Art and Architecture Journal (2024) 5, (2) 145–166

ISSN : 2805-2838 (Print) ; 2805-2846 (Online)
Art and Architecture Journal
Available online at : https://aaj.journals.ekb.eg/

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Keywords: children's drawings; dyslexia; Arabic alphabet; educational book; illustrations; digital drawings

Title: New Language to Simplify the Reading Alphabet and Treat Dyslexia

ABSTRACT

Illustrations play a crucial role in developing reading skills for both typical children and those with dyslexia during early childhood. Educational illustrated books for the Arabic alphabet help establish a connection between the shape of a letter and its sound using simplified illustrations that represent Arabic letters. These illustrations align with the letter's phoneme, which is the smallest unit of sound in a language. This research aims to develop a scientific method using illustrations to create a simplified approach for teaching the Arabic alphabet to children and to address dyslexia. The research highlights the significance of a scientific approach to using illustrations to simplify the Arabic alphabet in a way that aligns with the visual perception of young children and those with dyslexia. Given that children need to develop their language skills during early childhood as a precursor to learning to read

The research problem are:

- How can a connection between the shape of a letter and its sound be established in a using illustration?
- Did the illustrations contribute to the recognition of Arabic letters by typical children?
- Did the illustrations help in treating dyslexia in children?

The research employs an experimental methodology, which includes: Creating illustrations representing Arabic alphabet letters. Measuring children's responses to the illustrations and the effectiveness of treating dyslexia.

The expected research results include:

Establishing a connection between the shape of a letter and its sound The researcher recommends using to develop reading skills during early childhood.

Introduction

Reading is a complex mental process of recognizing letter sounds represented in orthographic patterns, requiring a working memory that performs phonological processing to link the letter's sound with its shape. Thus, children understand what they read and use it in mental and cognitive growth and mental skills like conversation and personality formation. Without this, they fail in education. *(Wafiq Safwat, 2009, p.128)*[1] - (*Botros Hafez, 2009, p.386)*[2]

The study's objective is to help children through illustrative drawings to link letter shapes and sounds in a simplified manner (researcher's comment).

In early childhood, children use their imagination through books and stories containing illustrations to understand, remember, and link names and meanings of things and creatures with their functions and drawings, ultimately leading to abstract words. Therefore, they must be trained to comprehend letter sounds, shapes, and syllables to form words and understand text meanings with the help of illustrations. *(Botros Hafez, 2009, p.389)*[2] – *(Awatef Ibrahim, no date, p.23)*[3]

The study used a pictorial alphabet to help children generally and children with dyslexia specifically to learn Arabic language letters and thus reading, highlighting the research's importance (researcher's comment).

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Learning reading and spelling requires children to enjoy good overall health, especially sensory health (vision, hearing, speech), and learn word recognition and comprehension skills. This typically occurs between 6-7 years of age, alongside emotional stability, tranquility, and previous experiences of increased linguistic vocabulary and expressions.
(Wafiq Safwat, 2009, p.129)[1] *- (Botros Hafez, 2009, p.389)*[2]
Therefore, the question remains: Can illustrations help them learn these skills and thus read and overcome dyslexia through a pictorial alphabet? (researcher's comment)
Drawings are a visual language that can express words and are a key element in attracting attention, stimulating interest, and evoking emotional aspects. Drawings are a comprehensible medium for both learners and non-learners. *(Khalil Sabbat, 1987, p.231)*[4] *– (Mahmoud alm aldeen, 1998, p.23)*[5]
Thus, it is necessary to understand learning difficulties, their types and characteristics, and then explore one of the most important difficulties (dyslexia) and how to address it through illustrations.

1- Learning Difficulties in Children
These are multiple challenges that impede the learning process and knowledge acquisition, along with associated difficulties in managing cognitive processes such as attention, memory, perception, thinking, reading and writing disorders, speech, and spelling. This includes cognitive disabilities and brain injuries. *(Anita Woolflok, 2019, p.301)*[6]
According to the Wechsler Intelligence Test, which measures intelligence, cognitive abilities, evaluates intellectual development, and diagnoses learning difficulties through verbal comprehension, memory, and problem-solving skills.
1-1-Learning Difficulties are Divided into:
- Good visual memory with weak auditory memory
- Weak visual memory with good auditory memory
- Finally, both memories are weak, alongside subsidiary difficulties represented in developmental reading difficulties, slow reading, and mixed types
(Down .P, 2017, p.25)[7] *- (Mohammed Ali Kamel, 2005, p.183)*[8]
1-2-General Characteristics of Learning Difficulties: Related to language, motor skills, and social behavior
- **Language and Attention-related:** Difficulties in pronunciation, incomplete speech, weak verbal vocabulary due to lack of prior knowledge, reading acquisition not matching mental age without hearing, vision, or brain problems, difficulty learning, remembering, and retrieving new letters, words, place names, days of the week, numbers, and following instructions due to working memory constraints.
- **Motor Skills-related:** Difficulty distinguishing between right and left directions, using the left hand, weak balance in walking and movement, handling small objects, buttoning shirts, tying shoes, and avoiding drawing or tracing lines.
- **Social Behavior-related:** Stereotypical activity, difficulty continuing it, hyperactivity, impulsive behavior, difficulty interacting with others, playing alone due to lack of external motivation, anxiety, tension, and fear of failure. *(Ahmed fathey alzayat, 2015, p.467)*[9] *– (John D, 1999, p.43-65)*[10]

2-Reading Disorder (Alexia & Dyslexia)
Reading disorder is considered one of the learning difficulty disorders, which is divided into two main types:
2-1-Developmental Alexia
A cognitive disorder with a hereditary basis, typically occurring after a stroke or brain injury, leading to severe difficulty or slowness in reading, difficulty in visual recognition of written or familiar words, phonological processing, and disrupting the connection between visual inputs and language processing areas in the brain. This results from damage in traumatic brain regions responsible for language processing - specifically the left occipital lobe which is one of the four main cortical lobes at

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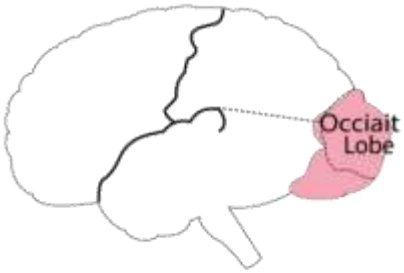
the back of the head **(figure 1)** and the angular gyrus located in the posterior part of the parietal lobe's inferior section **(figure 2)**. *(Richard L. Day, 2011, p. 120-135)*[11] - *(Antonio M, 2018, ch,5)*[12]

(figure 2) Angular gyrus



(figure 1) Left occipital lobe (drawing by researcher)

2-1-1- Developmental Alexia is Divided into Four Types:

- **Pure Alexia:** Children can write but cannot read, due to damage to the visual word form area resulting from occipital lobe damage.
- **Surface Alexia:** The phonological reading pathway develops, while the lexical-semantic pathway does not, thus weakening the ability to recognize words with irregular spelling like "Colonel" and "Though". *(Jane Oakhill, 2002, Ch7)*[13]
- **Phonological Alexia:** Opposite of surface alexia, where the phonological reading pathway does not develop, meaning a loss of phonetic expression. They can only read familiar words, while new words pose reading challenges, despite having normal speech.
- **Deep Alexia:** Rare cases combining phonological and surface levels with semantic errors, including word substitutions related to concepts (e.g., the word "cat" might be read instead of "dog"). *(Lorain K, 2007, Ch9)*[14]

٢-١-٢- General Characteristics of Alexia Children:

- Most have average intelligence, some are highly intelligent, speak fluently, and possess artistic and engineering talents.
- Linguistically, they struggle with spelling and mirror-image reading of letter sequences (e.g., "kalb" read as "blak"), complicating the learning process.
- Their features are unusual compared to typical children due to different electrical activity in the skull.
- Anatomically different from typical children, with the temporal planum (language representation area) being larger on the left side of the brain, whereas in alexia, both regions are equal due to the enlarged temporal area on the right side.

2-1-3- Alexia Symptoms can be Mitigated Through:

- Visual training, phonological awareness exercises, and audio-visual rehabilitation using assistive technology and support programs. (*Gavin Reid, 2016, Ch8)*[15]

٢-٢- *Acquired Dyslexia:*

Also called Central Dyslexia, involving damage to central reading areas in the brain. The term "dyslexia" originates from Greek, meaning "word difficulties". In 1877, Adolph Kussmaul defined reading disorder as "Word Blindness". In 1883, German scientist Rudolf Berlin combined "Dys" (difficulties) and "Lexia" (words), signifying reading and writing difficulties. *(Ian Smythe, p.13)*[16]

Dyslexia is not a disorder but a difference in cognitive processing with a neurological brain-related origin. The brain processes words differently, resulting in encoding problems and working memory capacity issues. The process involves: Phonological word storage within two seconds, Encoding using the child's linguistic resources, Visual recognition, Converting to corresponding sounds, Information retrieval. This affects language, spelling, and reading.

(Ian Smythe. p13)[16] - *(Mike Jones, p.20)*[17] - *(Berlin R, p.209)* [18]

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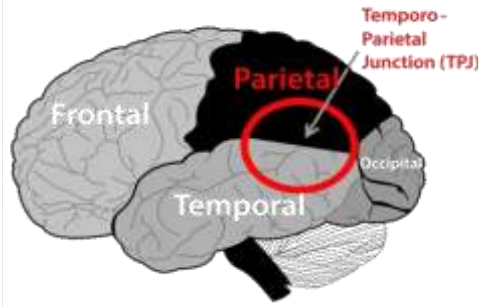
Illustrations play an important role in the success of working memory processes (researcher's comment)

2-2-1-Causes of Acquired Dyslexia:

Causes remain unclear, but can be understood through risk indicators. Children should be screened before school entry for linguistic and reading development. Difficulties vary according to several factors:

• **Birth Conditions:** Potential dyslexia may occur with low birth weight, extended nursery stay over 24 hours, breastfeeding or swallowing difficulties, or chronic ear infections leading to hearing weakness or loss. *(Ahmed fathey alzayat, 2015, p.448-450)*[9]

• **Neurological Factors:** Dyslexia children differ from typical children in brain imaging: They rely on anterior regions in the brain's left side. Process information differently, especially in phonological processing areas. Lack a strong neural network connecting vision, language, and memory centers. Typical children use three areas in the Temporo-Parietal reading process **(figure 3)** (*Botros Hafez, 2009, p.386)*[2] - (*Ben Foss, 2014, p. 130)* [19] - *(Kate Grigs, 2021, Ch.4)* [20]



(figure 3) Temporo-parietal junction
(drawing by researcher)

• **Genetic Factors:** Marshall describes dyslexia as having a genetic reference, with genes playing a role in its occurrence. It's common in families, though not all family members may experience it to the same degree. They have congenital differences related to reading and phonetic processing areas, leading to different language processing capabilities.

(Ben foss,2013.p. Range 130-90)[19] - *(Abigail Marshall,2023,Ch.4)*[21]

•**Environmental Factors:** Play a role in dyslexia. Early interventions or teaching methods can help mitigate or increase characteristics through different environments like schools that identify and support strengths and address weaknesses. If children are not exposed to language through reading and writing activities during early development (cultural or environmental poverty), they are more susceptible to dyslexia traits. *(Abigail Marshall, 2023,Ch.4)*[21] - *(Sandra F, 2010, p. Range 50-31)*[22] - *(Gavin Reid,2011,Ch.2)*[23]

2-2-2- Types of Dyslexia (Expanded):

Dyslexia is divided into several types that differ based on causes of occurrence and indicative characteristics:-

•**Deep Dyslexia (Semantic Paraalexia):** This term is used in neuroscience and psychology, referring to reading disorders associated with brain damage or injuries in the left hemisphere of the brain, or brain disease, stroke, head surgery, or loss of speech ability. Children in this case read using the right hemisphere of the brain and have weak short-term memory, affecting semantic, phonetic, and visual systems simultaneously. This impacts the ability to convert letters to sounds, causing children to experience the following during oral reading:

-Replacing words with grammatically similar ones (e.g., "recognizes" read as "recognized")
- Replacing words with similar meanings (e.g., "guilty" read as "judge")
- Reading "cat" as "dog"

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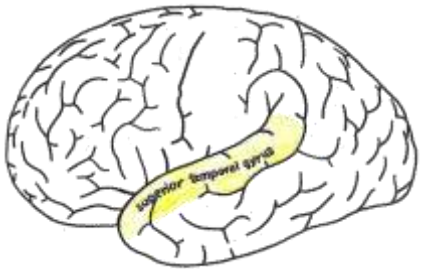
- Substituting functional words (e.g., "in" read as "to")
- Visual errors like reading "healing" as "fetus"
- Deleting or adding words to sentences
- Difficulty reading words
- Writing impairment

They can read functional words like tools, letters, pronouns, and numbers, and can read repeated words or words representing an image or sound (like "fire").
(E.B. Huey - 1908, p. Range 223-230)[24]*- (Usha Goswami, Michael A. Skeide, 2022,p. Range 19-24)*[25]

•**Surface Dyslexia:**
Patients have problems in the left occipitotemporal cortex, leading to: Weakness in spelling, Inability to process visual word forms, Difficulty understanding read meanings, They are Prone to errors when reading irregularly written words (e.g., "Yacht" pronounced as /Jaekt/) and they are Capable of phonetic encoding and reading unfamiliar words. *(Usha Goswami ,2022, p. Range 13-18)*[25]

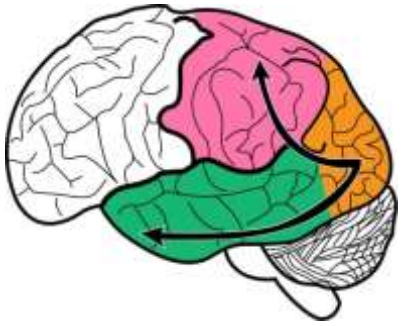
•**Phonological Dyslexia (or Dysphonetic Dyslexia or Dyseidetic Dyslexia):**
Related to slow visual processing brain regions, resulting in: Inability to recognize visual word forms, Difficulty spelling and pronouncing irregular words (e.g., "colonel"),Weakness in the left posterior superior temporal gyrus. (figure 4).



(Figure 4) The left posterior superior temporal-parietal gyrus in the brain (drawing by the researcher)

This Causing:
- Difficulty spelling and decoding new words
- Weak pronunciation and oral reading errors
- Deficit in phonological awareness and ability to hear, identify, and process individual sounds in words *(Usha Goswami, 2022, p. Range 7-12)*[25]

•**Visual Dyslexia:**Originates from neural basis with disruption in the dorsal visual stream and parietal regions (figure 5) leading to: Difficulty processing visual stimuli related to letters and words**,** Reading letters in reverse (e.g., "B" read as "D") and Words appearing to move. *(Gavin Reid, 2016, p. Range 52-60)* [15]



(Figure 5) Dorsal and parietal visual impairment (drawing by the researcher)

•**Attentional Dyslexia:**Stems from disorders in visual attention and working memory, causing: Difficulty focusing on individual letters or words in text and Mixing words together (e.g., "Pink Lamp" read as "Link Pamp"). (*Gavin Reid, 2016, p.45-51)*[15]

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•**Central Dyslexia:** It includes profound, phonological and superficial dyslexia together, so that its symptoms resemble those of a split brain disease in the way the right hemisphere performs. In some cases, it has been found that the right hemisphere has the ability to read, unlike the natural one, in which the left hemisphere of the brain is responsible for reading and language skills, which affects basic reading abilities. *(Margaret J , 2021,p. Range, 39-48)* [27]

•**Mixed Dyslexia:** A combination of phonological and surface dyslexia, resulting from complex interactions between hereditary, neural, and environmental factors. *(Sally Shaywitz , MD,2003, p. Range,59- 65)* [26]

•**Peripheral Dyslexia:** Includes attentional and visual dyslexia, affecting visual inputs and manifesting as inability to perceive letters on one side of a word or text. *(Margaret J, 2021, p. Range,31-38)*[27]

•**Primary Dyslexia:** Relates to genetic factors and atypical brain development in the left hemisphere. *(Gavin Reid , 2016, p.61)* [15]

•**Acquired Dyslexia:** Occurs after brain injury or neurological disease, similar to deep dyslexia but not hereditary. *(Margaret J, 2021, p. 25)*[27]

2-2-3-Symptoms of Dyslexia:

These are early signs of dyslexia in children's early developmental stages that parents and teachers should know and are expected to discover. First, by noticing any problems with their children, knowing that some children are not identified until they grow older. Generally, not every child with these symptoms has dyslexia, and not every dyslexic child shows all these symptoms.
(Patricia .A Reid, 2017, P. 6) [28] **-** *(Sandra. F, 2010, p. Range, 30-50)* [22]

Dyslexia symptoms appear through its relationship with:

-Intelligence, Memory, Senses,Understanding and learning, Language (speech, spelling, reading), Psychological state, Behavior,Talents and characteristics

•**Relationship of Dyslexia with Intelligence:** Dyslexia is not associated with low intelligence or lack of learning desire. Children often have average to above-average intelligence, showing excellence in thinking and problem-solving. This does not prevent some from experiencing low intelligence. *(Sally Shaywitz, MD,& Bennett Shaywitz M.2020,P. Range,35-55)* [29]

•**Relationship of Dyslexia with Memory:** Short-term memory disorder (short-term storage): This is the primary or active memory and retains a small amount of information in the mind in an active state for a short period representing 2 + - 7 words for a few seconds, and is linked to visual and auditory processes. This disorder results in difficulty remembering successive things such as the days of the week, as well as letters, their sounds, their order and their shape.
(Gavin Reid , 2016, P. Range,45-51) [15] - *(Sandra . F , 2010, P. Range, 30-50)* [22]

Multiple memory disorder types exist:

- Short-term memory disorder: Difficulty remembering sequential items like days of the week, letters, their sounds, order, and shape
- Working memory disorder: Losing word decoding symbols, reducing the child's vocabulary
- Sequential auditory memory disorder: Difficulty learning words with specific tones
- Visual memory disorder: Difficulty recognizing letter shapes and storing them in memory.

(Mohammed Ali Kamel, 2005, p.183)[8] - *(Mike Jones , 2015, p. Range, 63-46)* [16]

•**Relationship of Dyslexia with Senses:** There is no need for problems with vision and hearing to be present with dyslexia:

- **Hearing:** Dyslexic children suffer from difficulties in phonemic processing, which results from a disturbance in auditory perception and auditory discrimination. The auditory perception disorder appears in the failure to determine the center and source of the sound, its direction, intensity, height and lowness, which leads to the lack of auditory perception of letters, syllables and words and the mixing of sounds to form words, such as the word head consisting of three letters. As for the auditory discrimination disorder, it is the inability to distinguish between the sounds of the language, especially

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the similar ones (tam, qama), and to distinguish between the sounds of animals and cars, which leads to problems in phonemic awareness and the development of reading.
(Ahmed Fathi Al-Zayat, 2015, p. 451)[9] *- (Julian G, 2014, p. Range, 61- 83)*[30] *- (Hamdi Ali Al-Farmawi, 2001, p. 185)*[31].

- **Sense of sight:** Some children may suffer from visual discomfort or challenges such as unclear text, but this does not mean that dyslexia results from vision problems or poor vision. It appears in a disorder in visual perception of space and its relationship to children's bodies in space and the location of things in relation to them, which consists of visual discrimination, which appears in the difficulty of distinguishing between letters and words and distinguishing between similar letters (b-t-th) as well as similar words (aad-jad), closure, visual perception, visual memory, and visual-spatial sequence of letters and printed words, and thus leads to an inability to process written language. Fonts can be modified to a larger size in addition to developing phonetic awareness. *(Ahmed Fathi Al-Zayat, 2015, p. 451)*[9] *- (Kate Griggs, 2021, p. 1-3)* [20] *- (Kate Cain, 2010, p. Range, 102-120)*[32].
- **As for pronunciation:** Dyslexic children have delayed speech and difficulty in pronunciation, especially in the letters of the Arabic language and pronunciation of sounds (this is what the illustrated alphabet that was implemented by the researcher aims to do to train children to pronounce the letters of the Arabic language and link them to their shapes).
- **As for movement and daily routine:** They have difficulty in determining direction and motor performance and mixing between left and right and artistic motor skills such as coloring, drawing and copying with a routine in play and this is due to the presence of a simple functional disorder in the brain.
(Ahmed Fathi Al-Zayat, 2015, p. 451)[9] *- Mike Jones, 2015, p. 61)*[17] *- Sally Shaywitz, 3003, Ch. 1)*[26]

• **Relationship of Dyslexia with Comprehension, Absorption, and Learning:**
-Regarding Comprehension: They have difficulties with reading comprehension, understanding new word meanings, instructions, play behaviors, and delayed cognitive skills.
-Regarding Absorption: They show delay and slowness in academic achievement, inference, prediction, forming opinions, summarizing information, and difficulty concentrating when stories are read to them.
-Regarding Learning: They have general learning difficulties, especially in learning letters, symbols, signs (+, %, =), spelling, names, new words, reading, writing, clock hands, multiplication tables, time management, or learning a new foreign language. (Botros Hafez, 2009, p. 229)[2] **-** *(Sandra .f, 2010, P. Range, 30-5)*[22] *– (Gavin Reid, 2011, P. Range, 30-40)* [23] - (Mohamed ali kamel, 2006, p.192)[33]

The Relationship of Dyslexia with Language (Speech-Spelling-Reading):
-Regarding Speech: Related to reading, they have hesitation and delay in speech, lack of clarity and expressiveness inappropriate for their age, which makes self-expression difficult. This is due to slow learning of prepositions and verbs, while speaking away from reading is easier. They also struggle to understand others' speech and instructions, especially those involving a single step.
Regarding Spelling: They have problems with phonological awareness, identifying letters (especially similar ones), connecting them with their sounds and sequence, causing slow spelling and sound decoding, which affects reading comprehension and vocabulary growth. **(The researcher sought to find a solution through illustrative drawings)**
Finally, Reading: There is a general delay and difficulty in learning, recognizing, and using words in other contexts. In (Oral Reading), they experience hesitation, slowness, and clear disorders in fluency as a cognitive process, with difficulty using language, including omitting parts of words (e.g., "traveled" read as "travel",سافر سافرت تقرأ) adding non-existent words, and letter substitution (e.g., "rice" read as "button" , كلمة رز تقرأ زر). They also experience number transposition and previously mentioned reverse reading. In (Silent Reading), they experience extreme slowness, psychological difficulty reading in front of others, avoiding alternating reading, losing interest and enjoyment, and hating books and anything related to them. *(Sandra F, 2010, p. Range, 30-50)* [22] **-** *(Patricia A . Reid, 2017, p. 3)* [28] *– (Hamdy Ali AL-farmawi, 2001, p.259)*[31] - (Mohamed ali kamel, 2006, p.192)[33]

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-The psychological and behavioral characteristics of dyslexic children include: anxiety, frequent anger attacks, depression, random behaviors, and non-purposeful hyperactivity.
-Finally, dyslexic children enjoy: multiple talents in arts, design, music, drama, verbal skills, computer science, mathematics, mechanics, and physics. (Ahmed Fathi, 2015, p. 451)[9] - *(Patricia A, 2017, p. 7)* [28]
After presenting the types and characteristics of dyslexia: we must understand the preventive factors, treatment, and comprehensive evaluation through the researcher's applied experiment.
2-2-4-Protective Factors for Dyslexia:
Dyslexia cannot always be prevented. However, its effects can be reduced through early interventions and preventive measures that significantly improve results by addressing deficits early. We can avoid, reduce, or limit dyslexia symptoms, especially those caused by environmental factors, through:
-Early screening and identifying children at risk through phonological awareness tests to implement support early.
-Continuous care, follow-up, and a mother's systematic observations of children's capabilities, skills, and motor behavior.
-Continuous education and phonological awareness training using vocabulary, words, sound recognition, and interactive individual and group constructive games, technology training, and motor skill development.
-Parents participating in reading with children at home and encouraging reading aloud to enhance reading and writing skills.
-Professional development and teacher training to recognize dyslexia signs and apply multiple reading strategies. *(Sally Shaywitz, 3003, p, Range, 120-150)* [26]
٣-Applied Study by the Researcher:
Illustrative drawings and the use of colors and multiple prints play a crucial role in preventing and treating dyslexia. The researcher thus produced an unconventional method to avoid dyslexia and reduce its occurrence and symptoms by creating an educational book to simplify and teach the Arabic alphabet. This book aims to rehabilitate the child, activate their visual memory to recall the letter's image and sound, and train them in reading and writing.
-Comprehensive Evaluation and Treatment:
There is no complete cure or method for dyslexia, but it can be overcome by early detection (as mentioned previously). The treatment phase begins when indicators of its existence are integrated, using evaluation and treatment programs that identify children's capabilities, skills, and behavioral problems. These involve various sessions with parental participation, aimed at developing cognitive domains, attention, perception, memory, thinking, speech and language development, reading and writing, motor capabilities, sensory functions, problem-solving, self-expression, and social communication. *(Ahmed Fathi El-Zayat, 2015, p. 445)*[9]
The Comprehensive Evaluation is Divided into: Evaluation through psychological support, scientific content, and verbal and readable language.
3-1-Evaluation through Psychological Support: Psychological and emotional support, building confidence, flexibility, and patience play a crucial role in treating dyslexia through:
Listening to children's feelings, addressing negative emotions, and training them to express their feelings while avoiding negative words like "stupid" or "lazy".
Helping them set appropriate, achievable goals by simplifying instructions.
Requiring cooperation between parents and school, demonstrating patience to strengthen children's self-confidence and treatment, reinforcing strengths and talents through a personal support system that helps them be creative and become exceptional children. *(Kate Griggs, 2021, P. Range, 120– 130)* [20] - *(Patricia .A, Reid, 2017, P. 7)* [28]
-**Assistive tools for children:** Using computer sciences to help children read, such as: Audiobooks,Word and text-to-speech conversion programs, Note-taking and organization applications, Spelling applications, Screen readers and Word prediction programs.

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-Using interactive education and alternative assessment methods: Recorded tests focusing on their academic progress without emphasizing grade achievement

Finally, finding non-traditional ways to interact with children through activities they excel in, which help focus their brain, alongside using different letters and verbal instructions.*(Kate Griggs, 2021, P. 120-130)*[20] *- (Sandra . F, 2010, P.120-160)*[22] *- (Patricia A. Reid, 2017, P,7)*[28]

3-3-Evaluation through Language:Includes verbal, readable, and written language

3-3-1- Evaluation through Verbal Language: This is done by identifying the sounds of letters and learning them individually and collectively (auditory blending), then matching the letters with the sounds to learn words, then developing auditory perception and renewing the source of the sound and distinguishing its intensity, height and lowness, as well as distinguishing between similar basic language sounds, starting with learning the easy and most commonly used letters, then the less commonly used ones, taking into account teaching letters that are similar in shape at different times to avoid mixing them up.

In this specific problem, the researcher designed a method using illustrations representing Arabic letters in the form of different living creatures to help children differentiate between similar letters and learn them in an easy way at the same time and ensure that they are memorized (researcher's comment).

Finally, using the usual, repeated and easy-to-distinguish words such as (you, he, he said) and learning words that are different from each other in one sound such as (slept, slept, stood up).

(Muhammad Ali Kamel, 2006, pp. 192, 193) [33] *- (Boutros Hafez, 2009, pp. 297, 299)* [2]

Illustrations were used to activate visual memory and were designed specifically for children by the researcher.

3-3-2- Evaluation through written language: First, children are taught the correct direction of reading using geometric shapes and drawings and trained to determine the location of their bodies in space and the location of objects from them so that this is reflected in reading. They are also taught the relationship between the letter and its corresponding sound in a gradual manner in difficulty from simple concepts to more complex ones. We start with the letter, then the word, then simple sentences, then complete sentences, with continuous evaluation of children to control the educational process.

3-3-3- Evaluation through written language and dictation: It improves by focusing attention on printed letters and controlling eye movement while looking at the lines of the page, which helps build new ideas that are added to children's previous knowledge. *(Boutros Hafez, 2009, pp. 293-297)* [2] *- (Mohamed Ali Kamel, 2005, p. 193)* [8]- (Sally Shaywitz, 2020, p. Range, 35-55) [29] - (Mohamed Ali Kamel, 2006, p. 188) [33].

3-4- Designing an educational book to simplify the Arabic alphabet:

Through the above, the researcher designed an educational book to learn Arabic letters to achieve the goal of the research, which is to simplify the letters for children in general and children with learning difficulties, especially dyslexic children, through two stages: producing drawings and producing the alphabet (geometric letters).

***The first stage is producing illustrations representing Arabic letters: This was done through several steps.**

The first step is producing drawings manually: The Arabic language contains 35 syntactic sounds, 27 of which are consonant sounds (hamza, letters of the alphabet except ya and waw, الهمزة ، احرف الابجدية عدا الياء والواو), in addition to three letters representing long vowels (ya, madd, waw madd, alif madd , ياء، المد، واو المد، الف المد) and three representing short vowels (kasra, damma, fatha, الكسرة ، الضمة ، الفتحة). *(Mohamed Ali Kamel, 2006, pp. 88, 90)*[33]

Using illustrations is very important for treating dyslexia as it helps children learn letters by converting the letter into a drawing that can be saved in visual memory and then helps them learn the word by linking the shape of the letter and its sound and spelling the letters of the word and in turn recognizes syllables, sentences and paragraphs. It also helps visually distinguish between letters and helps them understand that color, size and writing material do not affect the differences in letters.

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(Mohamed Ali Kamel, 2005, p. 184) [8] *- (Ahmed Fathi Al-Zayat, 2015, p. 388)* [9].
The researcher began producing hand-drawn illustrations by searching for shapes of various living creatures whose names begin with the same sounds as the letters of the Arabic alphabet, as well as the number of letters, with a similarity between their overall shapes and the bodies of the letters or part of them, so that the shape of the letter can be extracted from the shape of the living creature, and thus the child links the shape of the living creature to the shape of the letter and its sound (after getting to know it in its environment and way of life, coloring it and interacting with it), which makes it easier for him to store it in visual memory. After that, the researcher drew these creatures manually in various sizes using acrylic paint on the manufactured canvas material. Acrylic paints were tested as a type of watercolors for their environmental friendliness (suitable for children) and quick drying. Once dry, they become resistant to water and various environmental factors such as light, weather and cracking, and are suitable for long-term artwork and are suitable for most surfaces and materials. *(Rachel Wolf, 1997, p. Range, 12 -20)* [37]
Canvas was also chosen as a material for drawing as it is characterized by the highest quality and durability of paper and lasts for many years, suitable for children's interaction with it and withstanding different factors.
It is made of cotton or linen and its texture varies to suit all types of drawings from soft to rough texture and does not absorb colors. *(Ralph Mayer, 1991, p. Range, 45 - 50)* [38]
With the use of the two materials together, the artwork gives a long life similar to the idea of educational tools with children's direct interaction with it (researcher's comment).
Living creatures were drawn in their natural environment in the following sizes:
- The letter Alif (الالف): represented by a manual illustration of a lion standing longitudinally, a complete front angle, measuring 25 cm by 35 cm.
- The letter Ba (الباء): represented by a manual illustration of a duck in a complete side-to-side shape, measuring 48 cm by 31 cm.
- The letter Ta (التاء): It is represented by a hand-drawn illustration of a crocodile in its environment in a frontal, half-width, measuring 42 cm by 44 cm.
- The letter Tha (الثاء): It is represented by a hand-drawn illustration of a green snake in a frontal, full-width, measuring 48 cm by 36 cm.
- Haram Al-Jim (الجيم): It is represented by a hand-drawn illustration of a shrimp in its environment in a side-width, measuring 48 cm by 31 cm.
- The letter Ha (الحاء): It is represented by a hand-drawn illustration of a chameleon in its home in a side-width, measuring 48 cm by 31 cm.
- The letter Kha (الخاء): It is represented by a hand-drawn illustration of a sheep in its environment in a side-width, measuring 48 cm by 31 cm.
- The letter Dal (الدال): It is represented by a hand-drawn illustration of a worm in its environment in a side-width, measuring 49 cm by 31 cm.
- The letter Dhal (الذال): It is represented by a hand-drawn illustration of a cat's tail in a longitudinal, full-width, measuring 40 cm by 30 cm.
- The letter Ra (الراء): It is represented by a manual illustration of a feather in a full frontal lengthwise shape measuring 43 cm by 41 cm.
- The letter Zain (الزين): It is represented by a manual illustration of a giraffe in its environment in a half-lengthwise side shape measuring 41 cm by 41 cm.
- The letter Seen (السين): It is represented by a manual illustration of a fish in its environment in a full side-width shape measuring 42 cm by 40 cm.
- The letter Sheen (الشين): It is represented by a manual illustration of a tree in its environment in a full frontal lengthwise shape measuring 42 cm by 41 cm.
- The letter Sad (الصاد): It is represented by a manual illustration of a shell in its environment in a full side-width shape measuring 49 cm by 35 cm.

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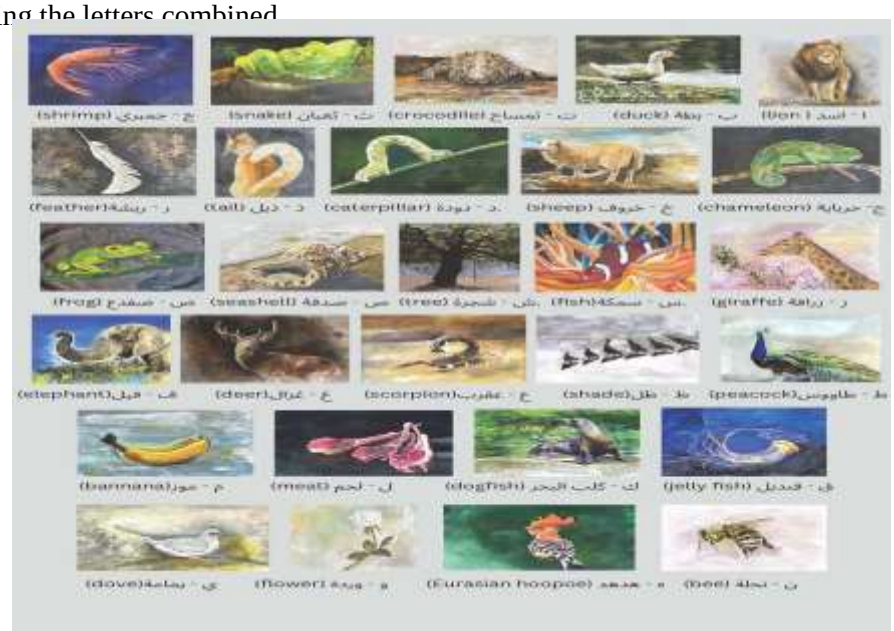
- The letter Dad (الضاد): It is represented by a manual illustration of a frog in its environment in a full side-width shape measuring 48 cm by 35 cm.
- The letter Ta (الطاء): It is represented by a hand-drawn illustration of a peacock in its environment in a full side view measuring 41 cm by 41 cm.
- The letter Dha (الظاء): It is a hand drawn illustration of the bird with its silhouette in full side view measuring 48cm x 48cm.
- The letter Ain (العين): It is represented by a hand-drawn illustration of a scorpion in a full side view measuring 47 cm by 44 cm.
- The letter Ghain (الغين): It is represented by a hand-drawn illustration of a gazelle in a front view measuring 50 cm by 40 cm.
- The letter Fa (الفاء): It is represented by a hand-drawn illustration of an elephant in a full side view measuring 48 cm by 40 cm.
- The letter Qaf (القاف): It is represented by a hand-drawn illustration of a jellyfish in its environment in a full side view measuring 49 cm by 42 cm.
- The letter Kaf (الكاف): It is represented by a hand-drawn illustration of a seal in its environment in a full side view measuring 50 cm by 39 cm.
- The letter Lam (اللام): It is represented by a hand-drawn illustration of a meat in a full side view measuring 50 cm by 38 cm.
- The letter Meem (الميم): It is represented by a hand-drawn illustration of a banana in a full side view measuring 48 cm by 42 cm.
- The letter Nun (النون): represented by a hand-drawn illustration of a bee in a full side view measuring 47 cm by 32 cm.
- The letter Ha (الهاء): represented by a hand-drawn illustration of a hoopoe in a full side view measuring 49 cm by 35 cm.
- The letter Waw (الواو): represented by a hand-drawn illustration of a rose in a full front view measuring 48 cm by 36 cm.
- The letter Ya (الياء): represented by a hand-drawn illustration of a dove in a full side view measuring 50 cm by 36 cm.

This is shown in (Figure 6) the hand-drawn illustrations of living organisms in their environment representing the letters combined.



(Figure 6) The researcher's hand drawings of living organisms representing the letters of the Arabic alphabet, assembled

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The second step to produce digital drawings representing the alphabet: The hand drawings were redrawn using the Adobe Illustrator drawing program to convert the hand drawings into vector digital drawings in preparation for printing them later using the educational book, so that the living organism was drawn completely with its environment and then the background was removed to use it in the following steps. (Figure 7) represents the researcher's digital drawings of living organisms without a background using the Adobe Illustrator drawing program

(Figure 7) Represents the researcher's digital drawings of living organisms collected without a background using the Adobe Illustrator drawing program

The third step in producing illustrations: The researcher extracted the shape of the letter from the shape of the living organism completely or partially by drawing the shape of the letter above the drawing in the form of a shadow over the living organism in a transparent form and in a different color so that we find:

-The letter Alif (الالف): It was extracted from the body of the lion almost completely.

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- The letter Ba (الباء): It was extracted from the body of the duck almost completely and point B represents the duck's foot.
- The letter Ta (التاء): It was extracted from the head of the crocodile, specifically the jaw and the points represent the eyes of the crocodile.
- The letter Tha (الثاء): From the body of the snake and the head partially and the three points are the mouth and eye.
- Haram Al-Jim (الجيم): From the body of the shrimp completely.
- The letter Ha (الحاء): From the body of the chameleon completely with the drawing angle modified.
- The letter Kha (الخاء): From the body of the sheep partially from the head and body.
- The letter Dal (الدال): From the body of the worm completely with the drawing angle modified.
- The letter Dhal (الذال): Partially from the cat's body represented by the tail.
- The letter Ra (الراء): Completely from the feather with the drawing angle modified.
- The letter Zain (الزين): Partially from the giraffe from the head.
- The letter Seen (السين): Partially extracted from the fish's body.
- The letter Sheen (الشين): was partially extracted from the tree from the branches.
- The letter Sad (الصاد): Partially extracted from the shell's body.
- The letter Dad (الضاد): was partially extracted from the frog's body.
- The letter Ta (الطاء): Completely extracted from the peacock's body.
- The letter Dha (الظاء): Partially from the bird's shadow with the drawing angle modified.
- The letter Ain (العين): Completely from the scorpion's body with the drawing angle modified.
- The letter Ghain (الغين): Partially from the gazelle's shape from the head, specifically the horns, with the drawing angle modified.
- The letter Fa (الفاء): Partially from the elephant's body for the head.
- The letter Qaf (القاف): Completely from the jellyfish's body with the drawing angle modified.
- The letter Kaf (الكاف): From the body of a sea lion as a whole with a modification of the drawing angle (in the letter Kaf at the beginning of the word)
- The letter Lam (اللام): From the shape of a piece of meat as a whole with a modification of the drawing angle.
- The letter Meem (الميم): From the body of a banana as a whole with a modification of the drawing angle.
- The letter Nun (النون): From the body of a bee as a whole with a modification of the drawing angle.
- The letter Ha (الهاء): From the body of a hoopoe as a part, specifically the head.
- The letter Waw (الواو): From the body of a rose as a whole
- The letter Ya (الياء): From the body of a dove as a whole with a reduction of the area.

(Figure 8) Represents the researcher's digital drawings representing the drawings of living beings and above them the shape of the letter with a transparent appearance

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represents the researcher's collected digital drawings representing the drawings of (٨Figure)
.living organisms, and above them the shape of the letter with a transparent appearance
the shape of the living organism in a flat color that shows the shape The fourth step represents
of the letter so that the shape of the letter appears through the body of the living organism as a
he shape of whole or part of it, in preparation for linking the shape of the original letter and t
represents the researcher's digital drawings representing (٩the living organism (Figure
.drawings of living organisms in the shape of the letters of the alphabet in a flat color

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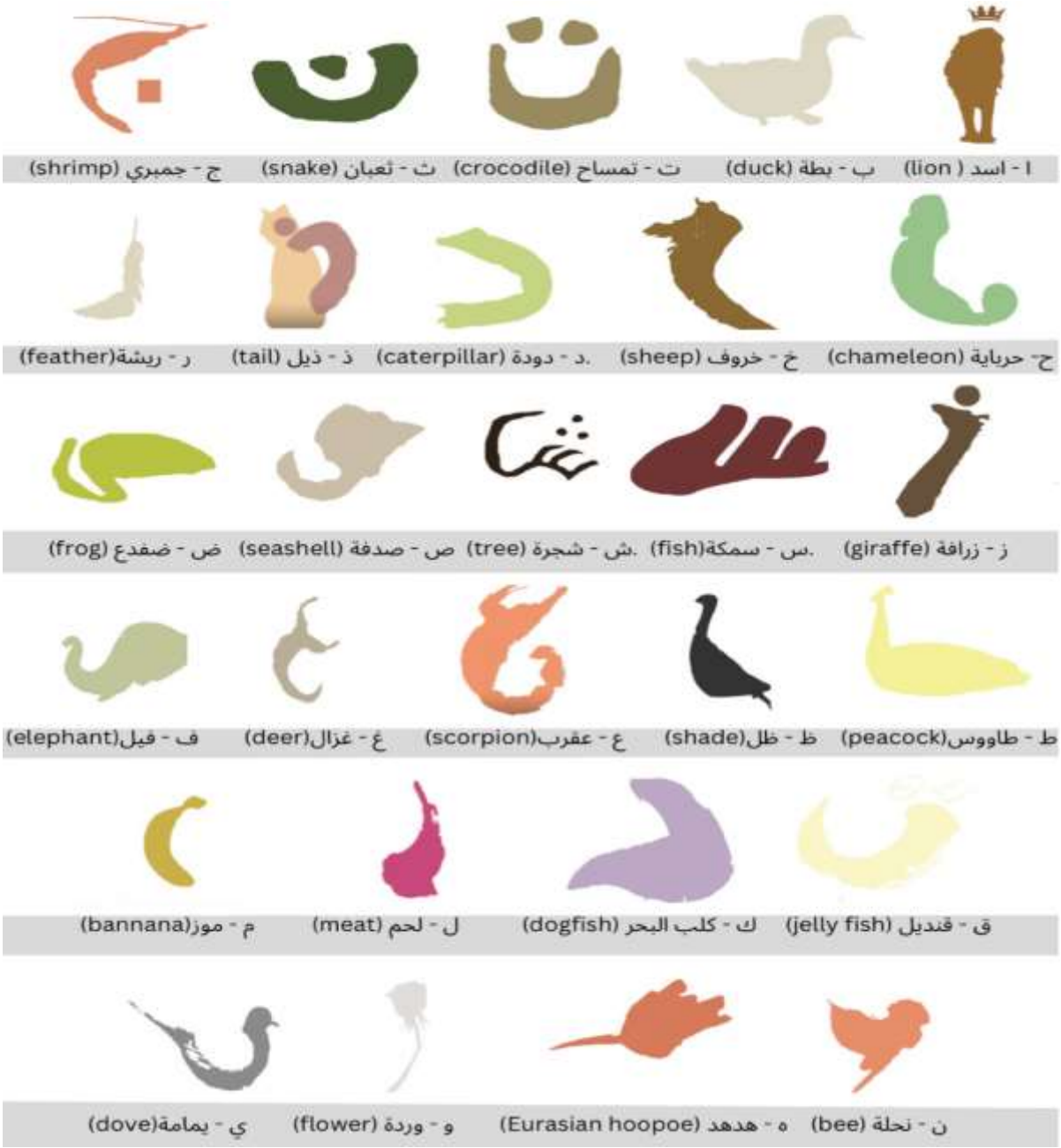

(Figure 9) represents the researcher's collected digital drawings representing drawings of living organisms in the form of alphabetical letters in a solid color.

Step Five: The drawings of living creatures were linked to the shape of the traditional letters representing the Arabic alphabet in order to bring the shape of the letter closer to the child's mind by linking the shape of the living creature to the shape of the letter and its sound (Figure 10), so that the drawing of the living creature appears in the figure and above it the traditional alphabetical letter representing it.

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(Figure 10) The researcher's digital drawings of living organisms, with the traditional alphabet letters representing them above them.

(Figure 10) The researcher's digital drawings of living organisms, and above them the traditional alphabetical letters representing them.

The second stage: producing simplified alphabetical letters in a geometric form:

In this stage, an alphabet for the letters of the Arabic language was produced in four steps in a simplified geometric form that is easy for the child to understand, away from the types of traditional Arabic fonts. First, the shape of the letters was drawn individually, then the shapes of the letters were

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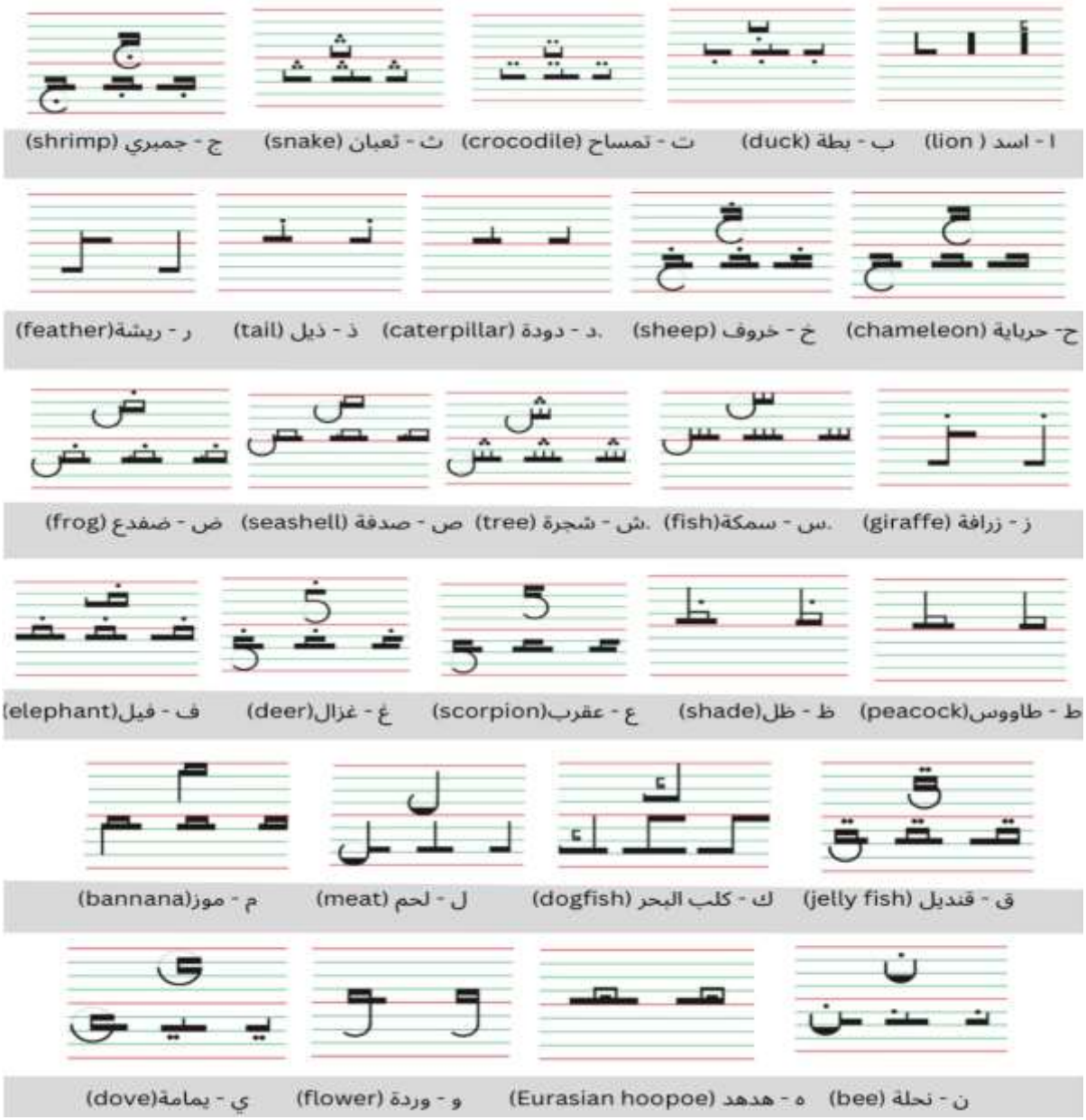
drawn at the beginning of the word, in the middle of the word, and at the end of the word. This is shown in (Figure 11)



(Figure 11) represents the researcher's digital drawings representing the letters of the alphabet in a simplified geometric form using the Adobe Illustrator drawing program.

The fifth step in producing the simplified alphabet is to empty the shape of the letters so that they can be colored by the children as an important stage to fix the shape of the letter in the short-term memory and thus retrieve it later and control the writing of the shape of the letter later in the sixth step, which represents the shape of the letter written in the form of dots with the starting point of the writing movement being determined by side arrows, thus making it easy for the children to rewrite on the dots (Figure 12) represents the researcher's digital drawings representing the letters of the alphabet in an empty form that can be colored.

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(Figure 12) represents the researcher's digital drawings representing the letters of the alphabet in a hollow form that can be colored.

After completing the two stages of preparing the illustrations and preparing the geometric alphabet, the two stages were combined so that a drawing of the living creature representing the alphabetical letter appears with the name of the living creature as an outlet for the geometric alphabet (Figure 13) A model of the letter Ha and the letter Qaf.

(Figure 13) A model of the letter Ha and the letter Qaf representing the shape of a living creature with the name.

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After completing the production of the vocabulary of the educational book to simplify the Arabic alphabet, the previous elements were collected from the hand and digital drawings and the geometric alphabet letters to form the pages of the educational book, which consists of 56 letters representing 28 letters, each letter was designed on two facing pages, starting from the drawing of the living creature and ending with the children writing the letter, passing through the intermediate elements mentioned above in the order of the letters of the alphabet (a, b, t, …….etc.).
This is shown in (Figure 14), where a model of the shape of the educational book page to simplify the Arabic alphabet represents two facing pages to display learning the letter in its stages.

(Figure 14) A model of the educational book page to simplify the Arabic alphabet. Two facing pages representing the letter Ha and the letter Qaf.

٣ - 5 - Field study:
The researcher conducted a field study with children in one of the associations affiliated with the Ministry of Social Solidarity. Then the study (experimental education) went through the following scientific steps:
-**First, the concrete experience (CE) was carried out:** which represents direct engagement in the experiment, where information about drawings of living creatures representing letters (lion, duck, ……etc.) was presented in the form of oral stories that help children use their sense of hearing while showing them the drawings and interacting with them using the sense of sight, touch and movement by coloring them. Then the shape of the living creature is fixed in their minds while focusing on their feelings and sensations and paying attention to them. Thus, interaction takes place through the drawings and the rest of the senses (Figure 15) represents the researcher's drawings manually for living creatures in a linear form that allows them to be **(**colored Out Line's)

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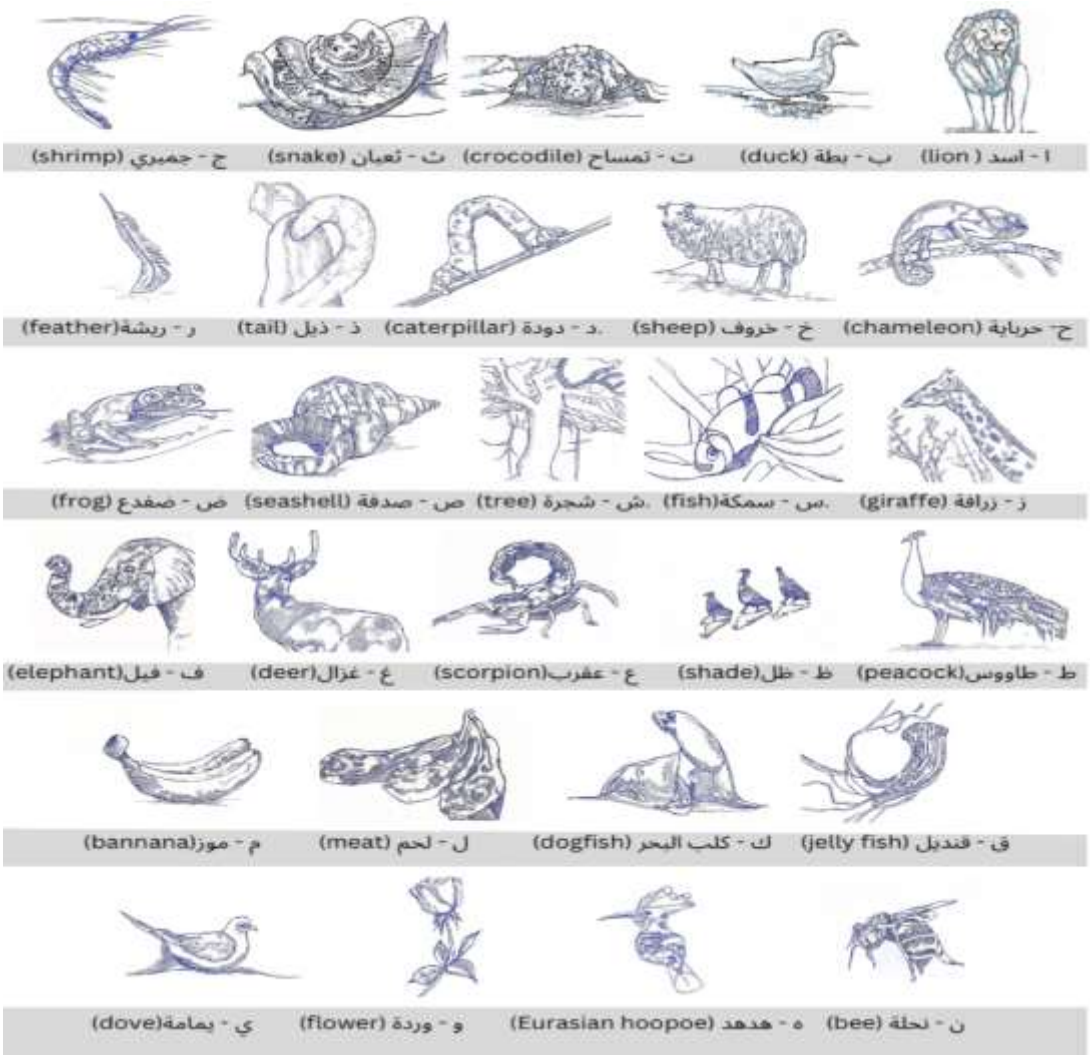

(Figure 15) The researcher's manual drawings of living organisms in the form of an 'Out Line'.

• Reflective Observation (RO):

Children reflect on their color experiences and discuss them, then the shapes are analyzed and letters are extracted from them in comparison with the researcher's drawings and the geometric alphabet previously presented.

• **Abstract Conceptualization (AC):** Previous reflections are used to develop and think about models in order to link the shape of the letter and the shape of the living organism and the sound of the letter to facilitate its fixation in short-term memory.

• **Finally, Active Experimentation (AE):** This is the application of what was learned in the end by coloring and writing the letters and reading them through the names of living organisms.

Children can prefer different stages depending on their learning style, and thus a different stage can be started from one child to another. (David Kolb, 1984, P.Rang 30-50) 39

From the above, the following results and recommendations can be drawn:

Results:

1- A solution was found to the problem of weak working memory (which must store the phonological information of words, then encode and recognize the visual image, then convert it to its complementary sounds) by linking the shape of the letter to its sound using the researcher's illustrative drawings representing the shapes of the letters of the Arabic alphabet with repetition, thus strengthening the activation of short-term memory.

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2- The illustrative drawings contributed to the normal children's perception and learning of the Arabic alphabet in an enjoyable and easier way, in addition to treating cases of learning difficulties with good visual memory with weak auditory memory, as well as with children with dyslexia.
3- The importance of illustrative drawings for children can be concluded as follows:
- The inevitability of their presence in children's curricula in the kindergarten stage and the primary education stage.
- Overcoming the difficulty of learning similar Arabic letters such as (B - T - Th) at the same time so that they can be differentiated through drawings of living creatures representing the letters.
- Suitable for normal children in kindergarten as well as children with learning difficulties and dyslexia.

Recommendations:

1- Applying and using the illustrated alphabet to teach Arabic letters in schools and specialized centers to develop children's abilities to treat learning difficulties.
2- Paying attention to producing illustrated educational books presented to children in kindergarten and primary education and treating learning difficulties according to the prescribed scientific curricula.
3- Focusing on learning using the child's multiple senses through interactive illustrated educational books with the participation of parents and the school to overcome the symptoms of dyslexia.
4- Teaching various cognitive problems, most notably learning difficulties, as curricula prescribed in various art colleges in order to give art the opportunity to contribute to treating such cases scientifically.

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