WORKING MEMORY CAPACITY IN PROBLEM SOLVING AMONG THE STUDENTS OF THE UNIVERSITY

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STATEMENT OF THE PROBLEM

Individuals may face any problems and challenges in their daily life .These problems range from simple problems that require simple cognitive processes such as temporary storage of given information to complex problems that require complex cognitive processes .Therefore , individuals face complex problems and they are in dire need to hold workshops that are not limited to storage information by short –term memory or direct retrieval out of long –term memory .Instead , they have to interact and coordinate between coded inputs by short-term memory and then they have to perform short activation of information so that active processing of information can be fulfilled which is termed as (working memory) (by Baddeley and Hitch ,1978) which is regarded as the core of cognitive processes .

In spite of the fact that working memory emerged as a research area in the field of cognitive psychology and developmental knowledge about its nature and role in the mental processes, but still it needs much understanding due to diversity of studies in explaining its real role in problem solving (Olzmann, 2012:5) .Some studies rely on explaining the nature of relations between working memory and problem solving (Pass et al., 2004) and this trend is based on existing fixed entity such as capacity and active sources together with the extent of attention which influenced on the individuals abilities and thus those individuals who enjoy high working memory capacity can input much more information for linguistic ambiguity for the sake of completing complex tasks (Arab Journal for Talent Development)

Accordingly the two researchers inquire about the level of working memory capacity during problem solving among the university students.

IMPORTANCE OF THE RESEARCH PAPER

The emergence of the importance of working memory capacity helps individuals to link their ideas and conceptions and this memory is considered a basic memory in order to figure out language and learning in that it enables people out of retrieving stored information symbolically and thus working memory is considered the system which intervened to a large extent in the contexts of developing oral and written linguistic behavior.(Nawany , 2005:34).

Working memory also helps individuals how to deal with interference or intervention and dispersion in the environment where they are in dire need to access to information in these critical situations and without intervention, it is possible to retrieve much more information that people need to deal with outside or external world out of long-term memory in sufficient speed to perform complex cognitive functions in life and when people are confronted with severe intervention circumstances with competitive information , it is possible to retrieve wrong information or controlled response of long –term memory .In this case people need to store new information related to the performance in order to settle down the conflict between tendency of retrieval response automatically and tendency of necessary response to perform the current task where the importance of working memory capacity emerged and individual differences speak for itself (Engle & Kane 2004:194) .

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It is predicted that working memory capacity plays an important role in controlling attention and curbing distractions in the situations of selective attention which refers to focus attention on something in the environment and important attentions can be distinguished out of casual or surrounding attentions and thus selective attention is measured typically through issuing instructions for participants by means of attentions and some sources of information and ignoring other sources and then defining their competence (Vandenbos,2007:826)

AIMS OF THE RESEARCH PAPER

The current research paper aims at :

1.Identifying the level of working memory capacity during problem solving among the students of the university .

2.Identifying the differences in working memory capacity during problem solving among the students of the university according to the variables gender male-female and field of specialization (scientific – humanities)

LIMITS OF THE RESEARCH PAPER

The following research paper is limited to the students of university of Al-Qadisiyah for field of specification (humanities –scientific) and the second and fourth classes of morning study for both (males – females) of the academic year (2017-2018).

TERMS DEFINITIONS

The researcher has defined working memory capacity during problem solving according to Baddeley (2000) " mutual process represented by a number of cognitive units that have been coded and encoded in a correct way and it needs to use a storage of information rules , skills and previous experience in solving , contrast or clarifying ambiguity or overriding a difficulty that prevented people from accessing to solve certain problem ."

 The operant definition of working memory capacity during problem solving. It is the degree that the respondent obtains out of a chain of test of working memory capacity during problem solving.

THE THEORETICAL FRAMEWORK OF WORKING MEMORY CAPACITY DURING PROBLEM –SOLVING

(Baddeley Model 2000)

Baddeley model is regarded as one of the most widespread models where it was well accepted by the scholars .Thus, Baddeley proposed that , in 1992 , there is a basic system that controls working memory together with its components , he named as " central executive ".Baddeley pointed out that there were several sub0systems that help the basic system .He named them as "service systems " He added fourth elements which is called "episodic buffer" (Abu Diyar, 2012:35).Accordingly , model working memory consists of four components that work together in integration and consistency (Baddeley ,2000) .These components are as follows:

1.Visuo-spatial Component

Visuo-spatial memory became a topic of major interest during the 1960s when (Posner and Konick ,1966) showed that memory for a point on a line was well retained over a period ranging up to (30) seconds, but it was disrupted by an interpolated information – processing tasks , suggesting some form of active rehearsal .Dale (1973) obtained a similar result for remembering a point located in an open field.In contrast to these spatial memory tasks, Posner and Keele (1967) produced evidence suggesting a visual store lasting for only two seconds. However, their methods was based on speed of processing letters, in which a visual letter code appeared to be superseded by a phonological code after two seconds although this could reflect the duration of the visual trace, it could equally well reflect a more slowly developing phonological code that then override the visual (Baddeley ,2012:12)

2. Verbal Component

This term appeared in (1990) where Baddeley (1974) named (phonological loop) or linguistic frequency (1986) (Myers,2007:170)

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This term is concerned with the verbal processes and processing verbal information and it recalls words or sentences and this component is the easiest three components which is responsible for storing oral and audio information temporarily since it faded away during (2-3 seconds) if it is not updated by recitation method (Al-Ghaleb et al., 2013:39)

3.Central Executive

Baddeley considered the central executive the basic component of working memory where it can control the visuo –spatial components and phonological loop in which they relate them to long-term memory and Baddeley believed that there is a correspondence to the two systems subsidiary to the central executive and that they both contain inactive storage of perceptual input which can be described byrapid waning.

This process can be solved by active control which is based on verbal response in the phonological loop and eye-movement in the visuo – spatial sketchpad (AlSuhaimy ,2015:33)

4.Eposidic Buffer

Episodic buffer has been added as a fourth component of the working memory and it is link between sub – systems and executive systems.On the one hand, and long –term memory on the other hand. This component has a limited capacity to be responsible for integrating information whether it is a phonological component or visuo-spatial component, Baddeley (2012:8) The researcher has adopted Baddeley (2000) model in building its scale (working memory capacity during problem solving.

REVIEWS OF LITERATURE OF WORKING MEMORY CAPACITY

1. Arab studies
    -   Ibraheem Study 2014
        The study is entitled " the working memory and meta memory and its relation to psychological pressures among the university students".

The current study aims at identifying the level of working memory capacity among the university students as well as the statistical significance differences in the level of working memory capacity according to the variables of Gender and specialization .Moreover the study intends to identify the level of meta memory among the university students and the level of psychological pressures.

The sample consists of (400) male and female students .The researcher has built a test for working memory capacity and he conducted Baddeley and Hitch model (1974) an meta memory scale has been built depending on Nelson and Narens model 1999.

Results show that there are statistical significant differences of working memory capacity in favour of female students and there are statistical significant differences between the average of the sample and the theoretical mean of the level of meta memory , and results show that the sample individual suffer from psychological pressures (Ibraheem 2014:190-197)

-   Omara study (2013) is entitled (the activity of training programme to develop skills of meta memory upon the performance of working memory during problem solving among a sample of students of college education).The current study aims at solving problems among a sample of students of college of education .For this reason a training programme has been designed to develop skills of meta memory among students .The researcher has chosen a sample of group one of college of education of university of Damanhour – the psychometric characteristics have

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been measured and the sample consists of (92) students .Results show that there are statistical differences between the averages of the grades of the samples in the two pre-test and pro-test of the extent of operant working memory in favour of post-test and there are statistical significant differences between the two averages of students grades of high and low performance on testing the operant working memory in skills od meta memory in favour of high performance test .(Omara 2013:153-185) .

- Bahar study (2016) is entiltled (the executive attention and its relation to the working memory capacity and perceptual speed among the university students).

The current paper aims at identifying the degree of executive attention and working memory capacity and the degree of perceptual speed among the university students. The study is limited to the variables of gender and field of specialization –grades (first, second, third , fourth) The researcher has built a test for a working memory capacity which is based on timing according to Baddeley theory.

The researcher has applied the three tests on stratified sample that has been chosen randomly which is amount to (500) male and female students .Results show that there are no statistical significant differences according to the variable of social gender and the level of executive attention is low and the level of working memory capacity is above the middle and the level of perceptual speed among the university students is very high (Bahar 2016:13)

2. **Foreign studies**
   - **Hollingworth and Henderson 2002 study** is entitled (the accuracy of visual memory concerning previously viewed items out of natural images).The current study aims at detecting the information that is kept out of previously viewed items in natural images by measuring retrieval of short visual memory and retrieval of long term visual memory .The sample consists of (12) American university students. Results show that the testees have retrieved that the short –term visual memory and the rate was high (Hollingworth and Henderson 2002:131-136)

   - **Research Methodology and Procedures**

     The two researchers have adopted the descriptive approach since it is regarded as the most suitable approach that can study the correlations between variables and identifying differences as well as describes the phenomenon carefully and expresses it quantitatively and qualitatively because the quantitative expression gives a digital description about the amount or size of phenomena with other phenomena whereas the qualitative expression describes the phenomenon and clarifies its characteristics (Obeidat et al 1996:286).

   - **Research Sample and Population**

     The population of the current research paper is limited to the university students of Al-Qadissiya morning classes for the academic year (2017-2018) out of the second and fourth - grade students.

The statistical population consists of (8262) male and female students –scientific and humanities streams chosen four (humanities and 8 scientific among them (4100) male and female students of humanities and(6162) male and female students of scientific colleges .Table (1) illustrates that :

Scientific Average	1247	1138	938	794	2185	1977	4162
Humanities Average	826	1205	828	1241	1654	2446	4100
Total Average	2073	2388	1766	2035	3839	4423	
	4461		3801		8262		

Stratified random sampling has been chosen and this approach has been used to divide the population into stratifications and each one is considered one class and selecting individuals of research sample randomly (Mulham 2000:126) and prepositional illocution has been used (Atwai 2000:90) of (600) male and female students out of students of university of Al-Qadissiya - second and fourth grade .Table (2) illustrates that :

Average of scientific	91	83	68	58	159	143	302
Average of humanities	60	88	60	90	120	178	298
Total	151	173	128	148	279	321	600
Average	324		276		600		

- **Research Instrument: Testing working memory capacityduring solving problems**

The following paper aims at identifying the level of working memory capacity during problem solving among the university students of Al-Qadissiya .The two researchers have built a test for working memory capacity during problem solving depending on Baddeley theory 2000. The test consists of 10 groups of tasks .Each group includes a number of solved simple arithmetic equation, and each equation has one word in a chain of verbal tasks and an image concerning visuo-spatial task (ranging from 3-7 questions plus words or images) where a number of group items increases with one word average starting from the first group (3 items into the fifth group 7 items).The researchers has used Microsoft office power point to introduce or present test task together with data show to present the instructions on tastes about the scale and the way of doing task and

retrieving words (Mohammed, 2017) .Thus , this scale has been prepared on the university students and discrimination force has been extracted as shown in table (3) .The two researchers have used face validity and coefficient of reliability is (0,74) Cronbach Alpha is (0,77).To achieve the validity of scale , the following study has used methods of selecting two extreme groups and coefficient of internal consistency where the two researchers have found that the items of the scale are statistically significant as shown in table (3).To extract the reliability of the scale , the two researchers have used the method of retesting by selecting random sample consisting of(40)male and female students and the degree of the two applications have been found by using Pearson correlation coefficient which amounts to (0,77) and this value refers to the fact that individuals are stable in their answers.

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Ser. No.	The Higher Group 27%		The Lower Group 27%		Calculated T-value	Decision
	Arithmetic mean	Standard Deviation	Arithmetic mean	Standard Deviation		
1.	2.28	0.94	3.02	0.16	8.002	Distinctive
2.	2.14	1.10	3.99	0.96	17.20	Distinctive
3.	2.57	1.15	4.98	0.13	21.53	Distinctive
4.	3.04	1.64	6.00	0.00	18.68	Distinctive
5.	3.07	1.65	6.69	0.46	21.88	Distinctive
6.	2.67	0.72	3.30	0.01	4.67	Distinctive
7.	2.53	1.27	4.00	0.03	11.96	Distinctive
8.	2.97	1.45	4.99	0.09	14.37	Distinctive
9.	3.10	1.88	5.99	0.09	15.87	Distinctive
10.	3.28	2.02	6.96	0.18	18.75	Distinctive

Table (4) coefficient of correlation between degree of item and the total degree of working memory capacity test during solving problem:

No. of Items	Coefficient of correlation of item by the total degree
1.	0.55
2.	0.77
3.	0.84
4.	0.34
5.	0.84
6.	0.34
7.	0.77
8.	0.77
9.	0.84
10.	0.84

- **Final Application**

After verifying the validity of the scale, it has been applied on a sample of basic paper amounting to 600 male and female students.

- **The statistical Means**

For the purpose of arriving at the results of the following research paper the following statistical means have been used .

1. Chi –square.
2. t-test for two independent samples.
3. t-test for one sample.
4. Pearson correlation coefficient
5. Alpha formula

RESULTS, DISPLAY AND DISCUSSION

- **The first aim**

  Identifying the working memory capacity during problem –solving among university students after applying working memory capacity test during problem solving and thus the arithmetic mean of sample individuals has been extracted amounting to(600) male and female students and the average of their grade have been amounted to (45, 011) by standard deviation amounting to (3, 89) to identify the significant difference between the two arithmetic means (and theoretical mean amounting to (25)T-test has been used .Results showed that there is a statistical significant difference because the calculated T-value is (125, 91) which is larger than tabulated T-value which is (1,69)

  Under the level of significance (0,05) with freedom degree amounting to (599) as it is shown in table (5) :

Variable	No. of Samples	Arithmetic Mean	Standard Deviation	Theoretical Mean	t-value		Level of significance
Working Memory capacity	600	45.011	3.89	25	125.91	1.96	0.05

EXPLANATION OF THE RESULT

Baddeley 2000 explains the role of maturity and experience in working memory capacity where adult people have the ability to comprehend a large number of information by depending on a group of basic principles which is subsumed into the process of learning and acquiring information , submitted stimuli visually such as retrieving short verbal words is easier than retrieving long words and he adds that images , stimuli and familiar words are easier than memorizing difficult words or images Baddeley (2000:86) .This result is in consistence with Ibraheem's study , Omara's study , Bahar's study and Henderson & Hollingworth (2002)

- **The Second Aim** : differences in working memory capacity during problem solving among university students according to the variable of gender and specialization as it is shown in table (6)

Variable	Arithmetic Mean	Standard Deviation	T-value		Level of Significance
			Calculated	Tabulated	
Humanities	36.697	2.028	38.127	1.96	0.05
Scientific	47.027	38.977	38.977		

The statistical process in table (6) shows the following :

There are statistical significant differences according to the variable of specialization in favour of scientific field of specialization because the calculated T-value is (38,977) which seems larger than tabulated T-value which is (1,96) under the level of significant of about (0,05) and this means that there are statistical significant in working memory capacity during problem solving between the scientific and humanities specialization in favour of scientific specialization where the arithmetic mean amounts to (47,027) for scientific specialization and the arithmetic mean for humanities specialization is (36 ,697)since those major in scientific have skills , abilities , and obsession differ from those of humanities and both of them have mental abilities and level of information supply and this study differs from Sala (Bahar 2016) which points out that there are no differences among students of scientific and humanities

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specialization .As to identify the differences according to the variable of gender. Table (7) illustrates the differences in working memory capacity during problem –solving according to the variable of gender .

Variable	Arithmetic Mean	Standard Deviation	T-Value		Level of Significance
			Calculated	Tabulated	
Male	45.687	3.609	4.464	1.96	0.05
Female	4.289	4.055	4.447		

There are statistical significant differences according to the variable of gender in favour of males since the calculated T-value is (4,464) which seems larger than tabulated T-value which is (1, 96) under the level of significant of about (0,05) .This means that there are statistical significant differences in the level of working memory capacity during problem –solving among male and female students in favour of males , because the arithmetic mean of male sample is (45.687)and for female samples is (4,289) and this means that males possess high working memory capacity that enable them to solve their academic problems and this contradict with Bahar's study and Ibraheem's study.

RECOMMENDATIONS

1. Emphasis on the importance of using modern techniques in teaching which take part in raising the level of working memory capacity among university students .
2. Deanships and chancellors of universities must care about training programmes for students which increase working memory capacity during problem solving which help them deal with big informatic units .
3. Working on training students in using strategies of coding information in memory since these strategies help raise working memory capacity in storing information .
4. Focusing on developing scientific, educational ,humanities curricula and including them in activities and programmes that activate working memory capacity among them .

SUGGESTIONS FOR FURTHER READING

1.Relation between working memory capacity during problem –solving by using new scale instruments to support the current research paper.

2.working memory capacity during problem –solving and its relation to stressful events among university students .

3. Conducting a study dealing with the variable of optimism and pessimism and its relation to working memory capacity among university students .

4. This study can be conducted on secondary school students and comparing results with the current study.

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