

# Validation of Cognitive Training Module in Assessment of Working Memory capacity in Cognitive communicative disordered population

*by* Hema N

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## PROJECT PROPOSAL

### Part-A

- 1.0 Title of the Project:** Validation of Cognitive Training Module in Assessment of Working Memory capacity in Cognitive communicative disordered population
- Area of Research :** Speech-Language Pathology
- 1.1 Principal Investigator :** Dr. Hema. N
- 1.2 Co-Investigator :** -
- 1.3 Collaborating Institution :** Nil
- 1.4 Total Grants Required :** Rs. 4,33,000.00 (Four Lakhs Thirty Three Thousand only)
- 1.5 Duration of Project :** 1 year
- 2.0 Project Summary (Max.300 words) :** Attached as separate sheet
- 3.0 Introduction**
- 3.1 Definition of the problem : Attached as separate sheet
- 3.2 Objectives : Attached as separate sheet
- 3.3 Review of status of research and development in the subject : Attached as separate sheet
- 3.4 International and national status : Attached as separate sheet
- 3.5 Importance of the proposed project in the context of current status : Attached as separate sheet
- 4.0 Work Plan**
- 4.1 Method
- Subjects/Participants : Attached as separate sheet
- Material : Attached as separate sheet
- Procedure : Attached as separate sheet
- Analyses : Attached as separate sheet
- 4.2 Time schedule of activities giving milestones (also append a bar diagram)
- Review of literature : 12 Weeks / 3 Months
- Recording and analyses of data : 20 Weeks / 5 Months

	Data interpretation and report writing	:	16 Weeks / 4 Months
<b>5.0</b>	<b>Budget summary</b>	:	<b>Rs. 4,33,000.00</b>
			<b>Expenditure in Rs</b>
a. Staff & Salary	1). Research Officer. – PG in ASLP or PG in SLP Rs 34,000/- x 12 months	:	4,08,000.00
c. Consumable Stationery		:	10,000.00
b. Travel Grants within India		:	10,000.00
d. Contingency and other expenses		:	5,000.00
	<b>Total</b>	:	<b>Rs 4,33,000.00</b>

- 6.0 Implications of the results of the study**
- a) Presentation of scientific papers in professional seminars/publication of articles : Data will be used for presentation in seminars and conferences
  - b) Discussion with professionals : Professionals will be consulted for statistical advice for the study
  - c). To utilize the results in the development of remediation : The present study helps in assessing working memory deficits in cognitive communicative disordered population using objective method and discusses its effectiveness as a clinical tool.
- 7.0 Utilization of results of the study** : Attached as separate sheet

## **2.0 Project Summary:**

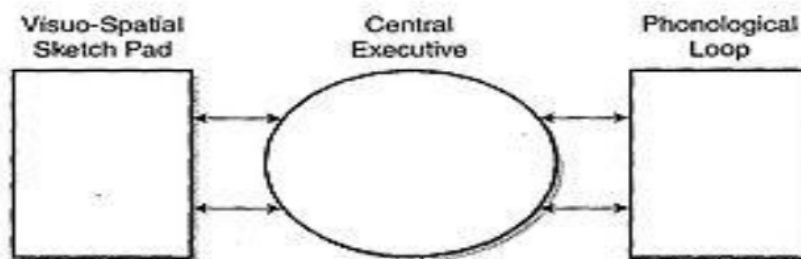
The purpose of this study is to investigate the feasibility and validity of a cognitive training module (Kumar & Sandeep, 2013), to assess working memory capacity (WMC) and cognitive control processes in individuals with cognitive –communicative disorders. Feasibility of the cognitive training module with adult cognitive-communicative disordered population will be assessed by measuring the ability of these adults to complete all the modules with very minimum errors. Validity of the module will be evaluated in two ways: First, because WM is affected in cognitive-communicative disordered population, we evaluate the relationship between these clinical populations and age, gender, education, socio-economic status matched paired group of neuro-typical adult population. Second, relations will be calculated between the cognitive performance and a measure of global language ability. It can be predicted that the relations between the cognitive module and the other measures of memory would remain robust even when age and language skills are statistically controlled, demonstrating that the cognitive training module has a component of unique variance related to WMC that is independent or dependent of other contributing variables.

## **3.1 Definition of the problem with importance of the proposal project in the context of current status**

Working memory (WM) is a construct that refers to the ability to retain and manipulate information during a short period of time (Klingberg, Forssberg & Westernerg, 2002). WM has a foundational role in many critical components of cognitive development, including controlled attention, reasoning, organization, and speech and language functioning (Baddeley, Gathercole, & Papagno, 1998; Baddeley & Hitch, 1974; Cowan, 2005; Engle, 2002). More specifically, WM is important to such components that rely heavily on cognitive control including the following: 1). Acquisition of language (Gathercole & A. M. A. S. E., 2000; Baddeley, 2003); 2). Language comprehension (Daneman & Merikle, 1996); 3). Reading ability (Daneman & Carpenter, 1980; Savage, Cornish, Manly & Hollis, 2006); 4). Mathematics (Bull, Espy & Wiebe, 2008) and 5). Reasoning (Baddeley & Hitch, 1974). WM is often thought of as a ‘mental workbench’ or ‘workspace’ because of its central role in language processing,

though and action. Because of its importance to cognitive functioning, it has received a great deal of attention over the years by cognitive and developmental psychologists and speech language pathologists.

Working memory (WM) is usually regarded as a framework for a series of interactive processes that comprise temporary storage and the manipulation of information (Baddeley, Allen, & Hitch, 2011). In Baddeley and Hitch's (1974) original model, three components were proposed: a phonological loop, responsible for storing and maintaining phonological information; a Visuo-spatial sketchpad, which stored and maintained visual and spatial information; and a central executive, which had a general storage capacity and was responsible for the manipulation of temporary information, as shown below.



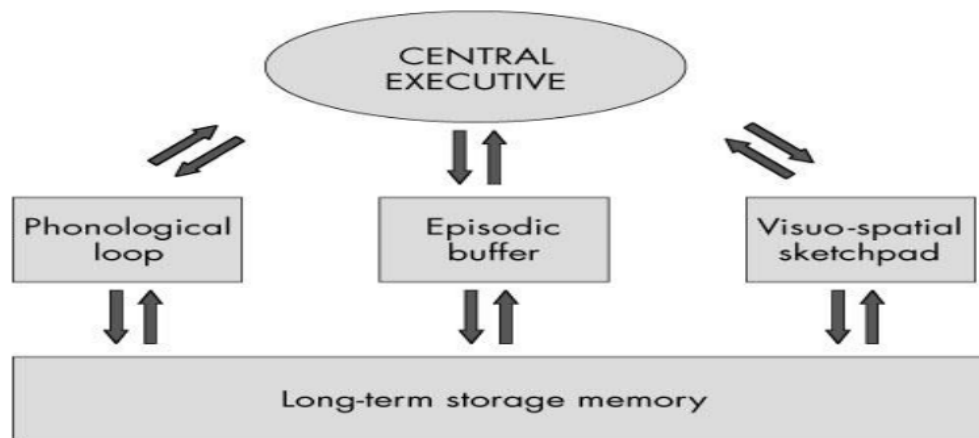
**FIGURE 5.1 Baddeley Model of Working Memory**  
Source: Baddeley, 1986

*Figure 1.*The three components model proposed by Baddeley and Hitch

The storage capacity was subsequently removed from the central executive (Baddeley, & Logie, 1999), which became a processing-only component. This led to some problems with the model, when it was observed that the short-term storage capacity of the phonological loop and visuospatial sketchpad (collectively known as “slave systems”) was insufficient to explain human subjects’ performance in a series of experimental tasks and complex cognitive activities (Baddeley, 2007, p. 141). Other problems were also raised, including the contribution of semantic factors to the recall of word sequences (Baddeley, 1966), the presence of substantial sentence span in some

patients although their phonological short-term memory was impaired (Baddeley & Wilson, 2002), the phenomenon of chunking (Baddeley, 2000; Baddeley, Hitch, & Allen, 2009; Miller, 1956), and individual differences in the WM span of Daneman and Carpenter (1980) exist.

To solve these issues, a fourth component was proposed: an episodic buffer (EB), conceived as a multidimensional storage system that integrates information from different sources, such as long-term memory (LTM), the slave systems, and perception. Access to the EB is achieved through consciousness. Therefore, the model provides a mechanism for multi-feature binding, which is regarded as a role of consciousness (Baddeley, 2000). In its latest version, the model contains connections between the EB, central executive, LTM, and both slave systems (Baddeley et al., 2011; Baddeley, 2012).



*Figure 2.* The revised four components model proposed by Baddeley et al

Regardless of the lens through which WM is viewed, numerous studies have made clear the centrality of WM to both higher-level cognitive processing as well as to language processing. The intimate connections between WM and language have been demonstrated with respect to both behavioral and neurophysiological data (Murray, 2004), and across both healthy (Daneman & Carpenter, 1983; Just & Carpenter, 1992) and language-disordered populations (Baddeley, 1986; Gathercole, Pickering, Knight, &

Stegmann, 2004). It follows that WM has been explored repeatedly in adults with aphasia. A large literature has established that individuals with aphasia demonstrate WM limitations affecting many aspects of linguistic and nonlinguistic processing (e.g., Caplan & Waters, 1999; Christensen & Wright, 2010; Friedmann & Gvion, 2003; Sung et al., 2009), and impacting functional communication as well as social, academic, rehabilitative, and vocational outcomes (Fillingham, Sage, & Lambon Ralph, 2005; Murray, 2004).

The thorough review of literature reveals that the assessment of working memory abilities across the different adult language disorders has been done using subjective methods. There have been a holistic approach for the assessment of working memory, but there is a lack of tests that assess the specific components of working memory in this population. Therefore, the present study is planned with the aim of investigating the working memory abilities, in persons with cognitive-communication disorders using a computer program “auditory cognitive training module” .

### **3.2 Objectives**

- To evaluate the effectiveness of Cognitive Training Module in Assessment of Working Memory capacity in Cognitive communicative disordered population.

### **3.3 Review of status of research and development in the subject**

Laura L. Murray (2012) had conducted the study pertaining to remediating, directly or indirectly, STM and WM deficits. Findings from a limited set of studies suggest that STM and WM impairments in individuals with aphasia do respond to treatment, and further that these treatments may also positively affect the language abilities of individuals with aphasia. Similarly Martin .N. et.al (2012) to identify the effects of increased verbal WM load on the performance of judgments of semantic similarity (synonymy) and phonological similarity (rhyming). Results revealed that for participants with aphasia, increased verbal WM load significantly reduced accuracy of performance on synonymy and rhyming judgments. Better performance in the low verbal WM load conditions was evident even after correcting for chance. The synonymy task

included concrete and abstract word triplets. When these were examined separately the verbal WM load effect was significant for the abstract words, but not the concrete words.

### **3.4 International and national status**

Mani and Bansal (2006) conducted a study to compare the nonverbal sequencing memory span in aphasics and normal individuals. The memory span was assessed by using digits, meaningful stimuli and non-meaningful stimuli. Result revealed that performances were decreased when complexity of the tasks were increased. Significant difference was seen in the performance of both aphasics and normal individuals except for meaningful stimuli.

Sunil Kumar (2009) had conducted a study in order to develop and standardize a test battery to assess person with Dementia. The 4 domains mainly memory, linguistic comprehension, linguistic expression and visuo-spatial construction were included in his study. Results revealed that there was significant difference seen between individuals with dementia and neuro-typical. Performance of the mild dementia individuals was near normal, while moderate and severe condition had performed significant lower than normal.

A study was conducted the by Agharwal (2007) to compare the performance of the verbal sequencing memory between aphasics and normal individuals. They were presented with two tasks such as digit tasks and meaningful word task. Result revealed that significant difference was seen for digit task between two groups whereas, there was no significant difference seen for meaningful word task.

## **4.1 Method**

### **Participants:** Selection criteria

A total of 40 participants are considered for the present study. Individuals with a diagnosis of cognitive-communicative disorders include individuals with Aphasia, Dementia, Right hemisphere damage and Traumatic Brain Injury. In total 20 individuals of this clinical population (5 with each diagnosis) in the age range of 20 to 70 years will form the clinical group (Group I). The participants in this clinical will be matched for age, gender, education, socio-economic status of 20 neuro-typical adults (Group II).



*Inclusion criteria for clinical group (Group I) are as follows:*

- Only those individuals with the diagnosis of cognitive-communicative disorders by a speech-language pathologist or by a neurologist, which includes individuals with Aphasia, Dementia, Right hemisphere damage and Traumatic Brain Injury language disorders will be included into the clinical group.
- Only those who have received speech and language therapy for a short duration of 2-3 months will be considered.
- They should have had a minimum of 10 years of formal education.
- All the participants should be bilinguals but predominantly Kannada monolingual/ Kannada-English bilinguals.
- The proficient language or L1 had to be Kannada (Mother tongue). L2 and/or L3 could be English (most frequently used/or medium of instruction at school/college) and/or Hindi and/or Tamil.
- All these participants should belong to a middle/high socioeconomic status as per the rating on re-adapted version of National Institute of Mental Health (NIMH) Socioeconomic Status Scale, (Venkatesan, 2009).
- They should be free from any neurological or psychological illness as determined by General Health Questionnaire (Golderberg & Williams, 1988). The participants should be physically fit during the testing.
- The participants should not have any alcohol/drug abuse.
- All individuals who are right-handed only will be considered for the study.
- The participants will be explained the purpose and the procedures of the study and an informed written consent will be obtained for the participation in the present study.

*Inclusion criteria for neuro-typical group (Group II) are as follows:*

- Age, gender, education, socio-economic status matched with clinical group. A total of 20 participants will be considered. They should have had a minimum of 10 years of formal education.

- All the participants should be bilinguals but predominantly Kannada monolingual/ Kannada-English bilinguals.
- The proficient language or L1 had to be Kannada (Mother tongue). L2 and/or L3 could be English (most frequently used/or medium of instruction at school/college) and/or Hindi and/or Tamil.
- All these participants should belong to a middle/high socioeconomic status as per the rating on re-adapted version of National Institute of Mental Health (NIMH) Socioeconomic Status Scale, (Venkatesan, 2009).
- They should be free from any neurological or psychological illness as determined by General Health Questionnaire (Golderberg & Williams, 1988).

### **Material and procedure**

A computer program “auditory cognitive training module” developed by Kumar & Sandeep, 2013 will be used to assess the working memory capacity of the clinical group. The domains included in the assessment module are as follows:

- (a) Phonological loop
- (b) Visuo-spatial loop

Under phonological loop, the tests for the assessment of phonological loop are as follows:

- Forward span digit
- Backward span digit
- Ascending span digit
- Descending span digit

Under visuo-spatial loop, the tests for the assessment of visuo-spatial loop are as follows:

- Forward span visual
- Forward span spatial
- Backward span spatial
- Ascending Visuo-spatial
- Descending Visuo-spatial

This software runs on any computer with an USB key and each positive response will be given a score of '1' and negative response as '0' under two domain of each test.

### **Analyses**

Statistical analysis will be done using SPSS software (Statistical Package for the Social Sciences, version 19.0). Descriptive statistics will be administered during the initial stage and later appropriate statistical procedures will be used.

### **Implications**

The present study helps in knowing the changes in the working memory abilities, if any, with respect to the different adult language disordered population. The study might also contribute to throw light on the importance of the assessment of the working memory capacity in this cognitive-communicative disordered population. It contributes in providing information about the probable correlation between the working memory abilities and the language characteristics of these individuals.

### **References**

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## Part-B

### 1.0 Personal profile of Principal Investigators

#### 1.1 Personal profile of Principal Investigators :

1.1.1 Name : Dr. Hema. N

1.1.2 Date of Birth: 07-05-1984 Age: 30 years

1.1.3 Present Position Held : Lecturer in Speech Sciences  
Department of Speech-Language  
Sciences

1.1.4 Institution : All India Institute of Speech &  
Hearing (AIISH)

1.1.5 Whether belongs to SC/ST : ST

1.1.6 Academic & Professional  
Career :

#### **Academic**

Degree/Position held	Year	University/Institution
<b>Ph.D. (Sp. &amp; Hg.)</b>	2013	All India Institute of Speech & Hearing, University of Mysore, Mysore.
<b>M. Sc. (Sp. &amp; Hg.)</b>	2008	All India Institute of Speech & Hearing, University of Mysore, Mysore.
<b>B. Sc. (Sp. &amp; Hg.)</b>	2006	All India Institute of Speech & Hearing, University of Mysore, Mysore.

#### **Professional**

Degree/Position held	Year	University/Institution
Lecturer in Speech Sciences	2014-present	All India Institute of Speech & Hearing, University of Mysore, Mysore.
Project Officer (DST project)	2013	All India Institute of Speech & Hearing, University of Mysore, Mysore.
Speech Language Pathologist Grade II. Department of Clinical Services	2012	All India Institute of Speech & Hearing, University of Mysore, Mysore.
Junior Research Fellow	2009-2012	All India Institute of Speech & Hearing, University of Mysore,

Speech Language Pathologist Grade I. Department of Clinical Services	2008-2009	Mysore. All India Institute of Speech & Hearing, University of Mysore, Mysore.
1.1.7 Projects completed:	:	Nil
1.1.8 Doctoral theses guided:	:	Nil
1.1.9 Doctoral theses under progress:	:	Nil
1.1.10 Master's dissertation guided:	:	Speaker Identification using fricatives in Kannada Speaking individuals: A preliminary study (Arjun M. S. 2014)
1.1.11 Master's dissertation under progress (Diploma FSST)	:	Benchmark for Speaker Identification using MFCC on the vowel following the nasal continuants in Kannada. (Suman Suresh, 2015)
1.1.12 Publication in journals:	:	Attached as separate sheet
1.1.13 Books edited, monographs:	:	Nil
1.1.14 Awards	:	Nil
1.1.15 Memberships:	:	Life member of Indian Speech- Language & Hearing Association (ISHA). L-1369. Member of Rehabilitation Council of India (RCI). A32071
1.1.16 Others	:	Nil
1.1.17 Other research projects as Co-Investigators (ARF, Extra Mural)	:	“Standardization of a Discourse Analysis Scale for conversation, narration and picture description in Kannada (DAS)” (PI - ARF)
1.1.18 Principal Investigator address:	:	Dr. Hema. N Lecturer in Speech Sciences Department of Speech-Language Sciences All India Institute of Speech & Hearing (AIISH) Mysore 570 006, INDIA Telephone: 91-821-

2514449(Ext.302) (work);

(M): 9343120039.

E-mail:

[hema\\_chari2@yahoo.com](mailto:hema_chari2@yahoo.com)



**Dr. Hema. N**

**1.1. 10 Master's dissertation completed:**

1. Speaker Identification using Fricatives in Kannada Speaking Individuals: A Preliminary Study (Arjun. S. M., 2014).

**1.1. 11 Master's dissertation on going (PGDFSST):**

1. Benchmark for Speaker Identification using MFCC on the vowel following the nasal continuants in Kannada. (Suman Suresh, 2015)

**1.1.12 Publication in journals:**

1. **Hema, N., & Shyamala, K. C.** (2014). Macrolinguistic analysis of discourse in TBI: Right Vs Left hemisphere insult. *Journal of All India Institute of Speech and Hearing, 31*.
2. **Hema, N., & Shyamala, K. C.** (2011). A Comparative Study in Narrative Discourse of Kannada-English Bilingual Normal Adults. *Journal of All India Institute of Speech and Hearing, 30*, 101-107.
3. **Hema, N., & Shyamala, K. C.** (2010). Discourse in Traumatic Brain Injury. *Journal of All India Institute of Speech and Hearing, 29 (2)*, 181-197.
4. **Hema, N., & Shyamala, K. C.** (2010). A study of discourse analysis in traumatic brain injury (TBI): Left hemisphere damage vs Right hemisphere damage. *Student Research at AIISH, Vol VIII, Part-B, Speech-Language Pathology*, 116-132.
5. **Hema, N., Sangeetha, M., & Pushpavathi, M.** (2009). Normative Data for Multi-Dimensional Voice Program (MDVP) for Adults- A Computerized Voice Analysis System. *Journal of All India Institute of Speech and Hearing, 28*, 1-7.
6. **Hema. N & Pushpavathi. M** (2009). Acoustic, Perceptual and Physiological correlates of Cleft Speech in Kannada Language- A single case study. *International Journal of Dravidian Language, Mysore*.
7. **Hema, N., Sangeetha, M., & Pushpavathi, M.** (2009). Nasalence value for English passage in Kannada speakers: A preliminary study. In 5<sup>th</sup> Kannada Vijnana Sammelana, Mangalore University, Mangalore.

8. **Hema. N.** (2009). "*Discourse Production in fluent Bilingual Aphasics with CVA and TBI*". Proceedings of the International Symposium on Bilingual Aphasia (pp 191-202) AIISH, Mysore

**1.1.15 Memberships:**

1. Life Member: Indian Speech and Hearing Association, India.
2. Member of Rehabilitation Council of India.

**1.1.17 Other research projects as Principal-Investigators (ARF)**

**Details of Projects on hand (clearly indicating the title, funding agency, duration, grants and other relevant information)**

1. Standardization of a Discourse Analysis Scale for conversation, narration and picture description in Kannada (DAS) (PI). (Rs. 3,85,000.00). ARF 2014-15. Ongoing.

# Validation of Cognitive Training Module in Assessment of Working Memory capacity in Cognitive communicative disordered population

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## ORIGINALITY REPORT

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**27** %

SIMILARITY INDEX

**9** %

INTERNET SOURCES

**17** %

PUBLICATIONS

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STUDENT PAPERS

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## MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

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Student Paper

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