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CORRELATING CONVENTIONAL WORKING MEMORY TASKS WITH VARIANT EVERYDAY WORKING MEMORY TASKS AMONG YOUNG HEALTHY ADULTS

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ABSTRACT

Working memory has been described as a cognitive system that permits interaction between attention, perception, and memory (Baddeley, 1992). Working memory forms the cornerstone in the effort to accomplish real-world goals. The aim and objective of the study were to correlate the working memory performance of young aged healthy adults on conventional working memory tasks with variant everyday working memory task. The study was done on 15 young healthy adults. The tasks consisted of conventional digit backward and letter ordering tasks along with six variant tasks. The tasks were presented visually beginning with simple 2 steps ordering to increasing complexity up to 6-7 steps. The correlation analysis results revealed that there was significant correlation seen between the conventional working memory tasks with most of the variant everyday working memory task. The present study highlights the importance of not restricting to conventional digit backward span and ordering tasks to assess the complete capacity of one's variant everyday working memory.

KEYWORDS Variant everyday working memory, and conventional working memory tasks

INTRODUCTION

Working memory has been described as a cognitive system that permits interaction between attention, perception, and memory (Baddeley, 1992)learning, and reasoning. This definition has evolved from the concept of a unitary short-term memory system. Working memory has been found to require the simultaneous storage and processing of information. It can be divided into the following three subcomponents: (i.Working memory system has also been described as a limited capacity system that is responsible for temporary storage and processing of information while cognitive tasks are being performed (Salmon et al., 1996). The domain specific storage, rehearsal processes and domain general executive attention are considered to be the three converging processes responsible for the active maintenance in the multi-component system.

One of the extensively researched theoretical construct of working memory is the Baddeley's model (Baddeley, 1992)Working memory. In: G.A. Bower, Editor, Recent Advances in Learning and Motivation Vol. 8, Academic Press, New York (1974. The model describes working memory construct to comprise of a central executive which is supported by the two slave systems: phonological loop and visuospatial sketch pad slave system. A revised version of the model introduced a fourth component called the "episodic buffer"(Baddeley, 2000).

Though working memory has been localized to prefrontal brain areas, these neural activation differences reveal that neuronal activation is task, stimulus, and strategy specific.

Assessing working memory capacity with respect to everyday communication has been a crucial aspect (Alloway, Gathercole, Willis, & Adams, 2004) as everyday communication may involves tasks that vary in complexity to greater extents which may be further influenced by several environmental factors. Conventionally working memory is assessed through digit backward, reading span, and operation span tasks.However, there is limited knowledge about how the performance data of the traditional working memorytasks can be generalized to everyday working memory capacity.

Thus, working memory assessment should be a combination of different nature of the stimulus (like numerals, alphabets), variety of complexity (multiple steps) and diversity in strategies used for operations (ordering versus reverse span). The present study is a preliminary attempt to device variants of existent working memory tasks which could provide greater association with an everyday function.

The aim and objective of the study were to correlate the working memory performance of young aged healthy adults on conventional working memory tasks with variant everyday working memory tasks.

METHOD

Participants:A total of 15 participants within the age range of 18-25 years (mean age= 21.5 years, SD=4.94 years) participated in the study. All the participants were well versed with English and did not possess any neurological and psychological problems that impair vision, hearing and cognitive processing.

Material and Stimuli: The study consisted of conventional digit backward (Wechsler,1939) and letter ordering tasks (Pollack, Johnson, & Knaff, 1959) along with six variant tasks. The variant tasks were double digit backward, triple digit backward, digit and letter ordering, spell the word, days ordering, month ordering, year ordering, and date ordering. The tasks were visually presented beginning with simple 2 steps ordering/back-

ward to increasing complexity up to 6-7 steps. Five sets of stimuli were prepared for each step of complexity for both conventional and variant tasks. The prepared stimuli were validated by three experts in the discipline. From the finalized stimuli for all the tasks, each level of complexity (2 steps to 6-7 steps) consisted of two trials each. The constructed stimuli were embedded into Paradigm experiment software version v2.3.0.29.

Procedure: All the prepared experiments were presented through visual modality using a laptop with a screen size of 15.6 inches. All the everyday working memory tasks also the appearance of the stimulus for 2500ms followed by an inter-stimulus interval of 1000ms.The participant were asked to follow the instructions given at the beginning of each experimental task and to respond through the microphone whenever a response window flashed. The duration of the response window was driven by the participants' response and they were asked to press a 'right arrow' on the keyboard of the laptop once they had finished responding.

Scoring: A score of 1 for each correct response and 0 for incorrect response was assigned across all the tasks.

Analysis: The response accuracy across all the task categories for the subjects were tabulated and subjected to descriptive and Pearson's correlation analysis using SPSS version 16.0.

RESULTS AND DISCUSSION

The present study was carried out with an objective of correlating the performance of young aged adults on conventional working memory task with the variant working memory task.

Working memory performance across all the tasks. Descriptive statistics was applied to the scores obtained by the subjects across all the tasks. The results of the same have been shown in Figure 1.

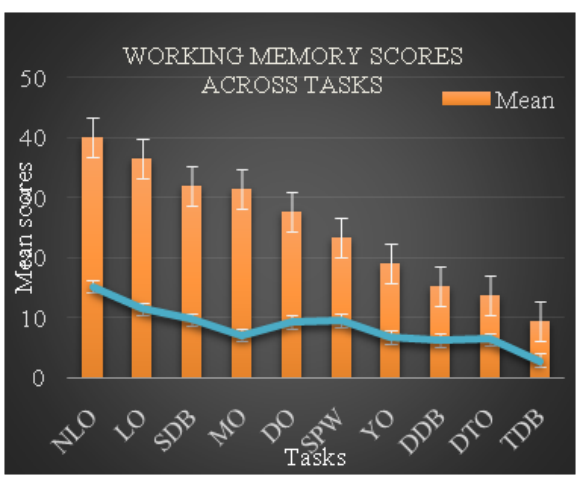

Figure 1 about here

The descriptive statistics revealed that the mean values was highest for number and letter ordering (NLO) followed by letter ordering (LO), single digit backward (SDB) month ordering (MO), date ordering (DTO), spelling a word (SPW), year ordering (YO) double digit backward (DDB), date ordering (DTO) and triple digit backward (TDB) .

Though the lesion studies localize the functions of working memory towards the dorsolateral prefrontal cortex which is mainly responsible for monitoring and manipulation abilities (Stuss & Levine, 2002), the underlying working memory processes such as encoding, storage/maintenance, rehearsal, inhibition, and scanning of working memory buffers require distinct strategies and separate processing (Stuss & Levine, 2002). In the present study, the difference in the mean performance scores across the tasks indicates the different levels of processing strategies required for the conventional and variant working memory tasks.

Correlation between the conventional backward span tasks with the variant tasks. In order to assess the performance on conventional working memory task and variant everyday working memory task, the data was correlated with the Pearson's correlation coefficient. Single digit backward task, the conventional working memory task, was taken as the reference and the correlation of the variant double digit backward and triple digit backward task was examined. The findings of the correlation analysis have been depicted in Figure 2.

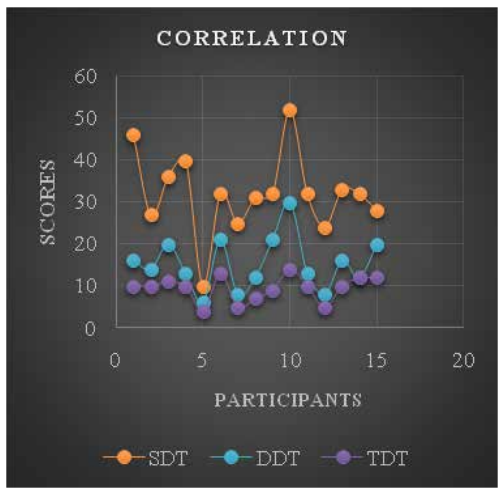

Figure 2 about here

The results of correlation analysis comparing the correlation of double digit and triple digit backward task with the reference single digit backward task revealed that the single digit backward task possessed a significant strong positive correlation with the two digit backward task (p=0.003, r=0.715) and the three digit backward task (p=0.003, r=0.703). The backward single digit span tasks' correlation with double digit and triple digit is explainable because the tasks require similar strategies. However the working memory capacity for the three may differ due to innate characteristics of the stimuli. The absence of correlation of reverse span tasks with the ordering tasks is crucial. This seems to confirm the proposed notion that the ordering tasks differ in their strength and phenomena of working memory as they involve different strategizing (Li et al., 2012).

Correlation between the conventional ordering tasks with the variant tasks. The second group of the variant tasks included the ordering tasks. Here, the letter ordering task was considered as the reference task and the variant tasks included number and letter ordering, month ordering, year ordering, days ordering spell the word and year ordering. The Pearson correlation was applied for the analysis. The results of the analysis have been shown in Figure 3 and Figure 4 respectively.

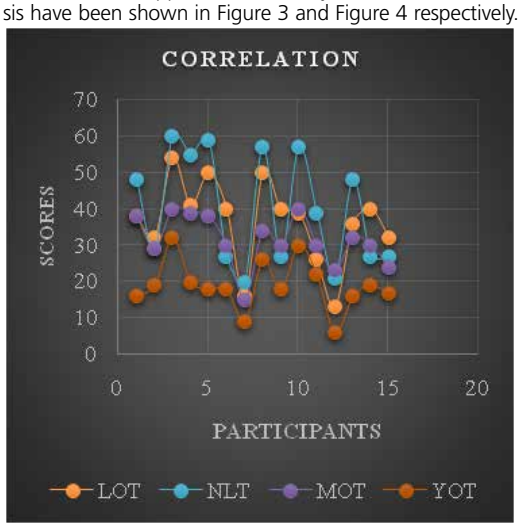

Figure 3 about here

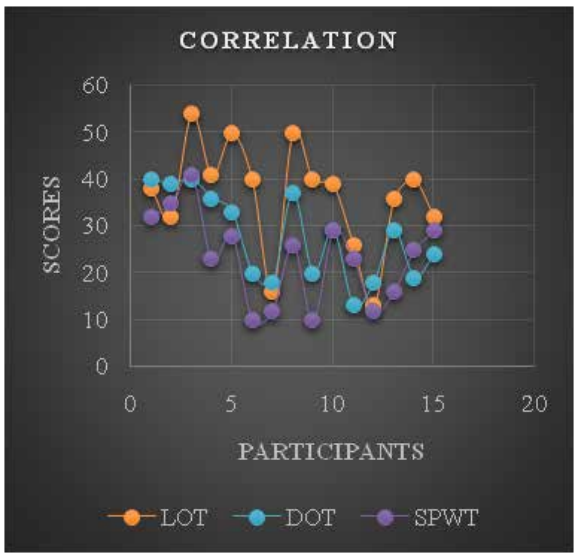

Figure 4 about here

The results of the correlation analysis, as depicted in Figure 4, revealed a significant strong positive correlation between the number and letter ordering task (p=0.002, r=0.729), month ordering (p=0.000, r=0.800), year ordering (p=0.001, r=0.749) with the conventional letter ordering. Correlation details, as observed on Figure 5, signifies presence of a moderate significant correlation between reference letter ordering tasks with the days ordering (p=0.014, r=0.617), and spell the word task (p=0.05, r=0.501). However, the date ordering task (p=0.084, r= 0.460) was not observed to be correlating with both conventional tasks i.e. letter ordering and digit backward tasks. The letter ordering tasks strong correlation with month, day, year ordering and spelling a word are examples of the same. This also suggests that this everyday working memory task may appear meaningful and relevant at no extra cost. Some of these correlations like, date ordering, would have reached a relevant level if traditional task like digit ordering would have been used. Letter ordering may not correspond well to date ordering as the latter involves numerical expressions too. The present study partially agrees with the conventional measures of backward digit span introduced by (Wechsler, 1939) or letter ordering introduced by (Pollack et al., 1959) but highlights the importance of not restricting to single digit backward span and ordering tasks to assess the complete capacity of one's variant everyday working memory.

Overall, the results of the present study shows that most of the variant everyday working memory tasks does possess a significant positive correlation with their respective conventional working memory tasks.

CONCLUSION

The present study aimed to correlate the working memory performance of young aged healthy adults on conventional working memory tasks (digit backward & letter ordering) with variant everyday working memory tasks. The information obtained from the present research is on a smaller scale but seems to be promising. Data acquisition on a larger sample size would enable us to identify the receiver operating characteristics of each of these variant everyday working memory tasks which would certainly possess a diagnostic strength. Performing similar experiments in association with other cognitive tasks like problem solving and sequencing may allow us to delineate the contribution on working memory in it. Usage of such tasks while planning intervention for individuals with working memory deficits may also be rewarding.

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