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Individual Differences in Working Memory Capacity and Task Switching Performance

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The present study was designed to examine individual differences in working memory capacity on task switching ability. Eighty-six students whose age ranged from 18 to 30 years voluntarily participated in this study. A 2 (Working memory span group: high vs. low) x 3 (Preparation Time: 200 ms, 600 ms and 1000 ms) x 2 (Trial type: repeat and switch) mixed factorial design was employed. Participants who scored in the upper and lower quartiles on the Operation span working memory task were designated to high and low-working memory span groups respectively. Both groups performed a digit and letter classification task in alternating-runs paradigm of task switching. In this task, participant switched back and forth between digit and letter tasks in which they were required to classify either digits as odd/even or letter as vowel/consonant. Three preparation intervals were also provided between trials to prepare for forthcoming task. Results revealed that high-working memory participants were faster and more accurate in classification of digits and letters on both switch and repeat trials. High-working memory span participants endowed smaller switch cost though they showed lesser improvement with increase in preparation time. Findings of the study provide evidences for executive attention view of working memory capacity.

Keywords: Working memory, Executive attention, Task switching, Preparation

Working memory (WM) is considered as a broader system comprised of storage and processing components. Researchers have differentiated between working memory and working memory capacity (WMC). The concept of WM was established with the multi-component model of Baddeley and Hitch (1974), which argued that WM is a flexible and limited-resource system with storage (phonological loop and visuospatial sketchpad), and processing capabilities (central executive) that are traded off as needed. Phonological loop and visuospatial sketchpad are closer to the traditional concept of short-term memory.

Baddeley and Hitch (1974) considered WM as a replacement of the short-term memory while, other researchers (Cowan, 1999; Engle, 2002) viewed working memory as consisting of memory units (of long-term memory) active above threshold, which can be represented via a variety of different codes (phonological, visuospatial, semantic etc.), and as an executive attention component.

Central executive is the component which differentiates conventional short-term memory with contemporary working memory. The executive attention component primarily deals with maintaining or suppressing activation of long-term memory traces and task goals, conflict monitoring and resolution, and the flexible allocation of attentional resources (Unsworth, Heitz & Engle, 2005). The working memory capacity is different from working memory and reflects primarily the executive attentional component of a broader working memory system (Engle, Kane & Tuholski, 1999).

Most of the initial work of Baddeley and other researchers were concentrated on the two storage systems and attentional component of WM model was ignored. Lately, researchers started to explore the central executive component of WM, which resulted in emergence of two distinct approaches; one approach attempts to understand the breakdown of executive processes following brain damage in the frontal lobe patients or in patients suffering