerza de Gravedad
Computadora / Tableta para cada estudiante
Tarjetas de notas para cada estudiante
Hoja de actividades Explorando la gravedad

</td></tr>
<tr><td rowspan="5"></td><td colspan="2">CALENTAMIENTO 5 minutos</td></tr>
<tr><td colspan="2">Activa el conocimiento previo liderando una discusión o haciendo que los estudiantes escriban un diario sobre las siguientes preguntas:
1. ¿Qué sabes sobre la gravedad?</td></tr>
<tr><td colspan="2">INTRODUCCIÓN 5 minutos</td></tr>
<tr><td>El profesor…
Proyecta la simulación / ayuda a los estudiantes a acceder a la simulación
Distribuye la hoja de actividades
Lee la introducción</td><td>El estudiante…
Comprueba las declaraciones que cree que son verdaderas</td></tr>
<tr><td></td></tr>
<tr><td rowspan="2">C
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N</td><td colspan="2">EXPLORACIÓN GUIADA 30 minutos</td></tr>
<tr><td>El profesor…
Circula por el salón para estar disponible para preguntas y hace preguntas de prueba / empuje tales como;
¿Qué son las variables? ¿Cuál es la diferencia entre una variable independiente y una dependiente?
¿Qué es una fuerza?
¿Qué es la gravedad?
Revisión de Variables
#2 Compartir en parejas: haz que los estudiantes compartan con su compañero sus respuestas a la pregunta #2. Pide a algunas parejas que compartan su respuesta con la clase.

#3 Compartir en parejas: haz que los estudiantes compartan con su compañero sus respuestas a la pregunta #3. Pide a algunos estudiantes que compartan sus respuestas con la clase.

#4, 5 Compartir en parejas: Haz que los estudiantes compartan con su</td><td>El estudiante…

Trabaja en la hoja de actividades mientras interactúa con la simulación Lab de Fuerza de Gravedad

Discute #2-
Pone atención al compartir la #2. Actualiza o modifica su respuesta a la #2 según la discusión en clase.

Continúa trabajando en la hoja de actividades, discutiendo la #5-6 con sus compañeros

Discute #5 y #6-
Discute y modifica las respuestas basándose en la discusión en clase.

Responde-
Verdadero/ Falso, encierra en un círculo la respuesta correcta según las observaciones

Discute-</td></tr>
</table>

	compañero qué variables manipularon y qué notaron. **Verdadero / Falso, Encierra la Respuesta Correcta:** Evalúa el aprendizaje de los estudiantes según sus respuestas. A algunos profesores les gustaría que los estudiantes justificaran su razonamiento, pero el objetivo principal de esta sección es obtener una evaluación formativa rápida. **Revisión de la Introducción, completar hoja de salida, Compartir en parejas:** Repasa la introducción, haz que los estudiantes discutan si la gravedad es una fuerza. Haz que los estudiantes vuelvan a las preguntas de la introducción y revisa las respuestas según sea necesario. Completar hoja de salida, entrega. **EXTENSIÓN OPCIONAL DE CONCLUSIÓN-EVIDENCIA-RAZONAMIENTO (CER):** Oportunidad adicional para análisis y redacción científica para profesores /estudiantes que estén familiarizados con la redacción de CER	Discute las respuestas revisadas, las actualiza o modifica según la discusión en clase. Completa hoja de salida, entrega para revisión
	DISCUSIÓN *5 minutos*	
	El maestro… • Facilita una discusión en clase para unir la comprensión entre representaciones. Recuerda a los estudiantes que cierren sus computadoras o se den la vuelta para que la simulación no los distraiga de escuchar. Usa una estrategia de enseñanza establecida, como una discusión	

	palomitas de maíz (un estudiante responde, llama al siguiente estudiante para que hable), pensar-compartir en parejas (plantear una pregunta, dar tiempo para pensar y hablar con el compañero) o discusiones en grupo (imprimir preguntas y hacer que los grupos hablen entre sí y escriban un consenso para compartir en voz alta con la clase). Las preguntas de muestra incluyen:[Text Wrapping Break] 1. ¿Alguien respondió una pregunta que tenía al comienzo de la actividad? ¿Cuál era? 2. ¿Alguien no respondió una pregunta? Comparte y llama a alguien que pueda responder.	

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EDUCATIONAL IMPACT OF EXPERIMENTATION IN NATURAL SCIENCES: A CASE STUDY AT THE ANDRÉS BELLO DISTRICT EDUCATIONAL INSTITUTION IN COLOMBIA

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Abastract. Results of an investigation that studies the impact of experimentation as a strategy that allows strengthening the acquisition of significant learning related to the area of Natural Sciences are presented. The case study is applied, selecting students from cycle II of the Andrés Bello District Educational Institution in Colombia. The sample had a total of 196 students and 9 teachers. To respond to the object of study, the following phases are developed. First, a diagnosis was developed by performing a pretest to the group of students, then 8 laboratory guides were applied that put the experimentation to the test; During these practices, participant observation was applied and at the end a socialization was made. Finally, a post test was carried out to analyze the learning obtained during the practices, proceeding to the triangulation of methods and test subjects. The results regarding the diagnosis show a lack of spaces and tools for experimentation; likewise, the students did not have internalized key concepts for their study cycle. However, they were motivated by the development of the guides, being able to show the understanding of the concepts worked in the laboratory. It is concluded that experimentation as an educational strategy benefits students at this age since, through exploration, it is easier for them to learn basic concepts. That is why it is suggested that the academic curriculum should give greater importance in time and space to the development of experimentation in Natural Sciences.

Keywords: experimentation, education, cycle II, Natural Science, learning.

IMPACTO EDUCATIVO DE LA EXPERIMENTACIÓN EN CIENCIAS NATURALES: ESTUDIO DE CASO EN LA INSTITUCIÓN EDUCATIVA DISTRITAL ANDRÉS BELLO EN COLOMBIA

Resumen. Se presentan resultados de una investigación que estudia el impacto de la experimentación como estrategia que permite fortalecer la adquisición de aprendizajes significativos relacionados con el área de Ciencias Naturales. Se aplica el estudio de casos, seleccionando estudiantes del ciclo II de la Institución Educativa Distrital Andrés Bello en Colombia. La muestra contó con un total de 196 estudiantes y 9 docentes. Para dar respuesta al objeto de estudio, se desarrollan las siguientes fases. Primero, se desarrolló un diagnóstico mediante la realización de un pretest al grupo de estudiantes, luego se aplicaron 8 guías de laboratorio que pusieron a prueba la experimentación; durante estas prácticas se aplicó la observación participante y al finalizar se hizo una socialización. Por último, se realizó un post test para analizar el aprendizaje obtenido durante las prácticas, procediendo a la triangulación de métodos y sujetos. Los resultados en cuanto al diagnóstico evidencian una falta de espacios y herramientas para la experimentación; asimismo, los estudiantes no tenían interiorizados conceptos claves para su ciclo de estudio. Sin embargo, se mostraron motivados con el desarrollo de las guías, pudiéndose evidenciar la comprensión de los conceptos trabajados en el laboratorio. Se concluye que la experimentación como estrategia educativa beneficia a los estudiantes en esta edad ya que, a través de la exploración les resulta más sencillo aprender conceptos básicos. Es por ello que, se sugiere que el currículo académico debe dar una mayor importancia en tiempo y espacios al desarrollo de la experimentación en Ciencias Naturales.

Palabras clave: experimentación, educación, ciclo II, Ciencias Naturales, aprendizaje.

Introduction

The construction of scientific thinking is one of the most important pillars expected to be developed during the primary education stage. In this sense, the educational system is ideally designed to strengthen children's investigative intuition in Natural Sciences, and it is expected that they will be able to apply what they have seen in class throughout their daily lives. In contrast to this, the traditional way of teaching from which students are considered as recipients in which knowledge is deposited and not as beings capable of interacting with the world, generates a rupture and a break in the development of that intuition and the application of the concepts in their daily lives (Jappe et al., 2019).

In several Colombian educational institutes, this form of teaching still has a great prevalence and, therefore, the imaginative and experimental capacity of students is often overshadowed, even, the value of theory and conceptualization usually has a greater weight than experimentation.

In this order of ideas, García and Estany (2010) mention that, although there is a clear differentiation between theoretical science and experimental science, they are not disjointed practices, but, on the contrary, they are mutually necessary. However, in conventional educational classrooms, practice has been cultivated as a subsidiary activity of theory, i.e., it is used for verification and of course, this is a problem that detracts protagonism, importance and above all life from experimentation (García and Moreno, 2020; Quiroz and Zambrano, 2021). In view of this situation, it is proposed to implement strategies that do not detract from the

importance of theoretical knowledge, but are aimed at eliminating the gap according to which experimentation is at the service of theory (García and Moreno, 2020) and provide benefits in the teaching-learning process.

The role of experimentation in learning

Authors such as Bascopé and Caniguan (2016) analyze the Chilean case and state that one of the most powerful reasons for including experimentation in science classes is that it allows a dialogue between scientific fundamentals and the students' everyday elements, thus making learning much more attractive and motivating students.

Fonseca and Gamboa (2017), professors at the University of Las Tunas (Cuba), adduce other reasons why a review of the methodology used in science teaching, which underlies the curricula not only in Cuban education but also in Latin America, is necessary. These authors point out that the curricular revision is pertinent to respond to the new demands of science and technology in order to prepare young people to be the main actors in the social changes that are taking place. Also, Hernández and Villavicencio (2017), reflecting on the necessary changes in science education in Mexican youth, state that the application of novel techniques such as experimentation is a step that must be taken to increase motivation levels, in order to create solid learning environments, which facilitate the construction of knowledge.

Jappe et al. (2019) expose that experimentation is an element of vital relevance for the teaching of Natural Sciences in basic education, mainly regarding phenomena of a chemical nature. The authors adopt the experimental approach through the playful construction, such construction allows strengthening and developing a transformation in teaching, allowing students to better acquire knowledge, since they relate it quickly with ideas.

Teaching Natural Sciences in Colombia

The Colombian educational scenario is no stranger to these discussions, and various researchers have outlined the reasons why experimentation could be effective. For example, Bejarano (2015), from the National Pedagogical Institute, reported what was pointed out in the preceding lines regarding the need to relate learning in science classes with elements of the everyday life of young people, as one of the most powerful causes to consider experimentation as a strategy in the educational framework.

In the Colombian case, the curriculum is divided by academic cycles; in the first cycles, the teaching of Natural Sciences involves a cohesion of knowledge and information according to Physics, Chemistry, Biology and Geology, among others, which may vary according to the management of the Institutional Educational Plan (Secretaría Distrital de Educación, 2011). According to the proposals of the Ministry of National Education, education in Natural Sciences in the initial and basic stages seeks that students receive their first experiences in the scientific world, based on the stimulation and development of a theoretical approach applied to these

purposes. In general terms, experimentation has always been part of the Natural Sciences classes, the real problem is that it has not been considered as an instrument to promote and strengthen scientific knowledge.

Main obstacles to experimentation in basic education

First, Meneses et al. (2016) undertook a study aimed at young students in Nicaragua, and managed to verify that one of the major impediments to the incorporation of experimentation as an educational strategy, was the lack of equipment in laboratories. However, they point out that this should be seen as a challenge to which teachers should respond with creativity and innovation, since research skills and the teaching of the scientific method do not inevitably require a laboratory.

On the other hand, Vázquez and Manassero (2017) disclosed a study applied in Spain in which some limitations similar to those already seen are demonstrated. The first limitation they report is that, although the curriculum enables experimentation as a fundamental axis in the teaching of Natural Sciences, it is not an aspect that is organized, in fact, they include it in a dispersed way and there is no clarity about this. On the other hand, they found skepticism on the part of Spanish teachers, who insist on implementing traditional practices because they consider that those focused on innovation are very complex and students are not able to understand them.

The teaching of Natural Sciences in early childhood education has great challenges and transformations, which creates a general framework oriented to the understanding of science as a theoretical-practical interaction. Teachers are currently undergoing the didactic need to modify their teaching guidelines, which are focused on leaving aside the traditional passive view of the student, making him/her an active subject in constant interaction with the phenomena of the world around him/her. Thus, the learning-teaching of Natural Sciences requires new practices and didactic strategies oriented towards the interaction between knowledge and experimentation. That is why, in this study we propose to analyze the impact of experimentation as a strategy that allows strengthening the acquisition of significant learning related to the area of Natural Sciences.

Creative Learning Environments for Natural Sciences

Information and Communication Technologies (ICT) play a really important role in the purpose of reconfiguring the teaching and learning practices of students in the area of Natural Sciences, however, as it has been evidenced, the context of the population that is the sample of this research does not allow these practices to be developed, since the access of this population to technological means is quite limited.

In this sense, the author proposes the development of some activities that can focus on the creativity and innovation of the students' knowledge, without having to contemplate the use of the so-called ICTs:

- Provide students with contextual problems related to life, earth, or physical and chemical sciences.
- Contextualize curriculum content according to student needs.
- Evaluate learning according to the teaching context.
- Employ strategies for the discovery of scientific knowledge.
- Apply the experimental process in learning scenarios.
- Apply problem-based learning activities (PBL) according to knowledge scenarios.
- Use autonomous and collaborative learning.
- Discussions and debates.

Method

Design

In order to identify the impact of experimentation as a strategy that allows strengthening the acquisition of significant learning related to the area of Natural Sciences, we propose to work with students of Cycle II (third and fourth grade) of the Andrés Bello District Educational Institution.

The case study is chosen since, according to Soto and Escribano (2019) it is a strategy or tool widely used in research in "human sciences" with a double application: for learning and as a method of inquiry because it allows obtaining much deeper data from small groups and with similar characteristics. It also makes it possible to situate the research in a socio-educational context, with spatio-temporal and curricular coordinates. The research is based on a mixed research approach, using both qualitative (participant observation, workshops and narrative records) and quantitative (questionnaires, pretest and posttest) techniques.

Taking into account the objectives set, 4 fundamental stages were consolidated for the collection of data in correspondence with these objectives.

- Preliminary diagnosis, in order to identify initial needs. This was done by applying a pretest to observe the students' previous knowledge.
- Design of the experimentation, based on the initial needs and aimed at favoring significant learning after the intervention. In this sense, a total of 8 laboratory guides were built based on the topics that the students work on throughout Cycle II, responding to the curriculum of the stage.
- Application of the designed guides, in order to intervene with the group to promote educational innovation and generate a more significant knowledge. The intervention time was extensive (6 months). Each session had two hours of work for two days, resulting in 4 hours of work for the execution of each guide. During the laboratory practice, a participant

observation was also carried out by means of an observation guide, where key professionals were involved.

- Final diagnosis, in order to verify the improvements obtained after the application of the guides. This phase involves the application of a post-test to demonstrate the changes in relation to the first test applied and to observe the nature of the learning achieved.

Participants

Regarding the sample of students, 100% of the students enrolled in Cycle II of the Andrés Bello Educational Institution, in the third and fourth grades, were selected. Specifically, 6 groups were selected, 3 in third grade, which are divided into three groups: 301, 302 and 303; and three in fourth grade, which are also divided into three groups: 401, 402, 403, thus participating in the study a total of 196 students. Regarding the sample of teachers and experts, a total of 9 professionals were intentionally selected. This selection is due to the fact that they are teachers of the subject under study at the Andrés Bello Educational Institution in the city of Bogotá (Colombia), as well as specialists with ample experience in the teaching practice of the Natural Sciences area..

Instruments

Instruments and techniques of a mixed quantitative and qualitative nature are combined, in coherence with the methodological approach selected to respond to the object of study. Specifically, in accordance with the research phases described above, the following are applied::

- Questionnaires (pre-test, post-test): A test is designed ad hoc to recognize and identify the knowledge acquired by the students. The questions they contain are related to the topics they are working on according to the curriculum of their cycle.
- Laboratory guides: in each of the laboratory practices, the pedagogical strategy of forming collaborative teams was proposed; the course was divided into 4 subgroups. In most of the practices, each subgroup had 8 students. These guides were adapted according to the needs identified in the students, in order to promote a more significant learning after the experimentation.
- Observation guide, applied during the realization of each laboratory practice. This instrument considered the following key dimensions: a) student motivation; b) academic performance; c) learning acquisition; and, d) teacher attitude and conformity with the activity.
- At the end of each practice, a socialization of the activity was carried out, which resulted in narrative information collected in the teacher's diary.

Participants

Data analysis was carried out by mixed procedures, according to the nature of the information obtained. The pretest and posttest analysis (quantitative information) was carried out using SPSS, applying descriptive statistical techniques to identify frequencies and averages. As for the qualitative information (observation and socialization guides), this information was analyzed taking into account the opinions and behaviors that were most repeated by the students, identifying relevant discourses and narratives that informed about the educational impact of the experimentation. Considering its meaning, the qualitative information was analyzed by establishing a system of categories and content analysis.

Results

The main findings obtained in the research are presented, sequenced in coherence with the phases followed in the research.

Initial diagnosis: determination of needs in the teaching of Natural Sciences

The results obtained in each of the questions asked during the pretest are shown below. As can be seen in Figure 1, only 11% of the total number of students got their answers right, while 89% opted for the second option in which the skull and thorax were identified as important parts of the human body.

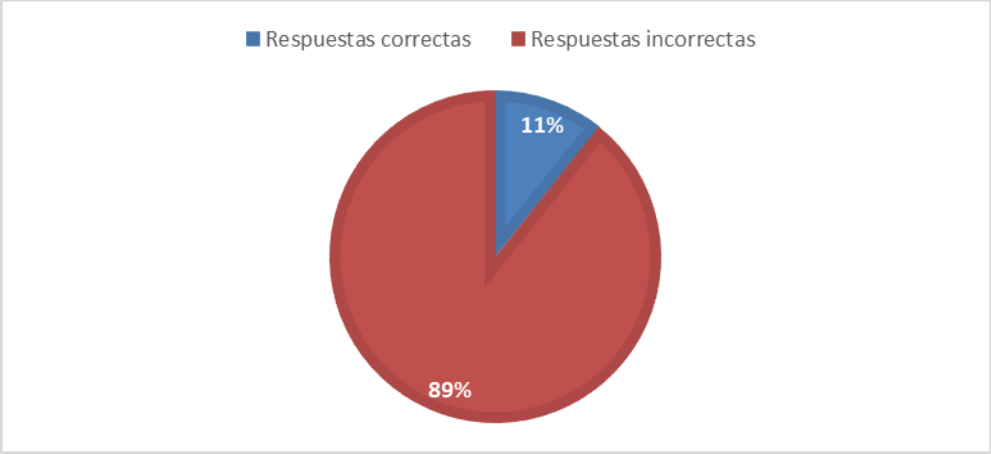


*Figure 1***.** Question 1. Parts of the body.

Note: Own elaboration.

Considering the answers to the second question, only 21% of the students indicated the correct answer: "cells", and 79% leaned towards the answer referring to organs (Figure 2).

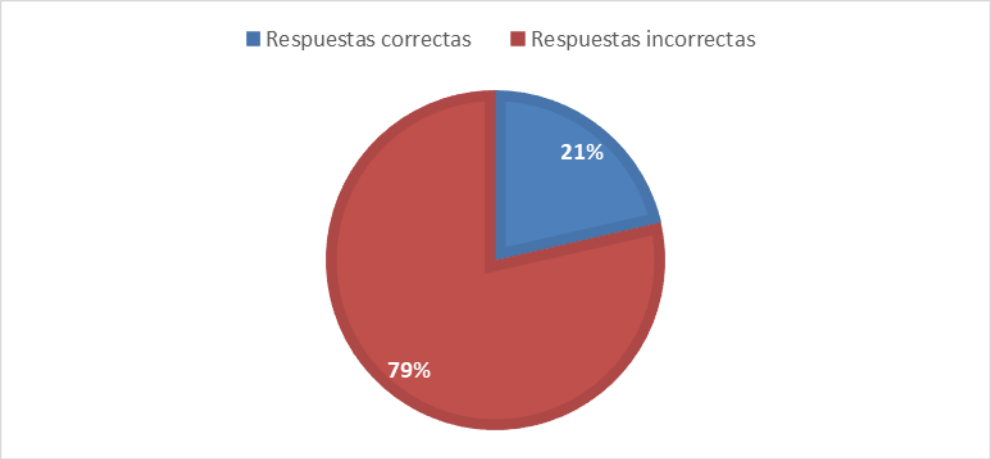


*Figure 2***.** Question 2. The human body is composed of millions of ..

Note: Own elaboration.

Figure 3 shows how the correct answer to the third question of the test was "organs", however, only 1% of the students chose this answer and 99% chose to answer "systems".

*Figure 3***.** Question 3. What makes up a set of tissues of the same kind?

Note: Own elaboration.

In the next question (4), we aimed to observe the students' memorizing capacity. According to the data presented, only 7% of the total number of students got the correct answer. The remaining 93% answered that the thorax is composed of 12 ribs, followed by the option of 14 and only a few considered that 28 was the correct number (Figure 4).

*Figure 4***.** Question 4. Number of ribs of the thorax.

Note: Own elaboration.

In relation to question 5, only 7% were able to adequately identify the parts of a plant, while 93% showed a low knowledge of plants (Figure 5).

*Figure 5***.** Question 5.Parts of a plant.

Note: Own elaboration.

Regarding questions 6 and 7, these were asked in an open-ended manner. Question 6 asked students to explain 3 statements about plants and question 7 asked them to describe the vital activities performed by living beings.

Regarding the sixth question it was possible to evidence that students answered in a general way, without stopping in each one of the statements. This showed the students' low comprehension of the statement of the question. Some examples of answers are shown in Figure 6:

" - Las plantas nos dan el oxígeno.
- Las plantan se alimentan por la raíz y nos dan oxígeno.
- Sí, toman agua por la raíz, además producen oxígeno, no sé."

*Figure 6***.** Fragments of answer to the sixth question.

Note: Own elaboration.

In addition, according to their answers, it was possible to confirm their low knowledge regarding the photosynthesis process. Regarding the seventh question, the students identified some of the vital functions of living beings; however, an adequate knowledge of clear terms about these was not identified and in addition many of them identified only three and in some cases only one vital function was mentioned. This can be evidenced in some examples of discourses in Figure 7:

"- Camina, respirar, tiene hijos.
- Comer, dormir, hablar.
- Comer, respirar y dormir."

*Figure 7***.** Fragments of answer to question seven.

Note: Own elaboration.

The results were more similar for question 8. While 54% got the answer right, the remaining 46% showed no knowledge or mastery of the subject (Figure 8).

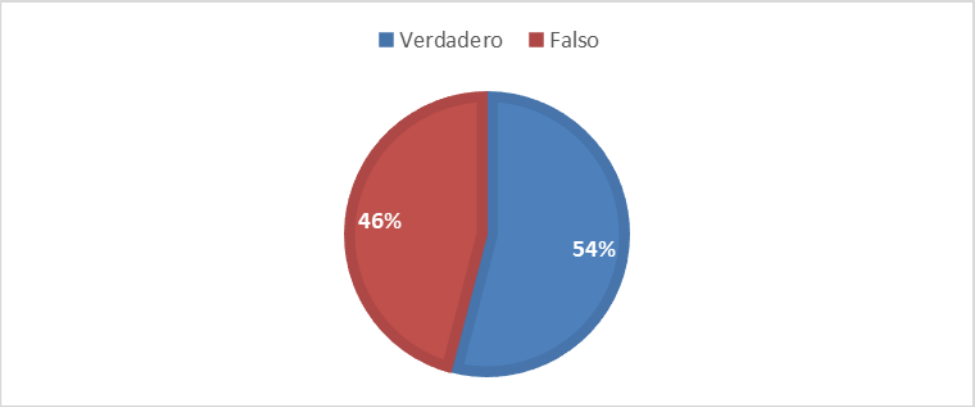


*Figure 8***.** Question 8. Statement on the definition of matter and some examples.

Note: Own elaboration.

If we look at questions 9 and 10 (Figures 7 and 8), it can be seen, respectively, that the majority of students (94%) were wrong in answering "false". Consequently, only 6% answered correctly. In the case of question 9, 24% of the students selected the correct option; however, the majority (76%) made a mistake on this point.

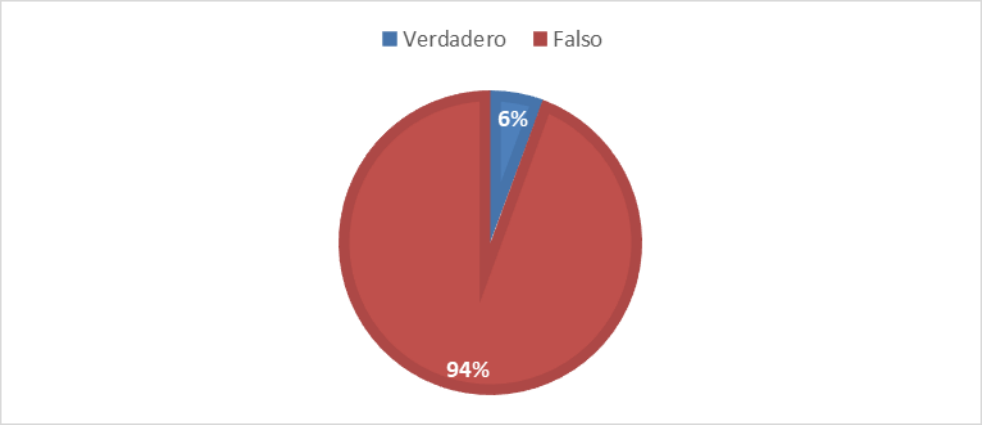


*Figure 9***.** Question 9. Statement: Liquids change shape depending on the container that holds them.

Note: Own elaboration.

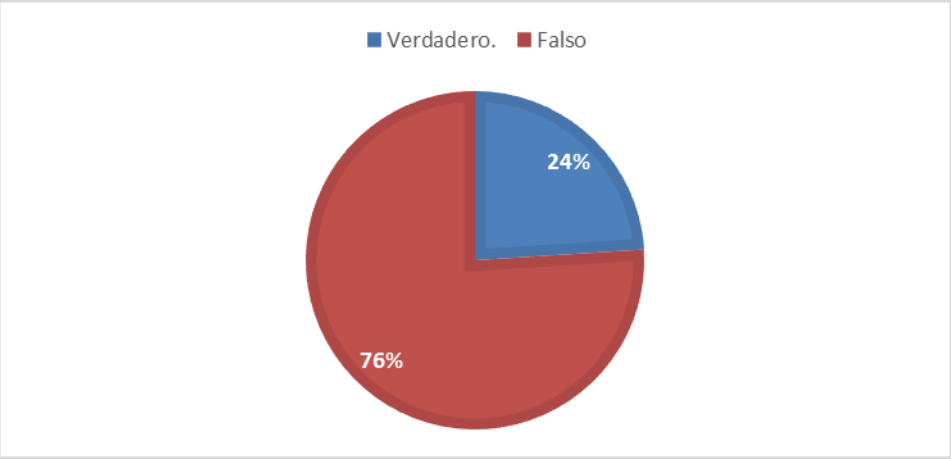


*Figure 10***.** Question 10. All bodies occupy a place in space.

Note: Own elaboration.

In the case of question 11 (Graph 9), only 9% answered correctly, while 91% did not get their answers right.

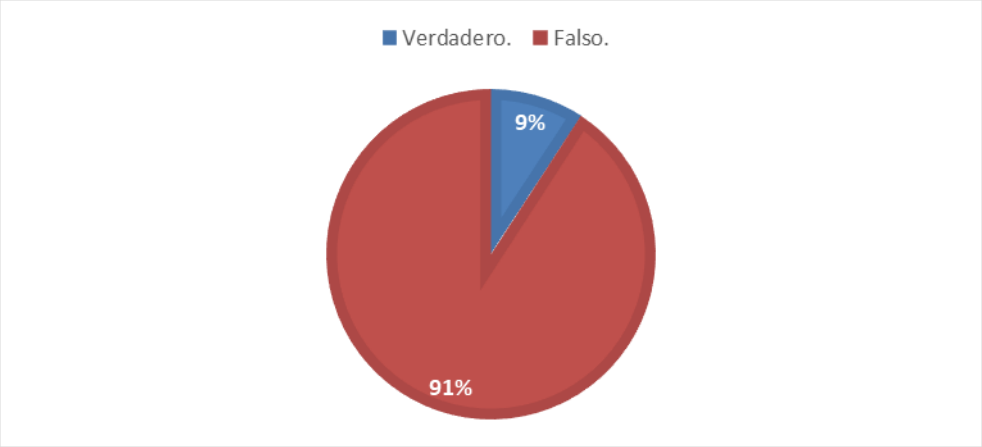


*Figure 11***.** Question 11. Gaseous bodies maintain neither shape nor volume.

Note: Own elaboration.

Question 12 was formulated as an open response and students were asked about two differences between living and inert beings. The answers in this case showed an apparently clear prior knowledge; however, the handling of key words is deficient and shows the need to enrich this knowledge. Below are some examples of answers (Figure 12) that show these interpretations:

"- Los seres vivos se mueven, los inertes no se mueven.
- Los seres vivos comen los inertes no comen.
- Seres vivos respiran los otros no hacen nada.
- Ser vivo come, ser inerte no come."

*Figure 12***.** Fragments of answer to the twelfth question

Note: Own elaboration.

Finally, question 13 was also an open-ended question based on an image of a pot of boiling water. The question was oriented towards the identification of the different states of matter; however, students answered only the process they observed in the image. Several students recognized evaporation as part of the transformation processes of matter. Even so, some students used the word "heating" to define what was happening in the image; that is, they do not have a clear understanding of the category of matter. As an example, some of the students' answers are shown in Figure 13:

"- El agua se está calentando.
- El agua se evapora.
- Se está evaporando el agua.
- Evaporación."

*Figure 13***.** Fragments of answer to the thirteenth question.

Note: Own elaboration.

Figure 14 summarizes the overall performance of the students who participated in the pretest.

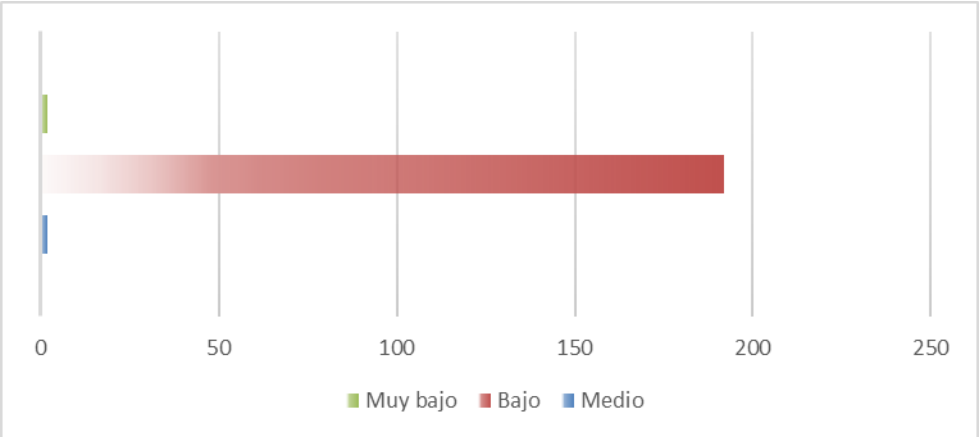


*Figure 14***.** Overall student performance at pretest time.

Note: Own elaboration.

Taking into account these initial diagnostic results, it is possible to affirm that there are learning needs in terms of key concepts such as the conformation of tissues and organs, plant processes and the different states of matter. Based on these identified needs, a series of experimentation guides are proposed.

Application of the laboratory guides: students' observations and comments

After diagnosing the knowledge and general situation of the students regarding the subject of Natural Sciences, we proceeded to the design and application of the proposed guides that responded to the previously identified needs. An observation guide was used in the application process, presenting the general results of this process.

In the design phase, the guides were elaborated taking into account the needs presented by the students. Likewise, an attractive presentation was chosen, the experiments should not be too complex and the topics to be covered should be applied in everyday life. Below is a summary of the guides and the aspects to be observed in each practice:

Table 1

Summary of the guides worked on.

Nombre de la guía	Tema	Objetivo	Aspectos a observar
El verde que alimenta	Fotosíntesis y coloración de las plantas.	Comprender el término de fotosíntesis y la coloración de las plantas.	¿Cómo reaccionan los y las estudiantes frente a las actividades propuestas? ¿cómo interactúan frente al procedimiento realizado para reconocer por qué las plantas son verdes y otras no? ¿qué comentarios hacen cuando realizan la experiencia del proceso de la fotosíntesis? ¿qué hacen respecto al procedimiento que realizaron?
¡Frutas color café!	Cambios en las frutas con la exposición a diferentes procesos.	Definir el término "oxidación" y explicar por qué aparece un color café a algunas frutas después de cortarlas o cuando sufren magulladuras.	¿Cómo reaccionan los y las estudiantes frente a las actividades propuestas? ¿cómo interactúan frente al procedimiento realizado para reconocer por qué aparece el color café en algunas frutas después de cortarlas o cuando se magullan? ¿qué comentarios hacen cuando realizan la experiencia de reconocer el fenómeno de la oxidación y cómo prevenirlo? ¿qué hacen respecto al procedimiento que realizaron?
Vamos a descubrir: ¿cómo es el sistema muscular?	Formación de los polímeros.	Explorar las características de los polímeros y cómo están formados.	¿Cómo reaccionan los y las estudiantes frente a las actividades propuestas? ¿cómo interactúan con la mezcla de reactivos para obtener el polímero? ¿qué comentarios hacen sobre el producto final que se propuso elaborar? ¿qué hacen con el producto obtenido?
Vamos a descubrir los secretos ocultos en el mundo de la saliva	Las enzimas de la saliva.	Explorar los componentes de la saliva y aportar diferentes explicaciones a cómo se forma y dónde se produce en el cuerpo humano.	¿Cómo reaccionan los y las estudiantes frente a las actividades propuestas? ¿cómo interactúan frente al procedimiento realizado para reconocer la función de la saliva en el proceso de la digestión? ¿qué comentarios hacen sobre la coloración y decoloración que la docente les muestra y que propuso elaborar? ¿qué hacen respecto al procedimiento que realizaron?
Vamos a descubrir los estados de la materia	Diversos cambios en la materia.	Explorar en diversas situaciones cotidianas los estados y cambios de estado de la materia.	¿Cómo reaccionan los y las estudiantes frente a las actividades propuestas? ¿cómo interactúan con las situaciones cotidianas sobre estados y cambios de estado de la materia? ¿qué comentarios hacen sobre situaciones cotidianas de estados y cambios de la materia que se propuso elaborar? ¿qué hacen respecto al experimento propuesto?
Vamos a observar ¿cómo es una célula animal?	Observación de la célula animal (frotis del interior de la mejilla y tejido sanguíneo).	Explorar las características de la célula animal y aportar diferentes explicaciones a las observaciones realizadas a la célula animal.	¿Cómo reaccionan los y las estudiantes frente a las actividades propuestas? ¿cómo interactúan con las observaciones realizadas del tejido sanguíneo y del frotis de la mejilla? ¿qué comentarios hacen sobre el montaje del frotis al interior de la mejilla y del tejido sanguíneo que la docente les muestra y que les propuso elaborar? ¿qué hacen respecto a las células que observan?
Vamos a observar ¿cómo es una célula vegetal?	Observación de la epidermis de la cebolla cabezona.	Explorar las características de la célula vegetal y aportar diferentes explicaciones a las observaciones realizadas a la célula vegetal.	¿Cómo reaccionan los y las estudiantes frente a las actividades propuestas? ¿cómo interactúan con las observaciones realizadas del tejido epidérmico de la célula vegetal? ¿qué comentarios hacen sobre el montaje de la epidermis de la cebolla cabezona que la docente les muestra y que les propuso elaborar? ¿qué hacen respecto a las células que observan?
Vamos a descubrir la composición de la materia	Descomposición de la sal	Explorar en diversas situaciones la descomposición de la sal.	¿Cómo reaccionan los y las estudiantes frente a las actividades propuestas? ¿cómo interactúan con la práctica de la descomposición de la sal? ¿qué comentarios hacen sobre la descomposición de la sal? ¿qué hacen respecto al experimento propuesto?

Note: Own elaboration.

After 6 months of application of the didactic guides, process information is obtained through observation with the support of the participating teachers and experts. Thus, the results of the observation and socialization with the students are presented below.

Regarding the practical guide "The green that feeds", the group was interested throughout the practice and there were no major problems in organizing the teams and dividing the activities. What they liked the most was to observe the color change in the porous paper of the experiment. The most difficult thing was to understand the name of the terms used, their origin and etymology. In addition, they considered that they wanted to try to do the experiment themselves with their own materials. The term that attracted the most attention was that of chlorophyll and the possibilities of pigmentation of many plants and flowers present in nature.

Regarding the practical guide "Coffee-colored fruits", the students are adapting more and more to the type of collaborative work, however, the formation of small groups implies for the teacher a longer explanation time. On the other hand, the students understood that oxidation is a chemical reaction and what they liked the most was to see the contrast of each piece of apple in each plastic cup when different substances were added to it, which configured its oxidation processes.

Additionally, it was important for them that the teacher let them manipulate the experiment in each case. The term that generated the most doubts was melanin, how it is produced and where, and finally, the most recurrent question was why only some fruits oxidize and others do not.

In the case of the practical guide "Let's discover: what is the muscular system like?", there were more interruptions, perhaps due to the number of students. However, most of them understood that many things around them are composed of polymers, as well as the human body; in addition, they learned how to make a polymer in the laboratory. This last point was what they enjoyed the most, as they were able to manipulate a polymer they created themselves. The most difficult part was the order established for the activity: one group had to wait for another to form their polymer, which made the students impatient.

In the practical guide "Let's discover the secrets hidden in the world of saliva", again the explanation to each group made the other students impatient, so it would be interesting to propose some complementary activity during this waiting time. On the other hand, the group learned how to test for the presence of enzymes in saliva; they also recognized the importance of saliva and chewing for digestion. One of the major difficulties was to understand the concept of amylase and they stated that there are some terms that are not easy to remember, but they manage to understand the process in a general way.

As for the practice "Let's discover the states of matter", the group showed interest in the activities of boiling and making cosmetic soap. The most difficult thing for some of them was the limited participation, due to the disposition of materials in each work group. Additionally, doubts were generated around the states of matter, especially the verification of sublimation and reversive sublimation changes.

Regarding the practice "Let's observe how an animal cell looks like", participation was high, there is astonishment when seeing the cells inside the cheek, likewise when seeing the blood tissue and how its cells move. The use of the microscope represented a great interest on the part of the group. The teacher concludes that the class time should be one block or more so that everyone can make observations and close the laboratory practice.

On the other hand, in the practice "Let's observe what a plant cell looks like", the use of the microscope allowed them to know in a real way the hexagonal shape that plant cells have and the different parts that compose them. What everyone liked the most was being able to manipulate the microscope and make assemblies. The most difficult part was the number of students, which made it difficult for each one to have a personal experience or for it to be delayed. Additionally, some students stated that they could not clearly see all the organelles that make up the plant cell.

Finally, in the practice "Let's discover the composition of matter", the students stated that they were able to learn more about the composition of salt and were able to understand that there are various compounds present in everyday life. What most caught their attention was to see how to light a light bulb in a non-traditional way. The most difficult thing in this case was that everyone wanted to participate and manipulate the experiment; however, since electric current was present, the teacher had to take special care in the socialization process.

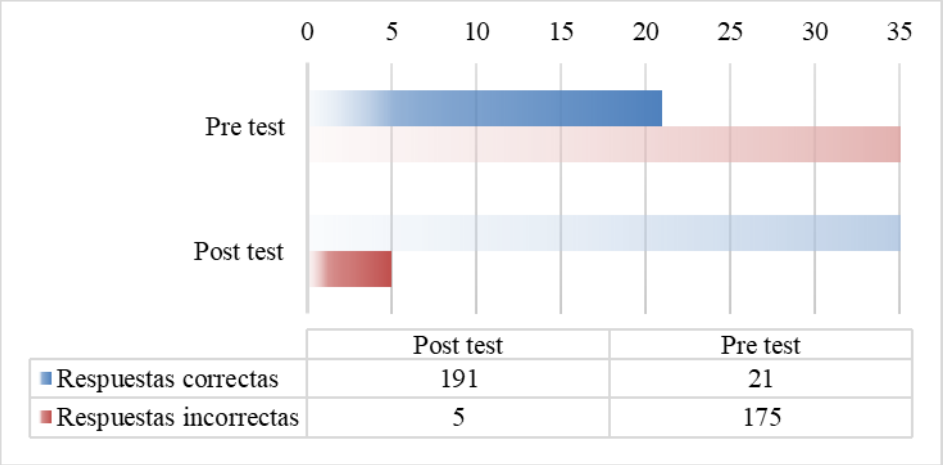
In general, the practices had certain particularities that depended mainly on the complexity of the experiments and the material used; however, a positive aspect is that in most cases the students were intrigued and wanted to participate. With the presentation of the results of the practical exercises, let us now look at the results of the post-test.

Comparison of pre-test and post-test results

Comparison of pre-test and post-test results

The last part of the research was the realization of a post-test to demonstrate if the concepts applied during the practices had really been learned and if the experimentation had an educational impact. Consequently, we are not going to refer to each of the results per question but to the comparison between these results and the results of the pre-test.

Regarding the first question on the parts of the body, the students' performance was positive, reaching 97%, which marks a significant difference with respect to the results obtained in the pretest application, as can be seen in Figure 15:

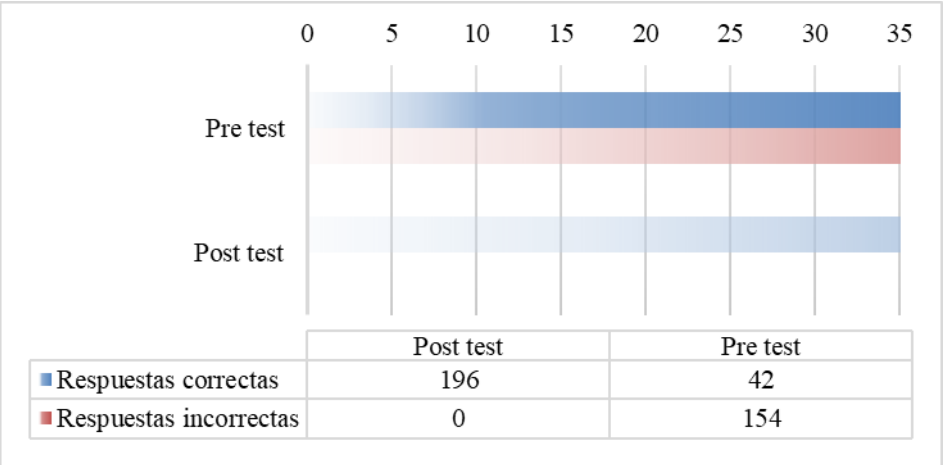


	Post test	Pre test
Respuestas correctas	191	21
Respuestas incorrectas	5	175

*Figure 15***.** Comparison between pre- and post-test first question.

Note: Own elaboration.

Now, in the second question, regarding the composition of cells in the human body, the students showed a favorable performance and none had an incorrect answer. When analyzing the results of the post-test (Figure 16), it can be seen that 100% of the population had a clearer understanding of the statement and were able to respond adequately to the formulation:



	Post test	Pre test
Respuestas correctas	196	42
Respuestas incorrectas	0	154

*Figure 16***.** Comparison of pre- and post-test second question.

Note: Own elaboration.

In the third question where the students are asked again about what makes up a set of tissues of the same class, only 4% of the students were wrong in their answers, the contrast between the pretest results is evident (Figure 17) and shows a significant improvement in the students' understanding of the concept of the tissues of the human body. However, it is necessary to continue working with this concept in order to consolidate the knowledge of all students:

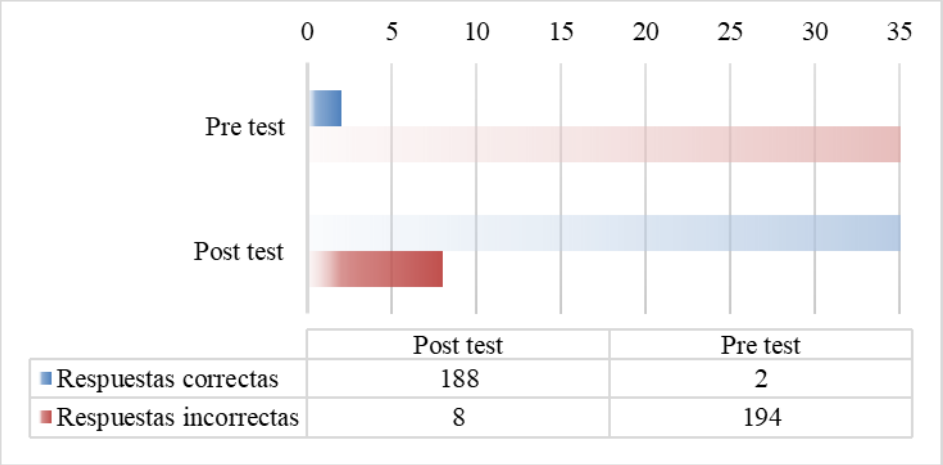


Figure 17. Comparison pre and post test third question.

Note: Own elaboration.

In this order of ideas, and continuing with the subject of the composition of the human body from its different systems, the students were asked about the ribs that make up the thoracic cage. In this case, 92% of the students significantly improved their appreciation of the evaluated point, a fact that contrasts with the results of the pretest (Figure 18), where the students' deficiencies in the knowledge of the human body and its parts could be seen.

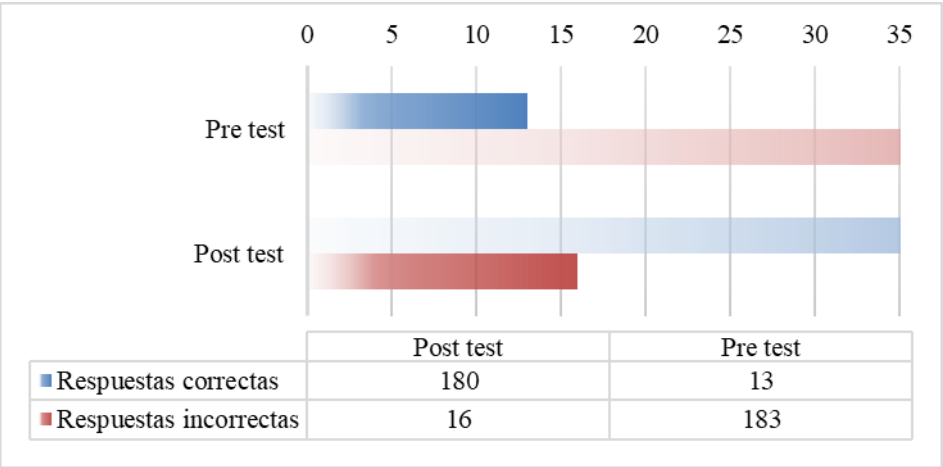
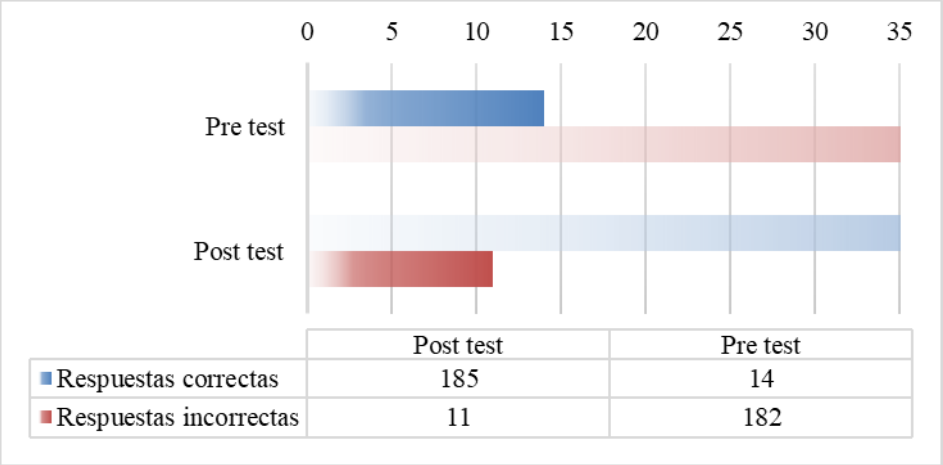


Figure 18. Comparison pre and post test fourth question.

Note: Own elaboration.

The fifth question was focused on the parts of the plant; the post-test results show that only 6% of the total number of participants made a mistake in their answer, so most of the students, that is, 94% got it right in identifying the parts of a plant, making an accurate and appropriate use of the corresponding lexicon for this case.



	Post test	Pre test
Respuestas correctas	185	14
Respuestas incorrectas	11	182

*Figure 19***.** Comparison pre and post test fifth question

Note: Own elaboration.

The sixth question was posed with an open response as mentioned initially, with the intention of knowing the way in which the students expressed their ideas and knowledge. A particular fact observable in the students' answers is that this time they did understand the statement in a more complete way, for this reason, of the three statements mentioned, the students were able to develop each of the ideas expressed, evidencing an adequate and sufficient knowledge of the photosynthesis process and the importance of plants in the production of oxygen. Some of the answers are shown in Figure 20:

> "- A) las plantas si elaboran su propio alimento gracias a la fotosíntesis. B) las plantas purifican el aire por qué ella recoge el CO2 y lo transforma en oxígeno. C) no por qué la fotosíntesis sólo se produce con presencia de la luz del sol.
>
> - Las plantas purifican el aire ya que nos dan el oxígeno por el proceso de la fotosíntesis pero requieren agua y la luz del sol.
>
> - Mediante el proceso de la fotosíntesis las plantas elaboran su alimento y producen oxigeno que ayuda a purificar el aire"

*Figure 20***.** Fragments of answer to the sixth post-test question.

Note: Own elaboration.

Complementary to the above, the seventh question was formulated around the vital functions of living beings. In this regard, the activities identified as vital in living beings were mentioned in some cases as vital functions and more than 4 of these were satisfactorily identified, which was not the case in the pretest when only two or three were adequately identified. Some of the responses are shown in Figure 21:

" - Comer, tomar agua, respirar, dormir, tener hijos con la reproducción.
- Nutrición, respiración, excreción, reproducción.
- Nutrición, circulación, respiración, excreción."

Figure 21. Answer fragments of the seventh post-test question.

Note: Own elaboration.

Regarding the eighth true-false question where a statement was made about the subject, 98% of the students answered correctly and only 2% made a mistake (Figure 16). Meanwhile, in the ninth true-false question where a statement was made regarding liquids, 94% of the students answered correctly during the post-test application (Figure 22).

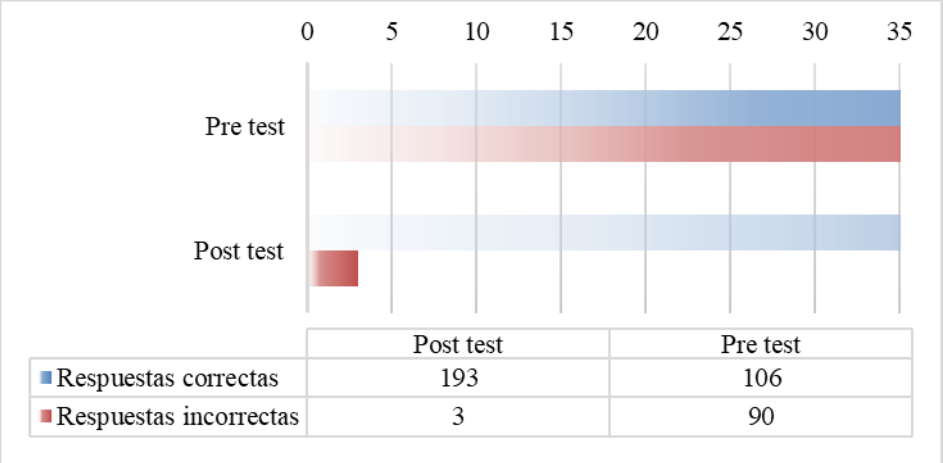


Figure 22. Comparison pre and post test eighth question.
Note: Own elaboration.

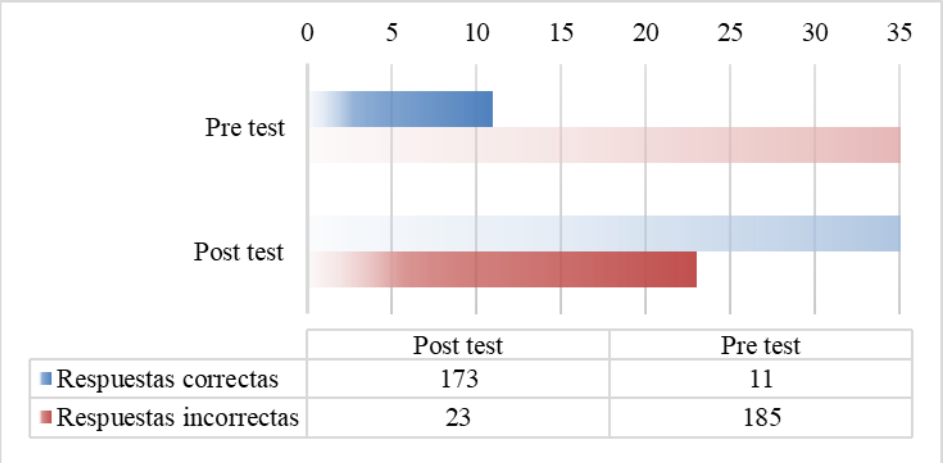
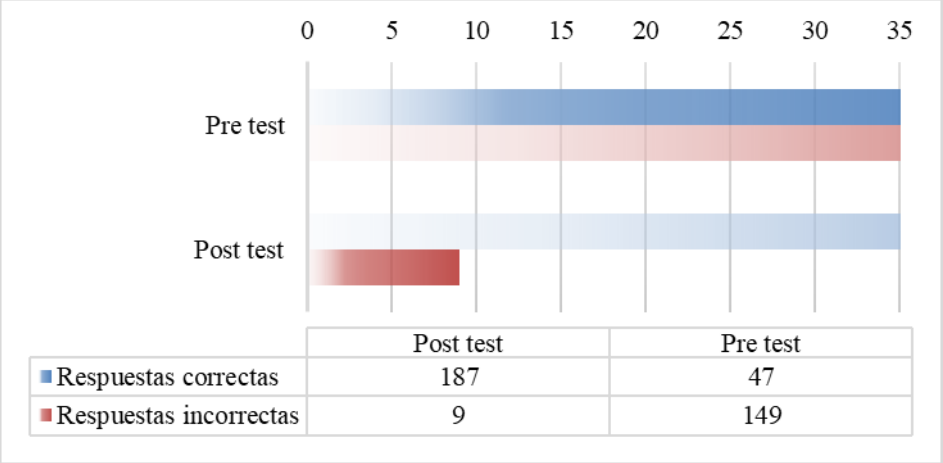


Figure 23. Comparison pre and post test ninth question.

Note: Own elaboration.

The above evidences a greater appropriation of the statements mentioned and knowledge of both topics.

Regarding the tenth question, about the changes in the subject, an improvement can be evidenced in all students, since 95% answered correctly. This shows a marked difference compared to the results achieved in the pretest:

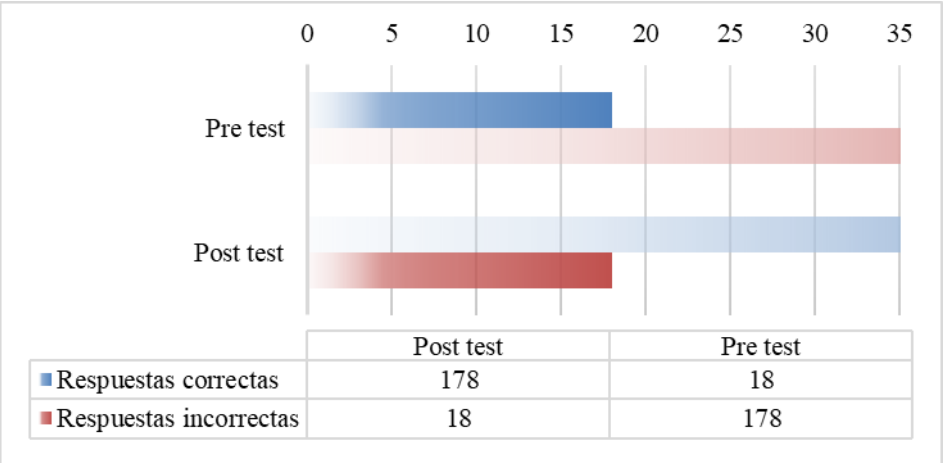


	Post test	Pre test
Respuestas correctas	187	47
Respuestas incorrectas	9	149

*Figure 24***.** Comparison pre and post test tenth question.

Note: Own elaboration.

Regarding the eleventh question on gaseous bodies, 91% of the students got the answer right and only 9% got it wrong. For this reason, there is greater clarity with respect to this type of knowledge; however, there are still students who persist with problems of clarity of concepts.



	Post test	Pre test
Respuestas correctas	178	18
Respuestas incorrectas	18	178

*Figure 25***.** Comparison pre and post test eleventh question.

Note: Own elaboration.

In the same direction, the last two open-ended questions showed a greater appropriation of the concepts and terms on the part of the students. Thus, in the first place, for the twelfth question, the students responded with respect to the differences between a living being and an inert being. Although the answers in the pre-test showed that the students were clear about the differences between living beings and inert beings, there was not a good command of key words, something that changed in the post-test results. Some results are shown in Figure 26:

" - Los seres vivos nacemos crecemos nos reproducimos y nos morimos los seres inertes no tienen vida, no se pueden mover solos.
- Los seres vivos realizan funciones vitales y los seres no vivos ayudan al ecosistema por ejemplo la luz del sol.
- Los seres vivos nacen y crecen y los demás seres inertes no sienten nada."

*Figure 26***.** Fragments of answer to the twelfth post-test question.

Note: Own elaboration.

Secondly, for the last question, students were able to identify more than one state of matter, based on the image and the statement presented. In this sense, it is also evident that there is a greater understanding of the approach of the question and, likewise, a greater clarity regarding matter and its states. Some results are shown in Figure 27:

" - Los seres vivos nacemos crecemos nos reproducimos y nos morimos los seres inertes no tienen vida, no se pueden mover solos.
- Los seres vivos realizan funciones vitales y los seres no vivos ayudan al ecosistema por ejemplo la luz del sol.
- Los seres vivos nacen y crecen y los demás seres inertes no sienten nada."

Figure 27. Fragments of answer to the twelfth post-test question.

Note: Own elaboration.

Secondly, for the last question, students were able to identify more than one state of matter, based on the image and the statement presented. In this sense, it is also evident that there is a greater understanding of the approach of the question and, likewise, a greater clarity regarding matter and its states. Some results are shown in Figure 28:

"- Sólido, líquido y gaseoso.
- Evaporación, condensación, fusión, solidificación.
- Sólido, líquido y gaseoso y el estado de condensación."

*Figure 28***.** Answer fragments of the thirteenth post-test question.

Note: Own elaboration.

Finally, the results were evaluated based on the total score and its evaluation, in this case, the student body performed as follows (Figure 29):

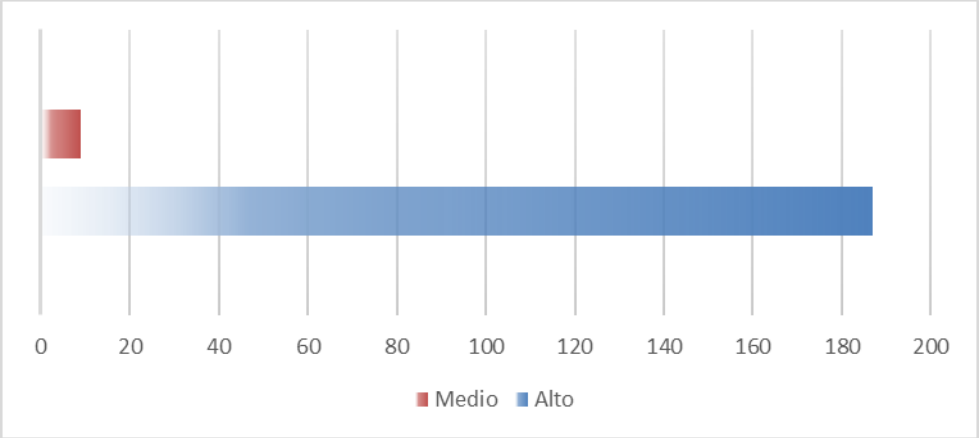


*Figure 29***.** Overall performance of students at post-test time.

Note: Own elaboration.

The data provided show that the student body had a high performance of 95% and only 5% obtained a medium performance. This fact was definitive to contrast the results of the post-test, thus establishing that of the 13 points evaluated in the post-test, most reached the maximum score and only a few people persisted in an average performance, although better than in the pretest. This shows the usefulness of experimentation for the achievement of significant learning in students.

Discussion and conclusions

In the first place, the diagnostic analysis through the pretest allowed us to identify a series of difficulties in the students with respect to the topics proposed in Natural Sciences for their specific cycle, mainly those related to the formation of tissues and organs, the processes of plants and the states of matter. This was not only evident in the low number of correct answers to the closed-answer questions, but also in the open answers provided by the students. There it was evident that they did not know the terms used, for example, the term photosynthesis, as well as the appropriate vocabulary to express their knowledge, for example, saying that water is heating instead of referring to the evaporation process. On the other hand, problems related to the lack of reading comprehension of the questions were also detected, since there were answers that did not correspond to what was asked of the students. These same needs have been identified by other authors such as Quiroz and Zambrano (2021), who report knowledge gaps in elementary school students in the subject of Natural Sciences.

Secondly, the construction of the laboratory guides was done in such a way that they were easy to understand for the students, with short and concrete activities. According to Torres and Guerrero (2018), part of the success of incorporating experimentation in the classroom corresponds to the proposal of dynamic learning through the design of simple experiments that do not involve greater complexity.

Regarding the observation guides, they reported four observations: first, that students are curious, interested and motivated to visit the laboratory spaces, interact with its tools and execute experimental tasks; second, that many times their interest leads them to adopt an impatient attitude, due to the limitation of the laboratory equipment and the large number of students; third, it was established that the laboratory visits have difficulties with respect to the

limited equipment, which limits the presence of a large number of students and the presence of a single teacher in charge of the whole group; and fourth, the teacher stated that in the first sessions of the laboratory visits, she spent more time in keeping the students in order than in explaining in depth the topics covered.

Additionally, the post-test application moment revealed a positive aspect of the application of the proposed practical guides, since the students showed a significantly higher performance than the pre-test moment in all the questions of the applied instrument. In this sense, not only was there a higher number of correct answers, but also through the open response questions, a greater mastery of the terms mentioned, a more elaborated vocabulary, which allowed most of the students to give complete and correct answers to what was asked of them, could be evidenced. This also meant deeper reading and reflection processes, in which the student solved the questions according to what was specifically asked, in that sense, all students had a significant improvement, which is consistent with the results of research such as that of Meneses, et al.(2016) and that of Hernández and Villavicencio (2017).

Taking into account the characteristics of the population addressed, it is necessary to question the importance and relevance of the provision of laboratory equipment as a tool for the development of content in natural sciences, it is evident that by having these instruments, the learning processes will be much more significant, because through experimentation is that students can demonstrate the theoretical and conceptual processes that the teacher raises.

However, it is necessary to state that the educational gaps mark a predominance in the Colombian educational system, for this reason, it is quite complex that all students have access to laboratories that allow them a better experimentation of what they have learned in class. However, Jaramillo (2019), states that the teaching-learning practices related to Natural Sciences do not only depend on the elements that a laboratory can provide, therefore, the author calls for the creative actions of teachers, incorporating above all the elements that the context of the students allows them to handle for the development of learning.

In short, the intervention of the proposal made is considered as positive, with which it can be affirmed that experimentation is a valid educational strategy to reinforce meaningful learning in students, in contents of the area of Natural Sciences. This reaffirms what Pósito (2012) mentions regarding the fact that the study of science through experimentation is important to the extent that knowledge is built from reasoning, observation, critical and reflective analysis. Taking this into account, the continuity proposal emphasizes a curricular plan that advocates experimentation as the basis for teaching and didactic guides with which students participate in the generation of their own knowledge.

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THE UNIVERSE WITHOUT WALLS: UNIVERSE, EARTHLY SOCIETIES AND THEIR INFLUENCE ON TODAY'S EDUCATION

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Abstract. This reflection article aims to establish multiple connections between the Cosmic and Terrestrial planes, involving life, society, and Education. Having as a general objective, to demonstrate the connections between Cosmic and Terrestrial mobilities interconnected by operational junctions and highlighting the numerous existing similarities. In this way, the main purpose of the study is to propose measures, aimed at introducing some improvements in social and educational life, in face of the changes currently taking place in the social and educational environment. This study starts from the connection between the concepts that establish scientific bases in the field of astrophysics and education, thus highlighting the numerous similarities, which add multiple links in the educational field. The referential framework is based on the reading of scientific and bibliographic texts, as well as other publications related to the theme. For the methodology we used the systematic analysis with a descriptive approach of scientific articles related to contents that show the proximities between the relationships about the whole of cosmic life and terrestrial societies, and their connection in the educational field. In conclusion, we can point out that there is a need to structure a new education with innovative future perspectives and, above all, aiming at renewing the educational practices among the comprehension of the innumerable facets about the human being, the universe, society, and their influence on education.

Keywords: universe, cosmos, education, future, innovations, planets.

O UNIVERSO SEM MURALHAS: UNIVERSO, SOCIEDADES TERRESTRES E SUA INFLUÊNCIA NA EDUCAÇÃO ATUAL

Resumen. Este artigo de reflexão visa estabelecer múltiplas conexões entre os planos Cósmico e Terrestre, envolvendo a vida, a sociedade e a Educação. Tendo como objetivo geral, demonstrar as vinculações entre as mobilidades Cósmicas e Terrestres interligadas por junções operacionais e destacando as inúmeras semelhanças existentes. Dessa forma, a principal finalidade do estudo é propor medidas, visando a introduzir algumas melhorias

na vida social e educativa, frente às mudanças atualmente em curso no ambiente social e educacional. Este estudo parte da conexão entre os conceitos que estabelece bases científicas no campo da astrofísica e a educação, destacando assim, as inúmeras similaridades, às quais acrescentam múltiplas vinculações no campo educativo. O marco referencial se fundamenta em leituras de textos científicos, bibliográficos, além de outras publicações relacionadas com a temática. Para a metodologia utilizamos o analise sistemático com enfoque descritivo de artigos científicos relacionados a conteúdos que evidenciam as proximidades entre os relacionamentos sobre o conjunto da vida cósmica e das sociedades terrestres, e sua ligação no campo educativo. Em conclusão podemos destacar que à necessidade de estruturar uma nova educação com perspectivas futuras inovadoras e sobretudo, visando a renovar as práticas educativas entre as compreensões das inúmeras facetas sobre ser humano, universo, sociedade e sua influência na educação.

Palavras clave: universo, cosmo, educação, futuro, inovações, planetas.

EL UNIVERSO SIN MUROS: UNIVERSO, SOCIEDADES TERRESTRES Y SU INFLUENCIA EN LA EDUCACIÓN ACTUAL

Resumen. Este artículo de reflexión pretende establecer múltiples conexiones entre los planos Cósmico y Terrestre, involucrando la vida, la sociedad y la Educación. Con el objetivo general, demostrar los vínculos entre las movilidades Cósmica y Terrestre interconectadas por cruces operacionales y destacando las numerosas similitudes existentes. Así, el objetivo principal del estudio es proponer medidas, con el objetivo de introducir algunas mejoras en la vida social y educativa, en vista de los cambios que se están produciendo actualmente en el entorno social y educativo. Este estudio parte de la conexión entre los conceptos que sientan bases científicas en el campo de la astrofísica y la educación, destacando así las numerosas similitudes, a las que se suman múltiples vínculos en el campo educativo. El marco de referencia se basa en lecturas de textos científicos y bibliográficos, además de otras publicaciones relacionadas con el tema. Para la metodología se utilizó el análisis sistemático con enfoque descriptivo de artículos científicos relacionados con contenidos que muestran las proximidades entre las relaciones en el conjunto de la vida cósmica y las sociedades terrestres, y su conexión en el campo educativo. En conclusión, podemos destacar la necesidad de estructurar una nueva educación con perspectivas de futuro innovadoras y, sobre todo, con el objetivo de renovar las prácticas educativas en la comprensión de las múltiples facetas sobre el ser humano, el universo, la sociedad y su influencia en la educación.

Palabras clave: universo, cosmos, educación, futuro, innovaciones, planetas.

Introduction

"(...) The infinity of the universe begins to be demonstrated, and the first argument is presented, taken from the fact that those who by means of fantasy want to build walls around it do not know where the world ends" (Giordano Bruno, 1998).

This study intends to constitute a descriptive and interpretative vision about the relationships that are verified between the movements of the universe, the dynamics that center the terrestrial collectivities, and education. It intends to show how the human being is a cosmic creature through his relationships with the universe, as Edgar Morin alludes to in his book on the Education of the future, "To know the human being is, above all, to situate him in the universe and not separate him from it." To which he adds, "We are at the same time cosmic and terrestrial beings." In other words, the author inquires about the human condition, whose complexity is disregarded in education and whose unity must be found in the diversity of knowledge and human beings as well as in the terrestrial identity, which must be at the level of the planetary destiny of the human race (Morin, p 46, 2001).

Morin (2001) approaches the education of the future as a means of teaching directed to the knowledge of the human being as part of the universe, thus coinciding with astrophysics that allows us to understand some questions about our existence, or where we are, and where we are going. This quest for understanding, inherent to the human species to understand the universe, allows us to have the basic knowledge to discover the technologies and services that are essential in our daily lives.

According to Morin (2001, p. 42), the human being is part of the Cosmos, whose relationship must be rescued, which was only generically referred to by him. Therefore, based on these statements, the research that gave rise to this work aims to demonstrate in greater detail how the human being is also cosmic. In this sense, the author tries to clarify the existing relationships between humans and their societies, highlighting the aspect that they are linked to the astral plane, conclusions that are reached from permanent functional similarities. In another aspect, the author states that when studying the affinities between the proximities of the Earth, with societies and the cosmos, numerous connections were found with the need to clarify this dynamic tuning as well as, in agreement with Morin, a new path must be taken to find support for the statements that humans are also linked to the Universe, of which they are inseparable.

However, the current literature on this subject addresses these contexts in a very scarce manner, not being the subject of extensive discussions, not even offering further clarifications, giving rise to debates as stated by López et al (2022, p.257). Thus, the motive of the study is justified, aiming to establish a continuous relationship of the human being with the Universe, expanding the links with Education to understand society in the scope of the mobilities that accompany the terrestrial and cosmic dynamics. In this sense, from the observations of Edgar Morin, who indicates that human beings are true cosmic beings, it begins then to establish close interpretative junctures with the universality of life, indicating reorientations also through the collaboration of the educational path.

The astral panorama is not dispersive but depends entirely on numerous cohesive activities, complemented by dynamics arranged in apparent relationships between societies on Earth and, probably, with other celestial bodies. In this sense, it focuses, evaluates, and reflects on living, social, and material terrestrial realizations in consonance with the dynamics of the Universe, acting with them in clear unison. It also examines the interpersonal relationships present in the functioning of societies while reflecting on many characteristics referring to astral mobilities, all interconnected, encompassing the Cosmos and the Earth. Explanations arising from the facts examined are further used to compare the concrete, virtual, and material relationships between these realms.

In the face of the progress of astral knowledge, changes in customs are expected in relation to the new postural orientations incorporated by terrestrial communities and brought about by the introduction of more perfected experiences in the spatial realm. Transitions in the behavior of groups originating in relations with space will gradually alter the course of human, social life, especially economic and relational due to new uses of technologies applied in innumerable sectors of terrestrial social life.

Therefore, other differentiated collective positions are expected so that they can interact with the Universe in spite of situations never experienced before. More complex connections in dealing with cohabitations coming from other patterns of contacts between human beings, social groups, and astral circles.

With all this, we highlight some of the great thinkers who also sought the same understanding as René Descartes (1596-1650), one of the great thinkers of the first half of the seventeenth century, who in his work, "The World," tries to explain his theory of the earth and scientific thought. On the other hand, we have Descartes' model of cosmogony, which had an enormous success in the 17th century.

These findings lead to the involvement of different circles linked to Education when proposing future measures in order to meet the expectations of the new social positions before the possible rapprochement of humans with the astral environment. Thus, we can establish the probability of humanity in the not-too-distant future, which makes us reflect that we need new educational standards. It is estimated that it is a necessary initiative to conduct the eventual relations between human groups, the advances in space research, and with other probable interplanetary existences, imputing consequences in the terrestrial social life.

In the mid-19th century, social changes brought about educational innovations. Since society is in constant transformation due to productive, political, scientific, and cultural changes, these influences were also reflected in the ways of teaching. They even changed the curricula and the forms of the teaching-learning relationship. In this way, we can better understand the intercurrences by interconnecting them with the proximities referred to the current technological and social moments.

According to these social transformations, educational methodologies have modified them, reconfiguring them to modern ways of teaching, making their practices freer and more participative. They are observed as consequences of the progress of science, of technological scenarios, and of the evolutionary orientations reflected on the subjects they cover. Thus, it is

proposed to support the postural reorientations envisaged in the social environments. These activities are centered on the new scenarios to which individuals, students and society will probably be exposed in view of the new intellectual molds under way as a consequence of the effects of the results of the space conquests. Thus, pointing out other roles that will be assigned to both society and education in the sense of creating sets of interactions by approaching the Universe with broad original visions. Therefore, we hope to contribute to raise the degree of understanding of the new destinies of humanity with the proclaimed cosmic connections in which terrestrial social life could be evolutionarily re-dimensioned with the help of Education.

Thus, this study describes analogous circumstances in which unusual relationships linked to schooling could also emerge. They would be the harbinger of new behaviors and orienting postures that we highlight in this study as a quest to understand the processes of different cultures, developmental stages, distances, pacifisms, and others. Likewise, we reflect on the new operating characteristics, reworking experiences originated by significant social changes, introducing new teaching methodologies, moving from the old to the modern.

According to some bibliography, we can point out that, in a fairly ancient school past, around the Middle Ages, students studied the disciplines of the Trivium (literary studies) and the Quadrivium (scientific studies) as part of their propaedeutic formation, indispensable to enter the higher courses of Theology. As well as Astronomy, according to some studies of the Quadrivium, a fact that was not regularly verified in the basic courses, at least in Brazil. Therefore, studies on the Universe are the exclusive responsibility of higher degrees, such as Physics, Astronomy, Astrophysics, Astrobiology, and others. Due to the fact that it would be interesting to have these subjects available for current students, it indicates that it would be feasible to investigate appropriate curricula for their insertion in the middle school levels, if allowed and possible.

We emphasize that, in the vast majority of the literature reviewed in this study, we found that a greater involvement of research teachers at different educational levels is necessary as well as the participation of families and school administrations. In the sense of approaching this topic through interviews, questionnaires, and discussions, in order to create conditions for a better application of the objectives and contents related to this topic in a probable implementation of educational improvements. In principle, it would help to understand the usefulness of this subject for students, not only to understand the Cosmos but also in order to help better understand many aspects of social life.

Therefore, an important aspect of this study is to develop the evolution of students in the sense of becoming true cosmic citizens, as intuited by Morin, a theme also referred to by Sagan (2020) when addressing the Universe. Likewise, we can highlight the innovations reported by names such as Comenius, Rousseau, Piaget, Vygotsky, and others, who gave a new sense, in written works, to the reorientations related to the way the school should work when teaching actively in the social, cultural aspect, and also in community life.

Education has always been didactically readapted, mainly in passive and active models. Today, there are prospects of other different changes, presenting visualizations about the destinies of mankind leading to significant surprises with extraordinary discoveries in the field

of space research. And also, significant changes in the educational field, with students being able to become scientists or researchers in astrophysics.

With all of the above, we emphasize the need to train students to acquire competencies to be able to operationalize the new relationships not only terrestrial but also sidereal. Schools would be appropriate fields of study for such initiatives. This work indicates that, from a new specific training, the students of later more advanced times were able to deepen their knowledge of astronomy. Thus, they would have at their disposal technological advances that would make more feasible, for example, a special training to begin preparations in the future to establish relations with other possible extraterrestrial civilizations.

Method

This study is based on a documentary analysis to understand the main changes and perspectives that signify the changes in human social life, based on cosmic and terrestrial relations that have an impact on educational environments. In the Scopus database, we obtained a total of 1,100 articles and books on the subject. With the characteristics of the research, we selected a total of 415 to perform the conceptual characterization.

For the analysis of the data, we used the qualitative analysis software Maxqda for the interpretation and organization of the main concepts, which allowed us to reach conclusions. And, when we had the data, we made a thorough reading of the main concepts of great thinkers and scientists to find the relevant concepts to understand these historical, social, political, educational and cultural studies as well as journalistic texts, adding those published with great prominence on the Internet on which we made some considerations. Mainly, in the sense of reflecting on the subject and, above all, highlighting the need to collaborate to prepare some conditions for possible new social and educational situations that we can highlight today.

Discussion and conclusions

As can be mentioned, as an illustration of what was seen in the previous item, the work mentions situations endowed with complexities, however, clarifying the conclusions of the studies that are the source of this article.

It is quite clear to establish these similarities with stars that present analogous stages of transformation from birth to final decay. Stars are also born, grow, mature, and die in a similar way to planetary life. It has already been scientifically demonstrated that the dust resulting from stellar explosions is subsequently agglutinated by gravity, from which new celestial bodies will originate. Thus, the cycles of life on Earth and in the stars are similar.

Research continues, developing similar reasoning that could also be used to illustrate the attractions that exist both on this planet and in the Cosmos. Here people are often drawn closer together by impulses of approach, which, in this case, can be both physical and psychological. Similarly, in space there are attractions, such as gravitational ones, that bring stars closer together as in the case of the planets and their stars. Here people are also united by

different attractions and by them they reproduce. An analogous situation is verified in the sidereal plane, where the attractions bring the stars closer together. Gravitational attractions also bind cosmic dust, giving rise to the birth of new celestial bodies.

There are also countless other different examples, among which we can illustrate the events of the numerous crises, be they political, economic, religious, or of any other nature that take place on Earth, presenting themselves in connectivity with what is also happening in space.

A well-known example is the stock market crisis of 1929, whose epicenter was in New York City in the United States. This crisis destabilized the world economy, but it was followed by subsequent readjustments in the years following its onset. Everything was then socially rebuilt years after the global imbalances that occurred at that time. There have also been other crises in different areas, such as those mentioned above, some political, religious, or warlike, all of them followed by rearrangements and new settlements.

Similar situations occur constantly in the sidereal environment when stars enter into exhaustion and explode, generating chaos in their environment, events that are always followed by environmental reformulations with the agglutination of residues by gravity for the formation of new stars. Everything is remade, both in the Universe and in terrestrial environments, or from crises originate renewals.

The referenced research also anticipates that the insistent searches for life through space indicate unexpected future discoveries, with the need for new ways of approaching educational issues. The possibilities of constant readaptations to the new environments created make it possible to detect understandings and adaptations to a new sense in which the human being will probably have to live as a cosmic creature, as intuited by Morin. This new environment would be the consequence of new forms of life that would affect society and education.

Possibly well connected to the Cosmos by more concrete relationships, many people could initiate the establishment of contacts with extraterrestrials, given the high possibilities of encountering civilizations through space. Obviously, adaptations would be necessary, which research will demonstrate.

From the observations contained in the study, it is not difficult to foresee these possibilities as technological levels advance at intense speeds. This is where research should focus its attention. It would be a way to foresee the possible changes that could be inserted in school environments in order to prepare, as well as to introduce changes pending readaptations in the educational and social spheres.

The work in reference describes that this is the direction in which the alterations are going, mainly the communicative ones, observing that the interplanetary communications are already in an advanced technological phase. This occurs judging by the artifacts that left Earth and that today transit regions beyond the Solar System.

It is to be expected that in the not-too-distant future this possibility will exist or that communications will be established between terrestrial and planetary civilizations, exchanging

cultures, sciences, images, languages, training, as well as other relational models aided by technological and scientific development.

Living examples are the exchanges of messages carried out here today through social networks, events that could be amplified in the future between interplanetary or cosmic beings. It was Edgar Morin who suggested, in the aforementioned work, the need to rescue cosmic human beings as a way of integrating them into the Universe. Here lie, therefore, the central ideas of the research, by demonstrating how these relationships can be possible, since the Earth and the Universe have always been united by ties of great proximity in similarities and dynamics. The social networks already functioning on Earth have been active for a long time, intensifying the internal relationships between people. Could this activity be the anticipation of an initial training for the establishment of future communicative relationships with outer space, whose concretion would depend on other adjustments?

According to the perspectives of technological development intensively searching for life through space, society will be able to face, in not-so-distant periods, the surprises of establishing direct interactions with other astral civilizations. There is a great possibility that these developments will be concrete achievements since, statistically, the existence of other inhabitants on many planets other than Earth can be considered certain. One of the unknowns at the moment would be to know their levels of development, as well as the necessary adaptations before having to make entanglements with unknown civilizations.

On the other hand, as can be observed, in terrestrial environments many business situations revolve around leadership. These are the cases of company bosses or in the military hierarchy, in sports, politics, among families, schools, and other areas, where we see situations that link people under the command of managerial sectors. There are always groups that are subordinate to one another, often revolving around something larger, such as tasks, discussions, or studies. So also, on the sidereal plane, everything is connected in constant orbital movements under the influence of the dominant stars that generate stronger gravities.

It is known, on the other hand, that even among microparticles these characteristics can be easily found. This is what happens with atoms in which there are elements that orbit in clouds indefinitely. This can be verified with the gravitational theory studied for centuries, these being the great achievements of Newton and Einstein. By studying universal gravitation, the well-known English physicist was able to establish very famous theories, such as Universal Gravitation, while Einstein in his investigations was able to conclude that, by attractions, the major bodies distort space, changing their position in the mechanical regularity of the stars.

On the other hand, the study compares and analyzes astral and terrestrial similarities. There is also the not so well-known dark matter, which, as it is known so far, can integrate a global matter network, influencing the whole Universe, regulating it or changing its movements. In the similarity, in the same way, among terrestrial living beings, there are the networks of brain neurons that may be with dark matter related in the similarities. Likewise, among terrestrial beings, organisms function in networks, such as respiratory, digestive, urinary, lymphatic, circulatory, cerebral, communicative, and others. As in the Universe, there

are also galaxies and planetary systems, cosmic and terrestrial syntonies appear, so the proximities illustrated in this study are quite evident.

From the readings carried out for the development of this study, we can refer to the educational advances, considering the conclusions of the last years in relation to the topic highlighted here. And also, the influence of the curiosities shown by the students in relation to the terrestrial cosmos. In this way, we conceptualize based on the referenced studies and readings, we can highlight the visible associations between cosmic mobility and social dynamics. Mainly, in the sense of terrestrial life, where education can occupy a prominent place, ensuring considerable aspects of the existence of movements that intertwine the earth with the mobilities of the universe and the perceptions of these connections reflected in the current educational field. Therefore, in this paper, we highlight the numerous evidences that confirm this aspect and facilitate the understanding of these perceptions.

According to the material reviewed in this study, we emphasize that a great majority points to an earthly movement, which has cognation with the astral plane, thus showing that there are correlations between these relationships. Therefore, we can affirm that terrestrial beings are not dissociated from the Universe, as it seems to be the desire of some thinkers. However, the proximities may not be exclusive, given the connections pointed out with the analogies. In other words, to think that living beings are centered only on Earth or that they exist as exclusive products of it, may be a mistake, as evidenced by certain literature that states that terrestrial life is marked by birth, development, maturity, old age, and death, thus demarcating the stages of the astral plane that mark the innumerable similarities between the successions of terrestrial and sidereal movements. On the other hand, we would like to point out, as a conclusion, that according to the analysis of the analyzed documents and articles, there is an association between the cosmic movements and the dynamic facts of life and terrestrial societies, from which humanity could draw lessons extended to the educational field. Also, to establish some convictions such as that there is a close connection between the Earth and the Universe, and human beings could be considered as cosmic creatures, as suggested by Morin.

However, on the lines of action and the statements established here, critical observations are admitted. In general, these observations are concepts that give rise to studies related to the subject, and even to related readings that seek the understanding of the dynamics of the Universe and the Earth in the face of human education. Therefore, almost all the mobilities observed on Earth have similarities that are also found in the Cosmos, as well as the great majority of the visible movements in the astral plane; in some way, they are equally associated to the terrestrial nature. This is strong evidence that it is safe to say that there are proximities between these two spatial areas from which lessons can be drawn.

In this way, according to the evidence of the proximities between terrestrial occurrences with the Universe, in addition to the relationships between humans and cosmic mobilities, in clear demonstrations of unequivocal affinities, by adding relational uniquenesses, supporting the inspirations expressed by Morin (2001), we consider that in the future they may be acceptable as possible unions between the innumerable civilizations, thus making their inhabitants and cosmic creatures, as Morin (2001) states to us, that we are true cosmic citizens.

The acceptance of these ideas would be rather a simple contribution to help make the universe without walls, as was in the past the desire of Bruno, commented in the work of White (2003, p. 114), who for his revolutionary ideas about the universe and religion earned him the relentless persecution of the inquisitors of Rome, who tried him and condemned him to death at the stake in the Middle Ages. Another characteristic highlighted by White is Bruno's connection with occult traditions derived from primitive philosophies linked to the iconic figure of Hermes Trismegistus, "he saw the occult as a pattern of ideas, a network of concepts that could be accessed to gain a greater understanding of the universe." Thus, we can consider that there are great possibilities of analogies between the functioning of terrestrial and possibly other space societies, in the sense that there are similarities between them. However, what concerns the issues discussed is that they are linked to the perceived mobility between the universe and terrestrial societies as extensive aspects of education.

However, we can conclude that, according to the concepts contained in this study and performing an analysis, there are incidences that allow the development of links with the subject, articulating with the ideas and considering the descriptive elements of the existing literature. This being an important aspect in today's society and an indispensable factor for the evolution of education, with the objective of achieving a better understanding in the sense of spatial and terrestrial connections.

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