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The Effect of Attention Retraining Intervention on Cognitive Functions of Patients with Schizophrenia and Healthy Controls in Egypt

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Abstract: **Neurocognitive functions are essential mental processes that help the person to perceive the world accurately and to respond effectively. These functions are altered in schizophrenia patients and are thought to precede the emergence of positive symptoms. On the other hand, university students are considered as normal healthy controls who have many challenges that may alter their neurocognitive functions and academic achievement. The study of neurocognition is important in nursing since they are both linked to human behavior in health and illness. Thus, this study had three aims. First, to determine the difference between patients with schizophrenia and a healthy control group regarding the neurocognitive functions in order to provide base line data on Egyptian population. Second, to explore the effect of the Attention Retraining Intervention on patients' neurocognitive functions. Third, to explore whether Attention Retraining Intervention can enhance neurocognitive functions of patients with schizophrenia as well as of Egyptians healthy controls. The study used four tools namely; Socio-demographic and clinical data questionnaire, The Rey Auditory-Verbal Learning Test (RAVLT), Trail Making Test (TMT), and The Executive Clock-Drawing Task (Royall's CLOX). Sixty patients and sixty students were matched regarding age, marital status, residence, and level of education. Each subject was randomly assigned to one of two groups, either study or control. The study thus followed a randomized control trial research design. The result of the study revealed that the performance of the studied healthy controls was good on attention, moderate on memory and low on executive function. There is a statistically significant increase in neurocognitive functions between patients' pre and post implementation of the Attention Retraining Intervention on the three neurocognitive functions. Additionally, there is a statistically significant increase in neurocognitive functions in post implementation of the Attention Retraining Intervention in the healthy control group. Although the healthy controls have higher means on the three neurocognitive functions than patients, the range of improvement observed on the patients (in terms of the observed difference in the three neurocognitive means, between pre and post implementation) is higher than that observed on healthy controls. Furthermore, it appears that the attention retraining intervention was successful in improving the studied patients' mean on recognition task (which is one task on the memory test, i.e., RAVLT) up to the level of studied healthy controls. Thus, it can be concluded that in Egypt, patients with schizophrenia are more impaired on neurocognitive functions than healthy controls on baseline data. The Attention Retraining Intervention proved to be efficient in improving neurocognitive functions for both the studied patients with schizophrenia and healthy controls.**

Keywords: **Attention deficit, attention retraining, Egyptian healthy controls, impaired executive functioning, memory impairment, neurocognitive impairment, schizophrenia.**

1. INTRODUCTION

People function effectively if their mental process can help them to focus on the most important information for further processing. This processing is performed under the umbrella of neurocognitive functions, which encompasses receiving, choosing, transforming, storing, processing and retrieving information [(1)]. Cognitive functions are integrated into each

other and work together in a complex manner for successful interaction with the world in order to respond to the daily permanent challenges and to make sense of multifarious and fast changing environment [2, 3]. These processes reflect the brain's cognitive functions which include; attention, memory and executive functions.

Attention is a cognitive function that refers to the set of operations that enable the individual to identify relevant stimuli in the environment, focus on that stimulus, sustain focus on the stimulus, and allow for the transfer of the stimulus to higher level processes [4,5]. Memory function is the term used to refer to a brain system responsible for storing and manipulating information. It is divided into multiple tasks including immediate and short-term memory, long-term and recognition task [6, 7]. Executive function refers to a set of general purpose control mechanisms that regulate the dynamics of human cognition and action. It includes working memory, attentional control, and shifting or cognitive flexibility. These skills are required for optimal mental health, academic success, and cognitive, social, and psychological development [7, 8]. The neurocognitive functions are primary carried out in the frontal lobe of the brain, which does not reach full maturation until a person is in his or her late adolescence to mid-twenties [9]. Thus, any disturbance in this period will lead to neurocognitive deficits for the person.

Schizophrenia is one of the mental disorders developed during adolescence to adulthood [10]. Therefore, cognitive impairments are considered as a core feature of schizophrenia since Kraepelin's (1919) description of the illness as "Dementia Praecox" [11]. Cognitive impairments are identified before the emergence of psychotic symptoms, during the first episode of schizophrenia and persist with the progress of the illness, even after improvement of psychotic symptoms [12-14]. These impairments have been shown to negatively influence multiple aspects of daily functioning, such as treatment response, employment status, social relationships, living status, insight into illness, therapeutic alliance and community functioning [15,16]. The importance of understanding and targeting cognitive impairments in schizophrenia is underscored by the relative lack of treatment success in many areas of functioning, despite the management of psychotic symptoms [17, 18]. Hence, successful management of neurocognitive impairment appears promising in proper management and improvement of the outcome of patients with schizophrenia as neurocognition appears consistently linked to functioning [19].

Cognitive Enhancement Therapy (CET) is an intervention that aims to improve cognitive skills as well as real-world functioning [20, 21]. It was developed in 1990s as an integrated approach to enhance neurocognition and manage the consequences of neurocognitive impairment in patients with schizophrenia [22, 23]. One of the important CET that has been reported to have a positive impact on neurocognitive functions is Attention Retraining Intervention [24]. Attention retraining Intervention includes the use of exercises to promote the ability to ignore distracting stimuli, and train participants to maintain continuous work performance and to process information from social interactions [22]. This is achieved by performing simple tasks like line bisection, simple number or word games, or reaction time and digit span exercises [8, 25].

Unfortunately, little published research has tackled the manipulation of neuro-cognitive functions in Egypt. The available literature used primitive tests, as the Mini Mental State Examination, only to give an overall view of the cognitive profile of the studied subjects [26]. There are also studies that assumed a more structured research methodology, yet they focused on Egyptian children with specific learning disability or on patients with Bipolar disorder [27, 28]. Thus, the present study focused on neurocognitive functions for Egyptian patients with schizophrenia.

Although several international studies explored the performance of people with schizophrenia and healthy subject at baseline data, no similar studies were done in Egypt. The purpose of comparing patients with schizophrenia and healthy controls in these studies was to provide baseline data from normal healthy control to which patients' performance on neurocognitive functions can be compared, to examine the effect size of the used intervention on both groups, to expand the literature on neurocognitive deficits in patients with schizophrenia and to determine which specific neurocognitive function is more impaired among the patients with schizophrenia than normal healthy control [29-32]. The researchers of this study did not find literature on the neurocognitive profile of Egyptians non-clinical/healthy controls group. This gap in knowledge when covered could shed the light on the difference between neurocognitive levels in clinical and non-clinical groups. It is also logical to examine the effect of CET on areas of low performance if any are found among Egyptian healthy controls.

In fact, it was reported that Cognitive trainings are safe, preventive remedial measures for individuals at younger ages and at earlier stages of illness [33]. Further, normal healthy controls whose cognitive functions are diminished due to stress, anxiety or cognitive overload may also benefit from these programs [34]. University students are subject to stress and anxiety related to social and academic factors which are known to affect the neurocognitive abilities of the healthy person [35, 36]. Consequently, their mental abilities as well as their social functioning are impaired [37, 38]. This study initial aim was not to compare the patients and the students since they are two distinct groups. The researcher rather wanted to provide baseline data on normal healthy controls from Egyptian population since the available literature examined only clinical groups [27, 28].

In nursing, the study of neurocognition is undermined with the myth that it is a field of study related only to psychiatry, psychology or clinical psychology. While in fact, Nursing is a discipline concerned with expanding knowledge about human experiences through creative conceptualization and research. In nursing practice, understanding of knowledge base is essential for proper judgement and decision making that are integral to critical thinking [39]. Consequently, in nursing it is beneficial to focus on neurocognition and updating the available nursing diagnosis (NANDA) in order to tackle this area of research and use it in improving the schizophrenic patients' daily life functioning.

Accordingly, the present study went through two phases to meet the desired three aims:

- To compare the baseline data of neurocognitive functions among patients with schizophrenia and Egyptian healthy controls. (Phase 1)
- To explore the effect of the Attention Retraining Intervention on patients' neurocognitive functions. (Phase 2)
- To explore whether Attention Retraining Intervention can enhance neurocognitive functions of patients with schizophrenia as well as those of Egyptian healthy controls. (Phase 2)

2. MATERIALS AND METHOD

Materials

Study design:

This study used a randomized control trial design to collect the necessary data. The study went through two phases to meet the three aims.

Setting:

The study was conducted at two different settings. EL-Maamoura Hospital for Psychiatric Medicine, in Alexandria, Egypt. The hospital is affiliated to the Ministry of Health and Population. The hospital serves three governorates, namely; Alexandria, Matrouh and El-Beheira. It is composed of twenty-four wards, with a total number of 948 beds. Out of the twenty-four wards of the hospital, ten wards are for psychotic patients.

The Faculty of Nursing, Alexandria University. The Faculty has nine departments namely; Medical-Surgical Nursing, Critical Care Nursing, Pediatrics Nursing, Obstetrics and Gynecological Nursing, Nursing Administration, Community Health Nursing, Gerontological Nursing, Psychiatric Nursing and Mental Health, and Nursing Education. The Faculty of Nursing is affiliated to Alexandria University and the Ministry of Higher Education. It offers Bachelor degree for undergraduate students, and Diploma, Master and Doctorate degree for graduate students. The Baccalaureate level is composed of eight semesters of basic nursing education. This program follows the credit hours system that offers students a flexible academic schedule.

Subjects:

Sample size was calculated using Epi info program, which revealed that a sample size of at least 30 subjects in each group is appropriate for this study. Thus, the subject of this study incorporated 60 in-patients with a DSM-IV diagnosis of schizophrenia and 60 healthy controls who are students in the Faculty of Nursing in their eighth semester.

Thirty patients and thirty students were recruited randomly to receive Attention Retraining Intervention, while, the other thirty patients and thirty students were randomly assigned to the control group. Matching was considered between the studied patients and students regarding their level of age, educational, marital status, and residence.

Inclusion criteria:

For both groups, subjects should have had an age group ranging between 20-30 years old and have a minimum of diplome, secondary, or post-secondary/university education.

For the students' group, the students had to report that they did not suffer from any mental illness currently or before the study, and that they did not receive any treatment or diagnosis for a mental illness.

For the schizophrenia group, patients had to be diagnosed by the senior ward psychiatrists according to DSM IV and had to have a duration of illness less than 5 years. Patients were excluded if they had a history of substance abuse or co-morbidity of any other psychiatric disorder as affective disorder, or head trauma or neurological disorder, or if the patient had evident hand tremors or visual impairment.

Tools:

Tool I: it included 2 parts:

- **Part I: Socio-demographic data interview schedule** of the studied subjects such as age, sex, residence (urban or rural), marital status, occupation and level of education.
- **Part II: Clinical data for patients with schizophrenia**, such as diagnosis, duration of illness, number of hospital admission, duration of present hospitalization and prescribed medication.

Tool II: Cognitive Functions Battery:

This battery is composed of several cognitive function tests including memory, attention and executive functions.

a. The Rey Auditory-Verbal Learning Test (RAVLT):

RAVLT measures recent memory (short-term memory), verbal learning, susceptibility to proactive and retroactive interference, retention of information (long-term memory), and it measures the recognition memory. The test was originally developed by Rey (1958), after that it was translated and adapted by authors from several countries (1995 and 1997) [40-42]. In the RAVLT, a list of 15 words (list A) is read aloud to the studied subjects five consecutive times. Each of the attempts is followed by a test of spontaneous retrieval. After the fifth attempt, a list of interference, also comprising 15 new words (list B) is read to the studied subjects, followed by its retrieval (attempt B). After attempt B the researcher asks the studied subjects to recall the words from list A, without reading it again (attempt A6). After a 20-minute interval, the researcher asks the subject to remember the words from list A (attempt A7) without reading this list. After attempt A7, the individual is submitted to a test of memory recognition.

The RAVLT allows the computation of several memory parameters

Trials A1 to A6 reflects Short-term memory and represent the number of correctly named words in 1st to 5^{th}.

List B is a measure of proactive interference, or the degree to which old learning can meddle with new learning.

Trial A6 represents a retroactive interference that reflect the degree to which new learning tangles with the recollection of old information

Trial A7 reflects Long-term memory and represents the number of correctly named words in 7th attempt, it is presented after 20 minutes.

Hits is a measure for the Recognition task and it reflects the number of correctly identified words from list A.

CR is a measure for the Recognition task and it reflects the number of words not on List A that was correctly identified as not being on the list.

The RAVLT score system is done by computing the total scores of (the 5th and 7th attempts). The score ranges from 0 – 30, and the higher scores indicate better memory performance. The studied subjects with a score less than 12 are classified as low performers. The studied subjects with a score ranging from 12–16 are classified as moderate performers. The studied subjects with a score ranging from 17– 30 are classified as high performers.

b. **Trail Making Test (TMT):** TMT was developed by Reitan (1995) [43]. Reitan found the test to be a good predictor of general mental ability especially attention functions and motor speed. The test consists of two parts, TMTA and TMTB, each consists of 25 circles distributed over a sheet of paper. In Part A (TMTA), the circles are numbered from 1 – 25, and the studied subjects should draw lines to connect the numbers in ascending order. In Part B (TMTB), the circles include both numbers (1 – 13) and letters (A – L); as in Part A, the studied subjects draws lines to connect the circles in an ascending pattern, but with the added task of alternating between the numbers and letters (i.e., 1-A-2-B-3-C, etc.). The scoring is based on the number of seconds to complete the task, where lower scores represent superior performance. In **TMTA** subjects who complete the test in (29 - 78 sec) are classified as high performers and those who complete the test in (>78 sec) are classified as low performers. In **TMTB** subjects who complete the test in (75 - 273 sec) are classified as high performers and those who complete the test in (> 273 sec) are classified as low performers.

c. The Executive Clock-Drawing Task (Royall's CLOX):

This test was developed by Royall (1998) to measure executive function. The test is divided into two parts to help discriminate the executive control of clock-drawing from clock-drawing per-se [44]. In part one, **CLOX1**, the subjects are instructed to draw a clock that represents a time of quarter to two. The instructions can be repeated until they are clearly understood, but once the subjects begin to draw no further assistance is allowed. While, part two, **CLOX2**, is a simple copying task, the researchers allow the studied subjects to observe their drawing of a clock and subjects are asked to copy the observed clock. The CLOX scores ranges between (0 – 15); for each error, one point is subtracted for the complete list of required elements. Executive functions impairment is indicated by a score of 10 or less on CLOX1, and a score of 12 or less on CLOX 2.

Reliability of tool II (TMT, CDT and RAVLT) was done in a previous study in Egypt[45] on 20 patients and it showed good stability over time in test-retest reliability where r=0.85, 0.73 and 0.69 respectively.

Method:

1. A written official approval to conduct the study was obtained from the responsible authorities; the director of El-Maamoura Hospital for Psychiatric Medicine in Alexandria, and the General Secretariat for Mental Health, Ministry of Health in Cairo. In addition, written permission from the department of Psychiatric Nursing and Mental Health was obtained.

2. Tool (I) the socio-demographic and clinical data questionnaire was developed by the researcher after thorough review of literature.

3. An Arabic version of tool (II), the cognitive battery (RAVLT, TMT, and CDT or CLOX) was created in a previous study [45] and revised for this study.

4. A jury of five experts in Psychiatric Nursing and Mental health evaluated the validity of the scales and reported that the scales had face and content validity.

Phase one of the study included the following steps:

5. A pilot study was carried out on five patients with schizophrenia and five nursing students to ensure the applicability of the study and determine possible obstacles.

6. Actual Study:

Regarding patients with schizophrenia:

- Wards were randomly ranked for starting data collection then the wards were revisited in the same order several times until the targeted sample size was obtained.
- Each time a ward was visited, the patients' charts were reviewed for inclusion criteria.
- Each time the round on the wards was done, the name of all the patients who met the inclusion criteria were written in a list then random assignment to either the study or the control group was done.
- After assigning a patient to either the study or the control group, the patient was approached individually to initiate contact and explain the aim of the study. If the patient refused to participate (n=7) or withdrew from the study at any point of time (n=3) or was discharged (n=5) they were replaced. Data was collected over a period of 1 year.

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Regarding healthy controls:

- Sixty students who met the inclusion criteria were recruited from a list of all students (n=245) enrolled in the eighth semester of the academic year (2017-2018).
- Students were approached in their clinical training of the psychiatric nursing and mental health department to ensure their availability for the intervention.
- The healthy control group was matched to the patients' group on age, residence, education and marital status.

Field Work:

Pre-intervention Phase:

- Baseline - assessment of each recruited subject in both groups was done on the subject's cognitive functions namely; RAVLT, TMT and CDT/CLOX.

Phase two of this study included the following:

Intervention Phase:

Subjects who were assigned to the study group for the patients and the students were interviewed individually to receive the Cognitive Enhancement Therapy which seeks to improve the cognitive functions through the Attention Retraining Intervention which is given 6 times a week for 5 weeks, where the session lasted for 20 minutes each. The training includes the following five tasks:

- **Grain Sorting Task** – the subject was asked to sort a mixture of grains into different piles as fast as possible. As well as, he was asked to compare and classify seeds into “small”, “smaller”, “smallest” categories. Gradually, as the efficiency of the person increased, the quantity increased and time limit was adjusted accordingly.
- **Letter Cancellation Task** – The subject was asked to cancel two randomly chosen letters from a group of letters. As the errors decreased, they were asked to cancel three letters. Complexity was increased by asking them to cancel a particular letter if preceded by another letter. The time limit would be adjusted accordingly.
- **Coloring Task** – The subject was given a sheet of paper, which has drawings in it. The subject was asked to fill in color with color pencils. The subject was instructed to maintain constant pressure of pencil on paper, make the strokes as even as possible and restrict the coloring to their respective boundaries. Initially, simple drawings will be given, and when the subject shows improvement on the task, the drawings become more complex.
- **Digit Substitution Task**– It consists of 100 small blank squares, each paired with a randomly assigned number from 1 to 9. Above these 20 rows is a printed key that pairs each number with a different nonsense symbol. Following a practice trial on the first ten squares, the task is to fill in the blank spaces with the symbol that is paired to the number above the blank space as quickly as possible for 120 seconds.
- **Visual Scanning of Numbers** – This task is composed of three subsets of numbers printed at random on a sheet of paper. The first set has numbers from 1 to 20 printed on a 4 cm X 5 cm area. The second subset has numbers from 1 to 48 printed on a larger area of 12 cm X 15 cm. The third subset has 48 numbers, which are more closely spaced. In each subset, the studied subject was asked to strike off numbers in a serial order.

Post- assessment phase:

A post-assessment was done immediately after the interventions for the study group on their cognitive functions. As for the control group, the post-test was done 5 weeks later.

Ethical consideration:

An informed consent was obtained after explaining the aim of the study to all the studied subjects who accepted to participate in the study. Studied subjects were informed that they are free to withdraw from the study at any point of time and that their participation will not affect them in any way. The studied subjects' privacy and confidentiality were maintained.

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Statistical analysis of the data:

Data was fed to the computer and analyzed using IBM SPSS software package version 20.0. Significance of the obtained results was judged at 5%. Quantitative data was described using number, percent, mean and standard deviation. Bivariate analysis was done using Student t-test for normally distributed quantitative variables, to compare between two groups. As well as, Paired t-test was used to compare between two periods. Chi square and Mont Carlo was done to compare between groups for nominal data.

3. RESULTS

Phase I:

I: Descriptive data of the studied subjects:

Table 1 displays the data related to distribution of the studied subjects (patients and students) according to their socio-demographic characteristics. The table shows that the 56.7% of the studied patient were in the age group ranging between 20 to less than 25 years old, while 60% of the studied students were in the same age group with no statistically significant difference (χ^2= 0.0685, p=0.7934). Male patients constituted 66.7%, while male students were 13.3% of the students with a statistically significant difference (χ^2= 17.78, p=0.001). The table also shows that the largest percent of the studied subjects (patients and students) had secondary school education (86.7% and 100% respectively) with no statistically significant difference (χ^2(Mont Carlo) = 3.537, p= 0.115). Regarding their marital status, the single subjects represent 80% in studied patients and 93.3% in studied students, with no statistically significant difference (χ^2= 5.585, p= 0.056). It can also be noticed that there is an equal distribution between the patients and the students' groups, according to their residence where 33.3% of them were living in rural areas and 66.7% of them were in urban areas, with no statistically significant difference (χ^2= 0, p=1.000). Finally, the table shows that 70% of the studied patients and 66.7% of the studied students were living with their families with a statistically significant difference (χ^2(Mont Carlo) = 7.398, p= 0.015)..

Table (1) Distribution of the studied subjects according to their socio-demographic characteristics

	Patients (n=30)		Students (n=30)		χ^2	P
	No.	%	No.	%		
Age						
20-25	17	56.7	18	60	0.0685	0.7934
25-30	13	43.3	12	40		
Gender						
Male	20	66.7	4	13.3	17.778*	<0.001*
Female	10	33.3	26	86.7		
Marital status						
Single	24	80.0	28	93.3	5.585	MCp= 0.056
Married	1	3.3	2	6.7		
Divorced	5	16.7	0	0.0		
Residence						
Rural	10	33.3	10	33.3	0.0	1.000
Urban	20	66.7	20	66.7		
Cohabitation						
Alone	5	16.7	0	0.0	7.398	MCp= 0.015*
With family members	21	70.0	20	66.7		
With relatives & others	4	13.3	10	33.3		
Level of education						
Diplome	2	6.7	0	0.0	3.537	0.115
Secondary	26	86.7	30	100		
Post secondary/University	2	6.7	0	0.0		

χ^2: Chi square test MC: Monte Carlo

p: p value for comparing between the studied groups

*: Statistically significant at p ≤ 0.05.

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II- Base line data of the studies subjects (patients and healthy controls) regarding the neurocognitive functions.

Table 2 elaborates on the mean scores and levels of the memory function among the studied subjects (patients and students) pre- implementation of Attention- Retraining Intervention. It can be observed that, the mean scores of the first five attempts which reflect the short-term memory are 2.80 ± 1.86, 4.0 ± 2.45, 5.07 ± 1.91, 5.13 ± 2.03 and 6.07 ± 2.36 respectively among the studied patients. While, in the studied students the mean scores are 7.07 ± 2.96, 9.77 ± 1.83, 10.67 ± 1.79, 10.97 ± 1.67 and 10.83 ± 2.36 respectively.

It can also be noticed that regarding the list B, the mean score of the studied patients was (1.77 ± 1.83) and that of the students was (7.57 ± 2.28). As regard to the 6th attempt (A6), the mean score of the studied patients and students are 3.77 ± 2.50 and 10.20 ± 2.16 respectively. It was also noted that the mean score of the 7th attempt (A7) was 2.93 ± 2.05 in the studied patients and 6.13 ± 3.03 in the studied students.

Coming to the recognition tasks, the mean score of the Hits was 11.03 ± 3.10 in the studied patients and 14.33 ± 0.99 in the studied students. While, the mean score of the CR was 12.93 ± 2.78 in the studied patients and 14.73 ± 0.58 in the studied students.

Additionally, regarding the study groups the table shows that 76.7% of the studied patients had low memory performance, while, 86.7% of the studied students had moderate memory performance, with a mean score of 9.0 ± 3.92 and 16.96 ± 4.09 respectively. Whereas, in the control groups the table shows that 56.7% of the studied patients had low memory performance, while, 96.7% of the studied students had moderate memory performance, with a mean score of 11.13 ± 4.61 and 17.67 ± 4.09 respectively.

Table (2): The mean scores and levels of the memory function among the studied subjects (patients and students) pre-implementation of Attention- Retraining Intervention:

RAVLT (n = 30)	Study group						Student t test	P	Control group						Student t test	P
	Patient			Student					Patient			Student				
	No	%	Mean± SD	No	%	Mean± SD			No	%	Mean± SD	No	%	Mean± SD		
A1			2.80 ± 1.86			7.07 ± 2.96	6.682*	<0.001*			2.80 ± 1.49			7.07 ± 1.76	6.682*	<0.001*
A2			4.0 ± 2.45			9.77 ± 1.83	10.325*	<0.001*			3.90 ± 1.88			9.57 ± 1.81	10.325*	<0.001*
A3			5.07 ± 1.91			10.67 ± 1.79	11.723*	<0.001*			5.60 ± 2.44			11.0 ± 1.60	11.723*	<0.001*
A4			5.13 ± 2.03			10.97 ± 1.67	12.153*	<0.001*			6.0 ± 2.07			11.0 ± 1.74	12.153*	<0.001*
A5			6.07 ± 2.36			10.83 ± 2.36	7.811*	<0.001*			6.70 ± 2.63			10.40 ± 1.89	7.811*	<0.001*
List B			1.77 ± 1.83			7.57 ± 2.28	10.847*	<0.001*			1.90 ± 1.37			6.90 ± 2.22	10.847*	<0.001*
A6			3.77 ± 2.50			10.20 ± 2.16	10.672*	<0.001*			4.80 ± 2.62			10.33 ± 2.66	10.672*	<0.001*
A7			2.93 ± 2.05			6.13 ± 3.03	10.791*	<0.001*			4.43 ± 2.43			7.27 ± 2.46	10.791*	<0.001*
Hit			11.03 ± 3.10			14.33 ± 0.99	5.550*	<0.001*			12.17 ± 2.51			14.83 ± 0.38	5.762*	<0.001*
CR			12.93 ± 2.78			14.73 ± 0.58	3.473*	0.002*			13.77 ± 1.76			14.73 ± 0.58	2.862*	0.007*
Low performance (< 12)	23	76.7		1	3.3				17	56.7		0	0.0			
Moderate performance (12- 16)	5	16.7	9.0 ± 3.92	26	86.7	16.96 ± 4.09	11.568*	<0.001*	10	33.3	11.13 ± 4.61	29	96.7	17.67 ± 4.09	11.568*	<0.001*
High performance (17–30)	2	6.7		3	10.0				3	10.0		1	3.3			

Hits: The number of words from List "A" recognized.

CR: The number of words not on List "A" that was correctly identified as not being on the list.

t: Student t-test for comparing between **Patient** and **Student** in each **group**.

*: Statistically significant at $p \leq 0.05$.

Table 3 shows the mean scores and levels of the attention function among the studied subjects (patients and students) pre-implementation of Attention- Retraining Intervention. Regarding the study groups, in TMTA, it can be noted that the mean scores of the studied patients and students were 183.1 ±68.74 and 38.50 ±11.11 respectively before implementing

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the intervention. Whereas, the mean score of the studied patients and students along the TMTB were 291.5 ±87.13 and 87.43 ±28.57 respectively. Regarding the control groups, in TMTA, it can be noted that the mean scores of the studied patients and students were 127.1 ±57.57 and 41.03 ±13.21 respectively before implementing the intervention. Whereas, the mean score of the studied patients and students along the TMTB were 244.1 ±76.53 and 90.83 ±37.05 respectively.

Table (3): The mean scores and levels of the attention function among the studied subjects (patients and students) pre-implementation of Attention- Retraining Intervention:

TMT (n = 30)	Study group						Student t- test	P	Control group						Student t- test	P
	Patient			Student					Patient			Student				
	No	%	Mean± SD	No	%	Mean± SD			No	%	Mean± SD	No	%	Mean± SD		
TMTA																
High (23 -78 sec)	1	3.3	183.1 ±68.74	30	100.0	38.50 ±11.11	11.377*	<0.001*	7	23.3	127.1 ±57.57	30	100.0	41.03 ±13.21	7.984*	<0.001*
Low (>78 sec)	29	96.7		0	0.0				23	76.7		0	0.0			
TMTB																
High (75-273 sec)	14	46.7	291.5 ±87.13	30	100.0	87.43 ±28.57	12.187*	<0.001*	18	60.0	244.1 ±76.53	30	100.0	90.83 ±37.05	9.872*	<0.001*
Low (> 273 sec)	16	53.3		0	0.0				12	40.0		0	0.0			

t: Student t-test for comparing between **Patient** and **Student** in each **group**

*: Statistically significant at $p \leq 0.05$

Table 4 presents the mean scores and levels of the executive function among the studied subjects (patients and students) pre- implementation of Attention- Retraining Intervention. Regarding the study groups, 96.7% of the studied patients and 73.3% of the studied students had poor executive function performance on CLOX1 with a mean of 4.30 ± 2.68 and 9.17 ± 2.13 respectively. Additionally, the majority of the studied groups in the patients (93.3%) and the students (80%) had poor executive function performance on CLOX2 with a mean of 7.63 ± 3.29 and 11.13 ± 1.72 respectively. Regarding the control groups, 96.7% of the patients and 76.7% of the studied students had poor executive function performance on CLOX1 with a mean of 5.57 ± 2.57 and 9.60 ± 2.30 respectively. Additionally, all the patients in the control group (100%) and 63.3% of the students in the control group had poor executive function performance on CLOX2 with a mean of 9.33±1.58 and 11.57±2.05 respectively.

Table (4): The mean scores and levels of the executive function among the studied subjects (patients and students) pre-implementation of Attention- Retraining Intervention:

CDT (n = 30)	Study group						Student t- test	p	Control group						Student t- test	P
	Patient			Student					Patient			Student				
	No	%	Mean± SD	No	%	Mean± SD			No	%	Mean± SD	No	%	Mean± SD		
CLOX 1																
Poor (0 - ≤10)	29	96.7	4.30 ± 2.68	22	73.3	9.17 ± 2.13	7.780*	<0.001*	29	96.7	5.57 ± 2.57	23	76.7	9.60 ± 2.30	6.409*	<0.001*
Good (11 – 15)	1	3.3		8	26.7				1	3.3		7	23.3			
CLOX 2																
Poor (0 - ≤12)	28	93.3	7.63 ± 3.29	24	80.0	11.13 ± 1.72	5.172*	<0.001*	30	100.0	9.33 ± 1.58	19	63.3	11.57±2.05	4.729*	<0.001*
Good (13 – 15)	2	6.7		6	20.0				0	0.0		11	36.7			

t: Student t-test for comparing between **Patient** and **Student** in each **group**

*: Statistically significant at $p \leq 0.05$

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Phase II:

III- The effect of the Attention Retraining Intervention on the Neurocognitive Functions of patients with schizophrenia:

Table 5 represents the comparison between the mean scores and levels of the memory function among the studied patients, pre and post-implementation of Attention Retraining Intervention. The table shows that there is no difference between the study and the control groups pre-implementation of the intervention in most of the trials (study versus control pre-implementation t_2 test column). Contrary, in the study group in post implementation of the intervention, the patients' mean scores in the RAVLT in all trials were higher than those of the pre-implementation with statistically significant difference. The mean scores of the first five attempts which reflect the short-term memory are 2.80±1.86, 4.0±2.45, 5.07±1.91, 5.13±2.03 and 6.07±2.36 respectively in the patients' study group. These means increased with statistically significant difference to 5.0±1.49, 6.43±1.30, 7.37±1.50, 8.17±1.58 and 9.43±1.63, respectively.

Regarding the second list (list B), it can be noticed that the mean score of the studied patients pre-implementation of the therapy was 1.77 ± 1.83 and increased to 3.83 ± 1.37 with a statistically significant difference.

As regard to the 6th attempt, the mean score of the studied patients which was 3.77 ± 2.50 increased to 6.83 ± 1.51 with a statistically significant difference. It was also noted that the mean score of the 7th attempt, which was 2.93 ± 2.05 increased to 7.20 ± 1.32 with a statistically significant difference.

Coming to the recognition tasks, the mean score of the Hits which was 11.03 ± 3.10 increased to 13.87 ± 1.43 with a statistically significant difference. Also, the mean score of the CR was 12.93 ± 2.78 increased to 14.20 ± 1.03 with a statistically significant difference.

Additionally, 76.7% of the studied patients had low memory performance before implementation with a total mean of 9.0 ± 3.92, while, post implementation 50% of the studied patients showed moderate performance and 50% showed high performance with a total mean of 16.63 ± 2.46 with a statistically significant difference (t=10.418, p<.001).

Finally, regarding the control group, the table shows that 56.7% of the studied patients had low memory performance before implementation with a total mean of 11.13 ± 4.61, and the percentage remained nearly the same post implementation where 50% of the studied patients continued to show low performance with a total mean of 12.07 ± 4.24. The table also shows that there is no statistically significant difference between the study and the control groups pre-implementation of the intervention (t= 1.92, p=0.57). Whereas, there is a statistically significant difference between the study and the control group post implementation of the intervention (t=5.037, p<.001). These results reflect that the intervention was successful in improving memory performance for the studied patients with schizophrenia.

Table (5): Comparison between the mean scores and levels of the memory function among the studied patients' post-implementation of Attention Retraining Intervention:

RAVLT (n = 30)	Study group							p	Control group						Paired t_1 test	p	Study versus control pre-implementation t_2-test	p	Study versus control post-implementation t_2-test	P
	Pre-implementation			Post-implementation			Paired t_1-test		Pre-implementation			Post-implementation								
	No	%	Mean± SD	No	%	Mean± SD			No	%	Mean± SD	No	%	Mean± SD						
A1			2.80 ± 1.86			5.0 ± 1.49	10.418	<0.001*			2.80±1.49			3.13 ± 1.38	2.065	0.048*	0	1.000	5.037	<0.001*
A2			4.0 ± 2.45			6.43 ± 1.30	7.592	<0.001*			3.90 ± 1.88			4.07 ± 1.64	0.817	0.420	.177	0.860	6.189	<0.001*
A3			5.07 ± 1.91			7.37 ± 1.50	10.962	<0.001*			5.60 ± 2.44			5.47 ± 1.83	0.611	0.546	.942	0.350	4.397	<0.001*
A4			5.13 ± 2.03			8.17 ± 1.58	8.571	<0.001*			6.0 ± 2.07			6.23 ± 1.92	1.126	0.269	1.638	0.107	4.256	<0.001*
A5			6.07± 2.36			9.43 ± 1.63	8.744	<0.001*			6.70 ± 2.63			7.0 ± 2.29	1.663	0.107	.982	0.330	4.739	<0.001*
B			1.77 ± 1.83			3.83 ± 1.37	7.598	<0.001*			1.90 ± 1.37			2.57 ± 1.07	3.595	<0.001*	.884	0.7751	3.993	<0.001*
A6			3.77 ± 2.50			6.83 ± 1.51	6.226	<0.001*			4.80 ± 2.62			5.17 ± 2.0	2.009	0.054	1.737	0.123	3.641	0.001*
A7			2.93 ± 2.05			7.20 ± 1.32	11.043	<0.001*			4.43 ± 2.43			5.07 ± 2.26	4.535	<0.001*	2.584	0.012*	4.464	<0.001*
Hit			11.03±3.10			13.87±1.43	6.731	<0.001*			12.17±2.51			12.93±1.95	3.434	0.002*	.887	0.125	2.116	0.039*
CR			12.93±2.78			14.20±1.03	2.850	0.008*			13.77±1.76			13.90±1.54	0.510	0.614	1.557	0.171	0.887	0.379
Low performance (< 12)	23	76.7	9.0 ± 3.92	0	0.0	16.63 ± 2.46	10.418	<0.001*	17	56.7	11.13 ± 4.61	15	50.0	12.07 ± 4.24	2.065	0.048*	1.92	.057	5.037	<0.001*
Moderate performance (12-16)	5	16.7		15	50.0				10	33.3		11	36.7							
High performance (17–30)	2	6.7		15	50.0				3	10.0		4	13.3							

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Hits: The number of words from List "A" recognized.

CR: The number of words not on List "A" that was correctly identified as not being on the list.

t_1: Paired t-test for comparing between **Pre- implementation** and **Post- implementation** in each group

t_2: Student t-test for comparing between **Study group** and **Control group** in each **period**

*: Statistically significant at $p \leq 0.05$

Table 6 represents the comparison between the performance of the studied patients on the attention function as measured by the TMTA, pre and post- implementation of Attention Retraining Intervention. The table shows that in the study group in post implementation of the intervention, there is a statistically significant increase (t= 10.353, p<0.001) in the percent of patients who had higher performance from 3.3% (with a mean of 183.13±68.74) to 33.3% (with a mean of 102.83±35.53), where as in the control group, there is no statistically significant difference in the studied patients means on TMTA pre and post implementation of the intervention (t=.880, p>.05). Although there is a statistically significant difference between the study and the control groups pre-implementation of the intervention (t=3.421, p=.001), there is no statistically significant difference between the study and the control group on post implementation of the therapy (t=1.834, p>.05) This indicates that the observed improvement in TMTA may be due to chance and cannot be proven statistically.

Regarding TMTB, there is a statistically significant difference between the means of the studied patients in pre and post implementation (t= 11.753, p<0.001) where the percentage of patients who had higher performance increased from 46.7% (with a mean of 291.47± 87.13) to 100% (with a mean of 169.63±54.10). Comparing the mean percent changes between both groups on TMTB, the t-test showed that the study group had more improvement after participation in the attention retraining intervention than the control group (t=4.010, p<0.001).

Table (6): Comparison between the performance of the studied patients on the attention function as measured by the TMTA, pre and post- implementation of Attention Retraining Intervention:

Trail Making Test (n = 30)	Study group						Paired t_1- test	P	Control group						Paired t_1- test	P	Study versus control pre-implementation t_2-test	P	Study versus control post-implementation t_2-test t_2- test post	P
	Pre-implementation			Post- implementation					Pre-implementation			Post-implementation								
	No	%	Mean± SD	No	%	Mean± SD			No	%	Mean± SD	No	%	Mean± SD						
TMTA																				
High(23 -78 sec)	1	3.3	183.13±68.74	10	33.3	102.83±35.53	10.353	<0.001*	7	23.3	127.13±57.57	8	26.7	125.57±57.84	0.880	0.386	3.421	0.001*	1.834	0.073
Low (>78 sec)	29	96.7		20	66.7				23	76.7		22	73.3							
TMTB																				
High(75-273 sec)	14	46.7	291.47±87.13	30	100.0	169.63±54.10	11.753	<0.001*	18	60.0	244.07±76.53	19	63.3	237.20±74.77	2.915	0.007*	2.344	0.029*	4.010	<0.001*
Low (> 273 sec)	16	53.3		0	0.0				12	40.0		11	36.7							

t_1: Paired t-test for comparing between **Pre- implementation** and **Post- implementation** in each group

t_2: Student t-test for comparing between **Study group** and **Control group** in each **period**

*: Statistically significant at $p \leq 0.05$

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Table 7 represents the comparison between the performance of the studied patients on the executive function as measured by the CLOX, pre and post- implementation of Attention Retraining Intervention. The table shows that regarding CLOX1, in the study group in post implementation of the intervention, there is a statistically significant increase (t= 14.054, p<0.001) in the mean of CLOX1 where the percentage of patients who had higher performance increased from 3.3% pre-implementation (with a mean of 4.30±2.68) to 13.3% post-implementation (with a mean of 8.0 ± 2.20), while in the control group, there is a slight increase in the mean from 5.57±2.57 pre-implementation to 6.17±2.39 post-implementation with statistically significant difference (t=2.757, p=.010). However, there is no statistically significant difference between the study and the control group pre-implementation of the intervention (t=1.869, p=.067) and there is statistically significant difference between the study and the control group post-implementation of the intervention (t=3.090, p=.003).

Regarding CLOX2, on pre-implementation there was a statistically significant difference between the mean of the two groups (t=2.553, p=.014) where the mean of the study group (7.63 ± 3.29) was significantly lower than that of the control group (9.33±1.58). Yet in post-implementation, there is a statistically significant increase (t= 10.212, p<0.001) in the mean of the study group from 7.63 ± 3.29 pre-implementation to 11.90 ± 1.54 and the percentage of patients who had good performance increased from 6.7% to 33.3%. Where as in the control group, there is a statistically significant difference between means pre and post-implementation of Attention Retraining Intervention (t=3.597, p=.001). Comparing the study and the control group on CLOX2 post-implementation of the intervention, the t-test showed that the mean of the study group is higher that of the control group with statistically significant difference (t=5.170, p<0.001).

Table (7): Comparison between the performance of the studied patients on the attention function as measured by the CLOX, pre and post- implementation of Attention Retraining Intervention:

Clock-Drawing Test (CDT) (n = 30)	Study group						Paired t_1-test	p	Control group						Paired t_1-test	P	Study versus control pre-implementation t_2-test	P	Study versus control post-implementation t-test	p
	Pre-implementation			Post-implementation					Pre- implementation			Post- implementation								
	No	%	Mean± SD	No	%	Mean± SD			No	%	Mean± SD	No	%	Mean± SD						
CLOX 1																				
Poor (0-≤10)	29	96.7	4.30±2.68	26	86.7	8.0 ±2.20	14.054	<0.001*	29	96.7	5.57±2.57	29	96.7	6.17±2.39	2.757	0.010*	1.869	0.067	3.090	0.003*
Good (11–15)	1	3.3		4	13.3				1	3.3		1	3.3							
CLOX 2																				
Poor (0 - ≤12)	29	93.3	7.63 ±3.29	20	66.7	11.90±1.54	10.212	<0.001*	30	100.0	9.33±1.58	30	100.0	9.97±1.33	3.597	0.001*	2.553	0.014*	5.170	<0.001*
Good (13 – 15)	2	6.7		10	33.3				0	0.0		0	0.0							

t_1: Paired t-test for comparing between **Pre- implementation** and **Post- implementation** in each group

t_2: Student t-test for comparing between **Study group** and **Control group** in each **period**

*: Statistically significant at $p \leq 0.05$

IV- The neurocognitive functions post-implementation of the Attention Retraining Intervention on patients and students.

Table 8 reveals the mean scores and levels of the memory function among the studied patients and students, post-implementation of Attention Retraining Intervention. It can be noticed that there is a statistically significant difference between the patients and the students of the study groups in seven trials. However, regarding the Hits and the CR there is no statistically significant difference between the two study groups (patient versus students) post implementation (t=0.624, p>0.05 and t=1.978, p>0.05, respectively).

Regarding the difference between the two study groups in the total score of the 5th and 7th attempts, the mean score of the studied students' group (24.43 ± 3.72) than that of the patients' group (16.63 ± 2.46) with a statistically significant difference (t=9.583, p<0.001). Additionally, the table shows that there is a statistically significant difference in the

memory performance between the two study groups in post-implementation, where 100% of the studied students have high memory performance versus only 50% of the studied patients.

Table 9 illustrates the mean scores and levels of the attention function among the studied patients and students, post-implementation of Attention Retraining Intervention. Regarding the TMTA, the mean scores of the studied students' group (30.50±9.49) was lower than that of the patients (102.8±35.53), reflecting higher performance, with a statistically significant difference (t=10.774, p<0.001). As for TMTB, the mean scores of the studied students' group (58.57±18.34) was lower than that of the patients (169.6±54.10) with a statistically significant difference (t=10.649, p<0.001) reflecting better performance.

Table (8): The mean scores and levels of the memory function among the studied patients and students, post-implementation of Attention Retraining Intervention:

RAVLT (n = 30)	Study group						Student t test	p	Control group						Student t test	P
	Patient			Student					Patient			Student				
	No	%	Mean± SD	No	%	Mean± SD			No	%	Mean± SD	No	%	Mean± SD		
A1			5.0 ± 1.49			9.33 ± 1.81	10.147*	<0.001*			3.13 ± 1.38			8.87 ± 2.0	12.935*	<0.001*
A2			6.43 ± 1.30			11.43 ± 1.83	12.175	<0.001			4.07 ± 1.64			10.93 ± 1.96	14.704	<0.001
A3			7.37 ± 1.50			12.23 ± 1.59	12.205*	<0.001*			5.47 ± 1.83			11.63 ± 1.81	13.112*	<0.001*
A4			8.17 ± 1.58			12.33 ± 1.63	10.074*	<0.001*			6.23 ± 1.92			11.70 ± 1.99	10.830*	<0.001*
A5			9.43 ± 1.63			12.80 ± 1.56	8.158*	<0.001*			7.0 ± 2.29			11.77 ± 2.11	8.382*	<0.001*
B			3.83 ± 1.37			8.47 ± 2.34	9.350*	<0.001*			2.57 ± 1.07			7.97 ± 2.24	11.927*	<0.001*
A6			6.83 ± 1.51			11.97 ± 2.22	10.470	<0.001			5.17 ± 2.0			11.60 ± 2.44	11.155	<0.001
A7			7.20 ± 1.32			11.63 ± 2.58	8.375*	<0.001*			5.07 ± 2.26			11.53 ± 2.13	11.412*	<0.001*
Hits			13.87 ± 1.43			14.07 ± 1.01	0.624	0.535			12.93 ± 1.95			14.67 ± 0.55	4.696*	<0.001*
CR			14.20 ± 1.03			14.63 ± 0.61	1.978	0.054			13.90 ± 1.54			14.50 ± 0.68	1.952	0.056
low performance (< 12)	0	0.0		0	0.0				15	50.0		0	0.0			
Moderate performance (12- 16)	15	50.0	16.63 ± 2.46	0	0.0	24.43 ± 3.72	9.583*	<0.001*	11	36.7	12.07 ± 4.24	29	96.7	16.30 ± 3.92	10.649*	<0.001*
High performance (17–30)	15	50.0		30	100				4	13.3		1	3.3			

****Hits:** The number of words from List "A" recognized.

****Correct Rejections (CR)**: The number of words not on List "A" that was correctly identified as not being on the list.

t: Student t-test for comparing between **Patient** and **Student** in each **group**

*: Statistically significant at $p \leq 0.05$.

Table (9): The mean scores and levels of the attention function among the studied patients and students, post-implementation of Attention Retraining Intervention:

TMT (n = 30)	Study group						t- test	Student t-test	Control group						t- test	Student t-test
	Patient			Student					Patient			Student				
	No	%	Mean± SD	No	%	Mean± SD			No	%	Mean± SD	No	%	Mean± SD		
TMTA																
High (23 -78 sec)	10	33.3	102.8 ± 35.53	30	100.0	30.50 ± 9.49	10.774*	<0.001*	8	26.7	125.6 ± 57.84	30	100.0	37.90 ± 11.22	8.149*	<0.001*
Low (>78 sec)	20	66.7		0	0.0				22	73.3		0	0.0			
TMTB																
High (75-273 sec)	30	100.0	169.6 ± 54.10	30	100.0	58.57 ± 18.34	10.649*	<0.001*	19	63.3	237.2 ± 74.77	29	96.7	73.80 ± 62.08	9.209*	<0.001*
Low (> 273 sec)	0	0.0		0	0.0				11	36.7		1	3.3			

t: Student t-test for comparing between **Patient** and **Student** in each **group**

*: Statistically significant at $p \leq 0.05$.

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Table (10) presents the mean scores and levels of the executive function among the studied patients and students, post-implementation of Attention Retraining Intervention. It can be noticed that in CLOX1 50% of the studied students had good performance with a mean of 10.50 ± 2.15, versus only 13.3% of the studied patients with a mean of 8.0 ± 2.20, with a statistically significant difference (t=4.459, p=0.001). In accordance to CLOX2, 43.3% of the studied students had good performance with a mean of 12.33 ± 1.63, versus 33.3% of the studied patients with a mean of 11.90 ± 1.56, with no statistically significant difference (t=1.053, p>0.05).

Table (10): The mean scores and levels of the executive function among the studied patients and students, post-implementation of Attention Retraining Intervention:

CDT (n = 30)	Study group						t- test	p	Control group						t- test	P
	Patient			Student					Patient			Student				
	No	%	Mean± SD	No	%	Mean± SD			No	%	Mean± SD	No	%	Mean± SD		
CLOX 1																
Poor (0 - ≤10)	26	86.7	8.0 ± 2.20	15	50.0	10.50 ± 2.15	4.459*	<0.001*	29	96.7	6.17 ± 2.39	21	70.0	9.67 ± 2.12	5.992*	<0.001*
Good (11 – 15)	4	13.3		15	50.0				1	3.3		9	30.0			
CLOX 2																
Poor (0 - ≤12)	20	66.7	11.90 ± 1.56	17	56.7	12.33 ± 1.63	1.053	0.297	30	1000	9.97 ± 1.33	24	80.0	10.77 ± 1.89	1.899	0.062
Good (13 – 15)	10	33.3		13	43.3				0	0.0		6	20.0			

t: Student t-test for comparing between **Patient** and **Student** in each **group**

*: Statistically significant at $p \leq 0.05$.

4. DISCUSSION

People require multi-dimensional mental skills to function properly in every social interaction [46]. These mental skills include neurocognitive functions which are interrelated in a hierarchical manner where attention is at the bottom of the ladder, memory in the middle and executive functioning at the top [16, 17]. Consequently, manipulation of attention function may lead to enhancement of the mental processes of normal individuals as well as in people with neurocognitive impairments such as those with schizophrenia.

Accordingly, the present study had two phases to meet the desired aims which are to provide baseline data in healthy controls as well as patients with schizophrenia, then to explore the effect of Attention Retraining Intervention on each group. Therefore, patients and students were matched regarding four variables namely, age, marital status, residence and level of education to control extraneous variables as much as possible.

As expected, the baseline data of the patients and the students revealed that patients with schizophrenia were more impaired than healthy controls in all the three neurocognitive functions. This finding goes in line with the available literature viewing neurocognitive impairment as a cornerstone feature of the disorder. They often precede the prodromal symptoms and are therefore useful in predicting the onset and relapse of schizophrenia [7]. A substantial body of research, on national as well as international levels, has shown that cognitive impairments are the main complaints of patients with schizophrenia [18, 45].

Regarding the studied patients with schizophrenia, the present study demonstrated significant impairments in neurocognitive functions namely; memory, attention and executive functions deficits. This finding is in line with the studies reporting that chronic schizophrenic patients have a diffuse and general cognitive impairment [47-49]. In relation to memory function, the results showed that the studied patients had short and long-term memory deficits. They often seem unable to maintain some form of volitional control over the maintenance and manipulation of even basic information [50]. These could be attributed to several factors namely; disturbance of the temporal ordering of information, deficits in encoding, retrieval and storage of information. Moreover, severe distractibility known to characterize schizophrenic behavior may interfere with normal recalling [20, 21]. In addition, deficiencies of arousal, motivation, and higher executive function may be the primary source of memory impairment [51]. Another factor for memory impairment may be the deficits of attention which may underlie the poor memory performance of patients with schizophrenia [25]. Further, functional MRI studies reported deficits in short-term memory in patients with schizophrenia [40]. Moreover, Hutton (2000) and Krieger (2005) found a diversity of memory impairments in patients with schizophrenia [52, 53]. Patients with frontal lesions as patients with schizophrenia are impaired in their ability to recall cued information [12, 18]. Another

possible explanation is that during encoding, it seems that the patients are unable to relate the similarities together in order to facilitate encoding and retrieval [6]. On the contrary, Danion et al., (1999) found that memory function is preserved in schizophrenia due to certain conditions under which information is learned and the way retrieval is tested [54], or the ability of a "memory" task to activate the part of the brain responsible for memory, depends greatly on the structure provided to the subjects during memory testing [55].

Interestingly in the present study, the short-term memory of the studied patients gradually improved after several presentations of the same items. This goes with the literature reporting that patients with schizophrenia can benefit from administration of blocked versus unblocked lists of words [11, 13-15]. It may be also noticed from the present study finding that the long-term memory of the studied patients was more impaired than their short-term memory. Long-term memory is a complex function that include several stages which are encoding of the information, its storage over time, and retrieval of stored information. Each of these stages may be affected by the illness [12]. Further, there is literature reporting that impairment on long term memory may be due to deficit in the processing speed, which is common in patients with schizophrenia. Accordingly, Baddeley (1998) reported that memory is stored and rehearsed in an articulatory loop. The more often the items are rehearsed, the stronger the mnemonic trace [56]. Therefore, a slowing of processing speed in schizophrenia could be deleterious to long term memory because information to be recalled would be rehearsed and refreshed less often in the articulatory loop. Consequently, patients fail to notice similarities among the items, and this interferes with recalling it after time [46, 56].

In the present study, patients generated new words not included in the original list during retrieval. These words are referred to as extra-list errors on the RAVLT. Extra-list error reflects the patient's filling a memory gap by invented new words. Thus, the patients tend to show deficits in relation to memory retrieval [57, 58]. The studied patients showed good performance on the recognition task where the researchers gave the patients a new list of words to identify previously mentioned words. This could be explained by finding that patients with schizophrenia have the potential to depend on familiar information rather than on recalling of a memory [13, 14]. Similarly, Danion et al., (1999) demonstrated that patients with schizophrenia exhibited intact familiarity-based recognition [54].

The present study showed that most of the studied patients with schizophrenia had attention function impairment. This may be due to finding that the studied patients were in a young age ranging between twenty to thirty years old and are expected to be in an early stage of their illness. People with schizophrenia have poor ability to maintain their attention even prior to the first psychotic episode [16]. Consequently, deficit in attention is considered as the main neuropsychological deficit in schizophrenia [17]. It was also reported that patients with schizophrenia perform poorly in episodes of active psychosis as well as during episodes of remission on tasks that require vigilance, quick responses, or sustained attention [57]. In the same line, Caspi et al (2003) reported that impaired attention is considered a primary cognitive deficit in schizophrenia [59]. In addition, Tuulio-Henriksson (2005) stated that the patients with schizophrenia usually perform poorly on tests of attention such as the Wisconsin card Sorting Test and the Trail Making Test [60].

The impairment in executive function of the studied patients in the present study could be attributed to a difficulty in formulating plans, initiating them, and flexibly changing a strategy once it is no longer effective. This may occur due to pre-existing pathophysiological processes in the prefrontal cortex that underlie executive impairment [18]. In this respect, studies of Computed tomography in schizophrenia showed an association between cortical atrophy, increased ventricular volumes, and impaired connectivity between brain regions, general slowing of information processing and poor executive function [53]. So, if a concept is understood, patients with schizophrenia have trouble adapting to changes in the environment that require different behavioral responses [61].

Regarding the baseline data of neurocognitive functions of the studied healthy Egyptians, the results of this study revealed that the performance of the largest percent of them was high on attention, moderate on memory and low on executive function. Although, the performance of the students on attention was high, they failed to have high performance on the other two neurocognitive functions. Sweller et al., (1998) discussed the cognitive load theory [62] which assumed that their studied subjects had limited working memory as learners may be bombarded by information resulting in cognitive overload. This cognitive overload impairs schema acquisition, later resulting in a lower performance on working memory [63, 64].

Furthermore, the moderate memory performance observed in normal healthy controls in this study may be explained in the light of the Gestalt learning first principle. This principle denotes that the mental ability to recall is strictly tied to the perception of the object. People tend to involve every perceived object in a memory pattern that standout against a simpler background which facilitate its recall. So, in this study, the studied students could moderately link each perceived word in the list of the RAVLT to a wholistic image or memory, that facilitates its recall [65].

The present study revealed that the performance of the studied students on short-term memory was higher than that of the long-term memory. This may be explained by finding that the performance of the students on attention was high. It also may be possible to postulate this to Gestalt second learning principle which denotes that all materials which are formed in a more complete, detailed fashion will override any less developed memory traces. This principle implies that a fundamental element of learning is attention [65]. Accordingly, the studied students who had high performance on their attention function were able to concentrate more on the new given materials of the RVALT which override the old given material of the previous RVALT attempts. Jugovac (2012) argued that memory impairments in undergraduate students may be attributed to attentional failures because students failed to register for later recall of the items presented. Thus, Jugovac (2012) is suggesting that there is a link between attention and short-term memory in order to integrate material into memory, as one of the basic requirements is the ability to concentrate [66].

Regarding the studied students' executive function, the results showed that they have low performance. A possible explanation may be that Executive function skills include working memory and attentional control [67-69]. Working memory is the capacity to hold information in mind for a delayed time [70-72], whereas attentional control is the ability to focus on tasks and resist irrelevant information in order to successfully complete the task [70-73]. Accordingly, it appears that the studied students' moderate performance of memory may be a factor contributing to their impairment of executive function. Another possible explanation for the low performance of the students in executive function may be the diverse educational tasks and life responsibilities. These can be overwhelming and may negatively affect their cognitive functions and planning strategies [74]. Additionally, anxiety level of the students was reported to impair the students' ability to think and concentrate [75]. Although anxiety can be adaptive, it can also be debilitating by interfering with daily life and goal-directed behavior. A population-based study reported impairments in executive function and episodic memory in anxiety disorders [76].

Phase 2

The impact of attention retraining Interventions on patients:

The current study was grounded on the hypothesis that Attention Retraining interventions have positive effect on cognitive functions; memory, attention and executive function among hospitalized patients with schizophrenia. The therapy usually includes exercises that require several mental skills which has the potential to improve patients' cognition and consequently their everyday activities [45].

This study demonstrated that subjects in the intervention group had significant improvement in their cognitive functions; memory, attention and executive functions in the post-test than those in the patients' control group. The success of the intervention demonstrates that the applied tasks allow for very precise alteration of the level of task difficulty based on an individual's performance. As performance improves, the difficulty of the task is increased, keeping expectations for success constant and at a high level. These results go with Wykes et al., (2001) and Taub et al., (2002) who noted that attention training would enhance performance on attentional tests and other cognitive functions [77,78]. In the same line, an earlier study examined the effects of attention training on inpatients with schizophrenia. The results showed significantly greater improvement in the cognitive training group compared with the control group [79]. On the other hand, subjects in outpatients with schizophrenia did not improve because they were poorly matched, which obscured the improvement made by the treatment [80].

Finally, it is worth mentioning that the Attention Retraining Intervention was successful in improving the **Hits (Table 8)** in post-test of the study groups, both the patients and students. This improvement was not observed on the control groups. Interestingly, the patients' performance level on the post-test reached that of the students reflecting excellence of the used intervention in improving recognition task of people with schizophrenia. This improvement may be because the patients are initially less impaired on the recognition task than the other neurocognitive functions, so when attention training is

applied, this function improved up to the normal control level. Similarly, Harvey et al., 2002 found that the recognition task in schizophrenia was intact [81]. It may also be possible that this improvement is subject to bias during application of the intervention. The researchers may have unconsciously put more effort to the therapy applied to the patients than that applied to students. This bias may be out of care and empathy to the patients and desire to help them. In this respect, Pannucci and Wilkins 2010 identify this type of bias and pointed out that when these biases are suspected they should be dealt with to provide evidence-based research [82]. Similarly, the CR improved in the post-test for both groups (patients and students), however, this observation was also observed in the control groups. This may imply that CR is a mental function that is initially less impaired in people with schizophrenia or that the observed improvement was related to other extraneous factors.

The impact of attention retraining Interventions on students:

The studied students were submitted to a condensed Attention Retraining Intervention to improve their attention function and consequently their memory and executive function. The results showed that the intervention was successful in improving all the neurocognitive functions including the executive function in which they had low performance in the baseline data. The general improvement in the students' cognitive functions reflects their readiness for improvement despite all the stressors and the responsibilities placed on them as college students. Additionally, it reflects the excellence and fitness of the applied intervention for the studied students. Contrary, Osborne et al. (2008) reported that there was no effect of CBT on performance quality of students [83].

5. CONCLUSION

Based on the results of the present study, it may be concluded that the studied students have good attention, moderate memory function and poor executive function. While, patients with schizophrenia have neurocognitive impairments in all domains; memory, attention and executive functions. Furthermore, the Attention Retraining Intervention can bring a significant improvement in cognitive functions among hospitalized patients with schizophrenia and healthy people.

6. RECOMMENDATIONS

The followings are the main recommendations yielded by this study:

- Assessment of the neurocognitive functions needs to be incorporated into routine clinical assessment of the patients with schizophrenia, in order to consider appropriate psychiatric nursing care and interventions.
- Psychiatric nurses need to be trained to take an active role in delivering cognitive enhancement interventions effectively in the in-patient and out-patient settings in order to promote patients' daily functioning.
- For successful skill acquisition, the instructor must repeat the instructions several times to the patients or the students, give only one piece of information at a time that is clear and direct to facilitate encoding and recalling materials.
- Neurocognition need to be included in nursing curriculum of Psychiatric Nursing and Mental Health since these areas appear to be promising in the care and management of patients with schizophrenia.
- There is a need to shift from the traditional learning and teaching strategies towards a more innovative approach that grasps the students' attention and induce a long-term memory schema which can be easily recalled and retrieved by the students.
- Assessment of the neurocognitive functions of the students may be done on admission to faculty and in the beginning of each academic year. This will help Faculty to identify students with low performance and to apply an early appropriate cognitive enhancement intervention accordingly.

Recommendations for further research

- Further studies may explore the effect of attention retraining intervention on students' academic performance.
- Further studies may explore the effect of attention retraining intervention on patients' social and occupational functioning and on their social cognition.
- Further studies may be needed to elucidate the effectiveness of the attention retraining intervention over long-term follow-up periods.

Limitation of the study

- A larger sample size may be beneficial in providing a better view of the neurocognitive functions of patients with schizophrenia and healthy controls.
- In this study, healthy people were defined by self-reporting of the studied students, in future studies, it is beneficial to use a measurement tool that excludes pathology or mental illness.

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