



## ORIGINAL RESEARCH PAPER

## Psychology

## GENDER DIFFERENCES IN VERBAL WORKING MEMORY AMONG GRADUATES ACROSS VARIOUS DISCIPLINES

**KEY WORDS:** Verbal working memory, Graduates, Arts, Commerce.

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### ABSTRACT

The present study examined the verbal working memory among graduate students of different disciplines. The sample for the study consisted of 30 males and 30 females which had been further classified into Arts and Commerce students. Purposive sampling procedure was used for the study. The sample was administered the Verbal working memory – N Back test – NIMHANS Neuropsychology Battery (2004) to measure verbal working memory. The obtained data were organized for statistical analysis. The descriptive 't' test of statistical significance was used for analysis of data. The B.A male and female students were found to be better than B.Com male and female students on Verbal Working Memory when the consonants were repeated alternately. The difference between males, females and B.A and B.Com students in verbal working memory was found to be negligible in all other conditions.

### Introduction

Memory is an organism's ability to store, retain, and recall information. The process by which we encode, store and retrieve information is termed as Memory. According to Atkinson and Shiffrin (1968, 1971), there are three kinds of memory storage systems. These storehouses vary in terms of their function and the length of time they retain information.

**Sensory memory:** Refers to the initial momentary storage of information lasting only an instant. Information is recorded by a person's sensory system as an "exact replica of the stimulus."

**Short term memory:** Short-term memory allows recall for a period of several seconds to a minute without rehearsal.

**Long term memory:** Material that makes its way from short-term memory to long-term memory, enters a storehouse of almost unlimited capacity (Feldman, 1974)

### Working Memory

Baddeley and Hitch (1974) proposed a working memory model which replaced the concept of general short term memory with specific, active components. In this model, working memory consists of three basic stores: the central executive, the phonological loop and the visuo-spatial sketchpad. In 2000 this model was expanded with the multimodal episodic buffer.

The central executive essentially acts as attention. It channels information to the three component processes: the phonological loop, the visuo-spatial sketchpad, and the episodic buffer.

The phonological loop stores auditory information by silently rehearsing sounds or words in a continuous loop: the articulatory process (for example the repetition of a telephone number over and over again). Then, a short list of data is easier to remember.

The visuo-spatial sketchpad stores visual and spatial information. It is engaged when performing spatial tasks (such as judging distances) or visual ones (such as counting the windows on a house or imagining images).

The episodic buffer is dedicated to linking information across domains to form integrated units of visual, spatial, and verbal information and chronological ordering (e.g., the memory of a story or a movie scene).

### Review of Literature:

Smith et al (1999) studied Components of Verbal Working Memory and its evidence from Neuroscience and they consider experiments that indicate that verbal working memory is composed of multiple components. One component involves the sub-vocal rehearsal of phonological information and is neurally implemented by left-hemisphere speech areas, including Broca's

area, the premotor area, and the supplementary motor area. Other components of verbal working memory may be devoted to pure storage and to executive processing of the contents of memory. These studies rest on a subtraction logic, in which two tasks are imaged, differing only in that one task presumably has an extra process, and the difference image is taken to reflect that process. They then reviewed studies that show that the previous results can be obtained with experimental methods other than subtraction. They focus on the method of parametric variation, in which a parameter that presumably reflects a single process is varied. In the last section, they consider the distinction between working memory tasks that require only storage of information vs. those that require that the stored items be processed in some way. These experiments provide some support for the hypothesis that, when a task requires processing the contents of working memory, the dorsolateral prefrontal cortex is disproportionately activated.

Petrides et al (2002) studied functional activation of the human frontal cortex during the performance of verbal working memory tasks and according to them; the Regional cerebral blood flow was measured with positron emission tomography during the performance of verbal working memory tasks. The same type of verbal response (i.e., reciting numbers) was required in the control and the two experimental tasks. In the control task, the subjects were required to count aloud. In the two experimental tasks, the subjects were required to maintain within working memory the numbers they generated (self-ordered task) or the numbers generated by the experimenter (externally ordered task). Examination of the difference in activation between these conditions revealed strong bilateral activation within the mid-dorsolateral frontal cortex during both experimental tasks. There was, however, no evidence of additional activation within the mid-dorsolateral frontal cortex when monitoring self-generated responses as compared with the monitoring of externally generated responses. These results provide evidence regarding the role of the mid-dorsolateral frontal cortex in mnemonic processing that are in agreement with recent findings from work with non-human primates.

### Objectives of the study:

The objective of this study was to find out the difference in verbal working memory among B.A. and B.Com students. The study also aimed at finding out if there were any gender differences in verbal working memory.

### Hypotheses:

The hypotheses framed for this study was null hypothesis which is a no-effect or difference hypothesis or negation hypothesis that tends to refuse or deny what is explicitly indicated in a given research hypotheses. The null hypotheses formed for the present study are as follows. :

- There is no significant gender difference among B.A. students

on verbal working memory when the consonants are repeated successively and alternately.

- There is no significant gender difference among B.Com students on verbal working memory when the consonants are repeated successively and alternately.
- There is no significant difference among B.A. and B.Com males on verbal working memory when the consonants are repeated successively and alternately.
- There is no significant difference among B.A. and B.com females on verbal working memory when the consonants are repeated successively and alternately.

**Need for the study:**

**Improving long term academic success:**

The researchers from Durham University surveyed over three thousand children and found that ten per cent of school children across all age ranges suffer from poor working memory seriously affecting their learning. Nationally, this equates to almost half a million children in primary education alone being affected. The researchers believe the early assessment of children will enable teachers to adopt new approaches to teaching, thus helping to address the problem of under-achievement in schools. In the light of this, the present study is helpful to improve their long term academic progress.

**Research Design:**

Ex-post facto design.

**Variables:**

Independent variable: Discipline of Education {Arts/Commerce}; Gender.

Dependent variable: Errors committed in Verbal Working Memory test.

**Sample:**

The sample used in this study consists of graduate students of different disciplines. The sample includes 30 males and 30 females aged between 17-20 years, hailing from urban population and further classified into students of arts and commerce (15 males and 15 females from Arts, 15 males and 15 females from Commerce). Purposive sampling, a non probability sampling method has been used in this study.

**Inclusion criteria:**

- The study included males and females of Arts & Commerce disciplines of the age group 17-20 years.
- Students of Urban background were included as samples in the present study.

**Exclusion criteria:**

- Students who were physically challenged were excluded from the present study.
- Students of Science background were excluded from the present study.

**Tool:**

**Verbal Working Memory: N- Back test (NIMHANS)** consisting of two lists of 30 randomly ordered consonants (such as 'Ma', 'Ra', 'Ja' ) common to multiple Indian languages. 9 consonants are repeated consecutively at different positions in the list in One-back test and 9 consonants repeated after an intervening consonant at different positions in the list in Two-back test.

**Procedure:** In order to collect data for research, Graduate students of Arts and Commerce were contacted personally to get their consent to participate in the study. With their consent, the purpose of the study was briefed and rapport was established. Their biographical information was obtained in the data sheet prepared for the purpose. Subsequently, the Verbal Working Memory - N Back Test to measure verbal working memory was administered. The test was measured as per standard directions and data were collected. After the responses were noted, participants were thanked for their participation and co-operation.

**Results and Discussions:**

Table 1 Mean SD and't' value of male and female B.A.students in 1-back test and 2-back test on Verbal Working Memory

CONDITION	MALES		FEMALES		't'value
	MEAN	SD	MEAN	SD	
1-back test	0.47	0.52	0.40	0.63	0.47 NS
2-back test	1.93	0.88	1.67	0.89	1.18 NS

**NS: Not significant**

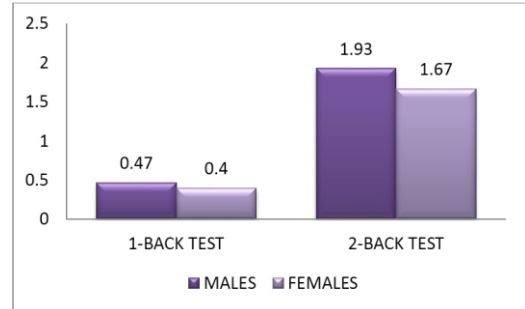


Figure 1 Mean score of male and female B.A.students on 1-back and 2-back test on Verbal Working Memory.

An examination of Table 1 reveals that when the consonants are repeated together, the mean score obtained by B.A males is 0.47 with a standard deviation of 0.52, and among B.A females, the mean is 0.4, with a standard deviation of 0.63. The obtained't' value of 0.47 is statistically not significant.

When the consonants are repeated alternately, the mean score obtained by B.A males is 1.93, with a standard deviation of 0.88, and among B.A females, the mean is 1.67, with a standard deviation of 0.89. The obtained't' value of 1.18 is statistically not significant. The null hypothesis which was formed as - "There is no significant gender difference among B.A students on Verbal Working Memory when the consonants are repeated successively and alternately " was found to be accepted.

The results are also presented in a graphical form. The above results indicate that the B.A males and females did not differ significantly when the consonants are repeated successively and alternately.

**Table 2**

Mean, SD and't' value of male and female B.Com students in 1-back test and 2-back test on Verbal Working Memory

CONDITION	MALES		FEMALES		't'value
	MEAN	SD	MEAN	SD	
1-back test	0.67	0.62	0.67	0.82	0 NS
2-back test	2.80	1.01	2.93	0.96	0.53 NS

**NS: Not significant**



Figure 2 Mean score of male and female B.Com students on 1-back and 2-back test on Verbal Working Memory

An inspection of Table 2 reveals that when the consonants are

repeated together, the mean score obtained by B.Com males is 0.67, with a standard deviation of 0.62, and among B.Com females, the mean is 0.67, with a standard deviation of 0.82. The obtained 't' value of 0 is statistically not significant.

When the consonants are repeated alternatively, the mean score obtained by B.com males is 2.8, with a standard deviation of 1.01, and among B.Com females, the mean is 2.93, with a standard deviation of 0.96. The obtained 't' value of 0.53 is not statistically significant. The null hypothesis which was formed as - "There is no significant gender difference among B.Com students on Verbal Working Memory when the consonants are repeated successively and alternately" was found to be accepted.

The results are also presented in a graphical form. The above results indicate that the B.Com males and females did not differ when the consonants are repeated successively and alternately.

Table 3 Mean, SD and 't' value of male students of B.A. and B.Com in 1-back test and 2-back test on Verbal Working Memory

CONDITION	B.A.		B.COM		't' value
	MEAN	SD	MEAN	SD	
1-back test	0.47	0.52	0.67	0.62	0.71 NS
2-back test	1.93	0.88	2.80	1.01	2.54*

\*p<0.05; NS: Not significant

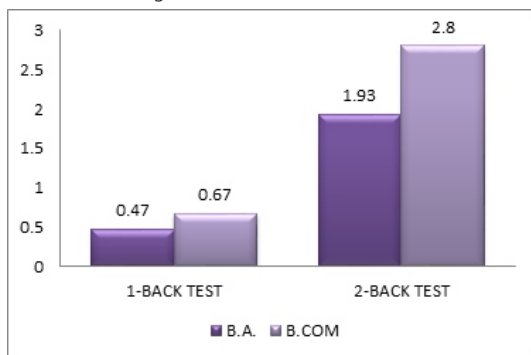


Figure 3 Mean score of male students of B.A. and B.Com on 1-back and 2-test on Verbal Working Memory

We infer from Table 3 that when the consonants are repeated together, the mean score obtained by B.A males is 0.47, with a standard deviation of 0.52, and among B.Com males, the mean is 0.67, with a standard deviation of 0.62. The obtained 't' value of 0.71 is not statistically significant.

When the consonants are repeated alternatively, the mean value obtained by B.A males is 1.93, with a standard deviation of 0.88, and among B.Com males, the mean is 2.8, with a standard deviation of 1.01. The obtained 't' value of 2.54 is statistically significant at 0.05 level. The hypothesis which was formed as - "There is no significant difference among B.A and B.Com males on Verbal Working Memory when the consonants are repeated successively and alternately" was found to be accepted when the consonants were repeated successively and was not accepted when the consonants were repeated alternately.

The results are also represented in a graphical form. The above results indicate that B.A and B.Com males do not differ when the consonants are repeated successively, but they do show difference when the consonants are repeated alternately.

Table 4 Mean, SD and 't' value of female students of B.A. and B.Com in 1-back test and 2-back test on Verbal Working Memory

CONDITION	B.A.		B.COM		't' value
	MEAN	SD	MEAN	SD	
1-back test	0.40	0.63	0.67	0.82	1.02 NS
2-back test	1.67	0.89	2.93	0.96	2.11*

\*p<0.05; NS: Not significant

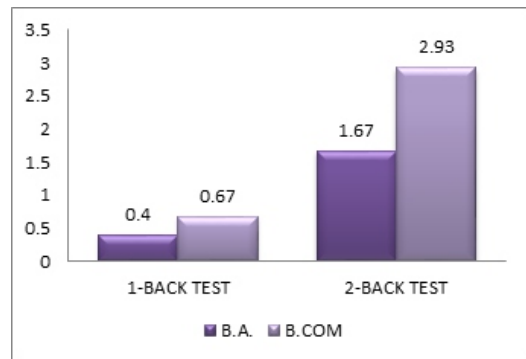


Figure 4 Mean score of female students of B.A. and B.Com on 1-back and 2-test on Verbal Working Memory

An examination of Table 5 reveals that when the consonants are repeated together, the mean score obtained by B.A females is 0.4, with a standard deviation of 0.63, and among B.Com females, the mean is 0.67, with a standard deviation of 0.82. The obtained 't' value of 1.02 is statistically not significant.

When the consonants are repeated alternatively, the mean value obtained by B.A females is 1.67, with a standard deviation of 0.89, and among B.Com females, the mean is 2.93, with a standard deviation of 0.96. The obtained 't' value of 2.11 is statistically significant at 0.05 level. The null hypothesis which was formed as - "There is no significant difference among B.A and B.Com females on Verbal Working Memory when the consonants are repeated successively and alternately" was found to be accepted when the consonants were repeated successively and was not accepted when the consonants were repeated alternately.

The results are also represented in a graphical form. The above results indicate that B.A and B.Com females did not differ when the consonants are repeated successively, but they do show difference when the consonants are repeated alternately.

**Summary and Conclusions:**

Based on the results and discussion, the following conclusions were drawn :

- The B.A males and females were found to have a better Verbal Working Memory than B.Com males and females when the consonants were repeated alternately.
- The B.A and B.Com students did not show any significant difference in Verbal Working Memory when the consonants were repeated successively and alternately.
- The Male and Female students did not show any significant difference in Verbal Working Memory when the consonants were repeated successively and alternately.

**Limitations of the study:**

- The sample was restricted only to urban background.
- Other factors like intelligence, socio-economic status, and cultural background were not taken into consideration in the study of Verbal Working Memory among graduates of various disciplines.

**Scope for further research:**

The study can be expanded by taking other samples such as school children of varying age groups, college students of various disciplines, professionals in the industrial and occupational settings to check their verbal working memory.

**Implications of the study:**

- The findings of the study is useful in creating an awareness among graduates regarding their working memory and also guide them in ways of improving on their working memory

- The finding of the study is useful in counseling the graduates for improvement of their Verbal Working Memory.

**References:**

1. Atkinson, R. C., & Shiffrin, R. M. (1968). Human memory: A proposed system and its control processes. In K. W. Spence & J. T. Spence (Eds.), *The psychology of learning and motivation* (Vol. 2, pp. 89-195). New York: Academic Press.
2. Baddeley, A.D., Hitch, G.J.L (1974). Working Memory, In G.A. Bower (Ed.), *The psychology of learning and motivation: advances in research and theory* (Vol. 8, pp. 47-89), New York: Academic Press.
3. Baddeley A (October 2003). "Working memory: looking back and looking forward". *Nature Reviews. Neuroscience* 4 (10): 829–39. Obtained from doi:10.1038/nrn1201. PMID 14523382.
4. Feldman.S.R. (2004). *Understanding Psychology*. 6th Ed. Tata McGraw Publishing Co.Ltd.
5. Petrides, Alivisatos, Meyer, Evans.(2002) (Montreal Neurological Institute, McGill University, Quebec, Canada.