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Difficulties In Learning Mathematics Among Cochlear Implant Students: A Field Study In Some Primary Schools In El Oued Province

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Abstract:

The focus on speech production and learning among cochlear implant students in the third grade of primary education has presented us with clear cognitive challenges. Therefore, this scientific paper examines one of these educational challenges that emerged in the educational path of cochlear implant students across various divisions. The aim of this study was to investigate the level of difficulties in learning mathematics among integrated classes of cochlear implant students in the third grade of primary education, whether residing in rural areas (where educational support sessions are unavailable) or urban areas (where such support is available). This was accomplished using a descriptive approach and the application of Mustafa Fathi El Ziyat's diagnostic assessment scale for mathematical difficulties. The study sample consisted of deliberately selected 27 cases during the academic year 2022-2023 from different primary schools in El Oued Province. The results indicated that cochlear implant students experience high levels of difficulty in learning mathematics.

Keywords: Mathematics Learning Difficulties, Cochlear Implant.

Introduction:

Learning difficulties in mathematics, also known as dyscalculia, encompass innate challenges in comprehending and mastering various mathematical calculations. Similar to dyslexia, it involves difficulties in understanding numbers, multiplication methods, and learning mathematical theories, among other symptoms. Although mathematical learning difficulties are commonly associated with children who exhibit lower intelligence quotient (IQ) scores, they can affect individuals regardless of their intellectual levels. Based on spatial and diagnostic measures, estimates suggest that approximately 3-6% of the population experiences this issue.

The ability of students to comprehend, process, and recall new information is virtually limitless, regardless of their differences in stimulating interest towards studying, demonstrating determination comparable to adults in overcoming challenges. Educational difficulties typically manifest after students enter school, where some

learners struggle to acquire academic skills, leading to discrepancies between their ability and achievement levels. This phase often identifies a greater number of students with learning difficulties, observable across various subjects, notably mathematics, which is crucial as it serves as the foundation for nearly all other sciences, representing abstract thinking. It is the language of the mind, encouraging contemplation and directly linked to technological advancement.

However, the focus here pertains to a specific group: children with cochlear implants, for whom traditional and even advanced hearing aids failed to fully restore auditory senses. Technological advancements have achieved remarkable scientific breakthroughs by stimulating the auditory nerve and translating sound vibrations into signals delivered to the auditory center in the brain's temporal lobe. Following psychological and speech therapy rehabilitation, some linguistic and cognitive developmental issues have arisen among these students with cochlear implants.

Academic challenges among hearing-impaired children and those with cochlear implants have begun to emerge. As specialists, it is imperative to study, diagnose, and provide solutions before this phenomenon exacerbates, inevitably impacting the educational attainment of these children.

2. Methodology and Tools:

2.1 Study Problem:

Hearing impairment significantly affects the academic and educational aspects of hearing-impaired students, influencing their academic characteristics. Several studies have highlighted this impact. For instance, Furth (1973) indicated that only a small percentage of the deaf population achieve comprehensive reading and mathematical abilities beyond the secondary level. Similarly, Writeston et al. (1963) surveyed approximately 5,307 deaf students with an average hearing impairment of 84 decibels and ages ranging from 8 to 16 years. Their findings revealed that the average reading grade level for this sample was equivalent to third grade elementary. Thus, the academic achievement of deaf children is influenced by several factors, including individual motivation, degree of hearing impairment, teaching methods, and others.

Considering schools as crucial social institutions established by societies to educate their children, helping them grow in all aspects of their personalities to maximize their abilities and preparedness to fit into their communities. Given the emphasis in our Arab societies, particularly on academic achievement as a key outcome of schooling, issues such as academic delay and failure pose a threat to its role. Therefore, supervision focuses on studying these problems in terms of their causes and solutions, despite the presence of health and educational monitoring units.

Statistics indicate that among cases of academic delay, the percentage suffering from learning difficulties reaches up to 18%, with advanced studies pointing to 9% severe cases and another 18% non-severe cases among elementary school students struggling with

learning difficulties (Maameria, 2008, p. 113). Today, many sciences rely on mathematics, although its importance varies from one society to another depending on technological development and the complexity of life, requiring mathematics as a means to facilitate and accelerate many matters by "measuring, ordering, expressing quantities, times, distances, sizes, weights, currencies, and others" (Al-Maliki, 2008, p. 14).

- Calculation is not limited to the educational environment, but extends to all aspects of our daily lives, regardless of cultural, economic, and social environments or the developmental levels of societies. Since learning difficulties "appear throughout a person's life and are not limited to childhood stages, and in culturally, economically, and socially different environments" (Habib, 2006, p. 43), it becomes a problem that pressures both schools and society, as it stands as a barrier to achieving one of their most important goals, prompting a focus on those with learning difficulties and ways to assist them (Hafez, 1998, p. 81).

However, concerning children suffering from various forms of deafness, technology has played a significant role in introducing them to the world of sound, after traditional hearing aids failed in this regard. Despite the importance of developing Arabic language reading skills among cochlear implant children to align with their rehabilitation (Dehaene, S., 2010).

Teachers of these children rely on their own assessments and tests to evaluate their performance in reading. The goal is to enhance reading levels among these children, focusing solely on this aspect rather than identifying other difficulties they may face during their studies. The current study aims to explore the mathematical testing of third-grade elementary students with cochlear implants in various integrated sections under the supervision of the Directorate of Education and the Directorate of Social Activities. Given the scarcity of such studies in the scientific community, the researcher highlights the existence of mathematical difficulties among these students.

Following the example of many countries worldwide, Algeria adopted an important project related to cochlear implants since 2003, performing surgical operations to implant electronic cochlear devices for children with sensory deafness, especially severe cases. Algeria has also responded to international legislation, particularly from the United Nations, advocating for the integration of these children and students with cochlear implants or traditional hearing aids, and others with disabilities, into regular schools. This integration aims to end their isolation and ensure their education in a natural environment alongside their peers. This initiative aims to achieve psychological balance, develop verbal communication, and improve academic performance to propel them towards higher educational achievements.

2-2 Study Questions:

- What is the level of arithmetic learning difficulties among third-grade elementary students with cochlear implants who are enrolled in integrated classrooms?

- Is there a difference in the level of arithmetic learning difficulties among third-grade elementary students with cochlear implants in integrated classrooms based on gender?

- Is there a difference in the level of arithmetic learning difficulties among third-grade elementary students with cochlear implants in integrated classrooms based on their surrounding environment (rural villages vs. urban areas)?

3- Study Objectives:

- To identify the academic challenges faced by third-grade elementary students with cochlear implants in integrated classrooms.

- To assess the level of arithmetic learning difficulties among third-grade elementary students with cochlear implants in integrated classrooms.

- To raise awareness among parents about the importance of educational integration for the development of arithmetic skills.

- To closely examine the school environment for students with cochlear implants and attempt to mitigate educational barriers to achieve successful educational integration.

4- Study Importance:

The importance of this study lies in its exploration of several important cognitive aspects, summarized as follows:

- Drawing attention of speech therapists not only to cognitive, perceptual, and linguistic development of students with cochlear implants but also to numerical and mathematical symbols.

- Advocating for educational support units to aid this group of students and teachers in facilitating the teaching of mathematics.

- The current study may contribute to diagnosing and treating arithmetic learning difficulties, which are among the primary challenges faced by students with cochlear implants in their educational and developmental journey, crucial for learning across all quantitative subjects.

5- Procedural Definitions of Study Terms:

5-1- Arithmetic Learning Difficulties:

Arithmetic learning difficulties, also known as dyscalculia, represent a specific type of learning disability involving innate challenges in comprehending or grasping mathematical calculations. It is closely related to dyslexia and encompasses difficulty in understanding numbers, multiplication concepts, and learning mathematical theories, among other similar symptoms, despite the absence of a defined scope for dyscalculia.

6- Study Hypotheses:

- Third-grade elementary students with cochlear implants enrolled in integrated classrooms experience severe arithmetic learning difficulties.

- The level of arithmetic learning difficulties varies among third-grade elementary students with cochlear implants in integrated classrooms based on gender.

- The level of arithmetic learning difficulties differs among third-grade elementary students with cochlear implants in integrated classrooms based on their surrounding environment (rural villages vs. urban areas).

7- Arithmetic Learning Difficulties:

1-7- Historical Background of the Term:

Dyscalculia is a diagnosis used to describe learning difficulties related to understanding and dealing with mathematics. It is sometimes referred to as "mathematical dyslexia." While dyslexia concerns difficulties in reading and writing, dyscalculia specifically pertains to challenges in mathematics.

Studies indicate that 3 to 7 percent of adults and children suffer from dyscalculia, finding it difficult to grasp mathematical concepts and rules, such as determining which amount is greater than another or solving a specific equation.

Symptoms of dyscalculia may vary depending on age and developmental stage. Common symptoms of dyscalculia include:

7-2- Symptoms of Dyscalculia in Early Childhood:

• Difficulty in learning counting.

• Difficulty in linking numbers with their meanings, such as understanding that the number "3" applies to groups of items like 3 apples, 3 cars, or 3 objects.

• Difficulty in recognizing sizes, such as smallest to largest or shortest to tallest.

7-3- Symptoms of Dyscalculia in Elementary School:

• Difficulty in learning and recalling basic number facts like number bonds, for example, 6 + 4 = 10.

• Continued use of fingers for counting instead of more advanced strategies like mental math.

• Poor understanding of mathematical symbols such as (+), (-), (×), and (÷), or making errors when using these symbols in their appropriate contexts.

• Difficulty in realizing that 3 + 5 is the same as 5 + 3 or inability to solve 3 + 26 - 26 without counting.

• Difficulty in understanding place value and placing numbers in their correct columns, often placing numbers in the wrong column.

• Inability to comprehend mathematical language or formulate a plan to solve a math problem.

• Difficulty in understanding mathematical phrases such as greater than and less than.

• Difficulty in remembering outcomes in games or competitive activities involving math.

• Difficulty in calculating the total cost of items being purchased.

• Avoidance of situations that require understanding or dealing with numbers, such as participating in games involving math.

7-4- Symptoms in Secondary School:

• Difficulty in understanding information on charts and graphs.

• Difficulty in finding different ways to solve the same mathematical problem, such as adding the length and width of a rectangle and doubling the answer to find the perimeter instead of adding all sides.

• Difficulty in learning and understanding multi-step thinking methods and calculation procedures.

• Difficulty in measurement, such as measuring sizes or weights in a simple recipe or liquids in a bottle.

• Lack of confidence in executing exercises that require understanding speed, distance, and directions.

• Difficulty in applying mathematical concepts to money, such as calculating payments and the remaining balance.

The history of the term dates back at least to 1949, where mathematical disabilities were originally defined as cases studied with patients suffering from specific calculation difficulties due to damage to certain brain areas, which are more commonly seen. Developmental difficulties in learning calculations include genetic factors that affect a person's abilities in understanding, remembering, or multiplying numbers and basic arithmetic facts (e.g., multiplication tables). The term also refers to the inability to perform arithmetic operations, but it has also been defined by some education specialists and cognitive psychologists like Stanislas Dehaene and Brian Butterworth as a fundamental inability to conceptualize numbers as abstract quantities (Fahmi, 1995, p. 45).

An early presentation of dyscalculia is difficulty with what is termed "subitizing," which is the ability to instantly recognize the number of elements in a small set without counting. Subitizing is an innate ability that manifests in humans, particularly children, from birth. Homologous circuits are present in primates, and many other animals possess similar capabilities. Typically, a human child can subitize up to three elements automatically, with this number increasing as they mature (Abu Fakhr, 2007).

7-5- Causes:

Scientists and researchers in cognitive psychology, education, and educational psychology have not fully understood its causes and have investigated several fields. According to current findings:

A. Neurologically: Dyscalculia is often associated with lesions in the angular and supramarginal gyri when connecting the temporal and parietal lobes of the cerebral cortex (Al-Maliki, 2008, p. 88).

B. Working Memory Deficit: Adams and Hitch suggested that working memory is a significant factor in mental arithmetic (addition operation). Based on this premise, Jerry conducted a study proposing that individuals with dyscalculia have a deficit in working memory. However, issues with working memory are often mixed with general learning difficulties, so Jerry's findings may not exclusively relate to dyscalculia but rather reflect broader educational deficits.

C. Other Causes: Short-term memory weakness can make it difficult to recall calculations. Studies have also clearly shown that congenital or hereditary disorders may be a possible cause of dyscalculia, establishing a close relationship that can be a clear cause.

8- Cochlear Implantation:

- Cochlear implant technology represents one of the most advanced solutions for individuals suffering from complete or severe hearing loss in both ears, where conventional hearing aids fail to compensate for their hearing impairment. Due to the absence of residual hearing in these cases, researchers have devised an alternative method: stimulating the auditory nerve via an electrode implanted inside the inner ear. In this procedure, sound is received by an external microphone, processed technologically to simplify it, and then transmitted to facilitate auditory perception (Al Khateeb, 1997, p. 82).

Researchers conducted practical experiments with electronic cochlear implantation on individuals who had acquired hearing loss after learning language due to accidents or illness (Abu Hamza, 2003, p. 86). These individuals possessed good auditory memory for sounds.

Children undergoing cochlear implantation often exhibit severe developmental deficiencies that negatively impact their life skills, including language production, audiovisual perception, arithmetic abilities, among others. This prompted specialists in audiology and cognitive psychology to identify these crucial skills and develop various programs to enhance them (Chouard, C-H, 1978).

8-1- Beneficiaries of Cochlear Implantation:

Typically, individuals with severe to profound deafness, whose hearing loss ranges from 50 decibels and above, and who cannot benefit from conventional hearing aids, are candidates for cochlear implantation. Profound deafness results from the loss of function

in the cochlear hair cells, which affect the generation of nerve impulses and electrical activity in the auditory nerve (Zraigat, Ibrahim, 2003). Medical professionals clearly distinguish between children eligible for cochlear implantation and those who cannot benefit from this significant technology.

However, adherence to age criteria for cochlear implantation is crucial to avoid various issues, including differences in auditory age. What is auditory age? What is its significance?

8-2- Auditory Age:

Auditory age refers to the period starting from the surgical procedure, the initial session of electronic programming of the electrodes, to the time when sound reaches the electronic cochlea.

8-3- Importance of Auditory Age:

Auditory age holds immense importance in the acquisition of oral language skills in children, largely due to the early detection of hearing impairment, which allows for greater opportunities to benefit from cochlear implantation. The primary goal of cochlear implantation is to develop the ability to perceive and produce speech (Salhi, 2019). Therefore, it is crucial to use meaningful speech as input for listening tasks and encourage children to respond to environmental sounds that occur naturally at home and in school. As auditory skills develop during the post-implantation phase, it becomes critically important for the child to establish the relationship between hearing and speech, enabling them to employ their new auditory capabilities in speech production.

This phase is considered one of the most critical stages because the child's ability to distinguish between sounds improves, and early development in auditory discrimination correlates with better speech skills, clearer speech, and eventually learning to link all sounds and their meanings to form words and sentences.

However, auditory-verbal education poses several challenges. The process of audiovisual perception varies among children depending on their chronological and auditory ages, affecting the smooth progress of psychological and educational care for children undergoing cochlear implantation. Salhi (2019) summarizes some critical factors that influence the fundamental outcomes of the educational process for these children.

9- Study Limits:

Every study is defined by the nature of its subject, objectives, methodology, concepts, as well as its temporal, spatial, and human scopes, enabling researchers to proceed accurately towards achieving their goals without deviation. The current study's boundaries can be summarized as follows:

9-1- Human Limits:

The study includes students who have undergone cochlear implantation (formerly deaf children) enrolled in integrated classes in primary schools in El Oued province, as indicated in Table 01.

9-2- Spatial Limits:

To fulfill the requirements of this study, the researcher implemented it with cochlear implant recipients in three primary schools in El Oued province, southern Algeria.

9-3- Temporal Limits:

This study was conducted during the first semester of the academic year 2022/2023.

10- Theoretical Framework of the Study:

10-1- Field Study Procedures:

10-1-1- Study Methodology:

The scientific methodology employed in this study is closely tied to the nature and objectives of the research topic. It serves as the structured approach that outlines principles and rules guiding the investigation of the research problem (Mohamed Abdelhafiz, 2000, p. 83). Here, we explore the difficulties in learning arithmetic among cochlear implant recipients. The most suitable and appropriate scientific approach to uncovering the intricacies of this topic is the descriptive-exploratory methodology. This method allows for the systematic description of phenomena or scientific problems, leading to logical interpretations supported by evidence and arguments that enable the researcher to establish specific frameworks for the issue and determine study outcomes.

10-1-2- Study Tools:

- Diagnostic Scale for Measuring Mathematical Learning Difficulties by Dr. Mustafa Fathi Al-Ziyat, designed for teachers. This scale initially comprised 20 items before two items, the first and last, were removed because they were not aligned with the curriculum set by the Ministry of Education. Additionally, the researcher relied on students' score sheets, which included their grades and evaluations by teachers, along with detailed notes.

10-2- Tool Validity:

The validity of the comparative reliability was assessed by calculating it for 20 male and female students in order of their scores on the Diagnostic Scale for Mathematical Learning Difficulties. Eight percent of the highest scores and eight percent of the lowest scores were selected, and the statistical significance of the difference between them was determined.

10-3- Reliability:

The reliability coefficient for the Diagnostic Scale for Mathematical Learning Difficulties was calculated using Cronbach's alpha consistency method on a sample of 19 second and third-year elementary students. The Cronbach's alpha value obtained was 0.081, which indicates significance at a 0.05 level.

11- Study Sample:

The primary study sample consists of cochlear implant recipient students aged between eight and nine years, with auditory ages ranging from three to five years. These children were hearing impaired and underwent cochlear implant surgeries between the ages of three and five years. They continue their audiological and psychological rehabilitation through various detection and school monitoring units, attending special classrooms both before and after benefiting from cochlear implant technology. They are currently studying in third-year elementary classes, as illustrated in the following table:

Table 01 illustrates the study sample:

Students / Age	**Number**	Chronological Age	Auditory Age	Grade Level	Note
Students	19	9 years old	5/4 years	Third Grade	/
	8	8 years old	3 years	Third Grade	Given age exemption or held back due to health issues

12- Statistical Methods:

The statistical program SPSS was utilized for data analysis, employing Chi-square test, mean, standard deviation, and Cronbach's alpha coefficient.

13- Previous Studies:

Due to the lack of previous studies specifically addressing arithmetic learning difficulties among cochlear implanted students, the researcher relied on studies that focused on arithmetic difficulties among normally hearing children. For instance, Atallah Benyahia's study on elementary students demonstrated that arithmetic difficulties are among the most prevalent learning disabilities (Atallah, 2009, p. 87).

Additionally, Souad Khelil (2004) indicated that children with arithmetic difficulties exhibit normal language and other skills but struggle with addition, subtraction, sequencing, and time-tracking tasks (Ait Yahia, 2009, p. 8).

Furthermore, Fahd Al-Dari's study (2005, p. 69) on children with special needs highlighted challenges in understanding arithmetic problems, converting story problems into numerical formats, interpreting arithmetic symbols (+ or -), sequencing numbers, and performing addition, subtraction, and division operations.

Research by Nunes and Moreno (1998) evaluated arithmetic activity in deaf children and found their performance significantly weaker compared to their hearing peers (Moreno, Nunes, p. 236). Similarly, a study by Hage, Charlier, and Leybaert (2006).

At the University of Philadelphia in 2008, research conducted by Blatto-Vallee, Kelley, Gaustard, Porter, and Fonzi confirmed that deaf students (who did not benefit from cochlear implant technology) and who successfully completed high school faced delays in mathematics. Their academic performance did not surpass that of their hearing peers enrolled in regular schools, and their performance levels remained unchanged without notable improvement in higher education levels.

14- Results and Discussion:

-Results of the Study:

14-1- Presentation and Discussion of the First Sub-Hypothesis Results:

The first hypothesis states that third-grade students with cochlear implants enrolled in integrated classrooms suffer from severe levels of mathematical learning difficulties. After applying the tests, the researcher obtained the results shown in the following table:

Table 02: Results of the First Sub-Hypothesis

Levels	**Number of Students**	**Mean Score**	**Standard Deviation**
Mild	07	39.90	0.76
Moderate	09	54.99	0.59
Severe	11	72.11	0.69

After calculating the mean score, the median value of the scale was analyzed, and the levels of dyscalculia were categorized as follows:

- From 20 to 40: Mild mathematical learning difficulties

- From 41 to 60: Moderate mathematical learning difficulties

- Above 61: Severe mathematical learning difficulties

Based on the study results, it is clear that the proportion of third-grade students with cochlear implants (the study sample) who suffer from mathematical learning difficulties is high.

14-2- Presentation and Discussion of the Second Sub-Hypothesis Results:

The second hypothesis posits that the level of mathematical learning difficulties differs among third-grade students with cochlear implants enrolled in integrated classrooms based on gender. The following table illustrates the statistical significance.

Table 03: Differences in the Level of Mathematical Learning Difficulties by Gender:

Mathematics Scores	N	X	σ	Calculated T	Degrees of Freedom	Significance Level	Decision
Males	09	52.72	2.85	3.54	17	0.05	Not significant
Females	18	65.07	2.91				

From the table, it is clear that the calculated T value of 3.54 is greater than 0.05, indicating it is not statistically significant. Thus, we conclude that there are no statistically significant differences in the level of mathematical learning difficulties among third-grade students with cochlear implants based on gender. This implies that males do not differ from females in their level of mathematical learning difficulties. This finding is corroborated by studies on the level of mathematical learning difficulties among third-grade students (with normal hearing) based on gender, such as the study by researcher Asma Al-Ashhab in 2016 on a sample of 19 students enrolled in the third grade, which also found no differences between them.

14-3- Presentation and Discussion of the Third Sub-Hypothesis Results:

The level of mathematical learning difficulties among third-grade students with cochlear implants enrolled in integrated classrooms differs based on their surrounding environment (rural villages – urban cities). The following table illustrates the statistical significance.

Table 04: Differences in the Level of Mathematical Learning Difficulties Based on the Surrounding Environment

Number of Students	Chi-Square (χ^2)	Significance Level	Statistical Significance
27	0.69	0.38	Not Significant

The table indicates that the significance level is greater than 0.05, leading to the conclusion that there are no significant differences in the level of mathematical learning difficulties among third-grade students with cochlear implants enrolled in integrated classrooms, regardless of their surrounding environment. In other words, third-grade students with cochlear implants living in rural areas do not differ in the level of mathematical learning difficulties compared to those living in urban areas. This finding holds true despite the rural group not adhering strictly to psychological and orthophonic support sessions, school follow-ups, and electronic programming of hearing aids, as well as differences in environmental characteristics (behavioral patterns, social life, smart electronic screens, etc.). This is consistent with studies such as Fayol (2015).

Additionally, this suggests that changes in lifestyle (rural vs. urban) do not necessarily lead to proficiency in mathematical skills. The skill is purely cognitive, and proficiency does not differ between the two groups.

Globally, it is recognized that there are students who suffer from low academic achievement. Upon closer examination, it is evident that these students often have physical, sensory, and mental abilities within the normal range. However, there remains a significant gap between their actual performance and expected performance, even with equal educational opportunities compared to their peers in the same educational environment. These students include those with cochlear implants, who have recently become more prevalent in the clinical setting in Algeria. These cases are particularly complex and obscure, exhibiting varying levels of severity. Hence, there has been increased attention to this group, especially after their inclusion among special needs categories. As Jamil Samadi notes, this issue is not only educational but also psychological and adaptive, affecting the child, their parents, and their family. Therefore, educational and therapeutic interventions are necessary to alleviate the struggles of these students, as highlighted in recent studies, including Samadi's (1998) research (Al-Khateeb, 1997, p. 114).

Discussion of Results:

The researcher based the presentation and analysis of the results on the same methodology used in the original test. Various methods were employed in data analysis, leading to the finding that the percentage of third-grade students with cochlear implants (the study sample) is high. This presents a real issue that requires consideration for resolution. It is essential for orthophonic specialists not to focus solely on learning and producing letters and speaking clearly and accurately. Mathematical problems are crucial in academic life (Belguidoumi, 2001).

Human knowledge is characterized by its diversity and the interrelation of its various fields. Mathematics is one of the most important areas of human knowledge. It is a sequential and integrated science that continually progresses, with no limits to its advancement. Mathematics is considered an abstract, organized, and precise science, capable of reaching any conclusion through the presentation, interpretation, and analysis of data and ideas.

We all understand that mathematics is an abstract science created by the human mind, focusing on methods, techniques, and concepts. It relies on a mode of thinking and proof that aids the mind in interpreting and analyzing many phenomena and situations encountered by humans.

Mathematics has been defined in several ways: some consider it a tool used in daily life and a method for pursuing scientific studies, while others view it as an indispensable computational skill (Benaissa, 1998).

The study also found no statistically significant differences in the level of mathematical learning difficulties among third-grade students with cochlear implants enrolled in integrated classrooms, regardless of gender. This finding aligns with studies on the level of mathematical learning difficulties among third-grade students with normal hearing, irrespective of gender or surrounding environment, even though rural students often do not adhere to attendance and schooling.

It is the duty of specialists in speech therapy and special education not to focus solely on teaching pronunciation and language production, as well as cognitive exercises and tracking the development of electronic programming sessions for the hearing device to improve cognitive abilities. Instead, we must also emphasize encouraging children with cochlear implants to interpret and analyze various mathematical concepts and phenomena, given their importance in the child's academic and educational life.

The success of students with cochlear implants in integrated classrooms in solving these problems depends on the degree of encouragement and attention they receive in the classroom, school, and even at home. This is due to the significance of mathematics and arithmetic operations in academic life and overall educational levels.

Psychological and speech therapy support allows students with cochlear implants to benefit from early education in an environment where they can develop their personality and gain acceptance of their disability. This support also enables them to be at the same level as their peers in terms of school activities. However, a deaf child, even one who has benefited from a cochlear implant, still faces challenges in correctly applying arithmetic skills, whether they have had early education or not. These challenges include incorrect application of arithmetic operations, which are related to arithmetic skills and are among the most complex problems researchers encounter in this field, posing the greatest obstacle to a child's success in school. Due to the lack of research in this area, we decided to study the particularities of "arithmetic skills in students with cochlear implants.

Among the proposals we advocate is to expand the study to a larger sample, as our study was limited to a sample of 27 students with cochlear implants.

- We also suggest generalizing the study to other levels, especially in primary and secondary education, where the arithmetic program advances to more abstract and logical thinking stages.

- Conducting more in-depth studies on arithmetic in students with cochlear implants, including anatomical analyses.

- Developing special curricula and methods for teaching arithmetic to students with cochlear implants, starting from the concrete stage to the abstract stage, enabling them to grasp the subject matter better.

After studying and discussing the results, the researcher recommends the following:

- Regular practice of basic mathematical concepts such as counting, addition, subtraction, multiplication, and division.

- Breaking down the subject matter into smaller units to facilitate information comprehension, especially for students with cochlear implants.

- Using small groups of other students to teach mathematics.

- Frequent review of basic mathematical concepts through practical and tangible exercises.

Conclusion

The study revealed that difficulties in learning arithmetic are not limited to hearing students alone; they also extend to those with special needs, including students in morning schools attended by most of our regular children. The researcher highlights that students with cochlear implants are also affected, emphasizing the need for optimal support for this group. It is essential not only to focus on speech and language production but also to pay greater attention to arithmetic symbols, operations, and cognitive activities.

Scientists have noted that some individuals with dyscalculia have called for a shift in perspective, suggesting that instead of viewing the disorder as something to be cured, individuals can excel in other areas, such as artistic skills. Programs have been developed to address or remediate arithmetic learning disorders (Romainville, 2007).

Various cognitive psychologists have pointed to neuro-sensory educational therapy as a potentially effective treatment. A study published in Current Biology highlighted the potential benefits of using non-invasive brain stimulation to enhance numerical learning capabilities selectively. This was achieved through transcranial direct current stimulation (tDCS) of the parietal lobe, demonstrating improvements that persisted six months post-treatment.

Through speech and psychological rehabilitation for children with cochlear implants, specialists must ensure that these children learn the fundamentals of arithmetic. This subject is crucial for early childhood education. Given the valuable time lost before and after the surgical procedure and during the electronic programming sessions of the hearing device, it is important to prevent further delays. This is especially critical as their hearing peers continue their arithmetic education without interruption, which can exacerbate the cognitive challenges faced by children with cochlear implants.

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