

Exploring Socioeconomic Variations in Semantic Fluency Task Performance: A Cross-Sectional Study

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Abstract

Introduction: Category fluency task involves several cognitive processes like word retrieval, ideational skills, inhibitory control, working memory. In these tasks examinee are instructed to name as many words as possible within a specific category. **Objective:** To examine the difference between the performances of High socio-economic status (HSES) & Low socio-economic status (LSES) children on category fluency task in 8-9 years old typically developing Punjabi developing children. **Method:** Thirty, 8-9 years old children from each socio-economic strata (HSES and LSES) were considered for the study. Individuals with any linguistic, hearing, cognitive or visual deficit were excluded from the study. All the participants were instructed to produce word lexicon from specific category within 60 seconds. **Results:** Results showed that children with high socio-economic status performed superior as compared to LSES group in all the three tasks. Across the task, outcome revealed animal category scores were as compared to food category followed by vehicle. Though, no significant correlation was observed with respect to gender. **Conclusion:** Socio-economic status is having relevant impact on the performance of semantic fluency task. During evaluation process, the attribution of socio-economic status should be kept in mind.

Keywords: Verbal fluency, Semantic fluency, High socio-economic status, Low socio-economic status, Working memory, Linguistic skills

Introduction

Verbal fluency is defined as ability of a person to produce words in a rapid manner with a specific letter or category. Prigatano quoted Baron work in his research

explained that in verbal fluency task, apart from verbal communication and ideational skills, working memory is also involved as participants are instructed not to repeat the previous stated word which occurs due to process of response inhibition (suppression of actions that are inappropriate in given context) (Prigatano et al., 2008). Semantic fluency/ category fluency is one of the subtypes of verbal fluency which is assessed by asking the individual to produce name of species or things from specific category. Najoung Kim discusses Maseda and Mioshi work in his research and mentions that semantic verbal task is sensitive to alteration in semantic memory and executive function (cognitive flexibility) (Kim et al., 2019).

Semantic fluency task has been found to be affected by number of factors which includes age, educational experience, race, knowledge of vocabulary, gender (Crossley et al., 1997; Tomer & Levin, 1993; Bolla et al., 1998; Johnson-Selfridge et al., 1998). According to Hackman et al. (2010) and Piccolo et al. (2014), SES contributes to performance on neuropsychological system particularly on selective attention, executive function, linguistic (oral and written skills) and decision making function, though impact of SES on semantic fluency has never been studied.

Method

• Participants

Cross-sectional study was done on two groups, where each group consisted of 30 students based on low and high socio-economic background. Students with age range of 8-9 years with Punjabi as their native language were considered for the study. All students were typically developing with no history of hearing, visual, cognitive, motor, speech and language deficit. Also, those who possessed emotional disturbances, learning problems or who were not able to follow the instructions were excluded from the study. All the information was collected from school records and teacher's interview and SES of children was based on National Institute for the Mentally Handicapped (N.I.M.H) socio-economic status scale.

• Procedure

Three tasks of semantic fluency (animal, food items and vehicle) were considered for the study. Students were instructed to produce as many words as they could of specific category within 60 seconds. Data was collected in a quiet, non-distractive room. Before actual data collection, a trial session was done in which students were guided about the time limitation and retrieval of information on specific category. Responses were recorded on tape recorder for off line analysis. Recall accuracy for each item was also recorded on a response sheet at the time of the test and each correct word was scored as one.

Statistical methods

Statistical software, STATA/SE version 14.2 (StataCorp LP, College Station, TX, USA), was used for the analysis. Each of the categorical variables was described in terms of

frequency and percentage, while continuous variable was presented as mean (standard deviation) and median (range). Comparison of semantic fluency between two groups was analysed using T test. For all statistical tests, a p-value of less than 0.05 was considered as statistically significant.

Results

Sixty students of 8-9 years of age were assessed on category fluency task in which 30 were from Low Socio-economic status (LSES) [16 males (53.33%), 14 females (46.67%)] and other 30 belonged to High Socio-economic Status HSES background [19 males (63.33%), 11 females (36.67%)].

Performance of category fluency task among LSES children

Across the task: Comparison between three different task of semantic fluency test revealed that mean(SD) scores for food were 8.5(2.73), for vehicle- 7.87(1.58) and for animal category scores were 8.68(1.40). Max scores were obtained for animal category followed by food and minimum scores were for vehicle category.

Among LSES children, maximum word span was 13 and minimum was 5 for food whereas maximum word span for vehicle and animal were 11 and 11 respectively and minimum word span were 4 and 6 respectively as shown in Table 1.

Table 1. Qualitative variables of HSES & LSES across the task on semantic fluency task

	Food		Vehicle		Animal		Total	
	HSES (n=30)	LSES (n=30)	HSES (n=30)	LSES (n=30)	HSES (n=30)	LSES (n=30)	HSES (n=30)	LSES (n=30)
Mean	11.66	8.26	11.03	7.56	12.03	8.5	34.73	24.33
SD	2.96	2.43	2.18	1.47	2.90	1.67	6.30	4.12
Median	12	8	11	8	12.5	9	33	24.5
Min	7	5	8	4	7	6	25	16
Max	16	13	16	11	16	11	48	32

Across the gender: Another comparison was based on gender. Mean(SD) scores for males for these three categories i.e. food, animal and vehicle were 8.5(2.73), 7.87(1.58) and 8.68(1.40) respectively. Whereas for females, mean(SD) scores were 8(2.11) for food, 7.21(1.31) for vehicles and 8.28(1.97) for animal as shown in Table 2. Results

indicated that that no significant difference was observed with respect to gender in any of the three categories ($p = 0.5837$) for food, ($p = 0.2281$) for vehicle, ($p = 0.5221$) for animal and ($p = 0.3085$) for overall semantic fluency scores

Table 2: Qualitative measures of LSES group across the gender on semantic fluency task

Low socio-economic status (LSES) children								
	Food		Vehicle		Animal		Total	
	M (n=16) (53.33%)	F (n=14) (46.67%)	M (n=16) (53.33%)	F (n=14) (46.67%)	M (n=16) (53.33%)	F (n=14) (46.67%)	M (n=16) (53.33%)	F (n=14) (46.67%)
Mean	8.5	8	7.87	7.21	8.68	8.28	25.06	23.5
SD	2.73	2.11	1.58	1.31	1.40	1.97	4.00	4.23
Median	8	8.5	8	7	9	8	25	23.5
Min	5	5	5	4	6	6	17	16
Max	13	12	11	9	10	11	32	30

Performance of category fluency task among HSES children

Similar to LSES group, comparison between HSES children was also done on the basis of inter-categorical relation and gender.

Across the task: In group two, again comparison among 3 different tasks (animal, vehicle & food items) was done. Outcome of mean(SD) scores for food were 11.66(2.96), for vehicle-11.03(2.18) and for animal scores were 12.03(2.90). Best scores were shown for animal than for food and worse for vehicle category as illustrated in Table 1.

Among HSES children, maximum word span was 16 and minimum was 7 for food whereas maximum word span for vehicle and animal were 16 and 16 respectively and minimum word span are 8 and 7 respectively as shown in Table 1.

Across the gender: Other comparison was done on the basis of gender in which mean(SD) scores for male among three categories were 11.31(2.60) for food, for vehicle-

10.68(2.16) & for animals 12.26(2.62). Whereas, mean (SD) scores for females were 12.27(3.55) for food, 11.63(2.20) for vehicle and 11.63 (3.44)for animal category as shown in Table 3. Comparison showed no significant correlation between males and females ($p = 0.4035$) for food, ($p = 0.2580$) for vehicle, ($p = 0.5783$) for animal and ($p = 0.6004$) for overall semantic fluency scores.

Table 3: Qualitative measures of HSES group across the gender on semantic fluency task

High socio-economic status (HSES) children								
	Food		Vehicle		Animal		Total	
	M (n=16) (53.33%)	F (n=14) (46.67%)	M (n=16) (53.33%)	F (n=14) (46.67%)	M (n=16) (53.33%)	F (n=14) (46.67%)	M (n=16) (53.33%)	F (n=14) (46.67%)
Mean	11.31	12.27	10.68	11.63	12.26	11.63	34.26	34.54
SD	2.60	3.55	2.16	2.20	2.62	3.44	5.62	7.56
Median	11	13	10	12	13	11	33	34
Min	7	7	8	8	7	7	27	25
Max	16	16	16	16	16	16	48	47

Performance of category fluency task among low and high socioeconomic strata

Comparison was done between these two SES groups on the bases of aforesaid outcomes. It was observed that overall and individual scores of all the categories were better for HSES group. And, p value for all three categories and overall scores ($p=0.0000$) indicates significant difference between HSES & LSES groups.

Discussion

The present study conducted analysis on retrieval of information in semantic ability under three categories. In literature, different researchers have used different combination of categories i.e animal, fruits, vegetables, vehicles, supermarket and occupation (Kempler et al., 1998; Huff et al., 1986; Mattis, 1988; Bolla et al., 1998).

Categories used in the present study were animal, food items and vehicles which would be appropriate for children of 8-9 years of age. Our mean (SD) scores for HSES group were 8.26(2.43) for food, 7.56(1.47) for vehicle and 8.5(1.67) for animal while mean(SD) scores for LSES group were 11.66(2.96) for food, 11.03(2.18) for vehicle and 12.03(2.90) for animal. Study by Acevedo et al.(1999) has documented similar findings where they recognized higher scores for animal category followed by food items which included fruits & vegetables. In Acevedo study, scores for 50-59 years old group of English speakers were 18.4(4.9), 16.0(4.1) & 16.0(4.1) for animals, vegetables and fruits categories respectively. In another study, results indicated that animal category yielded higher score than fruits and vegetables followed by vehicle for 18-30 years old normal population, mean(SD) scores computed in the mentioned study were 24.8(5.2), 23.2(4.5) and 15.1(3.4) for animal, fruit/vegetable and vehicle category respectively (Kave, 2005). In Brazilian study, scores for animal, fruit and clothes category for 8 and 9 year children were 11.0 (2.52), 8.86 (2.32), 7.89 (2.9) and 10.79 (2.73), 9.21 (2.43), 8.54(2.95) respectively (Leite et al., 2016). Above studies indicated that least scores were observed for children followed by older group (50-59 years) and maximum scores were obtained for younger adults (18-30 years)

Semantic fluency task has been found to be affected by gender, race or ethnicity (Anderson et al., 2001; Else- Quest et al., 2010). Few studies yielded female superiority in semantic fluency task (Acvado et al., 2000; Anderson et al., 2001; Else- Quest et al., 2010). Other researchers concluded male scores higher in spatial and mathematics task (which are part of cognition) while female scores higher in verbal task (Else- Quuest et al., 2010; Kimura et al, 1984; Levin et al., 2016). Though, contrary to this, in consonance to our study, there have been studies which showed no significant relation between males and females on bases of semantic fluency task (Brucki& Rocha, 2004; Brickman et al., 2005)

Semantic fluency task mainly asses uprightness of linguistic and semantic memory and it is an important measure for assessment of neuropsychological function (Brucki& Rocha, 2004; Ruff et al., 1997), thus these aspects are indirect ways to assess semantic fluency. Studies have revealed that the largest effect of SES have been seen on language processing and moderate effect on executive function and cognitive flexibility (Farah et al., 2006; Kishiyama et al., 2009). Present study has correspondingly indicated the effect of SES on semantic fluency in all the three categories of food, animals and vehicles. Though, impact of SES on semantic fluency has not been assessed directly in literature, however, its domains have been evaluated to check its influence on SES. Hurks et al.(2006)and Noble et al.(2005) suggests that language aspect and executive functioning are highly affected in low socio-economic status children. Prigatano (2008) quoted review of Ardila and Rossellisuggested that children from low socio-economic background performed poorer on cognitive task because they have less qualified teachers, usually placed in large classes and have poor library facilities which lead to poor educational experience. Studies which have shown

the association between SES and executive function revealed that results rely on academic achievement and measures of adult health (Blair & Rozza, 2007; Cohen et al., 2010). Also, poor working memory have been seen in LSES population because of their reduced complex working span, though LSES people have equivalent procedural memory (subset of implicit memory referred as unconscious or automatic memory) as HSES adolescents (Leonard et al., 2015). Contrary to this, Engel et al., 2008 and Miranda et al., 2007 found no effect of SES on working memory (Engel et al., 2008).

The study showed the impact of SES on category fluency and cut-off values obtained here are relevant as refined data on the basis of SES has been found for 8-9 years old children and it can be used clinically. Though, study came out with very conclusive remarks, it has few limitations also. Study didn't focus on switching (ability to switch to different clusters of a category) and clustering (refers to production of words within specific subcategory) process of semantic fluency task. Also, formal evaluation methods for exclusion criteria and large sample size could have given more appropriate results.

Conclusion

Study assessed the influence of SES on category fluency task. Results revealed significant difference between HSES & LSES children for food, vehicle and animal categories but no significant difference was observed with respect to gender. Present study provides raw scores of Punjabi speakers on semantic fluency task. These normative scores from the task can be used in pre & post intervention evaluation of cognitive and verbal communication abilities. Scores are also helpful with younger and non-cooperative children in clinical setting as it's an easy, quick, feasible and effective method.

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