

## **Analysis of Verbal Fluency Output on Semantic Categories in Typically Developing Malayalam- English Bilingual Children in Lower Primary School.**

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### **ABSTRACT**

*Verbal fluency tasks are used as a measure for understanding the complex process of retrieval of words from the brain. It involves rapid generation of words specific to a particular cue within a limited time span of sixty seconds. In the wake of limited knowledge of verbal fluency performance in children, the present study aimed at investigating the developmental changes in verbal fluency output on 6 selected semantic categories in typically developing (TD) Malayalam- English bilingual children attending lower primary school. The study was conducted on 36 children aged between 8 and 10 years. The result of the present study suggests that as age advances, there is a gradual increase in the scores in selected 6 semantic categories, cluster groups were found in common object and kitchen item fluency tasks. The study also indicated the influence of task effect differences on children's performance as age advances.*

**KEYWORDS:** *Verbal fluency, 6 semantic category fluency, TD Malayalam- English children.*

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Speaking involves the expression of thoughts in spoken words and phrases. According to Levelt (1999), during conversation, an adult individual produces approximately two to three words per second from a huge repository or a mental dictionary known as mental lexicon which is composed of fifty to hundred thousand words. In children, acceleration in vocabulary growth occurs between 18 months and 18 years with learning on an average of 9-10 new words a day (Bloom, 2000).

Verbal fluency is a cognitive function that facilitates information retrieval from memory. Successful retrieval requires executive control over cognitive processes such as selective attention, selective inhibition, mental set shifting, internal response generation, and self-monitoring (Lezak et al, 2004). This process is lifelong, growing in complexity with maturation and widening of the knowledge of the world around them. Attempts to understand the categorization of diverse world entities to similar mental representation in children are reported in the literature (Carneiro et al, 2008; Lucariello et al, 1992).

Verbal Fluency (VF) or Controlled Oral Word Association (COWA) is one task of testing word retrieval. It typically has two conditions, phonemic verbal fluency, PVF (also called letter fluency, initial letter fluency, phonological fluency, formal fluency, or letter-cue word generation), and semantic fluency (or category fluency or semantic-cue word generation). The task requires participants to produce as many words as possible within one min that satisfy the stated criteria. In the PVF condition, participants are asked to produce words that start with a given letter, excluding numbers, proper names, places, or words in different forms. In category fluency, participants are to produce words in a semantic category, such as animals or musical instruments, without the

additional restrictions noted for letter fluency. In the standard version of the task, participants are given 60 seconds to produce as many words as they can. Usually, only the productivity score (i.e., the raw number of legal words) is calculated. (Lezak et al, 2004).

Both semantic and phonemic verbal fluency tasks clearly require the complex interplay of a variety of cognitive functions, including selective and sustained verbal attention, vocabulary knowledge, storage, and retrieval of long-term semantic and lexical knowledge, and aspects of executive function such as strategic search and switching (Moura et al, 2015). Imaging studies suggest that the two types of fluency may engage different cognitive processes, as they are differentially sensitive to certain experimental manipulations (e.g., phonemic fluency is more disrupted by concurrent repetition of digits in reverse order than by object identification tasks, where the reverse is true for semantic fluency), and are differentially affected in clinical populations (Gierski & Ergis, 2004).

Though the letter and category fluency tasks are obviously very similar, they do differ in subtle but important ways in task demands. The category fluency task resembles everyday production tasks, such as making a shopping list, so that participants can exploit existing links between related concepts (e.g., between the category label and the category members and among associated category members) to retrieve responses. By contrast, in the letter fluency task, words must be retrieved from a phonemic category, which is rarely done in everyday speech production, so that participants must suppress the activation of semantically or associatively related words and must resort to novel retrieval strategies (e.g., Luo et al., 2010; Katzev et al., 2013).

Retrieving words based on their semantic categories is an overlearned process of language production. Thus, performance in category fluency is largely automatic and relies primarily on linguistic representation. The demands of letter fluency are to generate words from a phonemic category instead of from a semantic category which is more effortful because phonemic generation is not a common strategy in word retrieval, nor is there an obvious congruency with the organization of words in some representational system (Strauss et al, 2006).

Verbal fluency helps in understanding the development of categorization and semantic knowledge in children. Children exhibit different types of categorizations- based on taxonomic categorization, thematic categorization and script categorization (Nelson and Nelson, 1990). Clustering of words is a strategy that has been described for episodic memory retrieval, word association and fluency tasks. Semantic clusters consist of words with related meanings. Analysis of verbal fluency production by breaking the list into clusters of words that share similar properties can shed light on the ability of the participant to recall associated words and to switch to new categories when necessary. Because the clustering reflects both memory and organizational abilities, analysis of the cluster formation has been applied to various healthy and neurologically or psychiatrically impaired adult patients in order to further understand the nature of the cognitive impairment (Elvevag et. al, 2002).

Mathuranath et al (2010) conducted a study to examine the effects of age, education, and gender on the verbal fluency task of 153 cognitively unimpaired Malayalam-speaking older individuals. They concluded that level of education significantly affects letter fluency and age inversely affects category fluency.

John, Rajashekhar and Guddattu (2018) did a cross-sectional study to assess 2 semantic categories (food and vehicle) of verbal fluency on 1015 Malayalam-speaking school-going children between the age of 5 to 15 years which were divided into 5 groups. They reported that the total number of correct words produced increased with age, word output is relatively greater in the category of food than in the category of vehicle and they did not find any significant difference between the gender group. Cluster groups were also found in the food and vehicle fluency task with more clusters as the age advanced.

Nisha and Nataraje (2019), to find word fluency in terms of semantic fluency and phonemic fluency, selected 600 Malayalam- speaking TD children, aged 5 to 14-year-old and did a comparative study of phoneme /k/ and category animals across age and gender and the result showed that females performed better in both verbal fluency tasks and they indicated a statistically significant effect of age on word fluency.

## **I. NEED OF THE STUDY**

The process of how children organize semantic information and retrieve words (using qualitative analysis of clustering and switching) is still not clearly understood. Due to the differences in the development and maturation of semantic systems in children, a direct adaptation of adult data findings may not serve the purpose of understanding the developmental trend of verbal fluency in children. Understanding verbal fluency norms among TD children is paramount for the interpretation of verbal fluency among the disordered populations. Attempts were made in the past to understand verbal fluency in the Malayalam language but were limited. It is difficult to describe verbal fluency patterns in typically developing children. Hence to overcome the dearth of literature in this area Speech Language Pathologists (SLP) constantly need to translate data on verbal fluency output obtained from either Western countries or from children using other languages, which are inappropriate for evaluating Indian children. Linguistic factors (differences in word length, frequency of words/letters between languages), socio-cultural dissimilarity, extrinsic factors (differences in tasks) and developmental variations, prevent following a universal protocol of verbal fluency testing. Given the importance of aforesaid factors, the

use of demographically adjusted developmental data for Malayalam-speaking children is vital and preferred for its enhanced sensitivity to impairment.

In the wake of limited knowledge of verbal fluency performance in TD children which is highly language and culture-based, the present research findings would be helpful in understanding the developmental changes in the mechanism of word retrieval using different strategies during verbal fluency tasks.

### **AIM OF THE STUDY**

The aim of the present study was to analyse the performance in verbal fluency output on 6 selected semantic categories in TD Malayalam- English bilingual children attending lower primary school.

## **II. METHODOLOGY**

### **PARTICIPANTS**

In order to carry out the study, 36 children (both boys and girls) aged 8 to 10 years were selected from Government Higher Secondary School in Kulasekharapuram, Kollam district in Kerala. The selected participants are Malayalam- English bilinguals.

### **INCLUSION CRITERIA**

The participants were included in the study based on teachers' reports/school records. The candidacy filter was based on the following principles:

- Children between the age of 8 to 10 years.
- Currently in lower primary school.
- Bilingual children (Malayalam- English) with Malayalam as their first language.

### **EXCLUSION CRITERIA**

The exclusion was done based on direct observation, teachers' reports, school records, and parental information obtained through telephonic interviews.

- Children with a history of neurological disorders, developmental disorders, cognitive impairment, language difficulties, motor limitations, and visual/ hearing deficits.
- Children requiring special school placement.

### **PROCEDURE**

A pre-examination semi-structured interview was conducted to collect the demographic data (age, gender, education level, medical history, communication, psychiatric history, scholastic performance, and economic status) of each participant were studied.

Assessment of Language Development – A Manipal Manual (ALD- MM) is used to measure each child's receptive and expressive language skills. This study's task of verbal fluency was *semantic fluency/ category fluency*. The actual semantic fluency test was preceded by a practice trial in which the participants were asked to generate as many words as possible belonging to the category of *household items*, excluding names and proper nouns. If they had some difficulty, they were given cues by the examiner. The verbal fluency paradigm involved word generation on six categories of semantic fluency – common objects, kitchen items, vegetables, furniture, cloth and fruit fluency. These specific categories were chosen as they were concrete, rational, familiar, and known to children in the Indian context. The order of presentation was the same for all the participants. Flashcards containing the target category were presented and the subject is instructed to produce as many words (nouns excluding names and places) within the restricted time period (60 seconds). The children were instructed that they can use words from both Malayalam and English.

The scores were calculated based on the responses elicited within sixty seconds. The examiner alerted the participants by saying start. A stopwatch is used to track the time and recordings were done in PRAAT software in hp laptop using a Sony INZONE H9 headset.

For the analysis purpose, the Total Number of Correct Words (TNCW) is used - the total number of correct words produced during each type of fluency task was calculated by excluding Intrusions (words not an exemplar of the category), Perseverations (repetitions of any correct words already given as a response) and Morphological variants (example: bus, buses)

Score 1 was credited to the responses having a proper noun. Score 0 was credited to the responses lacking nouns. For the scoring purpose, the raw score of the total number of correct words obtained was retained, instead of being converted to percentage scores. This was done as the percentage of the correct words generated did not provide meaningful information on fluency performance compared to the reporting of the raw number of words generated (Troyer, 2000). For example, if the child says "cat, dog, cow, buffalo, ox, cat, lion", the total number of correct words was considered as six.

### STATISTICAL ANALYSIS

The collected data were summarized by using Descriptive Statistics: frequency, percentage, mean and standard deviation. The One way ANOVA was used to compare verbal fluency output between the age groups. In Post hoc analysis, the Tukey test was used for the multiple comparisons. The p-value < 0.05 was considered significant. Data were analyzed by using the SPSS software (SPSS Inc.; Chicago, IL) version 26.0.

### III. RESULT AND DISCUSSION

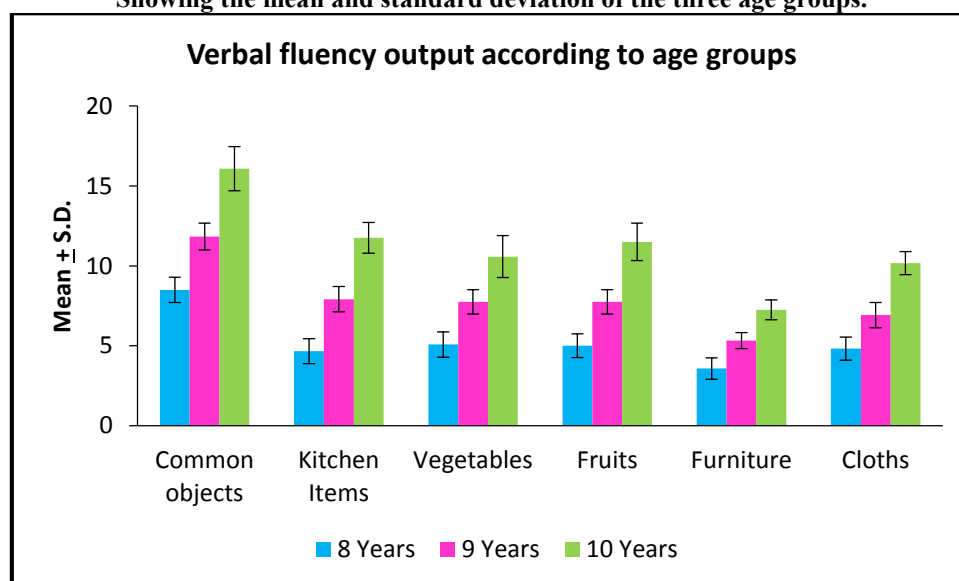
The present study was to analyse the performance in verbal fluency output on selected semantic categories in TD Malayalam- English bilingual children attending lower primary school.

**Table 1:**  
**Showing the Mean, Standard deviation, F and p value of performance in the verbal fluency task of 8year, 9year and 10 year old children.**

		Mean	S.D.	"F"	p value	Significance
Common objects	8 Years	8.5	0.8	160.78	< 0.001	S
	9 Years	11.8	0.8			
	10 Years	16.1	1.4			
Kitchen Items	8 Years	4.7	0.8	208.89	< 0.001	S
	9 Years	7.9	0.8			
	10 Years	11.8	1.0			
Vegetables	8 Years	5.1	0.8	93.37	< 0.001	S
	9 Years	7.8	0.8			
	10 Years	10.6	1.3			
Fruits	8 Years	5.0	0.7	154.71	< 0.001	S
	9 Years	7.8	0.8			
	10 Years	11.5	1.2			
Furniture	8 Years	3.6	0.7	112.56	< 0.001	S
	9 Years	5.3	0.5			
	10 Years	7.3	0.6			
Cloths	8 Years	4.8	0.7	156.76	< 0.001	S
	9 Years	6.9	0.8			
	10 Years	10.2	0.7			

("F" = One way ANOVA)

**Figure 1**  
Showing the mean and standard deviation of the three age groups.



From Table 1 and Figure 2, it is evident that children's performance of verbal fluency tasks increased as their age advanced from 8 to 10 years, hence significant statistical differences were noticed. The total word output was highest in the common object tasks, followed by kitchen items, fruits, vegetables then clothes and the least number of word outputs was for the furniture task.

#### IV. Discussion

The current study aimed to assess the verbal fluency output on 6 semantic categories in 36 Malayalam-English bilingual TD children between the ages of 8 to 10 years in three age groups. The verbal fluency paradigm involved 6 tasks of semantic category like common objects, kitchen items, vegetables, fruits, furniture and clothes. The Total Number of Correct Words (TNCW) was examined for each task in all children across the three age groups. The result of the present study suggests that as age advances, there is a gradual increase in the scores in all six semantic categories. The study also indicated the influence of task effect differences on children's performance as age advances. The results also revealed that in common objects, clusters of stationery items (e.g., eraser, sharpener, pen pencil, book, pencil box, etc) and in kitchen items, clusters of food and utensils (e.g., name of powdered spices) were used in all age groups which is in accordance with the study the previous study by John, Rajashekhar and Guddattu (2018).

#### V. CONCLUSION

The results of the performance on verbal fluency output on the six semantic categories in TD Malayalam-English children can be used as a baseline to compare the performance of disordered population of children with language impairment which will help in effective language assessment and better therapeutic management. Also, the current study findings provide strong support for the usefulness of verbal fluency tasks as a measure of semantic and executive functioning in children. Hence, to increase the usefulness of the verbal fluency measures in clinical and research settings and for a better understanding of verbal fluency development in Malayalam-English TD bilingual children, it is essential to create a culture and language-specific data for the fluency in Semantic Category.

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