Semantic memory studying among children with Down Syndrome (Mild intellectual disability)

دراسة الذاكرة الدلالية لدى الأطفال المصابين بمتلازمة داون (إعاقة ذهنية خفيفة)

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Abstract:
The current study aimed to assess the semantic memory of Down syndrome children with mild intellectual disability. We hypothesized that children with Down syndrome would experience difficulties at the semantic memory level. An experimental study was conducted at Ahmed Zabaneh elementary school for boys in Blida state, utilizing the descriptive method with a case study approach. The study consisted of 5 children with Down syndrome. The test results were analyzed both quantitatively and qualitatively. The results showed that children with Down syndrome and mild intellectual disability indeed face challenges at the semantic memory level.
keywords: down syndrome, mild intellectual disability, difficulties, semantic memory

1. Introduction

The issue of mental disability is a long-standing challenge that has attracted the attention of multiple professional groups due to its complexity. Caring for and rehabilitating individuals with mental disabilities require significant efforts from those responsible for their well-being, particularly as these conditions often manifest before adolescence, previously relying solely on intelligence to determine them.

Medically, mental disability is categorized into several cases, with Down syndrome being one of the most well-known, accounting for approximately 10% of all mental disability cases. The condition stands out due to its distinctive characteristics, while the term "Syndrome" refers to a group of defining features, the name "Down" originates from Dr. John Langdon Haydon Down, who first described this syndrome and attributed its cause solely to genetic factors.

While Down syndrome is the most commonly studied genetic cause of mental disability, there remain certain aspects of cognitive development and functioning in individuals with Down syndrome that have received little or no attention (Hamdi Al-Farmawy et al., 2010). One particularly significant aspect is semantic memory, which can be defined as a system that contains information about living things and organisms, including their names, characteristics, uses, and relationships. This knowledge is universally shared and not tied to personal experiences. Semantic memory plays a crucial role in encoding and retaining the meanings of words and concepts. It contributes to the

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choice of words that will be produced to convey a message as well as to its understanding. It is widely acknowledged that semantic memory is essential for processing isolated words and concepts.

Despite previous studies on semantic memory among children with Down syndrome, the results have not been highly accurate, and some relevant tasks were not included. Additionally, the lack of comprehensive studies on this topic highlights the importance of investigating semantic memory in this population. Therefore, our study aims to assess the semantic memory of children with Down syndrome through the application of a comprehensive test, providing valuable insights into this vital cognitive function.

2. Problem

In recent years, there has been a growing interest in understanding children from various aspects, including their physical and mental development. The goal is to accurately identify the stages of their growth and create programs that fully harness their abilities. This also applies to children who experience disabilities or disorders, as they too have the right to learn and actively participate in society. It's crucial to move away from the past practice of marginalizing these groups and considering them a burden on society.

One particular group of interest to researchers is children with Down syndrome. Down syndrome is a genetic disorder caused by a defect in the division of chromosome 21, resulting in the affected individuals having an extra copy, either complete or partial, of this chromosome. This genetic mutation is associated with varying degrees of mental disability among affected children. Numerous studies have been conducted to gain a deeper understanding of the impact of this genetic condition on those affected, examining various aspects of their lives. Among these studies, the study carried out by Mohamed Hassan Ghanem (2019), which aimed to compare the mental, cognitive, and linguistic characteristics of children with Down syndrome to those of typically developing children. The research included tests focusing on memory, visual-spatial cognitive abilities, semantic cognitive abilities, kinesthetic language and pronunciation, expressive language, receptive language, and comprehension. The findings revealed statistically significant differences between the scores of children with Down syndrome and those of typically developing children in all the six mentioned cognitive and linguistic areas. Children with Down syndrome experience delays in their mental development and tend to have lower intelligence rates, affecting processes such as perception, memory, attention, thinking, and language.

One of the most critical cognitive dimensions that researchers have explored regarding children with Down syndrome is memory, including its various components. Memory plays a vital role in their daily life and learning processes. Semantic memory, in particular, is a cognitive function that allows individuals to retrieve symbols, words, concepts, rules, and abstract ideas to solve problems and achieve adaptability and harmony in their lives.

Driffle (2007) conducted a study on semantic memory among Algerian children with Down syndrome, aiming to highlight the importance of semantic memory and its impact on verbal communication. The study included two groups, one serving as a control group, and the other as an experimental group, with ages ranging from 8 to 11 years and an estimated average IQ score of 60. Two tests were applied: Goodenough'sman's drawing test for assessing intelligence and a protocol for evaluating the child's semantic memory developed by Noémie Auclair-Ouellet (2015). The findings of the study revealed that children with Down syndrome exhibited deficits in their semantic memory. They showed difficulties in organizing linguistic knowledge to express ideas, weakness in semantic representations, and challenges in intentional retrieval. Additionally, the study found that they struggled with classification, discrimination, and generalization compared to the control group.

Mustafa Nouri Al-Qamsh (2011) conducted a study with the aim of exploring the activity of semantic memory and its impact on verbal language abilities, particularly in terms of comprehension and production, among children with Down syndrome. The study involved five participants aged between 10 to 12 years, with a mental age range of 4 to 5 years, indicating a moderate intellectual disability for three years. The same tests used in the earlier study, along with the Chevrie Muller language test, were applied to the participants. The study concluded that certain semantic memory tasks were not fully acquired among the sample, affecting their performance in understanding and producing language. Notably, the study found that semantic memory had a greater impact on linguistic understanding compared to production.

Tariq and others (2018) conducted a longitudinal study titled "Longitudinal Study of cognitive development in Children with Down Syndrome."Étude longitudinale du développement cognitif chez des enfants avec trisomie 21". The study aimed to investigate the cognitive development of 7 children with Down syndrome (3 males and 4 females) based on the longitudinal method. The participants' ages ranged from 7 years and 6 months to 9 years and 6 months. The study utilized the (EDEI-R) test replying to the sample after two years. The test consists of several sub-tests:

Vocabularies Test (A) - Naming Pictures (Ages: 3-5 years).
Vocabularies Test (B) - Defining Words (Ages: > 5 years).
Knowledge test.
Social Comprehension Test (A) - Ages: 3 to 5 years old.
Social Comprehension Test (B) - Ages: 5 years old and above.
Classification Test (A) - Ages: 3-5 years.
Classification Test (B) - Ages: > 5 years.
Categorical Analysis test.
Practical Adaptation Test.

The study of Hala Ibrahim Al-Jarwani (2012) results indicated weaknesses in various cognitive traits measured among children with Down syndrome, particularly in the knowledge test, classification, categorical analysis, and social understanding. However, the study did observe better development in verbal tests, represented by the vocabulary and social understanding tests. While there was no significant development observed at the eye level in logical activities, such as the classification and categorical analysis tests.

Several studies have investigated the semantic aspect in children with Dawn syndrome. One such study was conducted by G. Andreou and D. Katsarou from Thessaly University (2016) on semantic treatment among children with Down syndrome. The results showed that children with Dawn syndrome exhibited deficits in the semantic field of language. However, despite these weaknesses, the study revealed that receptive language skills were stronger than expressive language skills in this group. Moreover, it confirmed that semantic abilities tend to improve with age.

In another studies conducted by Yee Eiling and others (2018); and Fawkieh Hassan Radwan (2008) on the semantic memory of children with Dawn syndrome. The results showed that these children did not have a semantic disorder affecting the repetition of words, understanding vocabulary, naming pictures, understanding sentences, or functional linking of sentences. However, they did face challenges in areas such as the semantic repetition of numbers, semantic rhythmic structure, phonological discrimination, classification, and semantic arrangement. Consequently, it found a decline in the semantic memory abilities of children with Down syndrome (mild intellectual disability).

The cumulative findings from these studies indicate that children with Dawn syndrome experience difficulties at the level of semantic memory, leading to weaknesses in semantic representations and challenges in acquiring classification and categorical order. Furthermore, this affects their linguistic comprehension more than their language production. It is worth noting that studies on this topic are limited. The aforementioned studies did not solely focus on examining semantic memory in children with Dawn syndrome; instead, they were part of broader cognitive processes or were linked to linguistic aspects. Consequently, the results were not extensive enough to provide a comprehensive and accurate understanding of the semantic memory of this group.

Given the critical importance of semantic memory in language acquisition, communication, and later learning processes, the deficits observed among children with Dawn syndrome can negatively impact their learning and socialization opportunities. Thus, it is crucial to accurately identify the characteristics of various aspects of this cognitive ability in this group. Based on the gathered data, effective re-education programs and appropriate educational initiatives can be developed for children with Down syndrome, who are often marginalized in Algerian society.

Based on the information presented above, we seek to explore the following questions regarding children with Down syndrome:

- Do children with Down syndrome experience difficulties at the semantic level when linking visual input to its corresponding signified ?
- Do children with Down syndrome encounter challenges in identifying psychological-cognitive body features ?
- Do children with Down syndrome have difficulties at the classification and semantic order level ?
- Do children with Dawn syndrome have difficulties at the level of functional semantic understanding of things?
- Do children with Down syndrome face obstacles in retrieving concepts from their semantic memory?
- Do children with Down syndrome find it challenging to judge things based on semantic associations?
- Do children with Down syndrome have difficulties in spontaneously recalling semantic concepts?
- Do children with Down syndrome suffer from difficulties in linking auditory input to its corresponding signified ?
- Do children with Down syndrome experience difficulties at the semantic linking their acquired mental images to their graphic representations on paper?

3. Hypotheses

3.1. Children with Down syndrome experience difficulties at the semantic level when linking visual input to its corresponding signified.

3.2. Children with Down syndrome encounter challenges in identifying psychological-cognitive body features.

3.3. Children with Down syndrome have difficulties at the classification and semantic order level.

3.4. Children with Dawn syndrome have difficulties at the level of functional semantic understanding of things.

3.5. Children with Down syndrome face obstacles in retrieving concepts from their semantic memory.

3.6. Children with Down syndrome find it challenging to judge things based on semantic associations.

3.7. Children with Down syndrome have difficulties in spontaneously recalling semantic concepts.

3.8. Children with Down syndrome suffer from difficulties in linking auditory input to its corresponding signified.

3.9. Children with Down syndrome experience difficulties at the semantic level linking their acquired mental images to their graphic representations on paper.

4. Objectives of the study

- Detect/ identify disorders of semantic memory among children with Down syndrome.
- Identify disorders related to the association between the signifier and the signified (visual and audio input) and their ability to identify body parts among children with Down syndrome.
- Determine the difficulties of classification and semantic arrangement in the category of Down syndrome.
- Detect any disorders related to the functional semantic understanding of things in the category of Down syndrome.
- Recognize the difficulties of retrieving concepts from semantic memory and making judgments based on semantic associations.
- Identify any disturbances in the spontaneous recall of semantic concepts.
- Investigate the difficulties related to semantic linking between the acquired mental image and its graphic representation on paper.

5. Importance of the study

This study highlights one of the important cognitive abilities which is memory. It serves as a valuable reference for comprehending various aspects of Dawn syndrome. By contributing to the limited body of existing research on this topic, the study offers a scientific investigation into the syndrome, which has gained prevalence and poses challenges to the normal growth of affected children.

The findings of this study can serve as a valuable reference for practitioners in the field, aiding their understanding of semantic memory in children with Dawn syndrome and helping them identify areas of weakness to address through targeted interventions. Moreover, the results can serve as a foundation for future research, enabling the development of programs aimed at enhancing the semantic memory capabilities of children with Dawn syndrome.

6. Determinants

6.1. Semantic memory

It is part of the declarative memory within long-term memory. It encompasses the collective understanding of knowledge, facts, and information about the world around us (Adnan Yousef Al-Atoum, 2004, p. 145). In the current study, the semantic memory consists of 9 tasks, identified in children with Dawn syndrome and which include: picture naming, identifying the extremities of the body, classification and semantic arrangement, understanding and functional linking of sentences, semantic lexicon, judging things by semantic linkage, verbal fluidity and semantic segmentation, surrounding sounds recognition, and directed semantic drawing.

6.2. Dawn syndrome

Dawn syndrome is a chromosomal disorder resulting from an extra copy of chromosome 21 or part of it, leading to a genetic variation. This condition is characterized by large or small changes in the structure of the body. The syndrome is often accompanied by impairment of mind and physical development, and characteristic facial features (Ibrahim Abdullah FaragZureiqat, 2012, p. 186), (AwniMoinShaheen, 2008).

7. Materials and Methods

7.1. Design

The first basis for conducting any scientific study is to choose a method commensurate with the study objectives to be conducted, and since the study aims to study the nature of semantic memory among children with Down syndrome and to collect data about it for future use in the field or other research, we have opted for the descriptive method because it fits this goal and the case study.

The case study technique aims to identify the characteristics and content of a single case or phenomenon accurately and to reach results that can be generalized to other similar cases (Mohamed Obaidat et al., 1999, p. 44).

7.2 Participants

The process of selecting the study group is a crucial step in the research methodology and, therefore, the study group was intentionally chosen to align with the study variables and its primary objectives.

The study group consisted of 5 children with Down syndrome, all of whom had mild mental disability. The participants' ages ranged from 8 years and 7 months to 11 years and 3 months, both males and females were included to eliminate any potential gender bias. The children were enrolled in the special departments of Zabaneh elementary boys school in Blida State. The study group members' information is summarized in the following table.

Table1 **Demographics for the Sample**

Cases	Date of Birth	Gender	Academic level	Type of Disability
1st (Th. M)	11/03/2013	Female	Second-year	Down's syndrome (mild intellectual disability)
2nd(Q. A)	04/08/2010	Male	Second-year	Down's syndrome
3rd (Kh. Sh)	10/06/2010	Male	Second year	(mildintellectualdisability)
4th(M. W)	01/10/2011	Male	Second year	Down's syndrome
5th (D. M)	07/21/2010	Female	Second year	(mildintellectualdisability)

7.3. Instruments

7.3.1. Interview

An interview was used in the present study as follows:

a. Interview with officials: Prior to conducting any tests on the study group, we conducted interviews with the principal of ' Zabaneh boys school' and the teachers in charge of the special departments where the study group members were located. These interviews aimed to gather comprehensive information about the students, enabling the researchers to carefully select a study group that aligns with the study variables and the chosen test. Additionally, these interviews provided valuable insights into the selected study group members.

b. Interviews with the cases: We conducted interviews with the study group members, who were children with Down syndrome. These interviews were conducted in a supportive and trusting environment to create a safe psychological atmosphere. The purpose was to collect information and administer the semantic memory test, establishing a successful relationship with the study group.

7.3.2. Semantic memory test

The semantic memory test used in this study, prepared by Linda Laurila (2007) consists of 9 items. Each item aims to measure specific levels of semantic memory. The details of each item are as follows:

- Picture Naming Item:
  - Objective: This item assesses the examinee's lexical and vocabulary knowledge and their ability to identify semantic concepts represented in pictures. It also explores the ability to link the signifier and the signified, offering insights into the mental representations of the child's external world. This item serves to identify objects through pictures.
  - Tools: The label item contains 75 clear pictures with a white background, including both inanimate and living objects, fruits, vegetables, and more.
  - Instructions: We present each picture to the child and ask, "What does the picture represent?"
  - Marking: One point (n 01) is given for each correct answer, and zero (n 0) is given for an incorrect answer. The total points for this item are 75.

- Identifying the extremities of the body Item:
  - Objective: This item assesses the child's awareness of their own body and the ability to identify different body parts accurately.
  - Tools: A white sheet of paper containing a full and clear representation of a child's body.
  - Instructions: The child is asked to name each area of the body. "What is the name of this area?"

- Marking :One point is given for each correct answer, and the total points for this item are 12.

- Classification and semantic arrangement Item:
  - Objective: This item assesses the child's ability to classify and semantically arrange things in their daily life. It aims to determine the child's ability to differentiate between items and justify their categorization, providing insights into the organization of semantic concepts in the child's memory.
  - Tools: The same pictures used in the picture naming item are utilized.
  - Instructions:We ask the child to arrange the pictures and classify them according to their belonging to the same type and group:
  - General classification:
    - ✓ Put the animals together.
    - ✓ Put anything else together.
  - Specialized classification:
    - ✓ Put the fish together.
    - ✓ Put the animals that live in the house together.
    - ✓ Place predators.
    - ✓ Put the birds together.
    - ✓ Put vegetables and fruits into their respective groups.
    - ✓ Put transportation items together.
    - ✓ Put games together and tools used for work together.
    - ✓ Put kitchen supplies together, such as plates.
    - ✓ Put shapes and colors together.
    - ✓ Put insects together, like a butterfly.
    - ✓ Put the other items that do not fit into the previous groups together.
  - Marking: One point is given for each correct answer in each stage of classification. The total points for this item are 15.

- Comprehension and functional connection item:
  - Objective: This item evaluates the child's ability to understand functional semantics and determine the qualitative characteristics of objects encountered in their daily life and surroundings. It enables us to identify the child's capability to connect overall understanding with specific characteristics of objects depicted in the images.
  - Tools: We show the child a picture and provide sentence suggestions about the features of the object. The child is asked to select correct sentences that suit the picture and exclude incorrect ones. The item includes 6 cards, each with 5 sentences for each picture.

- Instructions: The child is instructed to answer "yes" or "no" for each sentence that represents the picture shown. "I will give you five sentences that represent the picture presented to you, and answer yes or no"
- Marking: One point is given for each correct and appropriate answer related to the picture, and zero (0) is given for incorrect answers not associated with the picture. The total points for this item are 30.

- Semantic lexicon Item:
  - Objective: Identify the child's ability to retrieve concepts and definitions from semantic memory while assessing the richness of their lexical knowledge.
  - Tools: 6 pictures shown to the examinee who identifies the name of the object depicted in each picture. Additionally. He is required to provide a comprehensive and indicative definition of the function or characteristic of the identified object. The pictures include: a saw, a wall clock, an orange, a cow, a mobile phone, and fish.
  - Instructions: Define what is shown in the pictures.
  - Marking:1 point for each correct answer; total points for this item: 6.
- Judging things by semantic linkage Item:
  - Objective: Measure the child's ability to make appropriate judgments, understand semantic connections, and distinction, as well as to classify objects by identifying the picture that does not belong to the group represented on each card.
  - Tools: 6 cards, each with three different pictures, one of which is not from the same group.
  - Instructions: " Look at the picture and tell us what is the thing that does not belong to the same kind and that is different from the rest of the things ".
  - Marking: 1 point for each correct answer, 0 points for wrong answers or no response; total points for this item: 6.
- Verbal fluidity and semantic segmentation Item:
  - Objective: Assess and understand the child's retention of information acquired and stored in their semantic memory.
  - Instructions:
    - ✓ Give me the names of four animals you know, such as a dog,etc. This exercise focuses on speed.
    - ✓ Give me the name of a non-living thing that starts with a specific letter (we specify the letter).
  - Marking:1 point for each correct answer; total points for this item: 8.
- Surrounding sounds recognition Items:
  - Objective: Determine the nature of presented sounds, as we measure through it the child's ability sound stimuli in the environment and the semantic concepts it

contains. It evaluates also the child's phonological perception, understanding, and classification.

- Tools: 28 different surrounding sounds (e.g., car engine, train, cow, water from the tap, dog, cat).
- Instructions: We ask the child to identify what the audible sound is. "Listen carefully to the sound and tell me what it is".
- Marking: 1 point for each correct answer; total points for this item are 28.

- Directed semantic drawing:
  - Objective: Evaluate the child's ability to associate mental images of concepts with their graphic representation on paper.
  - Tools: Pencil, white drawing paper (using no color).
  - Instructions: We ask the child to draw two animals of his choice, as well as two inanimate objects of his choice (e.g., a "table").

Psychometric properties of the Semantic Memory Test: Due to time constraints and the current conditions experienced in Algeria during the Corona pandemic, we decided to utilize the psychometric properties established by Linda Laurila (2007) who developed the semantic memory test used in this study. We followed the steps below to assess reliability and validity:

a. Test validity:

The test was administered to a sample of 100 normally schooled children aged between 6 to 10 years to determine the test's validity. It was compared to Jean-Louis Signoret's BEC96 memory and cognitive deficit assessment battery. The results showed statistically significant correlation coefficients (p. 0.01 and 0.05), indicating that all items of the semantic memory test are related to the items of the BEC96 memory and cognitive deficit assessment battery.

b. Test reliability: We calculated semantic memory test reliability using two different approaches:

The Cronbach coefficient: The Cronbach alpha value for the whole test was found to be (0.51).

Calculating reliability through test-retest: W obtained results ranging between 0.40 and 0.83, which were highly significant at (p. 0.01). This indicates that the semantic memory test demonstrates good reliability.

7.4. Data analysis

To analyze and interpret the results and verify the validity of the study's hypotheses, appropriate statistical methods must be applied to the raw scores of the study group obtained from the semantic memory scale.

Percentages allow to determine the proportion of correct answers in relation to the maximum possible score for an individual item or the entire test.

Arithmetic Mean is utilized to ascertain the overall performance of the study group in the semantic memory Test. Additionally, it helps to gauge the degree of similarity or variation in characteristics or behavior among the study group members.

8. Results and Discussion

- Children with Down syndrome experience difficulties at the semantic level when linking visual input to its corresponding signified

Table **Group Scores** 2 **in Picture Naming Item**

	1st case	2nd case	3rd case	4thcase	5thcase	Mean
Picture Naming Item (%)	72	53.33	77.33	54.67	70.66	62.63

To verify the first hypothesis and based on the results from the pictures naming item, we recorded the following observations:

• There was good retrieval of the names of living things represented in the pictures, and some success in naming non-living things.

• Weaknesses were observed in naming non-living things compared to living things.

• Children did not take long to come up with an appropriate name for an object.

• The limited lexical diversity was evident, as the participants demonstrated good recall for the names of familiar things they encounter in their daily lives.

• The sample faced difficulty naming pictures containing similar things (living and non-living) in terms of shape and color, often confusing similar animals like a chicken and a rooster or a turkey.

• Some participants only answered pictures of vegetables, fruits, and animals.

• Some individuals struggled to differentiate shapes and distinguish colors.

To verify the first partial hypothesis, we calculated the percentages and arithmetic mean of the eight cases in the item naming pictures. The results showed that the cases obtained scores above the average, estimated at 62.63%.

These results indicate that the possibility of semantic linkage between the visual input to its corresponding signified and mental representations of the things surrounding the child in their external world are not significantly affected in children with Down syndrome. These findings align with the conclusions drawn by Eiling et al (2018) who also state that children with Down syndrome do not experience disorders at the picture naming level. Similar results were found by Al-Qamsh (2015) where good word recall in the naming task indicated a richness of semantic memory in vocabulary and its meanings.

However, the researchers noted that the inability to name some images could be explained by disturbances in the process of remembering acquired information, possibly

due to a disturbance in the coding process and information retrieval, as well as the lack of semantic memory in terms of vocabulary and its significance.

The positive results of the study group in the picture naming item can be attributed to the emphasis placed on naming and assignment tasks in anthrophony guarantee.

As a result, we concluded that children with Down syndrome do not experience difficulties at the semantic level when linking visual input to its corresponding signified, leading to the unfulfillment of their first partial hypothesis.

- Children with Down syndrome encounter challenges in identifying psychological-cognitive body features

Table 3 **Group Scores in the Identifying the Extremities of the Body Item**

	1stcase	2nd case	3rd case	4th case	5th case	Mean
Identifying the Extremities of the Body Item(%)	91.67	75	75	83.33	83.33	81.66

To verify the second hypothesis, we calculated the percentages and arithmetic mean for the 5 cases in the "Identifying the Extremities of the Body" task. The results indicated that the cases achieved favorable outcomes, estimated at 81.66%. In this task, the participants scored between 9 and 11 points out of 12 possible points, demonstrating a strong understanding of most body extremities. However, some mistakes were noted in identifying the cheek and eyebrow. The most common confusion among the study group was between the leg and foot, as these were often considered as the same organ. Similarly, confusion also arose between the arm and hand.

These findings are consistent with the study conducted by Eiling et al (2018) which also observed similar results in the identification of body extremities. These consistent findings can be attributed to the focused efforts of speech therapist specialists in the sponsorship plan in psychological-cognitive identification of the body, as well as the parents' active involvement in reinforcing these skills at home.

Based on these findings, we concluded that children with Down syndrome do not encounter challenges in identifying psychological-cognitive body features. Therefore, the second partial hypothesis of this research was not fulfilled.

- Children with Down syndrome have difficulties at the classification and semantic order level.

Table 4 **Group Scores in Classification and Semantic Arrangement Item**

	1st case	2nd case	3rd case	4th case	5th case	Mean
Classification and Semantic Arrangement Item	86.67	33.33	86.33	73.33	40	64

To verify the third hypothesis, we calculated the percentages and arithmetic average for the 5 cases in the item of classification and semantic arrangement. The results indicated that the sample's performance in this task was above average, with an arithmetic average estimated at 64%, which aligns with the findings of the study by Eiling et al (2018) regarding the semantic arrangement in children with Down syndrome. The images presented to the sample were properly arranged and classified in the semantic memory.

Similar results were also observed in the study conducted by Al-Qamsh (2015) which concluded that the sample's success in the classification task indicates their acquisition of the concept of classification itself and their understanding of instructions.

However, the study group showed weaknesses in specialized classification, particularly in categorizing animals into predatory, non-predatory, and insects, as well as classifying tools, due to their difficulty in finding common features among the presented images and generalizing them to achieve correct semantic classification.

Overall, we concluded that children with Down syndrome do not encounter difficulties at the level of classification and semantic arrangement, leading to the non-fulfillment of the third partial hypothesis.

- Children with Dawn syndrome have difficulties at the level of functional semantic understanding of things.

Table 5 **Group Scores in the Understanding and Semantic Linking of Sentences Item**

	1stcase	2nd case	3rd case	4th case	5th case	Mean
Understanding and Semantic Linking of Sentences Item (%)	53.33	6.67	66.67	73.33	56.66	51.33

To verify the fourth hypothesis, we calculated the percentages and arithmetic mean for the 5 cases in the item of understanding and semantic linking of sentences. The results indicated that the group's performance in this item was above average, with an arithmetic mean estimated at 51.33%.

The findings of Eiling et others align with our results, indicating that children with Down syndrome do not experience disturbances in the level of comprehension and semantic linking of sentences. It was observed that children with Down syndrome can understand the functional semantics and determine the qualitative characteristics of the things surrounding them in their daily life and the surrounding world. Additionally, the group's ability to link overall understanding with the specific characteristics of the things depicted in images can be attributed to their level of cognitive ability, which includes mild mental disability. Moreover, good sponsorship and school integration have played a significant role in contributing to the positive results obtained.

As a result, it was concluded that children with Down syndrome do not have difficulties at the level of functional semantic understanding of things, leading to the non-fulfillment of our fourth partial hypothesis.

- Children with Down syndrome face obstacles in retrieving concepts from their semantic memory

Table 6 **Group Score sin the Semantic Lexicon Item**

	1stcase	2nd case	3rd case	4th case	5th case	Mean
Semantic Lexicon Item(%)	83.33	16.67	50	66.67	50	53.33

To verify the fifth hypothesis, we calculated the percentages and arithmetic mean for the 5 cases in the semantic lexicon item. The results indicated that the group's performance in this item was above average, with an arithmetic mean estimated at 53.33%.

Contrary to the results of the study conducted by Andreou and Katsarou (2016) which showed that children with Down syndrome suffer from a deficit in the semantic field of language, our study observed that sponsorship, rehabilitation programs, school integration, and special educational programs play a role in improving the memory capabilities of children with Down syndrome. We noticed an unmistakable ability of the participants to retrieve concepts and definitions from semantic memory.

Based on these findings, we concluded that children with Down syndrome face obstacles in retrieving concepts from their semantic memory, leading to the non-fulfillment of our fifth partial hypothesis.

- Children with Down syndrome find it challenging to judge things based on semantic associations

Table 7 **Group Scores in the Judging Things by Semantic Linkage Item**

	1st case	2nd case	3rd case	4th case	5th case	Mean
Judging Things by Semantic Linkage Item(%)	50	33.33	83.33	100	50	63.33

To verify the sixth partial hypothesis, we calculated the percentages and arithmetic mean for the 5 cases in the item of judging things by semantic linkage. The results indicated that the group's performance in this item was above average, with an arithmetic mean estimated at 63.33%.

We observed the ability of some participants to judge, distinguish, recall information, and link concepts to their representation in pictures. As a result, they did not find a significant deficit at this level, and the results for the cases in this item were above average.

Based on these findings, we concluded that children with Down syndrome do not encounter difficulties at the level of judging things based on semantic association, leading to the non-fulfillment of our sixth partial hypothesis.

- Children with Down syndrome have difficulties in spontaneously recalling semantic concepts

Table 8 **Group Scores in the Verbal Fluidity and Semantic Segmentation Item**

	1stcase	2nd case	3rd case	4th case	5th case	Mean
Verbal Fluidity and Semantic Segmentation Item(%)	50	50	50	50	12.5	42.50

To verify the 7th hypothesis, the researchers calculated the percentages and arithmetic mean for the 5 cases in the item of verbal fluidity and semantic segmentation.
The results indicated that the cases obtained scores below the average, estimated at 42.50%. The findings revealed that the study group exhibited a weak ability to automatically evoke semantic concepts from memory. Additionally, the semantic segmentation task yielded non-existent results, highlighting a significant deficit in their ability to connect and recall concepts based on semantic bonds. This was evident in the entire study group's inability to complete the name of a thing based on the first syllable presented to them.

Based on these observations, it was concluded that the 7th hypothesis, which suggests that children with Down syndrome experience difficulties in difficulties in spontaneously recalling semantic concepts, has been fulfilled.

- Children with Down syndrome suffer from difficulties in linking auditory input to its corresponding signified

Table 9 **Group Scores in Surrounding Sounds Recognition Items**

	1st case	2nd case	3rd case	4th case	5th case	Mean
Surrounding Sound Recognition Items(%)	35.71	42.85	46.42	28.58	64.28	43.56

To verify the 8th hypothesis, we calculated the percentages and arithmetic mean for the 5 cases in the item "Surrounding Sounds Recognition". The results indicated that the cases obtained scores below the average, estimated at 43.56%. These findings point to the weak ability of children with Down syndrome to link between the presented voice stimulus and its source. This weakness can be attributed to their limited abilities in phonemic comprehension and phonemic semantic classification within this category. Mohamed Ghanem's study (2019) also highlighted statistically significant differences between the scores of children with Down syndrome and those of typically developing children in items related to the recognition of animal sounds, supporting our own findings regarding the recognition of surrounding sounds.

The substantial difference between the results of visual recognition and sound recognition can be explained by the fact that the sponsorship plan often focuses on tasks involving naming images without adequately addressing tasks related to identifying surrounding sounds, which accounts for the lower scores of the study group in this item.

As a result, we conclude that the 8th partial hypothesis, which suggests that children with Down syndrome suffer from difficulties in linking auditory input to its corresponding signified, has been confirmed.

- Children with Down syndrome experience difficulties at the semantic level linking their acquired mental images to their graphic representations on paper.

Table 10 **Group Scores in the Directed Semantic Drawing**

	1st case	2nd case	3rd case	4th case	5th case	Mean
Directed Semantic Drawing(%)	0	0	25	25	50	20

To verify the 9th hypothesis, we calculated the average scores of the study group in the directed semantic drawing item, and the results revealed weak performance with an average score estimated at 20%. This highlights the extent of their limited ability to link the acquired mental image with its graphic representation on paper and to accurately depict the characteristics of the objects they intended to draw, particularly for living elements.

These findings suggest that the sponsorship plan lacks sufficient focus on improving the cases' ability in directed semantic drawing, even within specialized departments.

As a result, we conclude that children with Down syndrome experience difficulties at the semantic level linking their acquired mental images to their graphic representations on paper, leading to the fulfillment of our ninth partial hypothesis

After conducting the semantic memory test on the study group and analyzing the results quantitatively and qualitatively, the researchers discussed them in the context of our study's partial hypotheses and compared them with previous research on the same topic. They concluded that children with Down syndrome do not experience significant difficulties in tasks related to naming pictures, identifying extremities of the body, classification, semantic arrangement, comprehension, semantic linking, semantic lexicon, and judging things by semantic linkage. However, the performance of the study group in these tasks was generally average, with the exception of their good level in identifying body limbs.

On the other hand, the results showed that children with Down syndrome face challenges at the level of verbal fluidity and semantic segmentation in tasks related to recognizing surrounding sounds and directed semantic drawing, with the study group obtaining very low scores in these tasks.

Regarding the overall performance of the study group in the semantic memory test, which includes all nine items combined, it was below average, with a score estimated at 91 out of 184 points, equivalent to a percentage of approximately 49.45%. The study group's performance was weak in most of the tasks related to semantic memory.

These findings align with the results of Eiling et al (2018) who also observed a decrease in semantic memory abilities among children with Down syndrome (mild mental disability). Similar conclusions were drawn by Al-Qamsh (2011) in his study, indicating that some semantic memory tasks are not fully acquired in this group, which impacts their understanding and linguistic production.

Considering the results of the current study and previous others on this topic, we conclude that the general hypothesis, which suggests that children with Down syndrome encounter difficulties at the level of semantic memory, has been confirmed.

9. Conclusion

Down syndrome represents 20% of the total number of individuals with intellectual disabilities, prompting many researchers to study this group from various perspectives, each according to their specialization. For example, Tariq et al (2018) examined the cognitive development of individuals with Down syndrome and found weaknesses in classification, knowledge, categorical analysis, and social understanding.

In the present study, we chose to focus on one of the most critical cognitive processes related to memory, namely semantic memory. Where we applied the semantic memory test developed by Laurila (2007), consisting of 9 items covering tasks such as picture naming, identifying the extremities of the body, classification and semantic arrangement, understanding and functional linking of sentences, semantic lexicon, judging things by semantic linkage, verbal fluidity and semantic segmentation, surrounding sounds recognition, and finally directed semantic drawing. By assessing these tasks, the study aimed to encompass all aspects of semantic memory among children with Down syndrome and determine their performance levels.

The study concluded that children with Down syndrome, who have a mild mental disability, experience difficulties at the level of semantic memory. This finding is in line with Driffle's (2007) observation that the semantic memory of children with Down syndrome is characterized by weaknesses in the organization of linguistic knowledge and semantic representations, intentional retrieval, classification, and generalization.

In the future, we hope to replicate the study on a larger sample and explore a broader range of cognitive processes to generalize the results. Additionally, we aim to develop training programs that focus on specific tasks, such as identifying surrounding sounds and directed semantic drawing, which were significant weaknesses observed in the study group. Furthermore, expanding the scope of studies to include other cognitive processes will contribute to creating comprehensive rehabilitation programs that leverage individuals' abilities and maximize their potential, promoting their inclusion in society and enhancing their independence.

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