

Impact Of Anxiety Caused By The Covid-19 Pandemic On The Cognitive Activities Of Primary School Students

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Abstract

This study aimed to identify the level of anxiety caused by the emerging coronavirus pandemic in primary school Pupils and its relationship to some cognitive activities. Two hundred students from fifth graders (age: 10.3 ± 3.23) volunteered to participate in the study. The descriptive correlative approach was used to find out the relationship between anxiety caused by the emerging coronavirus pandemic and some cognitive activities, in addition to the comparative descriptive approach to compare the students who suffer from anxiety caused by the Coronavirus pandemic and students who did not suffer from this anxiety at the level of cognitive activities. The working memory test was applied as an indicator of some cognitive activities, which included four dimensions (Phonological Loop- Visual Spatial Sketch Pad- Central Executive- Episodic buffer). In addition to the scale of anxiety caused by the emerging coronavirus pandemic, which included three dimensions (the physiological dimension - the psychological dimension - the cognitive dimension). Results showed that there were statistically significant differences in some cognitive activities (working memory tasks) among students with high and low anxiety due to the Corona pandemic, and there was a negative correlation between anxiety caused by the coronavirus pandemic and cognitive activities. The study suggested that it is necessary to prepare a set of educational plans directed at reducing anxiety caused by the Coronavirus pandemic, in addition to preparing appropriate treatment programs to improve and raise the efficiency of working memory for primary school students who suffer from anxiety caused by the Coronavirus pandemic.

Introduction

Coronavirus (COVID-19) has affected all the world by different ways and it's been a worrying time for lots of people. As the situation changes, people might feel nervous about the future or frustrated by the way their life had been changed. With the onset of this virus and with the high rates of infection and death, children found themselves in front of the suspension of studies and distraction due to distance education, in addition to their constant concern about the spread of the Corona virus, and concern about the transmission of the infection to them or its transmission to their family members. Simultaneously, children are experiencing substantial changes to their daily routine and social infrastructure. The closure of schools also deprived children of opportunities for psychological support due to the quarantine, teachers are often the first to notice signs of deteriorating mental health for students and urge them to seek psychological support, as many schools provide counseling and psychotherapy services (David Robson, 2020).

The study by Louise Dalton & Elizabeth Rapa (2020) indicated that children have an excellent ability to quickly perceive the manifestations of anxiety and fear that appear on the features of their parents or those who care for them, and they may worry about their parents' anxiety, whether for fear of illness, job loss, or the pressures of home isolation.

David Robson (2020) states, "Children are generally aware of and interact with their environments, and the psychological stresses they are exposed to in the early stages of their lives will affect their development, mental health, and the development of their personal and social skills."

Johns Hopkins (2021) indicates that anxiety is the feeling of tense about things that are happening around us or about to happen, while high levels of anxiety lead to a constant expectation of danger, which leads to cognitive dysfunction and emotionality. and it is normal for people in general and children in particular to be concerned about the possibility of being diagnosed with the virus, in addition to concern that a close person will be infected, and concern that oneself or those close to them will be exposed to social isolation or quarantine.

Working memory is one of the most prominent cognitive functions that are affected by changing levels of anxiety. It is also one of the important factors that help the student to acquire experiences and knowledge and achieve success and excellence in various fields. Working memory involves the temporary storage and manipulation of information that is assumed to be necessary for a wide range of complex cognitive activities. It plays an important role in teaching and learning processes, and in acquiring educational experiences. As the capacity of working memory has a role Important in processing and retaining information, as it plays an important role in enabling the learner to understand and realize the relationships that exist between that information and then enable him to perform these tasks. (McCabe, et al. 2010). Baddeley (2002) explains that working memory is a special system whose function is to store verbal information in addition to other information-processing systems where a series of processing takes place to reach the correct response. Holmes & Gathercole (2014) defined it as the cognitive system responsible for maintaining and processing information during complex cognitive activities such as reading, comprehension and arithmetic. Dahlin (2011) also indicated that working memory is the ability to store information in short-term memory, while performing other mental operations that use this information.

Working memory, or operative memory, can be defined as the set of processes that allow us to store and manipulate temporary information and carry-out complex cognitive tasks like language comprehension, reading, learning, or reasoning. Working memory is a type of short-term memory. (Stone et al., 2015)

Working memory is a cognitive skill that we use in the majority of daily tasks. So the understanding of the level of working memory can be helpful in a number of different areas. For example academics, as it allows understanding if a child may have extra difficulties doing mental math or reading. Working memory, according to modified Baddley model, is made up of four systems, which include components for information storage and processing. These components are, the central executive system, works like an attention supervision system that stores information upon entry, and decides what pay attention to and how to organize a sequence of operations that need to do an action. The phonological loop, which relies on storing sounds that enter the memory, allows managing and retaining spoken and written material in the memory. Visuo-spatial Sketch Pad, which represents a qualitative system for playing visual-spatial information and temporarily storing it in an active image according to the situational task that the individual is going to accomplish. And the episodic buffer, which integrates information from the phonological loop, visual-spatial sketchpad, the long term memory and the perceptive entrance into a coherent sequence. (Gray, 2011)

Therefore, the research problem is a scientific attempt by the researcher to identify the level of anxiety caused by the emerging crisis of the Corona virus and its relationship to the cognitive activities (working memory tasks) of children, and as far as we realize the dimensions of these relationships, as much as we can achieve the largest share of children's mental health.

The current study aimed to identify the levels of cognitive activities (working memory tasks) among primary school students, and to know the differences in the components of working memory between students with high and low anxiety caused by the emerging corona virus pandemic, in addition to identifying whether there is a statistically significant correlation between anxiety caused by the Corona virus pandemic and the working memory of primary school students. The researcher assumed the following:

- There are statistically significant differences in the level of anxiety caused by the emerging corona virus pandemic and cognitive activities among primary school students.
- There are statistically significant differences between students with low and high anxiety caused by the Corona virus pandemic in the cognitive activities in the direction of students with low anxiety.
- There is a statistically significant correlation between anxiety caused by coronavirus pandemic and some cognitive activities of primary school students

2. Material and methods

2.1. Participants

Two hundred students from fifth graders volunteered to participate in the study, aged 10 -11 years selected from 5 primary schools (age: 10.3 ± 3.23). All the individuals included in the study and their parents agreed to participate in the study, Informed consent was obtained from their parents. After applying the scale of anxiety caused by the Corona virus pandemic, the sample was divided into two groups, the first with high anxiety about the Corona pandemic (HACP) and the second with low anxiety about the Corona pandemic (LACP).

2.2. Measurements

- Working memory test:

Baddeley's modified working memory test was applied to detect the level of cognitive activity of fifth grade students. The modified model has focused on storage within verbal working memory—the phonological loop—because so much of everyday cognition (especially for students and academics) seems to rely on this cognitive function. The four components of the Baddeley's modified model interact to provide a comprehensive workspace for cognitive activity as shown in (Figure 1). The test divided into four subsystems (phonological

loop- visuospatial Sketch Pad- central executive - episodic buffer) each subsystem included a set of sub-tests. The phonological loop includes sequential retrieval, reverse retrieval, last word retrieval, true and false sentences, and the visuospatial scratchpad did much of the cognitive work in evaluating the spatial relationships in the true-false task. The visual-spatial component consisted of sequential clicking - back clicking - moving the shape - completing the shape. The central executive included word completion - extraction of even numbers - linking between similar shapes. The episodic buffer included the retrieval of words and their location - retrieval of small space numbers- remembering the location of the stimuli in the table. The total of the sub-tests was 15 tests, a different method of performance and correction method according to the task to be performed. The total score for the test is calculated by calculating the scores obtained by the student in all test items, as the highest score in the test is (53) degrees. The students' results were divided into five levels, results from (0-10) weak, (11-21) below average, (22-32) medium, (33-43) above average, (44-53) high. The Test- Retest was used to confirm the reliability of the test by calculating the correlation coefficient between the first and second applications, which ranged between ($r=0.78: 0.89$). In addition to measuring the internal consistency coefficients (Cronbach's alphas), the correlation coefficients for repeated measures were as follows: (0.72) to phonological loop, (0.69) to visuo-spatial Sketch Pad, (0.66) to central executive, and (0.75) to episodic buffer. The validity coefficient between the highest and lowest quartile was ($t=6.52$). This indicates reliability and validity of the working memory test used in the study. So, we can underline the validity and Reliability of the measure.

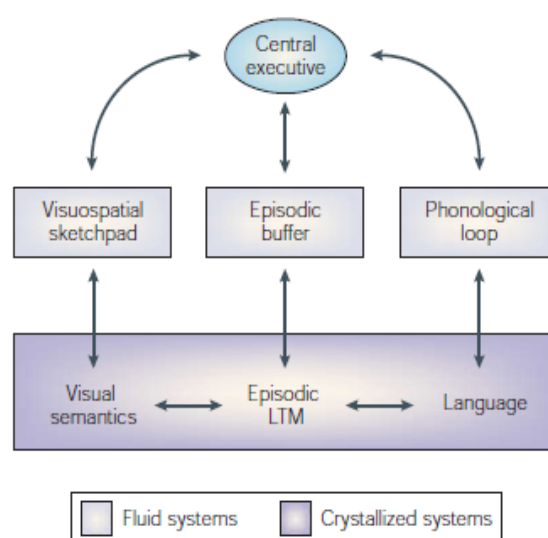


Fig.1: The multi-component working memory revision

- COVID-19 Pandemic Anxiety Scale (CPAS):

This study aimed to identify the level of anxiety caused by the emerging corona virus pandemic in primary school Pupils. For this purpose, the COVID-19 Pandemic Anxiety Scale was designed based on some studies, as Cao et al (2020), Louise Dalton & Elizabeth Rapa (2020), Spence (1998), Beck, (1988). The Scale was divided into three dimensions (the physiological dimension - the psychological dimension - the cognitive dimension). This dimensions included of (8) sub-tests. The physiological dimension includes physical symptoms. The psychological dimension includes social concerns, obsessive compulsive disorder, Sleep disorders, and general anxiety. The cognitive dimension includes poor focus, Attention Deficit, Forgetting. The scale included (50) statements as shown in table (1), some of them were negative statements which are (19-26-38-40-41-43-47), while all the other statements were positive. Responders specify their level of agreement to a statement typically in five points. The 5-Point Likert Scale was relied upon to answer the questions. When the scale is corrected, the scores are calculated as follow for the positive statements: (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree, and as follow for the negative statements: (5) Strongly disagree; (4) Disagree; (3) Neither agree nor disagree; (2) Agree; (1) Strongly agree. Therefore the highest score of the scale was (250) degrees and the lowest score was (50) degrees. To verify the validity and reliability of the scale, it was applied to the pilot study sample consisting of (40) students. The validity coefficient was calculated using the internal consistency validity by calculating the correlation coefficient between each statement within the dimension and the total degree of the dimension, as shown in the table (2), in addition to calculating the correlation coefficient between the degree of each dimension and the total degree of the scale. The correlation coefficients were respectively as follows: ($r:0.75$) to physiological dimension, ($r:0.67$) to psychological dimension, and ($r:0.80$) to cognitive dimension. The Test- Retest was used to confirm the reliability of the test by calculating the correlation coefficient between the first and second applications, as

shown in table (3). The scale was shown to have strong psychometric features with internal consistency coefficients (Cronbach's alphas). The correlation coefficients for repeated measures were as follows: 0.70 to physiological dimension, 0.69 to psychological dimension, 0.68 to cognitive dimension, and 0.71 to the total of the scale. This indicates reliability and validity of the COVID-19 Pandemic Anxiety Scale (CPAS) used in the study. So, we can underline the validity and Reliability of the measure.

Table (1): Dimensions and phrases of the Coronavirus Pandemic Anxiety Scale

Statements	
Physiological dimension	
Physical symptoms	
1	I often feel short of breath, especially after the spread of the Corona virus
2	Sometimes I get a stomachache when I think about the Corona virus
3	I often feel my heart rate increase when I think about someone in my family being infected with the Corona virus
4	I often feel shivering in my extremities when I hear news about the Corona virus
5	Many times I feel like my head is going to explode from thinking about the Corona virus
6	I get bouts of nausea when a relative visits us for fear of infection with corona
7	I feel a headache when I hear new news about the Corona virus
8	I feel dry in my throat when I am among others
9	Suddenly I get dizzy and dizzy in crowded places
10	I often suffer from a loss of appetite after watching the news of the Corona virus
Psychological dimension	
social concerns	
11	I am very afraid for my health and the health of my family from the Corona virus epidemic
12	I do not shake hands with anyone for fear of contracting the Corona virus
13	I refrain from leaving my room when a relative visits us for fear of infection
14	I do not play with my relatives for fear of infection with the Corona virus
15	Stay away from my friends for fear of infection with the Corona virus
16	I refrain from leaving my room when I hear that the virus is approaching my city
17	I am afraid of crowded places for fear of infection with the Corona virus
18	I feel afraid when I use the bathroom outside the house in light of the spread of the corona virus
19	Go quickly when asked me go to outside to get something necessary from the groceries
Obsessive compulsive disorder	
20	I feel need to sterilize the neighborhood in which I live for fear of the spread of the Corona virus
21	I make sure that we have enough detergents in our house more than once a day
22	Wash my hands every hour to prevent corona virus
23	I went down the stairs several times and could not continue my journey for fear of infection
24	Ensure that the door of the house is closed several times
25	I feel that the corona virus will kill everyone including me
Sleep disorders	
26	I can sleep peacefully after hearing any news about the corona virus
27	My sleep is disturbed due to my fear for my family of infection with the Corona virus
28	I sleep intermittently because I think about the possibility of contracting the Corona virus
29	I have a desire to sleep continuously to escape hearing news about the Corona virus
30	I am afraid to sleep so as not to hear the news of the death of my relatives due to the Corona virus
31	I feel exhausted thinking all night about what I heard about the Corona virus
32	There were times when I couldn't sleep because I was thinking about the Corona virus
33	I have bad dreams or nightmares because of my constant fear of infection with the Corona virus
General anxiety	
34	I am feeling anxious about the corona virus
35	I worry about getting infected with the Corona virus almost all the time
36	I don't feel happy most of the time because I think a lot about the Corona virus
37	I feel bad things are going to happen to me every time I think about the corona virus
38	I have increased confidence in myself that you will not be infected with the Corona virus
cognitive dimension	

poor focus	
39	My thoughts are always wandering while I interact with others for fear of infection with the Corona virus
40	I think about unimportant things so I don't think about the corona virus
41	I shake hands with others despite my mother's constant warning not to shake hands
42	My thoughts often get strayed in social situations, especially when they talk about the Corona virus
Attention Deficit	
43	I have a great ability to focus attention when I am asked to do something
44	I can't focus my mind on one thing because I'm always busy thinking about the corona virus
45	When he asks me to bring something, I go and come back again to inquire about that thing
46	When someone talks to me, ask them to talk again to answer them
Forgetting	
47	I can take back the advice my mother gives me to prevent corona virus infection
48	I know that touching contaminated objects can cause infection, and yet I do touch them
49	Remember to wash your hands frequently as soon as you come back from outside
50	I remember well to wear a mask and gloves when I go out of the house

Table (2): Correlation coefficient between each statement within the dimension and the total degree of the dimension in (CPAS)

N	R	N	R	N	R	N	R	N	R
physiological dimension									
1	0.677*	3	0.714*	5	0.697*	7	0.648*	9	0.702*
2	0.679*	4	0.656*	6	0.688*	8	0.731*	10	0.701*
psychological dimension									
1	0.679*	7	0.656*	13	0.731*	19	0.748*	25	0.702*
2	0.762*	8	0.752*	14	0.648*	20	0.644*	26	0.752*
3	0.698*	9	0.731*	15	0.697*	21	0.662*	27	0.699*
4	0.719*	10	0.599*	16	0.688*	22	0.698*	28	0.649*
5	0.651*	11	0.763*	17	0.562*	23	0.712*		
6	0.689*	12	0.697*	18	0.608*	24	0.612*		
cognitive dimension									
1	0.766*	4	0.639*	7	0.710*	10	0.633*		
2	0.608*	5	0.648*	8	0.677*	11	0.698*		
3	0.714*	6	0.731*	9	0.716*	12	0.612*		

N= statement number R= Correlation coefficient *= statistically significant

Table (3): Means, standard deviations (SD) and Correlation coefficient between the first and second applications for COVID-19 Pandemic Anxiety Scale

Variables	measurement		R value	P value	
	First	Second			
the scale dimensions	physiological dimension	27.02±2.95	26.40±2.87	0.87	0.00
	psychological dimension	66.66±3.77	66.73±3.82	0.84	0.00
	cognitive dimension	26.88±2.96	26.86±3.11	0.86	0.00
	Total score of the scale	120.57±5.26	120.00±4.76	0.85	0.00

2.3. Procedures

This study was conducted to test the relationship between anxiety caused by the emerging coronavirus pandemic and some of cognitive activities. COVID-19 Pandemic Anxiety Scale (CPAS) was used to determine the level of Anxiety caused by coronavirus pandemic and after that the sample was divided into two groups; the first one was a high anxiety (HACP) and the second was a low anxiety (LACP) about the Corona pandemic. The working memory test was applied to measure some of the cognitive activities for the sample of the study, and also to identify students have a high working memory (HWM), and students who have a low working memory (LWM). Components of working memory were measured as an indicator of some cognitive activities of two groups (HACP), (LACP). Then the relationship between corona pandemic anxiety and working memory was found as an indicator of some cognitive activities.

2.4. Statistical analyses

All statistical analyses were performed using the SPSS version 11.0 software (Statistical Package for Social Sciences; SPSS Inc., Chicago, IL, USA). Descriptive statistics (mean \pm SD) was calculated for all of the variables. The independent sample t-test was used to find out the differences between study groups (HACP, LACP) in anxiety caused by the emerging corona virus pandemic and components of working memory as an indicator of some cognitive activities. The correlation coefficient was also used to find out the relationship between anxiety caused by the emerging corona virus pandemic and some cognitive activities. The level of significance was set at $P \leq 0.05$.

3. RESULTS

This study aimed to identify the levels of cognitive activities (working memory tasks) among primary school students, and to know the differences in the components of working memory between students with high and low anxiety caused by the emerging corona virus pandemic. Table 4 shows the significant differences between the two groups (HACP-LACP) in the anxiety caused by the coronavirus pandemic and the components of working memory, as the results showed that there were statistically significant differences between the two groups. Figure 2 shows the mean working memory scores for the HWM and LWM groups on the verbal and visual-spatial WM tasks In addition to central executive and episodic buffer tasks. Table 5 also shows the significant differences between the two groups (HWM-LWM) in the working memory tasks, the results showed that there were statistically significant differences between the two groups (HWM-LWM) in the Components of working memory. The results also showed that students with low anxiety about the emerging corona virus pandemic can perform cognitive activities better than students with high anxiety as shown in Figure 3, 4. The findings revealed detrimental effects of anxiety caused by the coronavirus pandemic on performance accuracy in the working memory tasks as an indicator of some cognitive activities, it also showed a correlation between anxiety caused by the Corona virus pandemic and working memory tasks, as shown in table 6.

Table (4): Means, standard deviations (SD) and significant differences between the two groups (HACP-LACP) in Corona Pandemic Anxiety and working memory tasks

Variables		(HACP) Group	(LACP) Group	T value	P value
Corona Pandemic Anxiety		174.80 \pm 10.49	115.25 \pm 7.98	28.57	0.01
working memory	Phonological loop	6.55 \pm 1.87	10.73 \pm 1.55	10.88	0.00
	Visuospatial Sketch Pad	7.03 \pm 1.93	11.63 \pm 1.56	11.72	0.00
	central executive	3.50 \pm 0.68	5.05 \pm 0.99	8.19	0.00
	episodic buffer	3.40 \pm 0.55	4.38 \pm 0.87	6.02	0.00
	Total Score	20.48 \pm 4.22	31.87 \pm 3.17	13.53	0.00

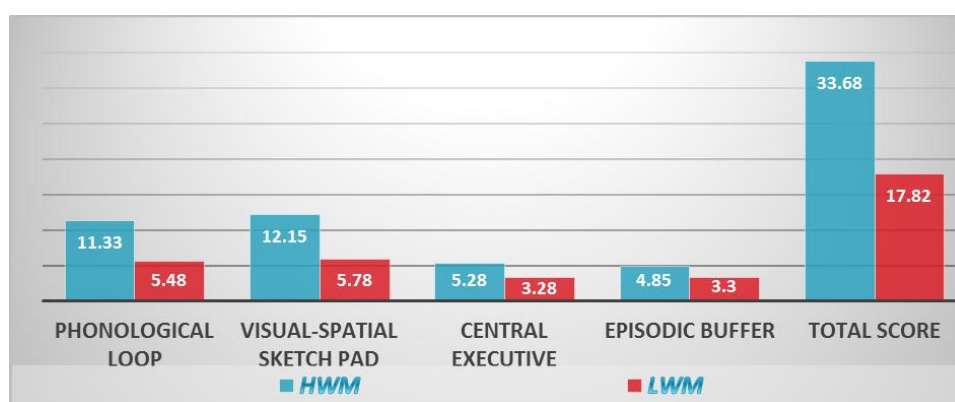


Fig.2: Differences between students with high working memory (HWM) and low working memory (LWM) in the working memory tasks

Table (5): Means, standard deviations (SD) and significant differences between the two groups (HWM-LWM) in the working memory tasks

Variables		(HWM) Group	(LWM) Group	T value	P value
working memory	Phonological loop	11.33 \pm 1.21	5.48 \pm 0.72	26.37	0.00

Visuospatial Sketch Pad	12.15±1.12	5.78±0.70	30.52	0.00
central executive	5.28±0.78	3.28±0.45	13.98	0.00
episodic buffer	4.85±0.70	3.30±0.46	11.67	0.00
Total Score	33.68±1.47	17.82±1.24	52.07	0.00

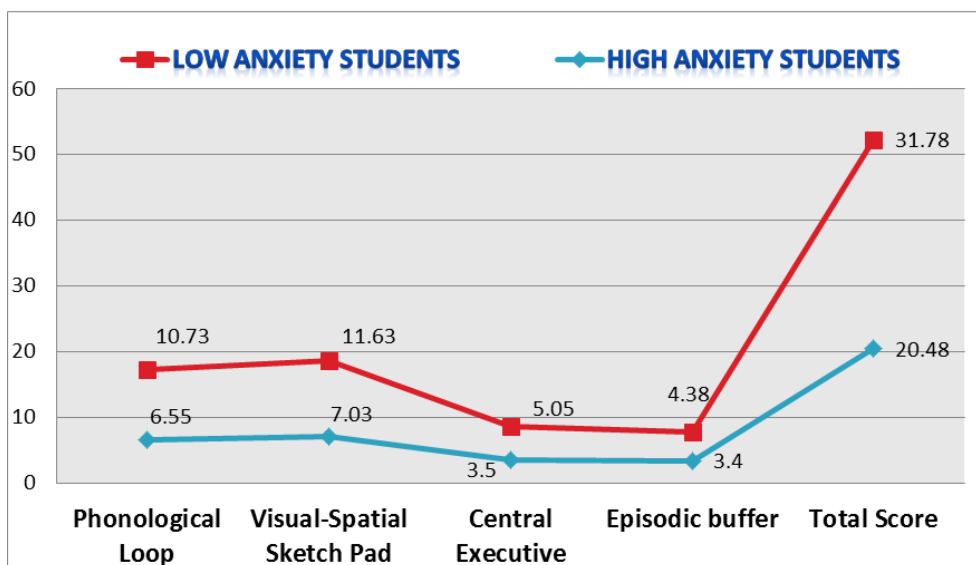


Fig.3: Differences between low and high anxiety students in working memory tasks

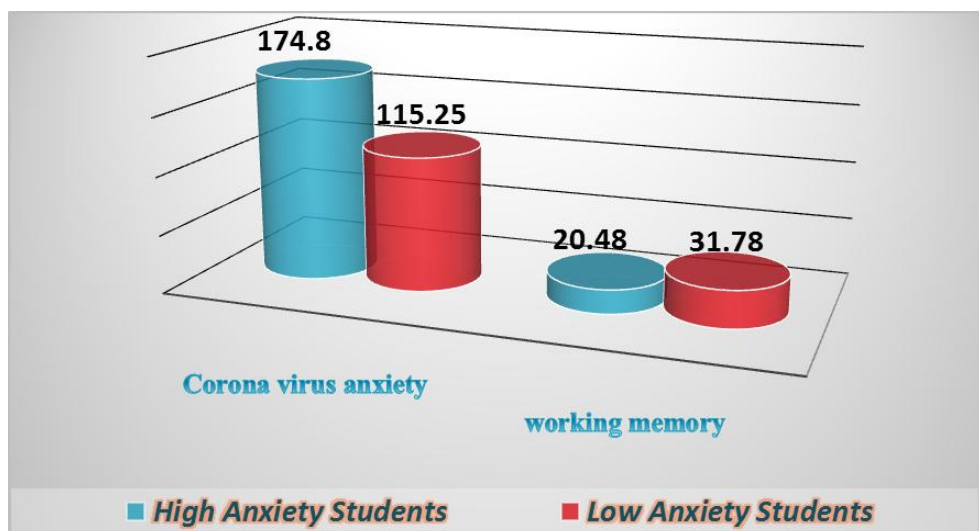


Fig.4: Differences between students with low and high anxiety in Corona virus anxiety and working memory

Table (6): Means, standard deviations (SD) and Correlation coefficient between Corona pandemic Anxiety and working memory

Variables	Corona pandemic Anxiety	working memory	R value	P value
High Anxiety Students	174.80±10.49	20.48±4.23	0.57	0.01
Low Anxiety Students	115.15±7.89	31.78±3.17	0.47	0.00
All Students	145.03±31.36	26.13±6.79	0.77	0.00

4. Discussion

Results of all analyses highlighted the significant impact of anxiety caused by the emerging corona virus pandemic on all the measured aspects of cognitive activities (working memory tasks). The first hypothesis of this study was, there are statistically significant differences in the level of anxiety caused by the emerging corona virus pandemic and cognitive activities among primary school students. The results showed that there were

statistically significant differences between high anxiety students about the Corona pandemic (HACP) and low anxiety students (LACP), and there were statistically significant differences between students with low working memory (LWM) and high working memory (HWM) in the components of working memory tasks. Some literature studied the anxiety caused by COVID-19 pandemic on different groups of society, such as the study of Kang et al. (2020), which aimed to know the impact of the spread of the new Corona virus on the level of enjoyment of mental health among a sample of doctors and nurses, and found that about (6.2%) of the total sample suffer from very high levels of anxiety, (56.8%) suffer to a moderate degree, while About (37%) of the sample showed low levels of anxiety. The study by Cao et al. (2020), which aimed to examine the level of anxiety among university students in China as a result of the psychological stress of the outbreak of the new Corona virus, and the study found that (76%) of the total sample suffer from a very high level of anxiety, (2.7%) suffer from a moderate level of anxiety (21.3%) suffer from a low level of anxiety. The study by Qiu et al. (2020), which aimed to know the chagrin caused by the emerging corona virus in China, and the results showed that over time, the levels of chagrin were significantly reduced, and this decline can be partially attributed to the effective prevention and control measures taken by the Chinese government to stop the spread of the virus. The study also suggested providing more support to vulnerable groups such as young people, the elderly and women.

The second hypothesis of this study was, there are statistically significant differences between students with low and high anxiety caused by the Corona virus pandemic in the cognitive activities in the direction of students with low anxiety. The results showed that there were statistically significant differences between high anxiety students about the Corona pandemic (HACP) and low anxiety students (LACP) in cognitive activities (working memory tasks). The low-anxiety students had better working memory tasks (Phonological loop- Visuo-spatial Sketch Pad- central executive- episodic buffer) than the low-anxiety students, as shown in Figure 3, 4. This is because Children in the primary stage are often afraid of physical injury, social isolation and fear for the physical health status. Anxiety is a set of non-specific fears that appear in the child's behavior and have many negative effects on the cognitive side represented in the child's inability to properly perceive the situation, objective thinking and attention Concentrating, remembering and solving the problem, which contributes to his inability to perform well, feeling helpless and incompetent, and thinking about the consequences of failure, and the feeling of insecurity resulting from psychological inadequacy, which has become dominating many aspects of behavior.

The third hypothesis of this study was, there is a statistically significant correlation between anxiety caused by coronavirus pandemic and some cognitive activities of primary school students. To study this relationship, the correlation coefficient was used between Corona pandemic Anxiety and working memory as an indicator of some cognitive activities for two groups (HACP) and (LACP). The results showed that there were statistically significant correlation between anxiety caused by coronavirus pandemic and some cognitive activities (working memory tasks) as shown in table (6). This result is in line with previous research showing negative changes caused by coronavirus pandemic. Such as the study of Engzella et al. (2021) which aimed to evaluate the effect of school closures during the COVID-19 pandemic on primary school performance and found that, students made little or no progress while learning from home. Baliyan et al. (2021) examined neuropsychological impact of COVID-19 (perceived anxiety, stress, and depression-like symptoms) and the impact of the strict social confinement during the first wave of the COVID-19 pandemic, the results showed significant increase in self-perceived helplessness and total perceived stress. Wunsch et al. (2019) examined the effect of physical activity on working memory performance after acute stress exposure in preadolescent children overall findings suggest that physical activity buffers the negative effects of stress on cognitive performance in children. Fellman et al. (2021) examined whether COVID-19-related anxiety levels during the early stage of the pandemic predicted demanding working memory, this study was conducted to healthy adults (age range, 18–50), the results showed a higher level of COVID-19-related anxiety during the first weeks of the pandemic outbreak were associated with poorer working memory performance.

Conclusion

The major conclusion drawn from this study according to the results was that there was a negative correlation between anxiety caused by the coronavirus pandemic and some cognitive activities (working memory tasks) in primary school Pupils. so, it is necessary to prepare a set of educational plans directed at reducing anxiety caused by the Coronavirus pandemic, in addition to preparing appropriate treatment programs to improve and raise the efficiency of working memory for primary school students who suffer from anxiety caused by the Coronavirus pandemic, because this type of programs can be effective for improving cognitive activities.

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