Evaluation of semantic memory in deaf children with cochlear implants

تقييم الذاكرة الدلالية لدى الطفل الأصم الحامل للزرع القوقعي

Khadidja LAGOUG *

Lecturer B, University of Algiers 2

K.lagoug@univ-blida2.dz

Receipt Date :25/01/2025 **Acceptance Date :20/05/2025** **Published Date: 25/05/2025**

Abstract: The present study aims to evaluate the level of semantic memory, which serves as a repository for information processing and storage in children with cochlear implants, considering it an essential system for language and important knowledge, as well as a significant cognitive process in life in general and in the educational process in particular. This study involves three cases aged between 6 and 7 years, which applies the Yacine Semantic Memory Test aimed at children between 6 and 10 years. The descriptive method was us .After reviewing the literature on the subject, previous studies, and analysing the results of the cases, the findings indicate that the child with a cochlear implant has a level above average in semantic memory, with some difficulties in naming, recognizing body parts, semantic classification, semantic lexicon, and semantic drawing. The level was determined to be at or below average with difficulties in functional sentence connection, verbal fluency, and semantic parsing, particularly evident in the area of sound recognition. This is attributed to a lack of prior auditory experiences due to the hearing impairment, which indicates the difficulty in the process of acquisition and adaptation to the external environment. Therefore, the researcher recommends early intervention for deaf children, providing healthcare and psychological support that aids in rapid and healthy cognitive development, especially in semantic memory. Additionally, it is necessary to focus on training the cognitive aspects for the child with a cochlear implant rather than concentrating solely on the linguistic aspect.

Keywords: Semantic memory, deaf child, cochlear implant.

الملخص: تهدف الدراسة الحالية لتقييم مستوى الذاكرة الدلالية لدى عينة من الأطفال الصم الحاملين للزرع القوقعي، أجريت على 3 حالات تتراوح أعمارهم بين 6-7 سنوات، حيث قمنا بتطبيق اختبار الذاكرة الدلالية لياسين لعجال الموجه للأطفال بين 6 إلى 10 سنوات، واستخدمنا المنهج الوصفي، وتوصلت النتائج إلى وجود مستوى فوق المتوسط في الذاكرة الدلالية لدى الطفل الحامل للزرع القوقعي مع بعض الصعوبات في كل من بند التسمية، التعرف على الأعضاء، التصنيف الدلالي ، المعجم الدلالي، الرسم الدلالي، وإلى مستوى متوسط وتحت المتوسط وكانت الصعوبات في كل من بند الربط الوظيفي للجمل، السيولة اللفظية، التقطيع الدلالي، و يظهر ذلك خاصة في بند التعرف على الأصوات وهذا راجع إلى نقص الخبرات السمعية السابقة بسبب الإصابة بالصمم، مما يدل على

*-Corresponding author

صعوبة عملية الاكتساب والتكيف مع المحيط الخارجي، لذلك أوصت الباحثة بالتدخل المبكر للأطفال الصم، وتقديم الرعاية الصحية والنفسية التي بدورها تساعد على نمو معرفي سريع وسليم بالأخص الذاكرة الدلالية.
الكلمات المفتاحية: ذاكرة الدلالية، الطفل الأصم، الزرع القوقعي.

1-Introduction:

Deaf children are individuals with special needs who face numerous challenges and difficulties in their daily lives, stemming from their families, schools, and communities. These challenges arise from their inability to hear, which hinders their communication with others and can lead to social isolation and withdrawal. This is due to difficulties in retaining, storing, and retrieving information, which is a result of impairments in the complex cognitive process known as memory.

Memory is a set of functions related to the ability to record, prepare, store, and retrieve information after it has been stored in various areas of the brain. One of the most important types of memory is semantic memory, which is the memory of meanings and meaningful knowledge. It allows for the storage of semantic and conceptual linguistic knowledge and represents the individual's general knowledge. This cognitive knowledge is not tied to a specific learning situation and, therefore, is not dated within a particular temporal context.

Among the most important types is semantic memory, which is considered the memory of meanings and meaningful knowledge. It allows for the storage of semantic and conceptual linguistic knowledge, and represents the individual's general knowledge. This cognitive knowledge is not tied to a specific learning situation, and therefore is not dated within a particular temporal context.

This information has been semantically encoded, then stored. Semantic memory capacity is vast, reaching tens of thousands of words in a well-educated individual. It is utilized in educational and pedagogical fields. Despite the significance of semantic memory as a cognitive function, there is a scarcity of Arabic and foreign, particularly local, studies, especially concerning hearing-impaired children. Deaf children encounter difficulties in linguistic skills, leading to problems in semantic storage, organization, and retrieval.

Based on the aforementioned, this study aims to assess the level of semantic memory in deaf children with cochlear implants.

2-Problematic:

The field of deafness has captivated the interest of numerous researchers from various disciplines, with the topic of hearing correction being particularly prominent (Awajijah, 2015, p. 202). Hearing plays a vital role in the life of any living organism, as sound vibrations transmitted through air are converted into neural signals by the ear and sent to higher brain centers via the auditory nerve. The significance of this function becomes apparent upon its loss, whether due to damage to the auditory organ or the auditory neural centers, leading to difficulties in keeping up with life and problems with speech, either in the form of delays or pronounced articulatory distortions resulting from a lack or deficiency of linguistic input (Rakza, 2014, p. 6).

Among the most significantly affected mechanisms in deaf children are linguistic mechanisms, due to the child's inability to hear sounds. Since language acquisition is primarily based on the linguistic input stored in the early years of a child's life, the storage process requires essential mechanisms such as cognitive abilities. Among the most important and initial of these is attention, which is necessary for selecting stimuli. This is followed by the stage of perception, where the child assigns meaning to the selected information. For retention, inputs are transferred to memory, which is divided into three basic types: sensory memory, short-term memory, and long-term memory. Sensory memory is linked to the senses and receives external information through the senses, such as auditory or visual input, retaining approximately 10% of the received information and preparing it for organization. This information is then transferred to short-term memory, where it undergoes necessary processing before being stored in long-term memory (Bouti, 2012, p. 20).

This last category [long-term memory] contains two specialized elements: procedural memory and declarative memory. The former concerns the rules and regulations governing an individual's daily activities and is characterized by difficulty in

storage but ease of retrieval. The latter includes both episodic memory, which relates to the temporal and spatial sequence of specific events in an individual's life, and semantic memory, which encompasses the meanings of knowledge and facts about the environment. Semantic memory is considered the memory of words, concepts, rules, and abstract ideas, and is essential for language use. It is the mental organization of information that individuals process about words and various other verbal symbols and their meanings and references, in addition to the rules and systems that govern them and the necessary systems for processing these symbols, concepts, and relationships (Tulving E, 1993, p. 175) .

Despite the global interest of researchers, specialists, and educators in educating children with hearing impairments, there are numerous obstacles and challenges. Studies have shown that deaf students face multiple difficulties, including difficulties in connecting ideas, difficulties in accessing and processing information, and academic difficulties among others (Qasmi, p. 10, 2014).

Our choice of this study is also supported by the findings of Qasmi's (2014) study on semantic memory in deaf children. After applying several tests of semantic memory to a sample of 120 children, divided into two groups - the first group included 61 normal-hearing children and the second group included 61 deaf children - several results were obtained. Most notably, there was a negative correlation between deafness and semantic memory, and deaf children were found to have problems organizing information at the working memory level (Qasmi, 2014, p. 217).

In addition, a study by Alverde Lili and Benkemou, Estelle (2016) evaluated semantic and episodic memory in deaf children with cochlear implants based on their visual and auditory abilities. They found that the performance of deaf children with cochlear implants develops according to the age at which the implantation is performed, the duration of the implantation, and the speech therapy provided (Benkemoun, 2016, p. 73).

Through our interactions with this group, we have observed several problems, including difficulty remembering previously learned words and trouble recalling them on demand, despite the possibility of spontaneous recall. Consequently, all language disorders mention memory problems without focusing on semantic memory specifically. Based on the above, we pose the following question:

What is the level of semantic memory in deaf children with cochlear implants?

3-Hypothesis:

The level of semantic memory in a child who is deaf and has a cochlear implant is low.

4-Objectives of the study:

- To investigate the level of semantic memory in children with cochlear implants.
- To shed light on semantic memory as a cognitive ability in deaf children with cochlear implants.
- To identify the strengths and weaknesses of semantic memory in children with cochlear implants

5- The importance of the study:

- Highlighting the importance of semantic memory function as a neurocognitive process and explaining it in terms of disorder for the group of deaf children with cochlear implants.
- Providing insight to specialists and educators on the importance of the function of semantic memory, to focus on it in therapeutic, educational, and pedagogical programs

6-Definition of terms :

A-Theoretically:

1-Semantic memory:

"According to Tayeb Rashwan (2006), semantic memory is the part of the brain that stores our knowledge about the world, such as facts, concepts, and words. It's like a mental encyclopaedia"

2-Deaf child:

"A deaf child is someone who cannot hear well enough to understand language. They may have a hearing loss that is mild, moderate, or severe."

3-Cochlear implant:

"A cochlear implant is a device that helps deaf people to hear. It's a small electronic device that is surgically implanted into the cochlea, a part of the inner ear."

B-Procedurally:

In our study, it refers to the score obtained by the deaf child with a cochlear implant on Yassine Ladjal's semantic memory test, for children aged 6-10 years.

7-Methodological procedures for the study:

7-1-Exploratory study:

The preliminary study is considered the most important step in this field of research. The objectives of our study are as the following:

- To identify and define the study sample.
- To verify the psychometric properties of the semantic memory test.

7-2-Study method:

The nature of the study dictates the methodology to be employed. In our research, we adopted a descriptive approach

7-3-Limitations of the study:

7-4-Time period: The semantic memory test was applied in February 2024

7-5-Spatial limitations: The field study was conducted at Beni Messous University Hospital

7-6-Study sample:

In our research, we relied on purposive sampling, which involves selecting several typical cases or cases that represent different dimensions of the research population. This is also referred to as deliberate sampling, as the researcher intentionally selects specific individuals (Obaidat, 1999, p. 103).

The study sample consisted of 3 cases, aged 6-7 years, who were deaf and cochlear implant users

7-7-Study techniques:

Test of semantic memory Yassin Lajjal: This study relied on the Semantic Memory Assessment Test for children aged 6-10 years, developed by Yassin Lajjal. This test consists of 9 items, including:

1-Naming Item

2- Body Recognition Item

3- Semantic Classification and Order Item

4- Sentence Comprehension and Functional Connection Item

5- Semantic lexicon Item

6-Semantic judgment

7- Verbal Fluidity and Semantic Segmentation Item

8- Sound Recognition Item

9- Directed semantic drawing Item

Test objectives :

1-To assess the child's ability to name objects.

2-To assess the child's ability to identify body parts.

3-To assess the child's ability to categorize and sequence semantically.

4-To assess the child's ability to understand and make functional associations between sentences.

5-To assess the child's semantic vocabulary.

6-To assess the child's ability to make semantic judgments about objects.

7-To assess the child's verbal fluency and categorization.

8-To assess the child's ability to identify environmental sounds.

9-To assess the child's ability to draw semantically.

The psychometric properties of Yassin Lajjal's semantic memory test (validity/reliability) :

In his 2016 study, Lajjal conducted a validation study to assess the reliability and validity of the test items. This was based on theoretical concepts and cognitive models of semantic memory. The test comprises a set of items designed to measure the same objective: evaluating the level of semantic memory, its organizational patterns, and any associated disorders.

To assess the test's validity, the researcher calculated the Pearson correlation coefficient between the items of the semantic memory test and the items of the BEC96 battery for the assessment of memory disorders and common cognitive deficits, which was adapted by Yassin Lajjal in his master's thesis and used as an external criterion (Lajjal, 2010).

The correlation coefficients between the "naming images" subtest of the semantic memory test and the battery items ranged from 0.1 to 0.39, with three correlations significant at the 0.05 level. For the "body part identification" subtest, correlations ranged from 0.1 to 0.55, with four significant at the 0.01 level. Correlations for the "semantic categorization and sequencing" subtest ranged from 0.1 to 0.37, with four significant at the 0.05 level. For the "sentence comprehension and functional association" subtest, correlations ranged from 0.01 to 0.43, with two significant at the 0.01 level and two at the 0.05 level.

Similarly, for the "semantic vocabulary" subtest, correlations ranged from 0.01 to 0.46, with two significant at the 0.01 level and two at the 0.05 level. For the "semantic judgment" subtest, correlations ranged from 0.01 to 0.62, with two significant at the 0.01 level and three at the 0.05 level. For the "verbal fluency and semantic categorization" subtest, correlations ranged from 0.01 to 0.53, with three significant at the 0.05 level and three at the 0.01 level. Correlations for the "environmental sound identification" subtest ranged from 0.01 to 0.79, with two significant at the 0.05 level and six at the 0.01 level. Finally, for the "guided semantic drawing" subtest, correlations

ranged from 0.01 to 0.68, with two significant at the 0.05 level and three at the 0.01 level.

Most of the correlation coefficients between the test items and the battery items were significant at the 0.01 and 0.05 levels. The remaining correlation coefficients were significant at the 0.05 level. This indicates that all items of the semantic memory test are related to the items of the BEC 96 battery, suggesting that the semantic memory test is valid and measures what it is intended to measure.

Regarding reliability, Lajjal calculated the split-half reliability by dividing the items into odd (9, 7, 5, 3, 1) and even (8, 6, 4, 2) numbered items. The reliability coefficient for the first half was 0.23, while for the second half, it was 0.43, which is considered acceptable and indicates reliability. The Spearman-Brown coefficient for the corrected total score was 0.519, and for the uncorrected total score, it was 0.52, indicating high consistency.

Furthermore, test-retest reliability was calculated for a group of normal children, yielding correlation coefficients ranging from 0.40 to 0.83, which were significant at the 0.01 level. These results indicate that the test is reliable and can be used to assess semantic memory and its disorders in Arabic-speaking Algerian children. It can be employed in both academic research and clinical settings (Lajjal, 2016, p. 70).

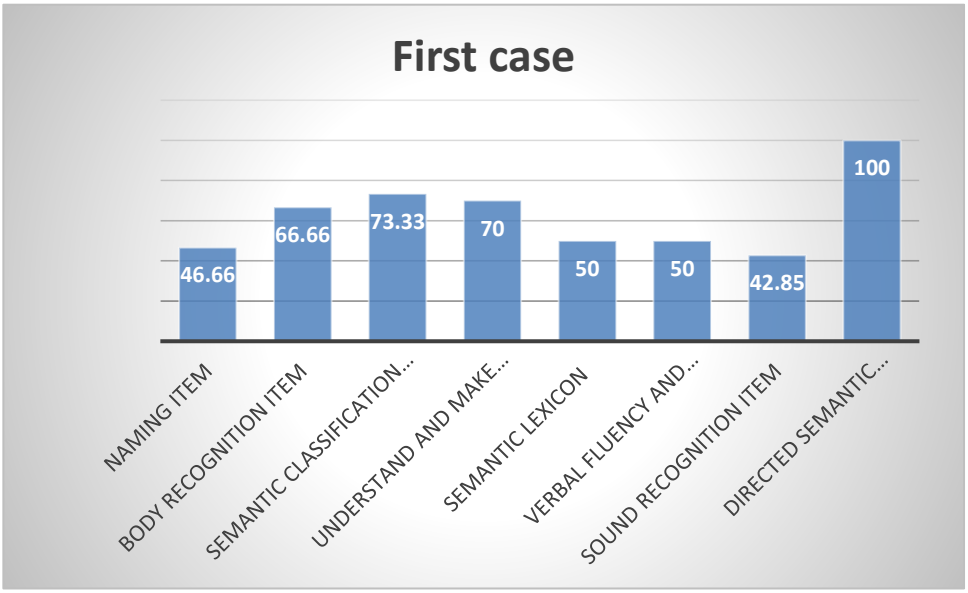
Case Presentation 1:

Child A, 7-year-old male, who underwent cochlear implantation in 2022.

Table number 01: shows the results of the first case

Test components	Correct answers	Wrong answers	No answer	Total:	Percentage of correct answers
Naming item	35	18	20	35/75	46,66%
Body Recognition Item	8	0	4	8/12	66,66%
Semantic Classification and Order Item	11	2	2	11/15	%73,33

Sentence Comprehension and Functional Connection Item	21	7	2	21/30	%70
Semantic lexicon Item	3	0	3	3/6	%50
Verbal Fluidity and Semantic Segmentation Item	4	0	0	4/8	%50
Sound Recognition Item	12	0	0	12/28	%42,85
Directed semantic drawing Item	4	0	0	4/4	%100
Total	98	27	35	160/178	%89,88



Graphical Number 01: Representation of Correct Answers for first Case

Quantitative analysis: Table number 1 presents the results of the semantic memory test for the case:

The case scored the highest in each of the following items:

- Body Recognition Item: 12/8, equivalent to 66.66%

- Semantic Classification and Order Item: 11/15, equivalent to 73.33%

- Sentence Comprehension and Functional Connection Item: 21/30, equivalent to 70%

- Directed semantic drawing Item: 4/4, equivalent to 100%

The case scored average in the following items:

- Semantic Lexicon Item: 3/6, equivalent to 50%
- Verbal Fluidity and Semantic Segmentation Item: 4/8, equivalent to 50%
- Naming Item: 75/35, equivalent to 46.66%

The case scored low scores in the following items:

- Sound Recognition Item: 28/12, equivalent to 42.85%

Note: The sixth item was removed as it is specific only to special and clinical populations such as children with psychosis

Qualitative analysis:

Based on the results obtained above, it appears that the first case has an average semantic balance, as indicated by the score of 46.66% in naming item, suggesting a moderate ability to connect the signifier and signified and recall semantic concepts. Additionally, the recognition score for body parts is 66.60%, confirming child's ability and knowledge regarding body parts.

Moreover, the score of 73% in the classification and semantic order item indicates an awareness of categorization of objects. It means that in the understanding and functional connection of sentences category, he received 70%, indicating satisfactory comprehension and good capacity for understanding.

In Semantic Lexicon Item, the score was average at 50%, where child "A" answers regarding the image of the phone were correct; child "A" stated that we talk with it and even conducted a dialogue with himself as if he were on a call. He also recognized other words, such as "fish," stating that it is edible, as well as "orange" and "watch," but he did not achieve a perfect score due to his inability to remember some words.

As for verbal fluidity and semantic segmentation item, child "A" scored 50%, as he responded to the first instruction by easily naming four animals. However, he did

not respond to the words beginning with the letters we presented to him in the instruction; he did not understand the instruction correctly but mentioned a word beginning with the letter "ب ," (c) which was "بقرة ." (cow).

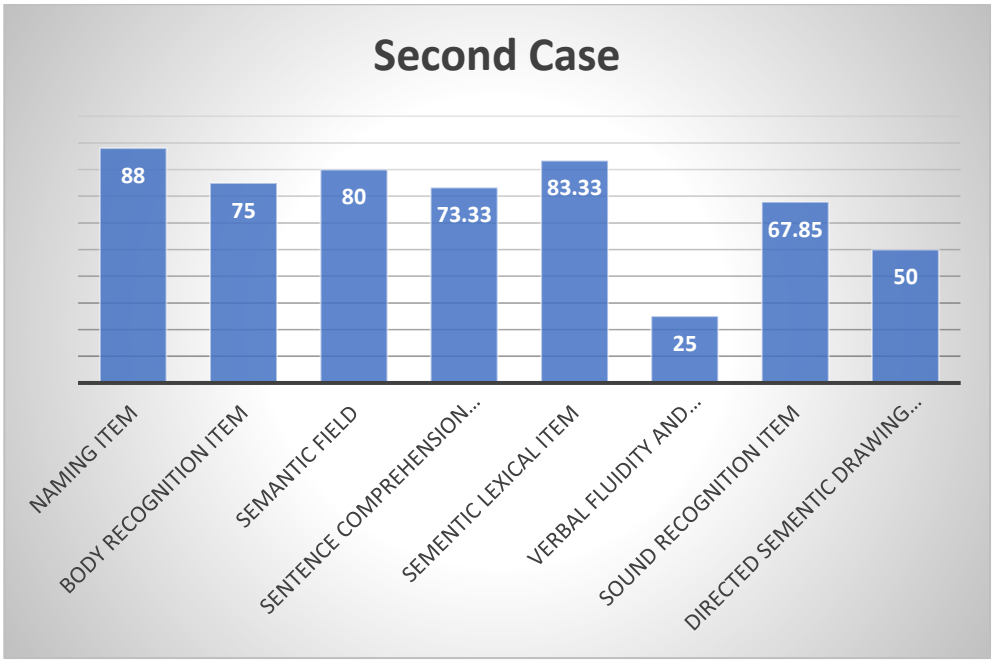
In the second to last section, which involves sound recognition item, child "A" experienced a significant failure rate of 42% due to a weakness in perceiving differences between sounds and tones, which could later develop into a problem in distinguishing between sounds. However, he succeeded in obtaining a perfect score in directed semantic mapping part, achieving a high score of 100%.

The second case:

Child B. 7-year-old boy who received a cochlear implant in 2021

Table Number (02): shows the results of the second case

Test components	Correct answers	Wrong answers	No answer	Total	Percentage of correct answers
Naming item	66	5	4	66/75	88%
Body Recognition Item	9	2	1	9/12	%75
Semantic Classification and Order Item	12	2	1	12/15	%80
Sentence Comprehension and Functional Connection Item	22	5	3	22/30	%73,33
Semantic lexicon Item	5	1	0	5/6	%83,33
Verbal Fluidity and Semantic Segmentation Item	2	1	5	2/8	%25
Sound Recognition Item	19	3	6	19/28	%67,85
Directed semantic drawing Item	2	0	2	2/4	%50
Total	137	19	22	137/178	%76,96



Graphical Number (02): Representation of corrects answers for second Case

Quantitative analysis: Table number (02) presents the results of the semantic memory test for the second case:

The case scored the highest in each of the following items:

-Naming Item: 66 /75 equivalent to 88 %

- Semantic Classification and Order Item :12/ 15 equivalent 80%

- Sentence Comprehension and Functional Connection Item:22 /30 equivalent 73, 33 %

-semantic lexical Item :5 / 6 equivalent 83,33%

- Sound Recognition Item: 19 /28 equivalent 67,85%

The case scored average in the following items:

- Directed semantic drawing Item :2 /4 equivalent 50 %

The case scored low scores in the following items:

-Verbal Fluidity and Semantic Segmentation Item :2/8 equivalent 25%

Note: The sixth item was removed as it is specific only to special and clinical populations such as children with psychosis

Qualitative analysis:

According to the results presented above, it appears that "child B" has a high semantic score, with a percentage of 88% in naming item. This indicates that there is an ability to connect the signifier and the signified, as well as to evoke semantic concepts. Additionally, the percentage for body recognition item reached 75%, confirming his awareness of body parts.

Furthermore, a score of 80% was recorded in the category of classification and semantic ordering, which indicates that he is aware of the belonging of things. In sentence comprehension and functional connection item, he attained 73.33%, suggesting that his level of comprehension ability is good.

In the category of semantic vocabulary, he obtained a score of 83.33%, indicating the child's ability to retrieve concepts and definitions from semantic memory, which reflects the richness or poverty of the child's vocabulary inventory However, in verbal fluidity and semantic segmentation item, they scored 25%, which is a low percentage, indicating that he was unable to recall what they had acquired and stored in their semantic memory, highlighting the child's lack of ability for spontaneous evocation of semantic concepts.

In sound recognition item, which pertains to recognizing environmental sounds, he achieved a score above average of 67%, indicating that child "B" could connect the auditory stimulus present in the environment with the semantic concepts it encompasses, although they did not succeed with all sounds.

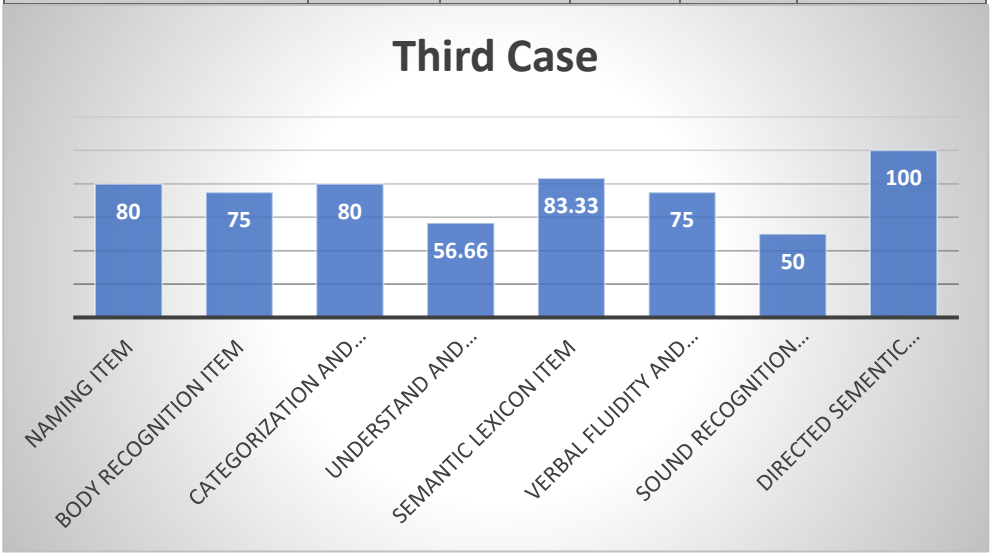
The Third case:

Child C, 6-year-old who received a cochlear implant in 2021

Table number (03): shows the results of the third case

Test components	Correct answers	Wrong answers	No answer	Total	Percentage of correct answers
Naming item	60	1	14	60/75	80%
Body Recognition Item	9	0	3	9/12	%75

Semantic Classification and Order Item	13	2	0	13/15	86,66%
Sentence Comprehension and Functional Connection Item	17	3	10	17/30	56,66%
Semantic lexicon Item	5	0	1	5/6	%83,33
Verbal Fluidity and Semantic Segmentation Item	6	0	2	6/8	%75
Sound Recognition Item	13	1	14	14/28	%50
Directed semantic drawing Item	4	0	0	4/4	%100
Total	137	19	22	127/178	%71,91



Graphical number (03): Representation of corrects answers for third Case

Quantitative analysis: Table number (03) presents the results of the semantic memory test for the third case:

The case scored the highest scores in all of the following items:

- Naming item :60/75 equivalent to 80%
- Semantic Classification and Order Item: 13/15, equivalent to 86,66 %
- Body Recognition Item:9/12, equivalent to 75%

-Verbal Fluidity and Semantic Segmentation Item :6/8 equivalent 75%

- semantic lexicon :5/6 equivalent 83,33%

- Directed Recognition Item :4/4 equivalent 100%

The case scored average scores in the following items:

- Sound Recognition Item: 14/28 equivalent to 50 %

Note: The sixth item was removed as it is specific only to special and clinical populations such as children with psychosis

Qualitative analysis:

According to the findings mentioned earlier, it appears that the third case shows a high semantic inventory, as indicated by the percentage of 80% in naming item, which suggests that child "C" has the ability to connect the signifier and the signified and to evoke semantic concepts. Additionally, body recognition item scored 75%, confirming his cognitive capacity and knowledge of body parts. Furthermore, child "C" recorded a percentage of 86.66% in semantic classification and order item, indicating an awareness of the belonging of objects. In sentence comprehension and functional connection item, he received a score of 56.66%, indicating an average level of understanding and medium capacity for comprehension.

In the semantic vocabulary section, the case obtained 83.33%, which indicates the child's ability to retrieve concepts and definitions from semantic memory, reflecting either the richness or poverty of the child's vocabulary inventory. Regarding Verbal Fluidity and Semantic Segmentation Item, he achieved 75%, which is above average, suggesting that he was able to recall what has been acquired and stored in his semantic memory, thereby demonstrating the child's ability for spontaneous retrieval of semantic concepts.

Table number (04): shows the results of the three cases

Test items	First Case	Second Case	Third Case	Percentage of correct answers for each case
Naming item	46,66 %	88%	80%	71,53%
Body Recognition Item	66,66%	75%	75%	72,22%
Semantic Classification and Order Item	73,33%	80%	86,66%	79,99%
Sentence Comprehension and Functional Connection Item	70%	73,33%	56.66%	66,66%
Semantic lexicon Item	50%	83,33%	83.33%	73,22%
Verbal Fluidity and Semantic Segmentation Item	50%	25%	75%	50%
Directed semantic drawing Item	42,85%	67,85%	50%	53,56%
	100%	50%	100%	83,33%

8-Discussion and Analysis of Results:

The current study aimed to evaluate semantic memory in children with cochlear implants. It relied on Dr. Yassin Lajjal's semantic memory test. Through the presentation and analysis of the results obtained after applying the semantic memory test, it became clear that the three cases experienced some difficulties in the following aspects, achieving a success rate of 71.53% and a failure rate of 28.47% in the naming task. The cases were unable to name unfamiliar images in their daily lives, indicating some difficulties in linking the signifier and the signified. The success rate in recognizing body parts was 72.22% with a failure rate of 27.78%, which demonstrates a good recognition of their bodies with cognitive awareness.

For the task of ordering and semantic classification, the success rate was 79.99% and the failure rate was 20.01%. In the semantic imagery task, the success rate was 73.22%, with a failure rate of 26.78%. For the directed semantic drawing task, they

achieved a success rate of 83.33% and a failure rate of 16.67%. Meanwhile, the three cases encountered difficulties in the aspect of comprehension related to the functional connection of sentences, where the success rate was 66.66% and the failure rate was 44.44%. In terms of verbal fluency and semantic segmentation, the success rate was 50% and the failure rate was also 50%. In the sound recognition task, the success rate was 53.56% and the failure rate was 46.44%.

In light of the above, it is clear that the children in the study sample achieved above-average results in both the naming of pictures and the recognition of body parts, as well as in ordering, semantic classification, and semantic vocabulary. Meanwhile, their results were average in terms of understanding through functional sentence linking, verbal fluency, semantic segmentation, and sound recognition. From this, we can say that the study's hypothesis was not confirmed, which stated that the level of semantic memory in hearing-impaired children with cochlear implants is low. Rather, the results indicate that they have an average level of semantic memory.

Referring to previous studies, they confirm a close relationship between memory capabilities and hearing impairment. Zainab Al-Ghani mentioned the impact of memory in children with hearing impairments, noting that better results can be achieved among hearing-impaired students in terms of recall and retrieval by using audiovisual stimuli. The loss of one of the senses affects processing, organization, and storage in the brain, especially the sense of hearing, as it is closely related to language. Bouchet (2001) mentioned in a study he dedicated to assessing and rehabilitating semantic memory in children with hearing disabilities that the impairment particularly affects the level of primary organization in the child, thus preventing the spread of semantic relationships (Bouchet, 2001, p. 30).

Additionally, Binter pointed to the existence of a relationship between sensory deprivation and the general cognitive abilities of hearing-impaired children. His study found that the cognitive abilities of hearing-impaired children are generally lower than those of normal children during early development. Other studies have shown that

hearing impairment negatively affects language development, which in turn impacts cognitive, emotional, and psychosocial growth in children. Shaqer Qandel (1995) clarified that the cognitive abilities of hearing-impaired individuals are negatively impacted by their disability due to a lack of sensory stimuli in their environment, resulting in deficiencies in their perceptions and limitations in the cognitive domain, and sometimes even delays in their cognitive development compared to their normal peers. Jerger and her colleagues (2006) noted in their article that there have been numerous research findings and explorations (Yoshinaga-Itano, Downey, Moeller, 1986; Moeller et al., 1996) that showed that auditory input plays an important role in constructing representational images. Learning a word through a diminished or disturbed auditory channel may reduce the wealth of semantic representations due to hearing loss and an inability to infer from context. Therefore, some studies have focused on the role of the environment in forming and shaping information in children. Interactions at home, in school, and in other settings can generally contribute to semantic differentiation in children. However, this may be different for children with hearing impairments compared to normal children. This means that most deaf children grow up in hearing families, where their linguistic interactions are usually limited. (Qasmi, 2014, pp. 202-204)

Conclusion:

The primary objective of the current study is to reveal the level of semantic memory in deaf children with cochlear implants, as semantic memory is considered a fundamental and reference cognitive process for language when retrieving its cognitive material such as words, meanings, and connotations. This study was conducted at Beni Messous Hospital Center and included 3 cases. The semantic memory test was applied to these cases, and the results showed an above-average level with some difficulties in naming, identifying body parts, semantic categorization, semantic dictionary, and semantic drawing. However, a moderate to below-average level was observed, with

more difficulties in sentence functional association, verbal fluency, semantic segmentation, and sound recognition.

Through the results of this study, we can conclude that children with cochlear implants suffer from a decreased level of semantic memory, particularly evident in the sound recognition task. This is attributed to the lack of previous auditory experiences due to deafness, indicating difficulties in the acquisition process and adaptation to the external environment.

Recommendations:

- The results of this study cannot be generalized due to the small sample size, but they can serve as a starting point for a new study with a larger sample.
- The study should be conducted on the remaining deaf children who use hearing aids."
-Early intervention for deaf children, along with the provision of health and psychological care, can significantly contribute to rapid and healthy cognitive development, especially semantic memory
-"It is crucial to focus on training the cognitive aspects (memory in all its forms, attention, executive functions, etc.) of deaf children with cochlear implants, rather than solely on language development.

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