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Abdulrahman Ali Bedaiwy[1]
Hajar Hawass Al-Shammari[2]

# Differences in the Pattern of Control of the Cerebral Hemispheres' Functions between Female Ordinary and Dyslexia Students in intermediate Stages

*Abstract*

*The study aimed to determine the pattern of control of the cerebral hemispheres' functions between female ordinary students and those with dyslexia. The aim is also to compare these two groups using the descriptive method. The sample included 52 female ordinary students and 10 female students of dyslexia at middle school in Dammam and Qatif cities. Diagnostic Assessment Scale of Reading Difficulties of Al-Zayat (2007)', 'Crane Scale to Alert Cognitive Pattern (1989)', 'Arabization & Rationing of Hammouri (2020) were applied. In addition, the psychometric properties were verified in more than one way. The results showed no statistically significant differences in the pattern of control of the functions of the cerebral hemispheres among female ordinary students and those of dyslexia. The results also indicated that the dominant pattern among them is integrative. Based on these findings, the researchers recommend the necessity to diversify the use of educational strategies and activities that contribute to the revitalization of the cerebral hemispheres in public education classes, and in the integrated classes of students with learning difficulties.*

*Keywords:* Cerebral Control, Cerebral Hemispheres, Dyslexia, Intermediate Stage.

## Introduction

At present, the world is undergoing a revolution in brain researches and its functions, the mechanism by which an individual processes information, and mental processes that occur in the cerebral hemispheres from attention, perception, remembering, thinking, and language, where each half performs different mental functions and activities than the other half in receiving and processing information. Researches in this area have increased, confirming that each half of the brain has more specific functions responsible for it than other one, where the cerebral hemispheres working together in an integrated manner.

These researches have also classified the functions of each part, as the left half specializing in linguistic, analytical and mental functions, which is why the left half is called the realistic, logical, analytical, and verbal half. This half analyzes the information into parts and then gathering them logically, after that arranging them until it reaches the conclusion or result. It also tends to work daily tables and plans, performs sub-tasks and continues to perform them until it finishes from the main task, and tends to deal with digital skills, complex calculations, character symbols and words, where the owners of this half have a good ability to express themselves, and tend to do computational and verbal work. The right half specializes in visual spatial functions

Abdulrahman Ali Bedaiwy[1], Special Education Department, College of Education, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia. Email: aabediwi@iau.edu.sa
Hajar Hawass Al-Shammari[2], Master of Special Education in Learning Disabilities, Teacher at the General Administration of Education in the Eastern Province, Saudi Arabia.
Email: 2200500227@iau.edu.sa

associated with creativity, imagination, emotion and intuition, therefore it is called sensory, intuitive, non-verbal half. This half works in a holistic way where it deals with information from all to the part, and tends to deal with the parts randomly, moving from one part to another without adhering to a clear plan, and the owners of this half have the ability to reach intuitive results but cannot provide an explanation of the results reached (Abdul Quwai, 2017).

Consequently, educators were interested in the phenomenon of cerebral control or what Torrance called it *'Learning & Thinking Patterns'*; in an attempt by him to learn how students preferred to learn and think by linking the learning style to the functions of cerebral hemispheres and studying them (Beni Araba, 2005). As many people prefer one way of thinking and learning over another and their preference for this method depends on how it is appropriate for their abilities and potential. Educators always try to figure out appropriate educational methods that improve the educational process for students, this has led to interest in students' different thinking and learning styles, and training teachers to learn about these patterns and methods so that they can provide information to their students in a manner consistent with their abilities and preferences for learning and thinking methods (Murad, 1994).

The field of learning difficulties is one of the first educational fields concerned with modern scientific researches and theories that enabled educators and researchers to study the methods of learning students, studying the best ways to teach them in proportion to their abilities. In addition to these studies varied between studies that looked at differences between those with learning disabilities and their ordinary peers such as the study of Beni Araba (2005). Also, the study of Wajnsztejn et al (2016) that looked at the prevalence of asymmetry between the cerebral hemispheres in children and adolescents with a multidisciplinary diagnosis of non-verbal learning disorder. Al-Yami study (2017) looked at the relationship between linguistic intelligence and cerebral control patterns in dyslexia students, while Al-Jabali study (2019a) was more specific in looking for gender differences among students with learning disabilities in middle school.

Dyslexia is one of the most widespread difficulties, it is an important element of academic learning difficulties, and as many researchers and learning disability specialists see dyslexia as the main cause of student failure, it affects students' self-concept and self-competence (Jujiga, 2018). Abdul Quwai (2017) states that the left spherical half is prevalent in language functions, due to the different size in certain areas of the cerebral cortex, where it is larger in the left spherical half than the right one. This means that language functions depend on the work of the two halves together, although the role of the right half is lower than left one, which has dominance in language functions. Hilalahan et al. (2005/2007) explained that there is sufficient consistency and stability between a group of research teams that have found statistically significant differences in brain composition and its functional performance between people with dyslexia and people without dyslexia. They found that the left half of the brain is often the subject of dysfunction, but some of these research teams may also found significant differences related to the right half of the brain among people with dyslexia and those without suffering.

The association between neuroscience and education has led to significant developments in understanding the vital neural learning requirements of individuals with dyslexia, neuroflexibility of the brain, and the participation of the right half in reading. Researches into *'Neural Network Theory & Cortical Oscillation'* suggests that the cerebral hemispheres cooperate in high-level linguistic processes (Kershner, 2020). Reigosa-Crespo at all (2020) stated that bridges between results from cognitive neuroscience and teaching practice have not been systematically created. However, many researchers who are interested in this field agree on the positive impact of knowledge on how the brain learns teaching practices and educational policies. Therefore, in light of the results of brain researches and their entry into the field of education and information processing, it was necessary to employ them to explain the learning difficulties suffered by students and the way to overcome them. Moreover, in light of the scarcity of studies and researches sought to do so, which called on the two researchers to try to benefit from brain researches by identifying the cerebral control patterns of female students with dyslexia and habits and comparing them with ordinary ones, so the problem of study arises in the following question:

- What are the differences in cerebral control patterns in female ordinary students and dyslexia ones?

The following hypotheses are branched out from the main question:

1. There are no statistically significant differences at the level of significance (α=0.05) between cerebral control patterns (left, integrative, and right) attributable to the classification of the reading status of female students (ordinary, with dyslexia).
2. There are no statistically significant differences at the level of significance (α=0.05) between cerebral control patterns (left, integrative, and right) in female students with dyslexia.
3. There are no statistically significant differences at the level of significance

(α=0.05) between cerebral control patterns (left, integrative, and right) in female students with dyslexia attributable to age.

The importance of the current study is due to the fact that it is concerned with the subject of cerebral control in female students with dyslexia, and the interpretation of their difficulties, as this study provides a theoretical framework, neurologic information and scientific results on the functions of the cerebral hemispheres that benefit educators and teachers in identifying the mental functions of those with learning disabilities, and providing a comprehensive education that serves all categories of students based on the latest theories.

**Theoretical Framework & Previous Studies**

Disparity in the interests of educators, psychologists and neuroscientists has generated intersections in brain researches that have provided educators with cognitive foundations, and understanding the teaching methods that enable students to learn better, not only with knowledge that requires remembering, but will require dynamic and interactive education (Al-Salti & Rimawi, 2009).

The difference between the cerebral hemispheres in terms of composition despite the apparent similarity between them, not only stands at the anatomical dimension, but it goes beyond the functional differences between the cerebral hemispheres, as the difference in brain centers is associated with differences in the functions for which these centers are responsible (Abdul-Quwai, 2017). Both halves play a role in determining how information is processed, how we think, learn and act, and each half works in a distinctive way and has a specific function, the left half of the brain processes information in a sequential analytical manner while the right one processes information in a more holistic and intuitive way (J. D. Connell, 2005).

Students with left-half are good at dealing with abstract symbols, so they excel in mathematical calculations, they make extrapolational logic, criticism, and always try to find a system and pattern for any work, and the left half gives them a sense of separation and exclusivity, and their problem is that they can't reconsider a previous move (J. D. Connell, 2005 farmer, 2004).

Left pattern teachers generally prefer to teach using lecture and discussion, outline the blackboard or general subjects, love to adhere to prepared schedules. They prefer classes to be clean, organized and quite quiet, and resort to teaching methods with their students, including writing lesson outlines on the blackboard sequentially, creating organized discussions, and helping them in discussing large and abstract concepts (D. Connell, 2002).

While right pattern students, are more connected to the visual world and focus more on the visual and spatial features of information. They need first to see the whole picture, where the right half specializes in processing a lot of information at the same time (i.e. it sees the forest and does not see trees). It is in tune with feelings, music, art and sports. Right pattern people tend to perceive and share their feelings more frequently than people in control of the left side; they can form and maintain relationships, and they are imaginary creators who can contribute new ideas. In addition to being random, they need to learn how to track instructions or steps so they can assemble and organize their ideas (J. D. Connell, 2005; Farmer, 2004).

Right pattern teachers generally prefer to use practical activities and integrate many images, arts and music into their lessons, tend to use Garnder's multiple intelligences, love group projects and activities, prefer an active classroom environment, employ in their teaching the techniques that attract the attention of their students, and devote some time to group activities (D. Connell, 2002). The area of learning difficulties is the area where neuroscientist knowledge can be combined with its profound effects on education in so-called *'Educational Neuroscience'*. Dyslexia and what is related with it from theoretical, diagnostic and therapeutic strategies, we can find an explanation through brain-based theories, which are designed to lead to appropriate individual and collective treatment methods (Fawcett & Nicolson, 2007). The procedures for classifying, diagnosing and treating learning difficulties are topics worth researching in neuroscience and education, and as a result of the variation in procedures used by researchers in these areas, this has led to a kind of separation between identifying learning difficulties in educational environments and identifying them based on neurosciential evidence (Grant at all, 2020).

With regard to differences in the pattern of control of brain functions of cerebral hemispheres between ordinary students and dyslexia ones, several studies have indicated this, such as the study of Wajnsztejn et al (2016) that examined the prevalence of asymmetry between the cerebral hemispheres in children and adolescents who have multidisciplinary diagnosis of non-verbal learning disorder, the results of which resulted in the possibility of using asymmetry between the cerebral hemispheres to predict or support the diagnosis of non-verbal learning disorder. In addition to the study of Al-Makahla (2019) confirmed, in relation to the comparison between ordinary students and students with Maths difficulties in cerebral control patterns, that the right pattern was prevalent in students with Maths difficulties, while ordinary students had a integrative pattern. As well as statistically significant differences between the grades of students with Maths difficulties in the left and right pattern, and the differences were in favor of the right pattern; meaning that the right pattern prevailed more than the left pattern. While ordinary students who had the left pattern was their greatest dominance. There are also statistically significant differences in the left and right patterns between students with Maths difficulties and ordinary students, and the differences were in favour of ordinary students; meaning that the use of both right and left patterns was higher among ordinary students than with Maths learning difficulties ones.

With regard to differences in cerebral control patterns between the sexes in the three patterns (left, right and integrative) in students with learning disabilities, the study of Al-Jabali (2019a) reported statistically significant differences between averages of male and female student grades in the right pattern in favour of males. As well as statistically significant differences in the integrative pattern in favour of males, and the left pattern did not have statistically significant differences in grade averages between males and females in this pattern. Moreover, in another study of differences between patterns cerebral dominance in visual cognitive skills (non-motor), the study of Al-Jabali (2019b) indicated that there were no statistically significant differences between the three cerebral control patterns in visual cognitive skills (visual closure, visual discrimination, visual spatial relationships, visual memory, visual sequence memory, visual shape stability, shape and visual flooring). Furthermore, the study of Muhaisen (2015) confirmed statistically significant differences in logical, physical and linguistic intelligence in favor of the left half, musical and spatial in favor of the right half. The study of Obrzut & Mahoney (2011) indicated differences between ordinary people and those with learning disabilities in linguistics which attributable not only to delay of cerebral control only but also to other reasons such as selective attention deficits. In general, those with learning disabilities suffer from impaired language processing skills in the left half of the brain, and while the study of Obrzut (1995) indicated that the performance difference between people with learning difficulties and their ordinary peers do not exist in fixed structural differences in the cerebral hemispheres but are as the result of dynamic processing differences.

As for dyslexia, which is a challenge for people with learning disabilities, the area responsible for it, is the area around the left side of the half of the brain, where it deals with neuronal function and disorders (Castaño, 2002). The study of Arabmofrad et al. (2020) indicated that there was no relationship between the dominance of the left spherical half with reading strategies. As there was no relationship to the reading understanding of students who learn the language as a second language. While the role of the left half represents in dividing sentences and words within them. With regard to whether the greater bias of the left half in the division of the sensory subject based on linguistic processes, the study of Veronelli et al. (2020) found that the greater bias of the left half shown by healthy participants in the division of sentences; it is likely to be due to acoustic bone coding that occurs during the division the task. This acoustic bone coding is disabled in patients in the left half of the brain, leading to patients showing a decrease in left-half bias in the division of the sentence. The study of Gurunandan et al. (2021) also noted to the concentration of languages in the left spherical half of the brain. The study of Park et al. (2012) confirmed that people with bilingual dyslexia comparing to monolingual people without dyslexia in brain activity have relative hyperactivity in the right spherical half, as compensation for the inefficient performance of the left spherical half. Moreover, in terms of differences in processing speed and quality between ordinary readers and readers with dyslexia resulted in the results of the study of Shaul (2012) found that sufferers with dyslexia read slower with more errors than ordinary readers, while the performance of dyslexia individuals improved until it approached the performance of ordinary readers when stimuli were provided in their left visual field, and that individuals with dyslexia were relying more on the right hemisphere for language treatment. The study of Shwa`el (2012) noted the lack of dominance of the right pattern in dyslexia students, the lack of complete brain dominance in dyslexia students, and the lack of gender differences in cerebral control patterns, as well as dyslexia has neurological origin, which represents in the functional asymmetry between the cerebral hemispheres that related to language due to the absence of the typical pattern of language processing.

The study of Song et al. (2013) noted that dyslexia ones achieved lower levels of vocal tasks than their ordinary peers, and showed less activity in certain areas of the left half of the brain. In the studies of Kang et al. (2016), they stated that individuals with dyslexia appear to have normal cognitive abilities, and show dominance of the right half as compensation for weakness reading function in the left half areas. The study of Al-Yami (2017) confirmed that differences between ordinary and dyslexia students on the linguistic intelligence scale in favor of ordinary ones. As well as differences between cerebral control


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patterns (right, left, integrative) and linguistic intelligence in dyslexia people because there is a negative relationship between right pattern and linguistic intelligence, and the prevalent pattern in dyslexia ones is the right pattern. The study of Saban-Bezalel et al. (2019) indicated the raise of employment of the right half in people with dyslexia might be due to poor semantic treatment or differences in language areas in half left of the brain. In the study of Bonandrini et al. (2020), it was concluded that dyslexia might be due to injury to some areas in the left half of the brain. Finally, the study of Nora et al. (2021) reported the importance of voice therapy for the left half of the brain for effective vocal representations, and its disorder of dyslexia.

## Methodology & Procedures

The study relied on the descriptive approach on a sample of all the first, second, and third intermediate students of the ordinary female students of public education and (78) female students of learning disabilities distributed in East Dammam (36) students, West Dammam (12) students, and Qatif (30) students; including (18) students with dyslexia out of (78) students with learning disabilities enrolled in the resource rooms of the government girls' middle schools in the East and West of Dammam, and Qatif cities. The sample of the study was selected in accordance with the consent of their parents to participate, and their data came in accordance with the following table:

***Table 1.***

*Distribution of study sample members according to the classification of the state of reading status in female students (ordinary, dyslexia) and age*

| Age | Statistics | Classification of reading status among female students | | Total |
|---|---|---|---|---|
| | | Ordinary | with dyslexia | |
| **12** | Frequency | 8 | 1 | 9 |
| | Percentage | 12.9 | 1.6 | 14.5 |
| **13** | Frequency | 18 | 1 | 19 |
| | Percentage | 29 | 1.6 | 30.6 |
| **14** | Frequency | 8 | 6 | 14 |
| | Percentage | 12.9 | 9.7 | 22.6 |
| **15** | Frequency | 17 | 1 | 18 |
| | Percentage | 27.4 | 1.6 | 29 |
| **16** | Frequency | 1 | 1 | 2 |
| | Percentage | 1.6 | 1.6 | 3.2 |
| **Total** | Frequency | 52 | 10 | 62 |
| | Percentage | 83.9 | 16.1 | 100 |

## Study Tools

In order to collect the data and information needed to achieve the current study objectives, two tools have been applied:

### *First: Diagnostic Assessment Scale of Reading Difficulties*

To achieve the study's objectives, Zayat Scale (2007) was used for reading difficulties to diagnose students with dyslexia, where it aims to detect female students with reading difficulties who frequently have some or all behavioral characteristics related to reading difficulties. This scale was prepared, with the aim of obtaining teachers or parents' estimates of the frequency of these behavioral characteristics in female students, and the psychometric properties of the scale were verified through virtual validity and verification of content validity by being presented to five arbitrators and all the agreed arbitrators' observations were taken by (100%).

The internal consistency of the scale was also calculated by applying it to a sample of (17) female students with dyslexia; Pearson Correlation Coefficients[1&2] of the relationship of phrases on Diagnostic Assessment Scale of Reading Difficulties in students with dyslexia were calculated. To overcome the inaccuracy of Pearson's coefficient as an indicator of verification of internal consistency validity; Corrected Correlation Coefficients[3&4] of the relationship of

[1] $(\sum(x_i-\bar{x})(y_i-\bar{y}))/\sqrt{\sum(x_i-\bar{x})^2\sum(y_i-\bar{y})^2}$; $where\ r = correlation\ coefficient, x_i = values\ of\ the\ x - variable\ in\ a\ sample, \bar{x} = mean\ of\ the\ values\ of\ the\ x - variable, y_i = values\ of\ the\ y - variable\ in\ a\ sample, \bar{y} = mean\ of\ the\ values\ of\ the\ y - variable$

[2] Pearson Correlation Coefficient is not the most appropriate statistical method for verification of internal consistency validity of the scale phrases and its axes; it treats with the phrases of the scale and its axes as related linear variables, although in fact they are classification variables with a gradient, according to Likert Scale. Furthermore, not deleting the response value on the phrases of their scale and dimension to which it is followed; to give the pure correlation of the phrases to the scale and axis to which it is followed.

[3] $R_i = (COV(X_i, P) - S_i^2)/(S_i\tilde{S}_i)$; citation [SPSS V26: (IBM SPSS STATISTICS ALGORITHMS.PDF); Page: 922]

[4] Corrected Correlation Coefficient for the phrases with the scale or axis to which it is followed, is statistically more accurate than Pearson Correlation Coefficient. Because it takes into account the specificity of the phrases from being a grade-grade classification variable in line with Likert staging

phrases to the Diagnostic Assessment Scale of Learning Difficulties in students with dyslexia were calculated, as shown in the following table:

***Table 2.***

*Pearson Correlation Coefficients values & Corrected Correlation of the Relationship of phrases with Diagnostic Assessment Scale of Learning Difficulties in female students with dyslexia*

| No | Phrases Texts of Diagnostic Assessment of Learning Difficulties | Phrases with scale by using Correlation | |
|---|---|---|---|
| | | Pearson | Corrected |
| 1 | She looks nervous - restless - frown when she reads. | 0.47* | 0.45* |
| 2 | She reads loud and sharp - she presses the letter exits. | 0.50* | 0.49* |
| 3 | She resists reading, cries and breaks up the passages and words. | 0.53* | 0.51* |
| 4 | She checks the reading place and repeats what she reads frequently. | 0.47* | 0.46* |
| 5 | She pronounces intermittently convulsively during reading. | 0.68* | 0.62* |
| 6 | She looks anxious, confused and reading material gets closer to her eyes. | 0.52* | 0.49* |
| 7 | She deletes some words, jumps from one location to another while reading. | 0.81* | 0.77* |
| 8 | She replaces some words with other words that do not exist in the text. | 0.70* | 0.64* |
| 9 | She reflects/replaces some letters and words. | 0.52* | 0.51* |
| 10 | She mispronounces words/suffers from mispronouncing of letters. | 0.63* | 0.57* |
| 11 | She reads without showing some kind of understanding of what she is reading. | 0.53* | 0.46* |
| 12 | She reads the words in the wrong order. | 0.48* | 0.46* |
| 13 | She is hesitant about words she cannot say. | 0.49* | 0.48* |
| 14 | She finds difficulty to recognize letters, passages and words. | 0.75* | 0.70* |
| 15 | She finds difficulty to conclude the facts and meanings contained in the text. | 0.58* | 0.53* |
| 16 | She fails to re-read the content of a short story after reading it. | 0.63* | 0.59* |
| 17 | She cannot deduce the main idea of what she is reading. | 0.71* | 0.65* |
| 18 | She reads intermittently: (letter, letter), (section, section), (word, word). | 0.54* | 0.47* |
| 19 | She reads aloud, sharp, jerky. | 0.56* | 0.54* |
| 20 | She finds difficulty to use (full stop, commas, and pauses) during reading. | 0.48* | 0.47* |
| * Statistically significance (α=0.05), because the calculated value of the Corrected Coefficient is greater of its critical value (0.4516) at freedom score (15). | | | |

It is noted from table (2) that Pearson's Correlation Coefficients values for the relationship of phrases to Diagnostic Assessment Scale to Learning Difficulties in female students with dyslexia on their scale ranged from (0.47-0.81). Table (2) also notes that the values of Corrected Correlation Coefficients for the relationship of phrases to Diagnostic Assessment Scale to Learning Difficulties in female students with dyslexia on their scale ranged from (0.45-0.77). It is noted from the special values of internal consistency (consistency of homogeneity between the contents of phrases), the values of Pearson Correlation Coefficients, and the values of the Corrected Correlation Coefficients for the relationship of the phrases of the Diagnostic Assessment Scale for Learning Difficulties among female students with dyslexia. With their scale that did not fall below the standard to the lowest acceptable critical value of the discrimination coefficient (Pearson Correlation Coefficient, Corrected Correlation Coefficient) of (0.4516) at freedom score (15) for the level of significance (α = 0.05) computed according to the (t)[5] test which tests the *'Null Hypothesis'* of the Pearson Correlation Coefficient, and the Corrected Correlation Coefficient; which indicates the quality of the items in the Diagnostic Assessment Scale for Learning Difficulties in female students with dyslexia.

The stability of the scale was also calculated using Cronbach's α equation, which was valued at (0.83), which is high, indicating a record high homogeneity of the contents of the scale phrases.

### *Second: Alert Cognitive Pattern Scale*

To achieve the study's objectives, the two researchers chose the Alert Cognitive Pattern Scale that created by Lauren D. Crane (1989) to help people to know their cerebral control pattern as cited J. D. Connell (2005). Hammouri (2020) translated and rationed it on the Saudi environment, and the scale contains (21) phrases and each one contains two alternatives (A) and (B) which the examiner has to choose one of the alternatives. It is corrected by obtaining one degree for the examiner; if his choice of alternative (A) and zero score; if his choice of alternative (B), for the following phrases (1, 2, 3, 7, 8, 9, 13, 14, 15, 19, 20, 21), if his choice of alternative (B) and zero score; if his choice of alternative (A), for the following phrases (4, 5, 6,

method, and that it is not a related linear variable, and in that it is calculated from the dimension of the deletion of the response value on the relevant phrases of the scale and axis to which it is followed; giving the pure correlation of the phrases with the scale and axis to which it is followed.

[5] $t = \left(r\sqrt{n-2}\right)/\sqrt{(1-r^2)}$

10, 11, 12, 16, 17, 18), the examiners are classified according to the overall score of the scale as follows: (0-4) strong control pattern for the left side; (5-8) moderate control pattern for the left side; (9-13) control pattern for the integrative side; (14-16) moderate control pattern for the right side. (17-21) strong control pattern for the right side. Moreover, for the purposes of evaluating the pattern of cerebral control (Alert Cognitive Pattern ) in female students (ordinary, dyslexia ones), the right pattern classifications were statistically combined together (moderate, strong), and left pattern classifications were combined together (moderate, strong), as follows: cerebral control is on the left side; if its raw score is on the scale; ranging from (0-8), and cerebral control is for the left and right side (integrative); if its raw score is on the scale; ranging from (9-13), cerebral control is on the right side; if its raw score is on the scale; ranging between (14-21).

The psychometric properties of the scale were verified through virtual validity and verification of content validity by being presented to five arbitrators and all the agreed arbitrators' observations were taken by (100%). The internal consistency of the scale was also calculated by applying it to a sample of (20) female students; Pearson Correlation Coefficients of the relationship of phrases on the Alert Cognitive Pattern Scale to female students (ordinary, dyslexia ones) were calculated. To overcome the inaccuracy of Pearson's Coefficient as an indicator of verification of consistency validity; Corrected Correlation Coefficients of the relationship of phrases to the Alert Cognitive Pattern Scale in female students (ordinary, with dyslexia) were calculated, and the values of the correlation coefficients are shown in the following table:

***Table 3.***

*Pearson Correlation Coefficients values & Corrected Correlation of the Relationship of phrases with the Alert Cognitive Pattern Scale of female students (ordinary, with dyslexia)*

| No | Phrases Texts of Alert Cognitive Pattern | | Key Correction | Phrases with scale by using correlation | |
|---|---|---|---|---|---|
| | Alternative | | | | |
| | A | B | | Pearson | Corrected |
| 1 | I enjoy adventures and feel fun | I do not feel fun with adventures. | A | 0.66* | 0.57* |
| 2 | I find a new way to do old business. | I do not change the way I do if it is new. | A | 0.71* | 0.43* |
| 3 | I start with a lot of endless work | I finish the work I do and then go to the other one. | A | 0.47* | 0.46* |
| 4 | I am not imaginary in my job. | I use my imagination for everything I do. | B | 0.64* | 0.57* |
| 5 | I can imagine what is going to happen. | I can feel what is going to happen. | B | 0.72* | 0.71* |
| 6 | I am trying to find the best way to solve a particular problem. | I am trying to find more than one way to solve a particular problem. | B | 0.73* | 0.70* |
| 7 | My thinking is like pictures in my mind. | My thinking is like words in my mind. | A | 0.75* | 0.60* |
| 8 | I agree with new ideas before others. | I wonder more about new ideas than others do. | A | 0.72* | 0.64* |
| 9 | Others do not understand how I sort things out. | Others think I am well organized. | A | 0.59* | 0.53* |
| 10 | I have good discipline. | I usually act according to my feelings. | B | 0.47* | 0.46* |
| 11 | I organize time to do my job. | I do not think about the time when I work. | B | 0.62* | 0.53* |
| 12 | I pick what is right with difficulty. | I choose what I feel is right. | B | 0.59* | 0.47* |
| 13 | I do the easy things first and the important ones later. | I do important things first and easy ones later. | A | 0.73* | 0.48* |
| 14 | I have many ideas in the new situation. | Sometimes I do not have ideas in the new situation. | A | 0.63* | 0.59* |
| 15 | I have to change a lot in my life | I have to plan and organize my life. | A | 0.55* | 0.49* |
| 16 | I know I am right because I have good reasons. | I know I am right, even if there is no good reason. | B | 0.45* | 0.44* |
| 17 | I organize my work according to the time I have. | I would rather do my job at the last minute. | B | 0.49* | 0.44* |
| 18 | I keep everything in its own place. | Keeping things depends on what I do. | B | 0.46* | 0.45* |
| 19 | I have to make my own plans. | I can follow the plans of others. | A | 0.68* | 0.51* |
| 20 | I am a very flexible person. | I am a steady, hard-to-change person. | A | 0.74* | 0.58* |
| 21 | I decide how I work myself to do the new tasks. | I need someone to guide me to do the new tasks. | A | 0.67* | 0.63* |
| + The answer takes one score in the case of choosing the right alternative and score zero in case of choosing the wrong alternative. | | | | | |
| *Statistically significance (α=0.05), because the calculated value of the correlation coefficient is greater of its critical value (0.4516) at freedom score (18). | | | | | |

It is noted from table (3) that Pearson's Correlation Coefficients values for the relationship of phrases to the Alert Cognitive Pattern Scale in female students (ordinary, with dyslexia) on their scale ranged from (0.45-0.75). Table (3) also notes that the values of Corrected Correlation Coefficients for the relationship of phrases to the Alert Cognitive Pattern Scale in female students (ordinary, with dyslexia) on their scale ranged from (0.43-0.71). It is noted from the special values of internal consistency validity (consistency of homogeneity between the contents of phrases), the values of Pearson Correlation Coefficients, and the values of Corrected Correlation Coefficients for the relationship of the phrases to Alert Cognitive Pattern Scale among female students (ordinary, with dyslexia). With their scale did not fall below the standard to the lowest acceptable critical value of the discrimination coefficient (Pearson Correlation Coefficient, Corrected Correlation Coefficient) of (0.4194) at freedom score (18) for the level of significance (α = 0.05) computed according to the (t) test which tests the null hypothesis of Pearson Correlation Coefficient, and Corrected Correlation Coefficient, which indicates the quality of the items in Alert Cognitive Pattern Scale among female students ( ordinary, with dyslexia). The stability of the scale was also calculated by using Cronbach's α equation, which was valued at (0.87), which is high, indicating a high homogeneity of the contents of the scale phrases.

**Study Results**

The results include a presentation of the study's question as mentioned in the study problem, which states that 'What are the differences in cerebral control patterns prevailing in ordinary students and those with dyslexia?' To answer the study question that tests the '*Null Hypothesis'* which stated that 'there are no statistically significant differences at the level of significance (α = 0.05) between cerebral control patterns (left, integrative, and right) attributable to the classification of reading status in female students (ordinary, dyslexia ones). Their observed frequencies are calculated within cerebral control patterns (left, integrative, and right) and their percentages are in the reading status classification of female students (ordinary, dyslexia ones) individually. The values of the (χ2) test for independent[6] focus on observed frequencies of cerebral control patterns on the classification of the reading status of female students (ordinary, with dyslexia) or not, as indicated in the following table:

***Table 4.***

*Results of the (χ2) test for the independence of observed frequencies of expected frequencies of cerebral control patterns from the classification of the reading status of female students, and the percentages within their reading status classification*

| Classification of the reading status of female students | Statistics | Prevailing cerebral control pattern | | | Total | χ2 | Freedom Score | Chance Error |
|---|---|---|---|---|---|---|---|---|
| | | Left | Integrative | Right | | | | |
| Ordinary | Observed frequencies | 9 | 38 | 5 | 52 | | | |
| | Percentage within the line | 17.3 | 73.1 | 9.6 | 100 | 3.48 | 2 | 0.18 |
| | Adjusted standard rest | 1.4 | -1.9 | 1 | | | | |
| With dyslexia | Observed frequencies | | 10 | | 10 | | | |
| | Percentage within the line | | 100 | | 100 | | | |
| | Adjusted standard rest | -1.4 | 1.9 | -1 | | | | |
| Total | Observed frequencies | 9 | 48 | 5 | 62 | | | |
| | Percentage within the line | 14.5 | 77.4 | | 8.1 | 100 | | |

[6] Test of Independence $\chi^2 = \sum_{i=1}^{3}\left(\sum_{j=1}^{3}\left(\left(o_{ij} - e_{ij}\right)^2/e_{ij}\right)\right)$

Table (4) shows that there is no independence of observed frequencies of cerebral control patterns (left, integrative, and right) from classification the reading status of female students (ordinary, with dyslexia), where the value of (χ2) test for independence was (3.48) without statistical significance at (α = 0.05); stating that there is no relationship between the classification of the reading status of the female students (ordinary, with dyslexia) on the one hand and the patterns of cerebral control (left, integrative, and right) on the other hand, and also illustrated by table (4) the dominance of the pattern of integrative cerebral control in all female students with dyslexia by a percentage of (100%) out of (10) female students with dyslexia. The dominance of cerebral control patterns in ordinary female students is shown respectively as follows: a) Integrated cerebral control pattern in the first rank by a percentage of (73.1%) out of (52) ordinary female students. b) Left cerebral control pattern in second rank by a percentage of (17.3%) out of (52) ordinary female students. c) Right cerebral control pattern is in third rank by a percentage of (9.6%) out of (52) ordinary female students. Table (4) also shows that there is no possibility of testing each of the second hypothesis, which stated that 'there are no statistically significant differences at the level of significance (α = 0.05) between cerebral control patterns (left, integrative, and right) in female students with dyslexia'. The third hypothesis stated that 'there are no statistically significant differences at the level of significance (α = 0.05) between cerebral control patterns (left, integrative, and right) in female students with dyslexia attributable to age', due to dominance of integrative cerebral control pattern in female students with dyslexia by a percentage (100%) out of (10)female students with dyslexia.

## Discussion & Interpretation the Results

The results of the first hypothesis, which stated that 'there are no statistically significant differences at the level of significance (α = 0.05) between cerebral control patterns (left, integrative, and right) attributable to the classification of the reading status of female students (ordinary, with dyslexia)'; showed that there were no statistically significant differences between ordinary students and dyslexia ones. This result varies with the results of studies of (Park et al. 2012; Saban-Bezalel et al. , 2019; Shaul, 2012; Song et al., 2013) that showed statistically significant differences in the pattern of control of cerebral hemispheres functions between people with dyslexia, and people without dyslexia. Moreover, the results also indicated that the pattern in ordinary female students is integrative, then left and right pattern, and this result is consistent with the study of Al-Makahla (2019), which its results showed that the prevalent pattern in ordinary female students is integrative, then left and right. It also agrees with the study of Saban-Bezalel et al. (2019), whose results showed that the treatment pattern in people without dyslexia is integrative. While this result differs with the study of Muhaisen (2015), which indicated that the prevalent pattern in ordinary female students is the left, integrative, then right. However, the study of Arabmofrad et al. (2020), which its results showed those most ordinary students were left pattern.

The results also showed that the prevalent pattern among female students with dyslexia was the integrative pattern which meaning non-dominance of the right half of the female students with dyslexia. This was consistent with the study of Shwa`el (2012), whose results indicated that the right half was not prevalent among female students with dyslexia. While this result differed with the results of studies of (Al-Yami, 2017; Kang et al., 2016 ; Park et al. 2012; Saban-Bezalel et al., 2019; Shaul, 2012), which have shown the dominance of the right half in people with dyslexia. Crane states (as cited J.D. Connell, 2005) that many people have a dominant pattern either right or left; but some people have an integrative dominant pattern, where their ability is quite evenly distributed in the cerebral hemispheres. Moreover, D. Connell (2002) points out that people with an integrative pattern tend to be more flexible in how tasks are performed and more familiar than right or left pattern people, they are able to see and solve the problem from different points of view. However, the dominance of the integrative pattern is inconclusive; because from the neurological point of view most tasks can be performed either through the left or right cerebral hemisphere, while J.D. Connell (2005) states that many people who have been categorized as having the integrative pattern believe that they tend either towards the left or the right pattern. This result confirms the necessity to diversify the use of strategies and learning methods that activate the cerebral hemispheres of students. In addition to educators and teachers should make sure to use learning strategies and activities that develop the imagination, creativity and cognitive skills of students, also to diversify between activities based on group work and the development of social relations, individual activities that challenge the student's own capabilities.

For the results of the second hypothesis, which stated that 'there are no statistically significant differences at the level of significance (α = 0.05) between the patterns of cerebral control (left, integrative, and right) in female students with dyslexia'. The results of the third hypothesis, which stated that 'there are no statistically significant differences at the level of significance (α = 0.05) between the patterns of cerebral control (left, integrative, and right) among female students with dyslexia attributable to age.' The results showed the dominance of the integrative pattern among all members of the sample by 100%, therefore, there are no statistically significant differences between the female students with dyslexia due to the patterns of cerebral control and age. The two researchers attribute this result to the small number of dyslexic individuals in the research sample who responded to the scale, and in order for differences to be found, the sample must be larger in order to allow for finding statistically significant differences between its members.

## Determinants & Limitations

The small number of participants in the sample of female students with dyslexia due to the first reasons, the number of members of the research community is limited (female students with dyslexia in the middle-school in the cities of Dammam and Qatif).As for the second, relying on the selection of participants in the research sample on the written consent of parents, especially with the difficulty of obtaining written approvals in the conditions of distance learning. As for the third, it is represented in the absence of accurate statistics that classify those enrolled in the source rooms of those females with dyslexia at the middle school according to the type of difficulty in the study community (Dammam - Qatif), which made the two researchers use a diagnostic test to verify those females with dyslexia. In addition to the reliance of two researchers on a psychological tool to determine the patterns of cerebral control among the sample members, and the lack of support for the study with modern brain imaging tools such as magnetic resonance imaging (MRI).

## Conclusion

The study aimed to determine the pattern of control of the cerebral hemispheres' functions between ordinary students and those with dyslexia and compare them. The results showed that there are no statistically significant differences in the pattern of control of the cerebral hemispheres' functions between ordinary female students and those with dyslexia. The dominant pattern in ordinary female students and those with dyslexia is the integrative pattern. Based on these findings, the two researchers recommend focusing on educating and teaching students with dyslexia through active interactive strategies that contribute to the development and use of both sides of the brain, helping to develop and activate their entire brain, especially in early age, taking into account the neurological characteristics of the functioning of the cerebral hemispheres when building the curricula, and seeking other similar studies in which specialists in the fields of special education, neuroscience and neuropsychology collaborate using various tools between medical and psychological to make the results more accurate and generalizable.

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