Designing and standardization of Persian version of verbal fluency test among Iranian bilingual (Turkish-Persian) adolescents

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Original Article

Abstract

BACKGROUND: The present study aims to design and standardize the verbal fluency test (VFT) among bilingual (Turkish-Persian) adolescents in Tabriz, Iran.

METHODS: In the designing stage, 190 adolescents who were already selected randomly from among the guidance and high school students in Tabriz were classified into three age groups (11-12, 13-15, 16-18). The screening test including 33 Persian letters and three 'animal', 'fruit', and 'supermarket stuff' categories, and SDQ was administered to them. The results were the three letters 'M', 'D', and 'B' for phonological fluency, and two 'animal' and 'supermarket stuff' categories for semantic fluency in the Persian language. In the standardization stage, the letters and categories specified in the designing stage were administered in the same order to 302 adolescents. Moreover, 28 adolescents diagnosed with ADHD were selected to estimate the discriminant validity of VFT.

RESULTS: Pearson correlation coefficient between test-retest of the three letters 'M', 'D', and 'B' for phonological fluency were estimated at 0.67, 0.66, and 0.75, respectively. Furthermore, for the two categories of 'animal' and 'supermarket stuff' it was estimated to be 0.80 and 0.65, respectively. All these amounts were significant ($P < 0.01$). The discriminant validity, which was estimated through comparison between the scores of normal and ADHD adolescents, showed that the obtained t value for all indices except for the letter 'B' was meaningful. The results of MANOVA between two gender groups were significant at $P < 0.05$ for three 'M', 'D', and 'B' variables of verbal fluency and 'animal' semantic fluency. In both verbal and semantic fluency the mean of subjects' performance scores showed that females outperformed males.

CONCLUSIONS: The findings of the current study indicated that VFT is reliable in the studied sample group, and has a valid psychometric property in discrimination between ADHD adolescents and normal adolescents. Furthermore, age and sex could affect VFT performance.

KEYWORDS: Verbal fluency test, Reliability, Validity, Adolescent, Bilingual

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Introduction

Verbal fluency test (VFT) is an instrument, which is often used to estimate cognitive flexibility and strategic search after brain damage, and mainly to evaluate cognitive functions.[1] This instrument is highly sensitive to the various types of cognitive deficits.[2] Verbal fluency

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test depends on several executive functions, and usually includes phonological fluency measurement (vocabulary fluency) and semantic fluency (categorical fluency).[3] To evaluate vocabulary fluency, the testee is asked to utter any number of words that initiate with a certain letter in a specified and limited amount of time. To measure semantic fluency, the subjects should produce names which belong to a particular category.[4]

The allocated time for each part of the test is often one minute. Psychometrically, VFT is used to investigate different cognitive processes; for example, verbal knowledge, access to semantic memory, long-term verbal memory, attention, information processing speed, the amount of vocabulary, working memory, the prevention of irrelevant vocabulary, and executive functions.[5-7] The decrease in verbal fluency performance is associated with different pathological conditions; such as, Schizophrenia, Alzheimer, Multiple Sclerosis, and Attention-deficit/Hyperactivity disorder.[8-11]

Word clustering is a significant method of retrieving personal memory, association of vocabulary, and verbal fluency task.[3] The classification process includes a constant search for relevant terms, retrieving items from category, and then switching the retrieved items from one cluster to another.[3] The clustering process requires a successive search for the relevant vocabularies. Vocabulary is retrieved from clusters, and when the retrieval is insufficient they are changed into a new cluster. It is believed that semantic categories are mainly automatic and based on typical classification rules (such as wild, farm, and domestic animals), whereas phonological grouping is difficult and based on the performance of the frontal lobe.[12]

A study by Troyer et al. suggested that optimum fluency is based on two types of abilities; the ability to create categories, and ability to switch to other categories. The former refers to the ability to produce words that belong to semantic/phonology sub-categories. It also depends on verbal memory and vocabulary storage which are associated with the temporal lobe. The ability to change categories or to switch from one to another includes cognitive processes such as strategic search, cognitive flexibility, and the change of process which pertain to the frontal lobe.[13]

Rosen and Engel suggested that in accomplishing verbal fluency tasks, four factors are involved. These factors consist of 1) expanded, scattered, and automatic activation from the time of receiving the sign or clue until retrieving the relevant items, 2) supervising and monitoring the produced items in order to prevent errors (especially repetitive errors), 3) discontinue using previously recalled items, and 4) self-generating class markers in order to access new items. They proved that these retrieval factors represent the reciprocal dynamic relationship between automatic search and strategic components accomplished by frontal and middle temporal regions, respectively. This factorial framework shows that in the VFT, in addition to the sign sampling and item sampling stages, such factors as supervision and prevention are likely significant.[14]

Similar to many cognitive tasks, the arguments show that a successful performance of verbal fluency tasks depends on some processes, each of which pertains to a different neural substrate and might include individual differences. In addition to differences in individual abilities of verbal production, language and cultural differences also affect the performance of the verbal fluency test. Thus, to make a meaningful use of these tests, the availability of suitable normative data is crucial. Various studies have provided normative data for VFT among English speakers.[7]

However, owing to the effect of language factors on VFT performance, these norms are not applicable to the speakers of other languages.[15] For instance, in semantic verbal fluency, Kempler et al. found that Spanish

speakers have low production in animal verbal fluency compared with Chinese and English speakers, whereas Vietnamese speakers had higher animal verbal fluency.[2] Scientists attribute these differences to the length of animal names. In other words, animal names are long in Spanish, while in Vietnamese they are short. Study on phonological verbal fluency shows that the difference among produced words in a certain language depends on the number of words that initiate with a certain letter in that language. For example, Spanish speakers produce less words with 'F', 'A', and 'S', than English speakers, because these letters are less common in Spanish than in English.[16]

Ostrosky-Solis et al. in their study investigated the effects of age, education, and culture on semantic fluency and referred to bilingualism as an effective factor on intercultural variations.[17] The results of a few recent studies on verbal fluency among bilingual and monolingual speakers are controversial. A study by Gollan et al. on verbal fluency among Spanish-English bilinguals, and monolingual Spanish and English speakers indicated that bilinguals get lower scores in vocabulary and semantic fluency tests compared to monolinguals. However, the difference was greater between bilinguals and monolinguals in terms of semantic fluency.[18]

What has been ignored in these studies is that the patterns of letters and categories in monolingual communities may vary from the ones in bilingual communities. Thus, it seems that the instruments which are designed and normalized for monolingual speakers cannot be appropriate for bilingual speakers. Bearing in mind that the Iranian population is comprised of monolinguals, bilinguals, and multilinguals, the age of starting to speak a second language varies among different subcultures. This difference may affect verbal fluency. Therefore, it is necessary to identify the letter and category patterns among bilingual and multilingual speakers so that these groups are compared accordingly. According to the above-mentioned issues, the present study aims to specify an appropriate pattern for word and semantic fluency, investigate the psychiatric features of that pattern, and detect the effects of age and gender variables on verbal and semantic fluency.

Methods

1. Participants and Sampling

This study is a descriptive study aiming to design and normalize VFT. The population comprised of 11-18 year old bilingual (Turkish-Persian) adolescents from Tabriz who could read and write. The study was carried out in two stages. In the first stage, the focus was on designing a test. The sample constituted of 190 individuals from three different age groups (11-12, 13-15, and 16-18). This age categorization was due to assessing the impact of age variations on VFT and based on different developmental characteristics of adolescents in early, middle, and late adolescence.

In the second stage (i.e., standardization stage), 302 adolescents were classified into three similar age groups. To determine the discriminant validity of the test, 28 adolescents afflicted with attention-deficit/hyperactivity disorder (7 girls and 21 boys, with the mean age of 13.2) were selected and tested. They were screened using the Strengths and Difficulties Questionnaire (SDQ) in the first stage. Those adolescents, whose scores in hyperactivity subscale were higher than cut-off point, were interviewed clinically to ensure that they meet diagnostic criteria.

In both stages, there was cluster sampling in the first step and stratified random sampling in the last step. In the designing stage, three districts from among the five education and training districts in Tabriz, Iran, were chosen randomly. In each district, two junior high schools (one for boys and one for girls; the educational system in Iran at elementary, junior high

school, and high school levels is based on the segregated system) and two high schools (one for boys and one for girls), and at least 15 students from different grades in each school were selected. Likewise, in the normalization stage, a similar procedure was followed. The only difference was that at least 25 students were selected from different grades in each school.

2. Instruments

Persian version of VFT

The latest edition of the Persian VFT which has been copied using FAS and COWA constitutes letter fluency and category fluency. Letter fluency includes three one-minute attempts and category fluency includes two one-minute attempts, five one-minute attempts in total.

To test the subject's letter fluency, a Persian letter was presented to the subject and he/she should utter as many words as possible that initiate with that letter in one minute (words such as proper nouns, famous names, various derivations of a word, and numbers were not acceptable). For example, if the examiner uttered the letter 'S', the subject could say 'sabad' (basket), 'sahel' (seaside) and 'sozan' (needle), but she/he was not allowed to produce such words as 'Sarah' (a female proper noun), 'Saied' (a male proper noun) and 'Sari' (the name of a city). In addition, she/he could neither use synonyms nor similar words. For example, two final letters of the words 'sokhtam' (I burnt myself), 'sokhti' (are you burnt), and 'sokhtand' (they burnt themselves), and numbers like 'see' (thirty) and 'sizdah' (thirteen) are not considered as correct answers.

In the category fluency stage, the subject was presented with a name of category or a concept and she/he had to produce words that were semantically or typologically related to each other in just one minute. For example, if the examiner said 'animal', the subject had to produce words like 'asb' (horse), 'gousfand' (sheep) and 'shir' (lion).

Strengths and Difficulties Questionnaire (SQD)

The SQD is a sort of screening tool used to diagnose children's emotional and behavioral disorders. It comprises 25 items that estimate psychiatric symptoms in five subscales including; conduct problems, hyperactivity, emotional symptoms, peer relationship problems, and prosocial behavior. The impact score indicates the severity of the disorder and shows if it causes any problems in the daily or family life of individuals. This questionnaire has three versions of parent, teacher, and self-report. In this study the self-report version was used. Tehrani Doust et al. showed good psychometric properties for SDQ in the evaluation of Iranian children's psychiatric disorders.[19]

3. Procedure

The current study followed the following procedure to fulfill the proposed objectives. In the designing stage, 190 adolescents of 11-12, 13-15, and 16-18 years of age were selected from districts 1, 3, and 5. The testing materials constituted 33 Persian letters, three 'animal', 'fruit', and 'supermarket stuff' categories, and the SDQ test. Each age group comprised 60 students (30 boys and 30 girls). In the normalization stage, 302 students of similar age groups were selected from districts 2, 4, and 5. The test materials included three letters (specified in the designing stage) for letter fluency ('M', 'D', and 'B'), two categories for semantic fluency ('animal' and 'supermarket stuff'), and the SDQ test. Given that the selected sample population consisted of students from different schools, the educational level of two gender groups in each age group was similar.

Inclusion /Exclusion Criteria

Having a minimum level of literacy (to be able to read and write), being bilingual (Turkish- Persian), belonging to 11-18 age range, completion of a consent form by the participants' parents were among the criteria observed for sample selection.

Bearing in mind that any psychiatric disorder can affect the individual's verbal fluency performance, those adolescents who were diagnosed as sufferers of psychiatric symptoms using SDQ (those with scores higher than cut-off points in each subscale) were excluded from the study. In addition, history of neurological disorders such as brain injury, epilepsy, and head trauma, and also drug abuse were among the exclusion criteria.

4. Data Analysis

SPSS for Windows (SPSS Inc., Chicago, IL., USA) was used to analyze students' scores after coding and eliminating the likely errors. Pearson correlation coefficient (test-retest method was used to measure the reliability of the test), independent t-test (to estimate discriminant validity), and MANOVA and follow up Tukey Test (to compare the normal variables among different age and gender groups) were used to analyze the data.

Results

Given that the present study was carried out in two stages, the obtained results for each stage are presented separately. In the designing stage, 190 adolescents (94 men and 96 women) with the mean age of 14.63 ± 3.08, and mean education level of 9.91 ± 2.31) participated in the study. The results of presenting 33 Persian letters and three 'animal', 'fruit', and 'supermarket stuff' categories for bilingual (Turkish-Persian) adolescents of 11-18 years of age are illustrated in table 1.

In the normalization stage, 302 (151 men and 151 women) bilingual (Persian-Turkish) adolescents of 11-18 years of age were selected as the samples of study. The estimated mean age was 14.44 ± 2.76 and the mean of educational level was estimated at 8.82 ± 2.56. In order to compare the normal criteria of VFT among the three age groups, MANOVA was used. Given that Wilks' lambda index of MANOVA is meaningful at $P < 0.001$, and $F = 2.55$, the general effect of age factor on the criteria becomes clear. Thus, inter-subject effect test was used, the results of which are presented in table 2.

As illustrated in table 2, there is a meaningful difference among the three age groups in terms of VFT criteria except for 'animal' semantic fluency.

Tukey's follow-up test was used to identify the source of the variation, the results of which are presented in table 3.

As table 3 shows, there is a significant difference between the highest and lowest age groups in all phonological verbal fluency and category fluency (supermarket stuff) criteria. In most of the cases the difference between two neighbor age groups is not

Table 1. Mean and standard deviation of phonological and semantic fluency

	Phonological fluency			Semantic fluency	
	M	D	B	Animal	Supermarket stuff
Mean ± SD	9.68 ± 2.55	9.34 ± 2.81	9.20 ± 3.17	14.76 ± 3.77	13.57 ± 3.51

Table 2. Inter-subject effect of verbal and semantic fluency indices

Source of changes	Dependent variables	Sum of squares	df	Mean of squares	F
Age group	M	100.33	2	50.16	7.23**
	D	37.45	2	18.72	3.78*
	B	71.22	2	35.61	5.82**
	Animal	47.00	2	23.50	2.64
	Supermarket stuff	91.04	2	45.52	3.74*
Error	M	2141.76	300	7.13	_
	D	1492.46	300	4.97	_
	B	1863.02	300	6.21	_
	Animal	2667.89	300	8.89	_
	Supermarket stuff	3701.00	300	12.33	_

*P < 0.05 **P < 0.001

Table 3. Outcome of Tukey Post-hoc test

Source of changes	Dependent variable	Sum of squares	df	Mean of squares	F
Gender	M	33.11	1	33.11	6.63*
	D	23.92	1	23.92	4.80*
	B	35.81	1	35.81	5.76*
	Animal	35.81	1	35.81	5.76*
	Supermarket stuff	27.42	1	27.42	2.22
Error	M	2141.76	300	7.13	
	D	1492.46	300	4.97	
	B	1863.02	300	6.21	
	Animal	2667.89	300	8.89	
	Supermarket stuff	3701.25	300	12.33	

*P < 0.05

meaningful, which indicates a mild increase in performance between the highest and lowest age groups.

To investigate the role of gender on performance, MANOVA was used, the results of which show the meaningfulness of Wilks' lambda index (P < 0.049, F = 2.25), which in turn indicates that VFT indices are meaningful between the two gender groups. For further study on the relationship between gender and test performance, the inter-subject effect test was used, the results of which are presented in table 4.

As illustrated in table 4, all VFT criteria between two gender groups are meaningful at P < 0.05 except for 'supermarket stuff' semantic fluency. Furthermore, in both verbal and semantic fluency, females outperformed males in the test.

To estimate the validity, discriminant validity method was used. 28 adolescents who were diagnosed as ADHD were selected and VFT was administered to them, then they were compared with 28 normal adolescents. The two groups were matched in terms of gender, age, and educational level. Independent t-test was used to compare subjects' performance on three letters for verbal fluency and two classes for semantic fluency, the results of which are shown in table 5.

As shown in table 5, there is a significant difference between the performance of the normal group and the ADHD group in terms of two 'M' and 'D' letters for verbal fluency and two 'animal' and 'supermarket stuff' categories for semantic fluency. Taking the mean into account, the higher mean in all variables belongs to the normal group.

In other words, ADHD adolescents in both verbal and semantic fluency uttered less correct words in the specified time (1 minute) compared to the normal group. Test–retest method was used to estimate the reliability of VFT. Thus, two weeks after administering the test in the normalization stage, 30 subjects were selected randomly from among the

Table 4. Inter-subject effect on verbal and semantic fluency regarding the gender variable

Source of changes	Dependent variable	Sum of squares	df	Mean of squares	F
Gender	M	33.11	1	33.11	6.63*
	D	23.92	1	23.92	4.80*
	B	35.81	1	35.81	5.76*
	Animal	35.81	1	35.81	5.76*
	Supermarket stuff	27.42	1	27.42	2.22
Error	M	2141.76	300	7.13	_
	D	1492.46	300	4.97	_
	B	1863.02	300	6.21	_
	Animal	2667.89	300	8.89	_
	Supermarket stuff	3701.25	300	12.33	_

*P < 0.05

Table 5. Comparison of mean of normal and ADHD groups by Student's t-test

variable	Group	No. of testees	Mean ± SD	F	df	P
M	Normal	28	8.89 ± 2.99	2.61	54	0.012
	ADHD*	28	6.85 ± 2.82			
D	Normal	28	8.57 ± 2.42	2.14	54	0.037
	ADHD	28	7.21 ± 2.31			
B	Normal	28	8.00 ± 2.16	1.76	54	0.084
	ADHD	28	6.92 ± 2.38			
Animal	Normal	28	23.25 ± 2.57	3.17	54	0.003
	ADHD	28	10.92 ± 2.89			
Supermarket stuff	Normal	28	10.75 ± 3.05	2.46	54	0.016
	ADHD	28	8.64 ± 3.26			

*ADHD: Attention deficit hyperactivity disorder

participants and verbal and semantic fluency tests were administered. Pearson correlation coefficient between two sets of test scores was computed and the results showed 0.67, 0.66, and 0.75 for the three letters of 'M', 'D', and 'B' in phonological verbal fluency, and 0.80, and 0.65 for semantic fluency, respectively. All the obtained scores were meaningful at $P < 0.01$, which indicates the validity of the test. The highest and lowest reliability pertains to semantic fluency in 'animal' and 'supermarket stuff' categories which were estimated at 0.80 and 0.65, repectively.

Discussion

The current study aimed to design and normalize verbal fluency test for bilingual (Turkish-Persian) adolescents. It was carried out in two stages. The sum of attempts per individual in the designing stage included 36 one-minute attempts in which 33 cases pertained to alphabetic letters and three cases were related to categories. The recorded time for VFT administration, which was accompanied by interview and SDQ, was one hour. Taking the context into consideration, some deletion criteria were: proper and famous names, synonym and similar words, and numbers and digits. Logically, for verbal fluency in letter production more deletion criteria could be proposed; however, owing to likely problems during test administration process, we focused on just the three aforementioned groups. For example, there is a group of non-Persian words (borrowed from English, Arabic, and Turkish) that are common in different accents of Persian (video from English, 'dolme' (a kind of food) from Turkish). The three letters of 'M', 'D', and 'B' were the results of the designing stage which was quite different from the variables in the English version of phonological fluency test in which the three letters 'F', 'A', and 'S' were identified.[7] Unfortunately, no documented study in Persian was available in order to compare its findings with the results of the present study. According to the findings, the observed individual differences in verbal production are interpretable and justifiable on the basis of psychological and neuropsychological differences among different individuals. In addition, language and cultural backgrounds can affect performance in the verbal fluency test. As previously mentioned, the studies on phonological verbal fluency show that the difference in word production depends on a number of words initiated with a certain letter in that specific language.[16] Thus, the fact that language differences in producing proper letters, which could be used as verbal fluency task, depends on the language, cultural, and geographical backgrounds is fairly acceptable.

The considerations observed for the category fluency subtest mainly pertains to the meaning of the words and the similarities and differences between synonymous and relevant terms. Given that the present study made use of three categories of 'animal',

'fruit', and 'supermarket stuff', some specific considerations were taken into account.

Animal category

In this study the animal category encompasses all animal categories and insects. In the Persian language, some animal names are compound words; for example, 'marmahi' (sea snake), mar (snake) + mahi (fish). In such cases, the compound name and its components was acceptable.

Fruit category

Semantically, in some cases, this category overlaps with the vegetable category. For example, 'tomato' could be used mistakenly as a fruit. In the present study, public treatment of an item as a fruit was the criteria to be accepted as the correct answer.

Supermarket stuff category

The most important point in this category was to classify the related items under one semantic subgroup. For example, after using the word 'stationary', the subject could name stationary objects such as pen, pencil, and etcetera. In such cases, the subcategory 'stationary' was deleted but all called items which belonged to that specific subcategory were accepted.

Generally, in this study two 'animal' and 'supermarket stuff' categories were used as semantic categories. Different studies have focused on different categories because of cultural conditions and research observations. For example, Ito and Hatta considered 'job', 'sport' and 'animal' as semantic categories in their study.[20] However, Ostrosky-Solis et al. focused on 'animal'[17], and Unsworth et al. studied 'animal' and 'supermarket stuff'.[21] Furthermore, language and culture variables affect word production and performance.[2,15] Thus, the results of different studies from various language and cultural backgrounds are less comparable. In selecting proper categories for semantic fluency from among the existing categories, there are fairly big differences among different languages. While in a language a certain category, due to high word production, is used as an evaluation tool, in other languages/cultures this category may be less productive because of geographical and cultural conditions and the length of words in that certain category which constrains the rate of word production in the allocated time limit.

To estimate the validity of VFT, different methods were used the most common one was the discriminant validity, the results of which show that VFT is a suitable task to distinguish attention-deficit/ hyperactivity from normal children. In other words, discriminant validity of VFT is at an acceptance level. The verbal fluency is not only used to measure language performance, but it could also be used to evaluate the executive function, the deficit of which is the symptom of ADHD.[22] As the results of this study show, ADHD children suffer from verbal performance disorder and it is more noticeable in their semantic fluency. The results of the current study support the finding of the experiment by Schecklmann et al[11]. Their experiment proved the low rate of verbal fluency for these groups. According to Lipowska et al., verbal ability of ADHD children is lower than normal control group, and ADHD children have many problems in accomplishing verbal fluency tasks and in comprehending a complicated speech. It seems that the results of neuropsychological evaluations and information obtained via neural scan can explain the malfunction of ADHD children's forehead region and their verbal fluency problems.[22]

The findings of this study show that correlation coefficient between test-retest scores was high for all verbal and semantic fluency variables. This indicates the high reliability of VFT for bilingual (Turkish-Persian) adolescents. The results are consistent with the findings of the studies that report an acceptable reliability of VFT for children and adolescents. The reliability of test-retest with an 11-month time interval and

using 'three words replacement' was recorded as high and acceptable (r = 0.72).[7] Ito and Hatta investigated the reliability of letter fluency using test-retest method on 310 adults for one year. The results of their study showed high and meaningful correlation (P < 0.001, r = 0.77) between two sets of scores. They, also explored the reliability of category fluency (job, sport, and animal) on 68 normal adults for one year, the results of which showed an acceptable reliability (P < 0.001, r = 0.87).[20] In a similar way, Delis et al. reported a high reliability of VFT using test-retest method (r = 0.90).[23]

The results showed that gender influences all 'letter' fluency tests and 'animal' semantic fluency variables at P < 0.05 level; females outperformed males in all variables. These results support Kimura's findings. In his study, women's repetition speed of phonemic clustering was reported to be higher than men.[24] However, other studies on children and adolescents did not report similar differences between two gender groups.[25,26] Other studies show either insignificant differences between two gender groups[27] or if there is any difference, it is unnoticeable. For example, Prigatano et al. reported that only 1.5% of verbal fluency performance variance is due to gender.[28]

The effect of gender on fluency test performance is unclear. Ardila et al. noticed that gender difference affects fluency performance. However, the orientation of effect depends on the test type. In other words, the verbal fluency performance of boys is higher than girls, whereas in design fluency the results are vice versa.[29] This is contrary to the findings of the present study. In line with the findings of this study, some studies reported girls' relatively high performance of vocabulary fluency and fruit semantic fluency.[30,31] The results of the study by Van der Elst on the relationship between gender and animal semantic fluency and design fluency showed that gender has no effect on performance.[15]

According to the results of the present study, there is a significant difference among different age groups in terms of their verbal fluency performance. Moreover, the difference in all 'letter' fluency variables is more noticeable for age groups of 11-12 and 15-18 years. Regarding semantic fluency of 'supermarket stuff' category, a similar pattern was observed which supports the findings of Kave et al.[32] They showed that the total number of produced items increases between 8-17 years of age. However, studies by Sauzeon et al., and Anderson et al. concluded that verbal fluency develops during childhood and adolescence which is similar to adults. They also stated that verbal fluency production from 6-11 years of age increases and in 11-12 years of age is the same as adults.[26,30]

The results of the study by Van der Elst et al[15]. however, are different as they show an increase in performance in 6.5-16 year old Netherlandic children and adolescents in animal semantic fluency. Kave et al. believe that the improvement of teenager's verbal fluency performance is due to the increase in intercategory transfer scores. They believe that there is no change in classification related to age.[32] Thus, it seems that age difference in general performance of fluency is mainly due to difference in intercategory transfer rather than classification.

Conclusion

To our knowledeg, there has been no study to design and make a Persian version of VFT to date. The Persian version of VFT was prepared using an acceptable number of subjects. They were matched in terms of age, gender, and education.

The investigation of the collected data from normalization stage applied on a fairly big group of adolescents showed that this neuropsychological task is an appropriate tool to be used in the field of adolescents' behavioral sciences. As the results of the study showed, the validity

and reliability of this task is acceptable for bilingual (Turkish-Persian) adolescents. Indeed, the estimated reliability using test-retest method was quiet high.

The discriminant validity of the test made it a suitable tool to distinguish between normal and ADHD adolescents. In addition, the findings showed the effects of age and gender variables on the performance of bilingual adolescents, where older groups outperformed others especially in phonological verbal fluency. Adolescents from higher age groups outperformed others in the semantic fluency of two 'animal' and 'supermarket stuff' categories compared to younger groups. Therefore, the calculated mean of performance for 'supermarket stuff' fluency was significant.

The investigation of gender effect on test performance showed that girls outperformed boys especially in phonological fluency. Though in semantic fluency, girls outperformed boys in both categories, the mean comparison of two gender groups showed a meaningful difference in only 'animal' category.

Scientifically, VFT can be used to evaluate and compare neuropsychological performance and/or verbal ability of normal adolescents and those suffer from behavioral disorders. It can be used to diagnose children and adolescents with neuropsychological disorders, especially ADHD.

Conflict of Interests

Authors have no conflict of interest.

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