

The Effectiveness of a Cognitive Learning-Teaching Program on Cognitive Speed among Female Students in Primary Education Colleges

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Abstract

The current study aims to investigate the effectiveness of a cognitive-based instructional program on cognitive development speed among female students majoring in elementary education. The research sample comprised 91 female students, selected to represent the experimental group, consisting of 47 students, and the control group, consisting of 44 students from the Department of Early Childhood Education, Second Stage, College of Elementary Education, Mustansiriyah University. The researcher adopted a cognitive speed test consisting of three cognitive assessments, originally developed and translated by Al-Sharqawi (1983), in their final format, with 30 items for each test, distributed among the Visual Similarity Test, the Visual Association Test, and the Three-Dimensional Length Estimation Test.

The researcher verified the psychometric properties of the scale and subsequently applied it to the research sample. Several statistical methods were employed to achieve the research objectives, including Chi-square, Independent Samples t-test, and Cronbach's alpha. The results revealed that second-stage female students majoring in Early Childhood Education exhibited varying levels of cognitive speed.

Keywords: *Tutorial_educational program according to the cognitive theory of perceptual speed.*

1. Introduction

Research Problem:

The research problem revolves around the difficulty of learners' perception of information they receive and the manner in which they comprehend and assimilate it. This issue is considered the fundamental principle of cognitive theories, which emphasize how problems are solved swiftly because the collection, categorization, and mental organization of data are accomplished through perception, aided by both attention and motivation. This is corroborated by a local (Iraqi) study that the researcher has relied upon as a source for the research problem, namely the study by Kazem (2021). Cognitive speed activates mental capacities, highlights individual differences, and facilitates solutions to problems, as well as the processing of information that can elevate students' levels and improve educational outcomes. Achieving this necessitates the implementation of educational programs that employ the best strategies, especially those aligned with the principles of cognitive theories. It also involves selecting the most appropriate methods

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and techniques, effectively planned, to assist female students in perceiving and storing study materials within their cognitive structures for future use (Sabri, 2011, p. 39).

In light of the above, the research problem is encapsulated in a crucial question that requires an answer: Does the instructional program, based on cognitive theory, have an effectiveness in cognitive speed among female students majoring in elementary education?

Importance of the Research:

The significance of cognitive speed, as one of the crucial cognitive functions, can be perceived through two aspects: cognitive slowness versus cognitive speed and cognitive error versus cognitive accuracy. If an individual experiences visual cognitive slowness, meaning they require a longer time to recognize a stimulus compared to their peer group, it does not necessarily indicate visual impairment or deficiencies in the visual system. Instead, it may be an indicator of a disturbance in the general functioning of the central nervous system, which manifests itself in cognitive or motor responses (Al-Adl, 1995: 127).

Consequently, current research in the fields of psychological measurement, educational sciences, and psychology has shown a keen interest in cognitive speed, considering it as the ability to swiftly identify shapes, make comparisons, quickly determine visual patterns, or select them from among several visual patterns. This ability has implications for cognitive processes such as thinking, memory, perception, attention, and intellectual capacities (Omar, 1985: 11).

Given that universities are crucial educational institutions that serve and strive to develop society, particularly in the current era characterized as the "Information Age" and marked by technological advancements, there is a pressing need to dedicate every possible effort to educate individuals who possess sound thinking abilities, knowledge, and fundamental skills. Such individuals are capable of exhibiting intelligent behaviors and, as a result, adapting to their environment and the scientific and technological changes. Achieving this goal requires universities not only to transmit knowledge and enrich it through pedagogical methods but also to teach students how to think, be creative, and deal with life in a modern context. Therefore, higher education must be emphasized as an essential necessity for various reasons. Among these reasons, it is worth noting that the world is moving towards increased interconnectedness, overlap, and interdependence due to scientific, technological, and communication advances. Additionally, any nation's wealth lies in the ability of its citizens, based on their level of cognition and culture. When discussing the future, higher education must play a central role because it is the means of preparing individuals and equipping them with the necessary capabilities and skills to confront future challenges (Zayer, 2011: 31).

Research Objectives:

The current research aims to assess the effectiveness of an instructional-learning program on cognitive speed among female students majoring in elementary education.

Research Hypothesis:

There is no statistically significant difference, at a significance level of 0.05, between the mean scores of the experimental group who studied cognitive development according to the instructional-learning program and the mean scores of the control group who studied the same subject using conventional methods in cognitive speed.

Research Scope:

This research is limited to female students in the Department of Early Childhood Education, Second Stage, College of Elementary Education, Mustansiriyah University, for the academic year 2022/2023.

Research Terminology:

1. Effectiveness

- Defined by Ya'qubi (2008) as: "The change that occurs in something as a result of something else" (Ya'qubi, 2008: 8).

2. Teaching-Learning Program

- Defined by Sabri (2002) as: "Everything the learner receives inside and outside the educational institution in the form of purposeful experiences that result in desirable changes in cognitive, emotional, and skill aspects. Such programs can be individual or collective" (Sabri, 2002: 154).

3. Perceptual Theory

- Defined by Al-Zaghloul (2003) as: "One of the theories that emphasize that understanding and insight lead to the acquisition of a principle or rule associated with a specific situation that can be applied in other situations. The results of learning through insight are considered to enhance learning" (Al-Zaghloul, 2003: 171).

4. Perceptual Speed

- Defined by Abu Hatib (1987) as: "The ability that requires speed and accuracy in perceiving details and distinguishing between shapes in terms of similarities and differences" (Abu Hatib, 1987: 138).

2. Theoretical Framework

First Axis: The Instructional-Learning Program

The instructional-learning program is a comprehensive and integrated system of cognitive, psychological, and social foundations, along with integrated elements such as objectives, content, teaching methods and strategies, assessment, and development. This program is delivered by an institution to learners with the aim of fostering holistic development and achieving desired objectives (Maddkur, 2006: 61). The instructional-learning program is a precise and clear action plan characterized by integration and inclusivity in terms of principles, concepts, rules, and procedures derived from learning theories. These components assist learners in achieving their educational goals based on their capabilities, needs, and interests. Furthermore, they provide a set of guidelines and directions that should be followed step by step. This approach ensures that students have the opportunity to achieve their specific goals and verifies whether the learning process has occurred, whether students have learned or not, based on the implemented and applied program (Sabri and Radhi, 2021: 1290; Zayer et al., 2014: 38-36).

Second Axis: Perceptual Theory

The term "gestalt" is originally derived from the German word "gestalt," which means "shape." In most cases, it carries the meaning of "form" or "pattern." This nomenclature stems from the fact that studies conducted by this school of thought on sensory perceptions have shown that "the main truth in sensory perception is not the elements or parts that constitute the perception but the shape or general structure." For example, a triangle is not composed of three sides and three angles combined together. The evidence for this is that we cannot perceive a triangle from three lines placed in any configuration or three isolated angles. The general relationship or overall configuration, according to the Gestaltists, is the primary aspect of interest (Nasif, 1983: 204).

Concept of Perceptual Cognitive Integration:

In the perceptual cognitive integration concept, the whole, the overall shape, is considered to be more important than the sum of its parts. The total sum of Arabic letters does not

lead to words or sentences; letters do not equal words. Therefore, the word comes first, followed by the letters. This concept suggests that a child is born as a complete entity, and the best experiences provided to them must be holistic and integrated. The holistic experience takes precedence, followed by the arrangement of the parts or their combination to reach the whole.

Laws of Perceptual Organization:

According to the Gestalt perspective, the description of perceptual organization forms the key to understanding learning. There are fundamental laws that govern the perceptual organization of situational stimuli, as defined by Wertheimer: "Each law describes a feature of the visual field that affects the process of perception."

Perceptual Characteristics:

1. Proximity
2. Similarity
3. Open Direction
4. Simplicity

(Qatami, 2005: 80)

Third Axis: Perceptual Speed

The term "perceptual speed" is a combination of "speed" and "perception." It refers to the measurement of individual differences in perceptual speed, interaction, and sensory responses. This concept is closely related to "reaction time," which is the time required for a response and varies from one individual to another. Certain professions, such as pilots, require exceptional reaction times. It has been found that through specific mental exercises, one can improve their perceptual speed. These mental exercises involve conscious and cognitive effort to achieve a specific task. These exercises are performed through significant gestures, and individuals benefiting from them must be prepared for the sensory influence.

Additionally, individuals who train others in these exercises must possess the ability to convey gestures effectively (Abdel Aleem, 2005: 1).

Stages of Perceptual Speed:

1. Exposure to Stimuli (Stimulus Encounter): The environment is rich with numerous diverse stimuli that are challenging to count and quantify. Individuals find it challenging to process these stimuli. Therefore, it is necessary to select at least one stimulus quickly and perceptually to determine how to deal with it. This highlights the limitations of individuals' neural capabilities and their inability to process all these stimuli effectively.
2. Selection and Choice (Discrimination): Each individual has a perceptual system that aids them in the process of selection and choice among various stimuli they encounter. This allows individuals to access some stimuli while ignoring others.
3. Information Analysis (Categorization): All gathered information about stimuli is categorized into groups based on similarities in characteristics and causal relationships defined by the perceptual system. This involves breaking down all information into smaller components and quickly processing it to make decisions regarding a specific situation.
4. Interpretation and Translation of Stimuli: This involves generating a specific impression of perceptual speed by analyzing previously collected information.

5. Behavioral Responses: These represent the final outcome of the perceptual process, which is observed in an individual's behavior. In other words, the results of perceptual speed are manifested in behavior. (Smith et al., 2005, p.79)*

Factors Affecting Perceptual Speed:

There are several factors that influence an individual's perceptual speed, including:

1. Memory: Memory plays a significant role in an individual's perception of things or situations they have encountered before. In such cases, perception is easier and faster compared to things the individual has not encountered previously.
2. Physical and Psychological State: An individual's perception of the external world is influenced by their psychological and physical state. If a person is stressed or anxious, their perception and interpretation of things may differ from when they are emotionally balanced, as these states affect mental and neural functions, resulting in slower responses.
3. Attitudes: An individual's culture, beliefs, and attitudes have a significant impact on what they perceive and how they interpret stimuli, leading them to interpret stimuli differently based on their cultural and belief-related inclinations.
4. Personal Inclinations: An individual's personal inclinations and tendencies also affect their perceptual speed.
5. Perceptual Stability: Perceptual stability refers to an individual's ability to respond to stimuli and maintain balance despite variations in the characteristics of the stimuli or perceptions.

Factors Facilitating Perceptual Speed:

The researcher has identified several factors that can help individuals improve their perceptual speed, including:

1. Physical Maturation: Physical development and muscle formation are key factors that determine an individual's ability to perform the required behaviors in perceptual speed tasks.
2. Cognitive Maturation: Cognitive abilities and their maturity, including the learning of specific patterns, play a role in an individual's ability to reach different levels of intelligence.
3. Attention: Attention is a prerequisite for perceptual speed. It involves focusing the mind on a specific subject or thing and can be influenced by emotions, moods, and anger. An individual's response can vary depending on their emotional state, as they may perceive things differently from reality.
4. Expectations: Perceiving things as individuals expect them to be, rather than as they truly are, affects perceptual speed. Expectations and mental preparedness can help individuals quickly perceive and differentiate the desired stimulus from a set of stimuli or objects.
5. Cognitive Field Organization: Organizing all elements of a specific situation logically contributes to perceptual speed and problem-solving. (Alfulfi, 2012, p. 110)

3. Research Methodology:

To achieve the research objectives, the researcher employed a descriptive research approach in designing the program and an experimental approach in its implementation.

Research Population:

The research population comprises all the elements and components of the problem under study (Abu Al-Am, 2007, p. 160).

The current research population consists of female students in the second stage of basic education in the Department of Early Childhood Education for the morning study session during the academic year 2023/2022.

Research Sample:

The researcher purposively selected a sample of 91 female students representing both the control and experimental groups (Sabri, 2009, p. 342).

Research Tools:

Cognitive Perceptual Speed Test:

This research necessitates assessing the level of cognitive perceptual speed among the study sample. Therefore, the researcher adopted a standardized and translated test consisting of three subtests, including:

1. **Visual Similarities Test:** This test contains 10 items, each with 4 shapes. It assesses the students' speed in identifying the shape that matches the original shape (Obaid, 2019, p. 67).
2. **Visual Associations Test:** This test also includes 10 items, each with 4 shapes. It measures the ability of students to identify the shape that is different from the other shapes presented.
3. **Length Estimation Test:** This test comprises 10 items, each with 3 shapes. It assesses students' ability to select the correct answer that identifies the letter in the geometric shape presented to them.

The following were extracted from the tests:

- Difficulty coefficients and discrimination coefficients for the items in the perceptual speed test based on the correct answers in both the high-scoring and low-scoring groups, with a percentage of 27%. The number of items in each group is 27, as shown in Table 1.

Table 1: Discrimination Coefficients for Perceptual Speed Test Items

Visual Associations		
Paragraph Sequence	Paragraph Difficulty	Paragraph Discrimination
1	0.704	0.519
2	0.722	0.556
3	0.704	0.593
4	0.630	0.593
5	0.667	0.519
6	0.704	0.519
7	0.519	0.444
8	0.704	0.519
9	0.685	0.407
10	0.759	0.481
Visual Similarities		
11	0.704	0.593
12	0.741	0.519
13	0.685	0.556
14	0.667	0.519
15	0.667	0.519
16	0.704	0.519

17	0.463	0.556
18	0.722	0.481
19	0.611	0.556
20	0.630	0.741
Estimating Lengths		
21	0.667	0.444
22	0.741	0.370
23	0.667	0.370
24	0.704	0.444
25	0.685	0.481
26	0.704	0.370
27	0.667	0.444
28	0.648	0.630
29	0.722	0.407
30	0.593	0.444

Paragraph 2 - Extracting Paragraph Correlation Coefficients with Total Score (Point-Biserial):

For the perceptual speed test, point-biserial correlation coefficients were extracted, and their values were compared to the tabular value (1.98). All of them showed statistical significance, as the values were greater than the tabular value at a significance level of (0.05) with degrees of freedom (98).

1- Scale Validity:

Face Validity :Face validity suggests that the tool is valid if its title or appearance confirms the content it was created for or measures what it was designed to measure. (Al-Jabri, Sabri, 2015, p.148). The researcher achieved this by presenting the scale to a group of specialized referees in (teaching methods, measurement and evaluation, educational psychology), Appendix (2), to express their opinions and observations regarding its suitability and formulation accuracy for the purpose of using it for the current research. All referees agreed to its use.

2- Reliability:

The researcher calculated the reliability of the perceptual speed test using the internal consistency analysis (Cronbach's alpha) formula (Cronbach, 2001, p.87), and the internal consistency coefficient was (0.89), which indicates good reliability. Table (2) illustrates this.

Table (2) Paragraph Correlation Coefficients with the Field (Point-Biserial) for the Perceptual Speed Test.

Paragraph number	Paragraph Correlation Coefficient with the Domain	Critical Value of the Correlation Coefficient
visual Associations		
1	0.356	4.389
2	0.331	4.009
3	0.306	3.637
4	0.397	5.055
5	0.277	3.228
6	0.291	3.418
7	0.247	2.822
8	0.319	3.831
9	0.325	3.916
10	0.225	2.531
Visual similarities		
11	0.407	5.231
12	0.238	2.701
13	0.342	4.174
14	0.371	4.631
15	0.274	3.181
16	0.314	3.751
17	0.375	4.688
18	0.277	3.229
19	0.447	5.952
20	0.465	6.288
Lengths assessments		
21	0.365	4.533
22	0.297	3.510
23	0.342	4.169
24	0.391	4.962
25	0.381	4.789
26	0.243	2.763
27	0.308	3.670
28	0.446	5.925
29	0.334	4.049
30	0.282	3.291

Fifthly, Applying Experimental Procedures: To ensure the integrity of the experimental design and obtain its results, the researcher followed the following procedures:

A. The researcher initiated the experiment by applying it to the students of both study groups in the College of Basic Education/ Al-Mustansiriya University/ Department of Early Childhood Education, after obtaining the necessary facilitation and verification documents (Annexes 1-A, 1-B, 1-C, 1-D) on Monday, February 20, 2023. The researcher concluded the application of her experiment on June 18, 2023, as confirmed by Annex 1-C.

B. The researcher administered the Cognitive Speed Test to the students of both study groups on Thursday, May 11, 2023, at 9:30 AM.

C. Answer Correction: The researcher corrected the answers for the Cognitive Speed Test. The maximum score for the test was 30 points. After correcting the students' answers, the scores were processed statistically and prepared for the final results (Annexes 20 and 21).

Sixthly, Statistical Methods: The researcher used the statistical software package SPSS for her research procedures.

4. Presentation and Interpretation of Results

Presentation of the Results Related to the Second Null Hypothesis:

To verify the second null hypothesis, which states that there are no statistically significant differences at the 0.05 level between the mean scores of the experimental group, which studied the Cognitive Development subject according to the educational program, and the control group, which studied the same subject based on the vocabulary determined by the Academic Committee, in Cognitive Speed, the researcher administered a Cognitive Speed test consisting of three cognitive tests to both study groups (experimental and control), as shown in Annex 14. After correcting the answers, the scores for both groups were calculated, as illustrated in Annex 15. The arithmetic mean and standard deviation of the scores for the students in each of the experimental and control groups were calculated to determine the effectiveness of the educational program on cognitive speed for the students in both study groups through a comparison between the two groups. The data were then statistically analyzed using the independent samples t-test to identify statistically significant differences between the two groups. The results are presented in Table 3.

Table 3: Results of the Independent Samples t-test for the Cognitive Speed Test.

Groups	Female students total	The arithmetic mean	The standard deviation	Degree of freedom	T Value		Statistical significans
					accounted	tabular	
Experimental group	37	35.8298	8.34141	89	3.362	1.98	0.05 significant
Control group	44	29.9091	8.45458				

From Table (3), it is evident that the calculated t-value, which is 3.369, is greater than the tabulated t-value of 1.98 at a degree of freedom (89) and a significance level of 0.05. This indicates the presence of statistically significant differences between the mean scores of the control group and the experimental group in the cognitive development achievement test in favor of the experimental group.

Presentation of the results related to the second null hypothesis:

To verify the validity of the second null hypothesis, which states that there are no statistically significant differences at a significance level of 0.05 between the mean scores of the experimental group, who studied cognitive development according to the educational-programmatic approach, and the mean scores of the control group, who studied the same subject according to the curriculum set by the academic committee, in cognitive speed, the researcher applied a cognitive speed scale consisting of three cognitive tests to both study groups (experimental and control), as illustrated in Appendix (17). After correcting the answers, the scores for each group were as shown in Appendix (18). The mean scores and standard deviations of the students' scores in both the experimental and control groups were calculated to determine the effectiveness of the educational-programmatic approach in cognitive speed among the study participants through a comparison of the two groups. The data was statistically analyzed using the

independent samples t-test for statistically significant differences between the two groups. The results are presented in Table (4).

Table (4): Results of the Independent Samples t-test for Students' Cognitive Speed in the Research Groups

Arithmetic Mean	Arithmetic Mean of the Experimental Group	Standard Deviation of the Experimental Group	Mean (Average) of the Control Group	Standard Deviation of the Control Group	Freedom degree	Tabled Critical Value(t)	The counted critical value	Statistical Significance
Visuals associations	6.978723	1.242182	5.681818	1.196365	89	89	5.067	دالة 0.05
Visual similarities	7.106383	1.220015	5.636364	0.917299	89	1.98	6.463	دالة
Length assessments	6.851064	1.197438	5.704545	1.249736	89	1.98	4.469	دالة
Total measurement	20.93617	2.025965	17.02273	2.040162	89	1.98	9.177	دالة

- Picture Relations Test: As shown in Table 3, the calculated value for the Picture Relations Test, which is (5.067), is greater than the tabulated value of (1.98) at a degree of freedom of (89) and a significance level of (0.05). This indicates the presence of statistically significant differences between the mean scores of the control group and the experimental group in the Picture Relations Test, in favor of the experimental group.

- Similar Pictures Test: According to the mentioned table above, the calculated value for the Similar Pictures Test, which is (6.463), is greater than the tabulated value of (1.98) at a degree of freedom of (89) and a significance level of (0.05). This suggests the existence of statistically significant differences between the mean scores of the experimental group and the control group in the Similar Pictures Test.

- Length Estimation Test: It can be observed from the mentioned table above that the calculated value for the Length Estimation Test, which is (4.469), is greater than the tabulated value of (1.98) at a degree of freedom of (89) and a significance level of (0.05). This indicates the presence of statistically significant differences between the mean scores of the experimental group and the control group in the Length Estimation Test.

As for interpreting the results of the scale as a whole, it is as follows: It can be seen from Table 17 that the calculated value for the Cognitive Speed Scale, which is (9.177), is greater than the tabulated value of (1.98) at a degree of freedom of (89) and a significance level of (0.05). This indicates the presence of statistically significant differences between the mean scores of the experimental group and the control group in the cognitive speed variable.

5. Conclusions:

- All the activities and exercises prepared by the researcher in her program had an effective role in improving academic achievement and identifying important skills, abilities, and cognitive speed. The activities and exercises served as a training program that stimulated the students, elicited their ideas, and allowed them to understand their cognitive processes, enabling them to excel and perceive what was presented.

- The educational-learning program encouraged students to engage in self-learning and information discovery. It motivated them through positive interactions and collaboration.

6. Recommendations:

- It is necessary to train students on how to develop their cognitive abilities and how to grasp essential information that reveals differences in cognitive speed among them. This will help achieve cognitive, skillful, and conscious educational goals that align with the educational contexts and the subject matter to be taught.

7. Suggestions:

- Conduct a comparative study between the cognitive theory-based educational program and educational programs based on other learning theories in teaching cognitive development.

- Develop educational-learning programs based on cognitive theory for other educational stages and all subjects.

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