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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:

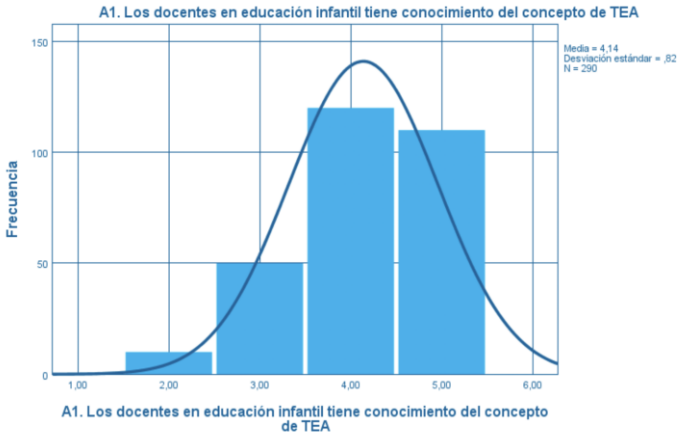

Figure 1. A1 of emotional intelligence.
Note: Own elaboration

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.

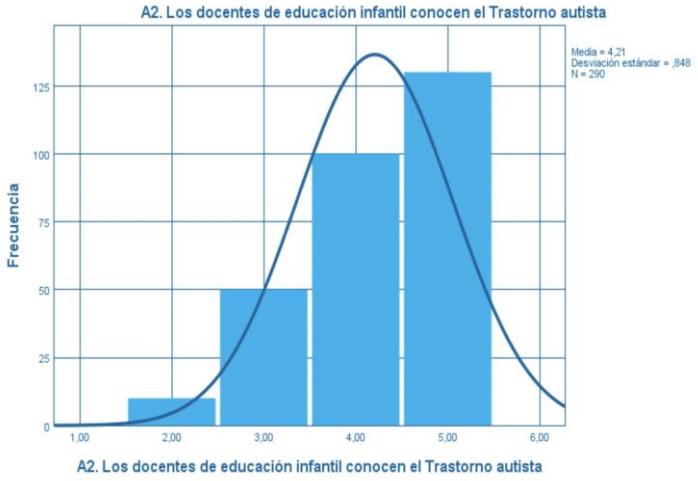

Figure 2. A2.
Note: Own elaboration

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.

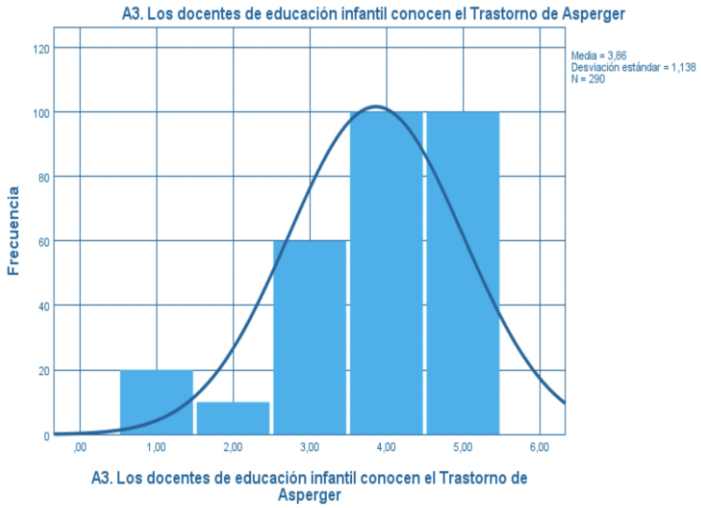

Figure 3. A3.
Note: Own elaboration

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.

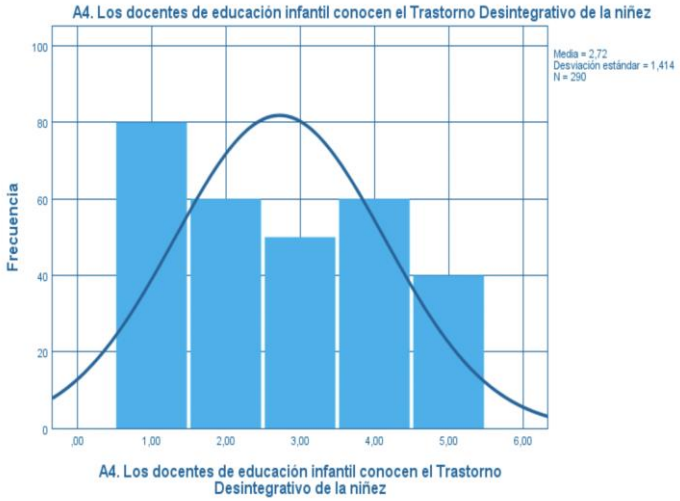

Figure 4. A4.
Note: Own elaboration

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.

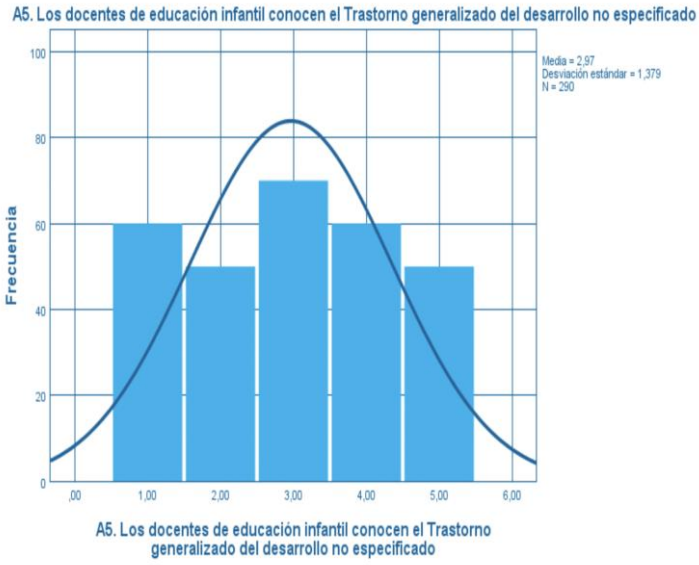

Figure 5. A5.
Note: Own elaboration

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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