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International Journal of Speech-Language Pathology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/iasl20

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To cite this article: Jessica Hayton, Jessica Marshall, Helen Girvan & Chloe Marshall (2023): Semantic fluency in primary school-age children with vision impairment, International Journal of Speech-Language Pathology, DOI: 10.1080/17549507.2023.2214711

To link to this article: https://doi.org/10.1080/17549507.2023.2214711

International Journal of Speech-Language Pathology, 2023; Early Online: 1–10

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Semantic fluency in primary school-age children with vision impairment

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Abstract

Purpose: Semantic fluency is potentially a useful tool for vocabulary assessment in children with vision impairment because it contains no visual test stimuli. It is not known whether in the primary school years children with vision impairment perform more poorly on semantic fluency tasks compared to their sighted peers.

Method: We compared semantic fluency performance of two groups of 5- to 11-year-old British English speaking children—one group with vision impairment and one without. We also investigated within-group differences in performance, based on severity of vision impairment. We administered one category (animals) to children with vision impairment ($n = 45$) and sighted children ($n = 30$). Participants had one minute to respond. Responses were coded for accuracy, error type, clusters, and switches.

Result: Correct responses increased with age within each group. Groups did not differ significantly on any outcome measure. Severity of vision impairment did not impact task performance.

Conclusion: Results suggested that semantic fluency performance—at least for the category animals—is not different in children with vision impairment compared to sighted children. Findings also suggest that semantic fluency could be a suitable addition to the tools that speech-language pathologists use to assess language abilities in children with vision impairment.

Keywords: *vision impairment; blindness; semantic fluency; vocabulary; children; primary-school*

Introduction

In this paper we present the first analysis of semantic fluency in primary school-age children with vision impairment (VI). The semantic fluency task requires participants to name as many members of a category (e.g. animals, foods, objects from around the house) as they can in a limited period of time (e.g. 30 seconds or 1 minute; see Chami et al., 2018; Mengisidou et al., 2020). Measures of interest include the number of correct items produced, the number of errors, and the number and size of clusters (common clustered responses for the category animals, for example, include farm animals [e.g. *horse*, *cow*, *sheep*], pets [e.g. *cat*, *dog*], and zoo animals [e.g. *lion*, *tiger*, *giraffe*, *elephant*, *zebra*]). Semantic fluency is a widely used tool in language and cognitive assessments in children and adults (see Ardila et al., 2006). However, to the best of our knowledge there is only one, small-scale, study exploring how children with vision impairment perform on semantic fluency tasks. We therefore do not know whether they are equally productive as sighted children and whether they retrieve words in the same way.

The vast literature on sighted children's word learning demonstrates how the acquisition of words and their meanings is grounded in sensory experiences (Rose et al., 2022). In the case of spoken language acquisition, word learning frequently involves a cross-modal association between a spoken word and an object or action in view. The child is supported in making these associations by caregivers who use visual cues such as eye gaze and a range of manual gestures such as pointing. Visual experiences help the child make and strengthen links between word and referent, supporting concept

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ISSN 1754-9507 print/ISSN 1754-9515 online
Published by Taylor & Francis
DOI: 10.1080/17549507.2023.2214711

formation with information about the what, who, how, and why. Children with VI are not likely to have the same quality of word learning experiences.

Vision impairment is defined as any ocular or brain based condition that cannot be corrected with medication, surgery, or prescription lenses, and the individual may have some degree of residual or functional vision (Solebo & Rahi, 2014; Wall, 2019). Blindness is defined under the same boundary, though the individual has no residual or functional vision, but may have light perception (Solebo & Rahi, 2014). Site (i.e. location) and severity of vision impairment have cascading effects on how children and young people explore and engage with their environment. The presence of a VI can reduce or deny access to incidental learning (i.e. learning through observation) in addition to reducing motivation to move towards or away from visual stimuli (Wall, 2019). In addition, the age of onset of VI is relevant: Notably, the visual experiences of babies born with a congenital VI (i.e. blindness) will differ from infants and young children who have acquired a VI shortly after birth or in infancy. This is because the latter will have had some previous visual experiences, regardless of whether they were able to consciously process or understand such visual input (Wall, 2019). Further details regarding classification of VI relevant to the sample in the current study are presented in the Methods section.

With respect to language acquisition, areas of vulnerability for children with VI include verbal concepts including words outside the child's direct experience (Rose et al., 2022). Yet, seminal work by Landau and Gleitman (1985) reported that toddlers with blindness had just as complex semantic knowledge for some words compared with sighted peers. Landau and Gleitman's findings are consistent with experimental studies of sighted toddlers by Wojcik and Saffran (2015) on word learning and syntactic sentence structure. Wojcik and Saffran (2015) demonstrated that the meaning of novel words can be learned effectively from speech input alone, without the presentation of visual information. Together, this body of work suggests that speech input alone can lead to effective semantic learning.

It is then an open question, and one we explore in this study, as to whether any differences in the word learning experience impact lexical retrieval measured by semantic performance in children with VI. Here we give an example relevant to the semantic category animals that we use in the semantic fluency task in the current study. Zebra and horse are closely taxonomically related, and are very similar to one another in shape. Yet there are very salient visual differences, notably the black and white stripes of the zebra that are lacking in the horse and the wider range of colours that horses can be. These visual characteristics that are obvious to a sighted child viewing toys, pictures, or real-life zebras and horses might not be accessible to a child with VI unless verbally described by a caregiver (or other interlocutor). The habitat of the two animals also differs (zoos and savannahs for zebras, stables and pastures for horses), but again this information might not be available to a child with VI unless verbally provided. These different experiences between sighted children and those with VI might give rise to different conceptual representations with different levels of richness, and therefore potentially different patterns of retrieval during semantic fluency tests.

There is one small-scale study of semantic fluency in English speaking Australian children with blindness ($n = 16$) aged 11–18 (Wakefield et al., 2006). The sample were either blind from birth ($n = 13$) or became blind before their first birthday ($n = 3$). The sample did not have additional cognitive disabilities, though two participants were medicated for epilepsy. The causes of blindness in the sample included Lebers congenital amaurosis (a congenital retinal dystrophy), retinopathy of prematurity (excessive development of retinal blood vessels in premature or low birthweight babies), retinoblastoma (a form of paediatric eye cancer), or an unknown birth/genetic defect as reported by parents. The semantic categories used were "all the things you might find around the house" and "all the things you might find in the supermarket". Combining the scores for these two categories, the authors found that the children with VI produced an average of 23.34 ($SD = 7.10$) correct responses in comparison to the sighted control group's average of 27.50 ($SD = 5.40$) responses. This group difference was not statistically significant ($t = -1.93$, $p = .062$), nor did the groups differ in cluster size. Age related differences were not investigated in this study. The authors point to Pérez-Pereira and Conti-Ramsden (2013), who argued that the most prudent interpretation of the limited data on language development in children with VI is that there are large individual differences and that it is difficult to point to areas where differences are consistently found. Nevertheless, although the aforementioned group difference in correct responses did not emerge as statistically significant in the study by Wakefield et al. (2006), their data do suggest that productivity might be lower in children with VI and that further studies are warranted.

Further studies of semantic fluency could also be valuable because in a review by Rose et al. (2022) of the language assessment tools that have been used with children with VI, semantic fluency does not appear (Rose et al., 2022). Yet semantic fluency might have some advantages over other assessments for eliciting language, because it does not rely on picture stimuli. On the other hand, given the importance of the sense of vision for word learning, we cannot assume that children with VI will give as many responses, and of the same type, as sighted children when responding to a semantic fluency task. It is this gap in the clinical and research literature on primary school-age children with VI that motivates our exploratory study.

Vision impairment is a low incidence disability. For example, recent figures from the UK's Department for Education (2021) suggest that 0.16% of school-age children have a primary diagnosis of vision impairment, marginally lower than the two in every thousand (i.e. 0.2%) prevalence rate detailed by the World Health Organization (WHO; 2022). Keil (2019) recommended caution should be used with government statistics, however, as most published materials focus only on primary diagnosis. UK statistics including VI as a primary and as a secondary diagnosis subsequently met the 0.2% threshold consistent with the WHO's classification of childhood VI and blindness, with similar figures in Australia (McLeod & Mckinnon, 2007). Higher figures have been reported in some other countries (e.g. India [0.5%, see Kulkarni et al., 2022] and Malawi [1.1%, see Kalua et al., 2008]) with country income predicting prevalence, i.e. low income is associated with a high prevalence of VI (WHO, 2022). Speech-language pathologists are therefore not likely to have much experience with this population. Likewise, research in language abilities of school-age children with VI without additional needs is sparse. The Royal National Institute for the Blind (RNIB) suggest that approximately 50% of children with VI have an additional educational need/disability (Emerson & Robertson, 2011; RNIB, 2022). Nevertheless, assessing the language of children with VI is important because the prevalence of language difficulties in these children may be underestimated (Rose et al., 2022).

Semantic fluency is a widely used task in language assessment and it might be particularly suitable for assessing the vocabulary skills of children with VI, because it requires no visual test stimuli. However, an open question concerns whether it is an appropriate measure for children with VI in the primary school years. Given the differences in language learning experiences for children with VI compared to sighted children, it is possible that semantic fluency scores will be lower in children with VI and that patterns of lexical retrieval will be different. It is this overarching research question that we set out to investigate in this study of 45 VI and 30 sighted children aged 5–11 years and resident in the United Kingdom. As far as we are aware, this is the first study of its kind.

Specifically, we compare the performance of two groups of 5- to11-year-old British English speaking children—one group with VI and one group without—on a semantic fluency task using the following measures: number of correct responses, number of errors, number of clusters, cluster size, and number of switches.

We investigate the extent to which the number of correct responses correlates with age within each group. We also investigate whether there are differences in performance between children with more or less severe VI.

Method

In this section we first define VI in a way that is relevant to our study and subsequent interpretation of results.

Vision impairment is defined as any ocular condition that cannot be corrected using surgical intervention, prescription glasses/lenses, nor medication. The scope of vision impairment encompasses: (a) the globe of the eye(s); (b) genetic/hereditary conditions; and (c) brain based cerebral vision impairment, whereby the globe of the eye(s) remains structurally unaffected, though processing visual information is compromised (e.g. due to trauma, infection, childhood stroke, or genetic mutations; see International Classification of Diseases-11 [ICD-11], 2022a). The site of vision impairment (i.e. globe of the eye[s], retina, optic nerve, or cerebral vision impairment) can indicate underlying causes of vision impairment and the nature of the progression of the condition, i.e. if the condition is stable (e.g. Albinism) or degenerative (e.g. retinitis pigmentosa).

Defining severity of vision impairment relative to visual acuity is offered by the World Health Organization (2022) via the International Classification of Diseases-11 (2022b). The classification uses both Logarithm of the Minimum Angle of Resolution (logMAR) and Snellen scores to explain and interpret severity (Solebo & Rahi, 2014). Both logMAR and Snellen scores are tests of visual acuity, characterised by a chart containing rows of capital letters that gradually decrease in size. Scores are based on the smallest discernible letter that the patient can read. The logMAR chart was introduced into clinical practice, resultant from its sensitivity threshold relative to visual acuity despite no direct correlation with the Snellen chart (Lovie-Kitchin, 2015). In logMAR, lower scores correspond to better vision; as the decimal notation increases this represents worsening visual acuity. The Snellen score offers a more relatable indication of a person's visual field whereby the fraction relates to the distance (i.e. 6 metres [in the UK context] or 20 feet [in the USA context]) that a person with a vision impairment can see compared to a typically sighted person. To illustrate, a Snellen score of 6/6 metres, otherwise known as 20/20 vision, corresponds to a logMAR score of 0.0. This means that a person can see at 6 metres what a typically sighted person can see at 6 metres. If a person with VI has a logMAR score of 1.00, equivalent to a Snellen score of 6/60, this means that a person with VI can see at 6 metres what a typically sighted person can see at 60 metres. As Snellen is better recognised in some contexts, conversions are offered where appropriate in this paper.

The WHO (2022) taxonomy classifies vision impairment into four groups. These are: (a) mild or no vision impairment, defined as vision better than or equal to 0.48 logMAR (6/18 Snellen); (b) moderate vision impairment, whereby vision is worse than 0.48 logMAR but equal to 1.0 logMAR (6/60 Snellen); (c) severe sight impairment acuity is worse than 1.0 logMAR, but equal to or better than 1.3 logMAR (3/60 Snellen); and (d) blindness, whereby vision is worse than 1.3 logMAR. It is important to note that there is no current defined taxonomy for childhood vision impairment, though it is acknowledged that chronological and developmental ages may affect the accuracy of the categorisation (Solebo & Rahi, 2014). For this reason, severe sight impairment and blindness are often merged, despite distinct phenotypes and characteristics of their vision. For example, a child presenting with 1.1 logMAR may still be able to navigate elements of their environment using available functional vision (a capacity that can be influenced by environmental factors, such as appropriate task lighting that may facilitate movement in the environment) but remains grouped with children in the category blindness who may have no light perception. The WHO taxonomy classifies vision impairment into four groups, this has been adopted in the current study for understanding the visual acuity of recruited participants (WHO, 2022).

Recruitment

Ethics were approved by UCL's Institute of Education research ethics committee. Parent/caregiver written informed consent was obtained, as was informed child consent and verbal assent during the testing phase. Participants were recruited from across the UK as part of a larger study, and parents/caregivers informed that depersonalised data would be processed. Sighted children were educated in mainstream settings. Children with vision impairment were educated in both specialist and mainstream settings, arguably representative of the types of formal education a child with a vision impairment may experience (depending on severity of diagnosis and its implications for education).

Participants

Data from 98 participants from a larger study (Hayton et al., 2021) were screened for eligibility in the current paper. The larger study explored sleeping profiles in children with vision impairment and sighted children (matched on chronological age) aged 4–11 years. The number of responses to semantic and phonemic verbal fluency and digit span tasks were collected, but did not predict sleep quality nor quantity as measured by questionnaire, sleep diary, and actigraphy data (Hayton et al., 2021). That study did not focus on the semantic fluency data nor present them in any detail, which is our aim here.

To be eligible for inclusion in the analysis in the current paper, children needed to have produced at least one item in the semantic fluency task. In total, 23 participants were excluded from analysis. Specifically, five children with vision impairment and one sighted child had no or missing data. Two verbal children with vision impairment and one sighted child dropped out from the study due to illness. Three children with vision impairment did not participate as parental report cited that they were non-verbal. Two children with vision impairment did not produce any responses in the semantic fluency task. One child with vision impairment required verbal reassurance from the test administrator (e.g. a confirmatory response to the child's question "is [sic] birds an animal?"), which voided the results. Seven sighted children dropped out due to time commitments as disclosed by parents/caregivers and one sighted child was identified as an outlier when examining data distribution. This participant named 32 animals, placing them 3 standard deviations above the sighted group mean and over 1 standard deviation above the next highest scores (25 animals) for two sighted children. Thus, data collected from 75 child participants are examined in this paper, whereby $n = 45$ children with vision impairment (female $n = 21$; age range 5.08–11.33 years; $M = 8.29$ years) and $n = 30$ sighted children (female $n = 17$; age range 5–11.75 years; $M = 7.9$ years).

Inclusion criteria included parental report confirming no hearing difficulties (e.g. no hearing aid) of their child/ren (child participants had the ability to hear and respond to test instructions), a clinical diagnosis of vision impairment (for the group with vision impairment), no diagnosed or suspected additional educational need/disability (both VI and sighted groups), and normal or corrected-normal vision (i.e. glasses/lenses for refractive error correction in the sighted group). Confirmation of visual and auditory status, no additional learning needs, and all demographic information were based on parental/caregiver report. Child participants were born in the UK so had English as either a first or additional language. Before testing, a short conversation was held with each child participant confirming their understanding and appropriate response to spoken English. Parents had English as a first or additional language confirmed via email correspondence and a telephone call. Parental first language was not an exclusion criterion for this study, as the data were based on children's language ability. Confirmation of proficiency in English was based on informed consent and child assent to participate in the parent study (Hayton et al., 2021), in addition to arranging a telephone call to inform parents/caregivers of the procedure and to speak with the child participants.

Table I shows the demographic characteristics of the sample, detailing timing of onset, severity, and diagnosis by site of vision impairment, where known. It is important to note the onset of vision impairment was based on time of diagnosis; all parents who provided information reported their children having the visual condition from birth.

Measures

Medical history questionnaires were completed by parents/caregivers detailing background information such as diagnosis/es and additional needs. This information was important in understanding clinical condition and any impairment(s) that might affect

Table I. Participant demographics for children with vision impairment and sighted children.

Demographic characteristic	Vision impairment ($n = 45$)	Sighted ($n = 30$)
Chronological age in years, mean (SD)	8.29 (1.84)	7.94 (2.04)
Sex		
Female	21 (46.7%)	17 (56.7%)
Male	24 (53.3%)	13 (43.3%)
Severity of vision impairment[a]		
Mild or no sight impairment	7 (15.6%)	–
Moderate	15 (33.3%)	–
Severe	16 (35.6%)	–
Blindness	7 (15.6%)	
Sighted		30 (100%)
Diagnosis by site of vision impairment		
Ocular (including retina)	26 (57.8%)	–
Cerebral (including nystagmus and optic nerve)	19 (42.2%)	–
		–

Note. [a]Severity of vision impairment using WHO classification (e.g. Solebo & Rahi, 2014); mild or no sight impairment = vision acuity better than or equal to 0.48 logMAR; moderate vision impairment = 0.6–1.0 logMAR; severe vision impairment = 1.1–1.3 logMAR; blindness = 1.4 logMAR.

participation in the verbal fluency measures. It is important to note that many parents do not and will not know the cause, severity, or sometimes site of vision impairment.

Semantic verbal fluency was measured using instructions provided by Strauss et al. (2006). First, a trial using the category "things that you find in the kitchen" was presented. Examples offered by the administrator were: *knives*, *forks*, *spoons*, and *plates*. Participants were then asked to continue and they included words such as *microwave* and *fridge freezer*. Upon completion of the trial, the target category of animals was introduced and the following instructions were read aloud: "Now tell me the names of as many animals as you can. Name them as quickly as possible." (Strauss et al., 2006). Timing of 1 minute commenced at the end of the verbal instruction. If a participant paused for 15 seconds, the instructions were repeated and the starting word *dog* was given.

Analysis

Coding

Responses were audio recorded for later transcription. Words were omitted from the correct semantic score if they violated the task instructions i.e. out of category words and repetitions (whereby repetitions were identified as either variations of the same word (e.g. *dog* and *doggie*) or exact repetition (e.g. *dog* and *dog*; Strauss et al., 2006). Words such as *chocolate* and *cockadoodle* were considered out of category errors. Although authors rarely describe how they treat mythical creatures such as *unicorn*, *yeti*, and *dragon*, we followed McGregor et al. (2018) in accepting them as correct responses.

Responses (including repetitions, but not out of category responses) were coded for semantic and phonological clusters. Codes were allowed to emerge from the data. In doing so, we followed the recommendation of Troyer et al. (1997, p. 140) who wrote that the large number of subcategories thus generated, "reflects the considerable individual variations in approach to this task and gives participants the benefit of the doubt regarding their use of clusters". This post hoc, emergent approach to coding is used far more commonly in the research literature (e.g. Beal-Alvarez & Figueroa, 2017; Chami et al., 2018; Henry et al., 2015; Kosmidis et al., 2004; Marshall et al., 2018; Mengisidou et al., 2020; inter alia) than the imposition of a priori categories that arguably do not fully capture how children retrieve lexical items (e.g. Nash & Snowling, 2008).

Clusters were defined as two or more adjacent responses that were closely related semantically, i.e. had a thematic association (e.g. the water animal cluster included *shark*, *whale*, *fish*) and/or a taxonomic association (e.g. the bear cluster included *polar bear*, *grizzly bear*, *brown bear*). We also identified phonological clusters, where the initial sound triggered further words beginning with the same sound but are semantically unrelated (e.g. /k/, *koala*, *chameleon*, *cat*, *cow*). It is unusual to code phonological clusters within the semantic fluency task and, where they have been coded, they have been reported to be much less frequent than semantic clusters (Koren et al., 2005). However, in keeping with our emergent approach to coding and mindful of advice from Troyer et al. (1997) that individuals vary considerably in how they tackle the task, we chose to include phonological clusters in our coding[1]. Some words fell into different categories depending on the context of the responses e.g. *butterfly* was coded under "minibeast" in the sequence *ladybird*, *caterpillar*, *butterfly* or as part of a phonological cluster in the sequence *bee*, *bear*, *butterfly*, *bird*.

By way of examples to illustrate how cluster size was calculated, the cluster *zebra lion* was calculated as having a size of two; *kangaroo*, *cheetah*, *lion* was calculated as three; and *bee*, *bear*, *butterfly*, *bird* was calculated as four, etc. The number of switches was calculated as the number of consecutive items that were not related to one another either semantically or phonologically, e.g. the transition in *snake bee*, was classed as a switch, as was *bird kangaroo*.

All participant responses were independently coded by two authors. Inter-rater agreement of cluster categories was 86.6%. This level of inter-rater agreement is comparable to figures reported in other studies (83%, Beal-Alvarez & Figueroa, 2017; 87%, Chami et al., 2018; 89%, Marshall et al., 2018). All disagreements in coding were discussed to reach consensus, including with a third coder if necessary.

Result

There was a great deal of variation in number of correct responses produced by participants. The group with VI produced a minimum three and maximum of 25 correct words, and the sighted group produced a minimum of five words and maximum 24 correct words. The number of errors was very low, with the majority of children not producing any errors.

First, we investigated whether the number of correct responses correlated with age in each group and we found that it did so moderately. For the VI group, $r = .448$, $p = .002$. For the sighted group, $r = .493$, $p = .006$. Not surprisingly then, an increase in age was associated with an increase in productivity. The scatterplot showing this association is presented in Figure 1.

Determining the distribution of the correct semantic responses was important for determining the type

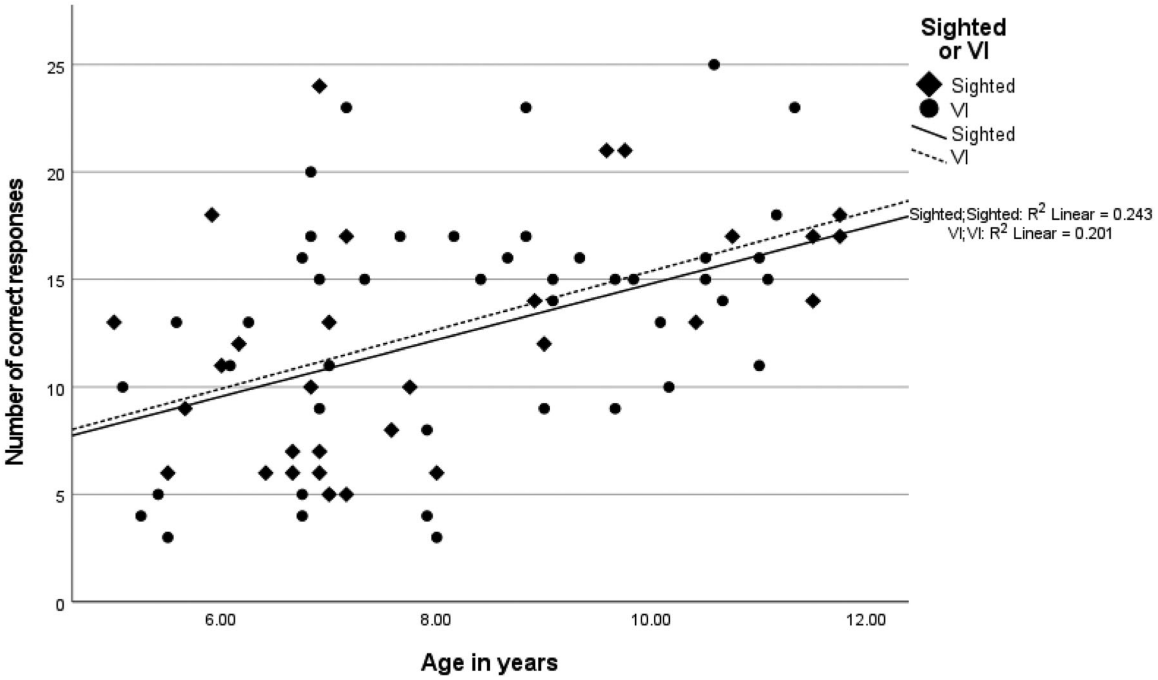

Figure 1. Grouped scatterplot illustrating the association between chronological age and the number of correct responses for both the vision impaired and the sighted groups.

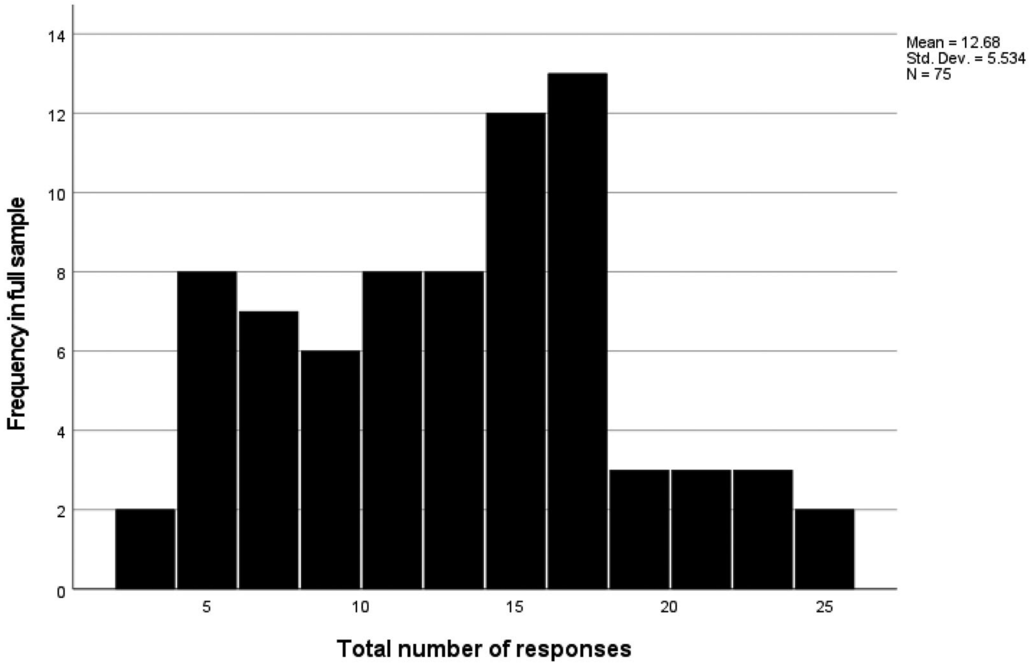

Figure 2. Histogram illustrating the distribution of the total number of responses in the full sample[2].

of statistical test used to compare group means. A Shapiro-Wilk test was performed (suitable for low sample sizes) and the distribution of number of semantic responses for both sighted and VI groups combined (Figure 2) was normally distributed ($W[75] = 9.68, p = 0.051$).

We therefore carried out a series of independent samples *t*-tests on the data[2]. In Table II we report the means and standard deviations for each outcome measure for the two groups. We also report the results of the *t*-test used to investigate whether the groups differed significantly for any of these measures. For the interpretation of effect sizes (i.e. *d*), we used the widely accepted interpretation of *d* values below 0.3 being judged small.

The results of the *t*-tests presented in Table II indicate that the VI and sighted groups did not differ significantly on any of the measures (i.e. number of correct responses, number of clusters, mean cluster size, and number of switches). *T*-tests could not be calculated on out of category errors or repetitions, owing to sighted children not producing any errors. Furthermore, all differences between the groups had a very small effect size (0.17 and below). The two groups therefore perform similarly on the semantic fluency task.

A further research question was to investigate whether severity of VI affects semantic fluency performance. For this analysis, the participants with VI were divided into two groups according to the severity of VI and WHO classification (Solebo & Rahi, 2014). These results are presented in Table III.

The results in Table III indicate that there is a trend for the children with a more severe VI to produce fewer responses, in comparison to children with moderate sight impairment. However, the two groups were not well matched for age. Because the severe sight impairment group were younger than the moderate VI group, it might be the case that the near-significant difference in correct responses is driven by age rather than by severity of VI. We therefore reran the analysis on correct responses with age as a covariate. A univariate ANOVA exploring whether the type of vision impairment affected the number of correct responses confirmed a near-significant group difference, $F(1, 43) = 3.85$, $p = .056$, $\eta_p^2 = 0.82$. The covariate, age, was significantly related to the number of correct responses, $F(1, 42) = 8.38$, $p = .006$, $\eta_p^2 = 0.173$. Rerunning the ANOVA with age as a covariate reduced the impact of severity of vision impairment on performance, $F(1, 42) = 1.30$, $p = .286$, $\eta_p^2 = 0.089$. We conclude, therefore, that the severity

Table II. Vision impaired and sighted group means, standard deviations, independent samples t-test, and effect size (*d*) exploring differences between vision impaired and sighted groups.

		Vision impairment ($n = 45$)	Sighted ($n = 30$)	*t*	*p*	*d*
Number of correct responses		13.09 (5.65)	12.10 (5.42)	−0.739	.462	0.17
Errors (total)[a]		0.24 (0.69)	0.00 (0.00)	–	–	–
	Out of category errors[a]	0.07 (0.33)	0.00 (0.00)	–	–	–
	Repetitions[a]	0.18 (.44)	0.00 (0.00)	–	–	–
Clusters	Number of clusters	3.24 (1.71)	3.06 (1.69)	−0.703	.484	0.17
	Mean cluster size	3.83 (1.44)	4.03 (1.34)	0.358	.721	0.08
	Number of switches	3.91 (2.49)	3.71 (2.52)	−0.531	.597	0.13

Note. [a]t not calculated due to no repetition/errors in sighted group.

Table III. Split vision impairment group means, standard deviations, independent samples t-test, and effect size (*d*) exploring the differences in severity of vision impairment.

		No sight impairment + moderate vision impairment ($n = 22$)	Severe sight impairment + blindness ($n = 23$)	*t*	*p*	*d*
Chronological age in years, mean (*SD*)		8.83 (1.75)	7.78 (1.83)	1.96	.056	0.59
Number of correct responses		14.73 (4.48)	11.52 (6.28)	1.98	.055	0.59
Errors (total)		0.36 (0.90)	0.13 (0.34)	1.14	.266	0.35
	Out of category errors[a]	0.14 (0.47)	0.00 (0.00)	–	–	–
	Repetitions	0.23 (0.53)	0.13 (0.34)	0.73	.473	0.22
Clusters	Number of clusters	3.64 (1.79)	2.87 (1.58)	1.53	.134	0.46
	Mean cluster size	3.75 (1.46)	3.91 (1.47)	−0.37	.711	0.11
	Number of switches	4.32 (2.23)	3.52 (2.69)	1.08	.288	0.32

Note. [a]t not calculated due to no out of category errors in the group with severe sight impairment and blindness.

of the vision impairment does not impact semantic fluency performance.

Discussion

The aims of this exploratory study were to investigate the semantic fluency of sighted children and children with VI, and to investigate whether severity of VI affected task performance. The rationale behind this study was to offer insight into the potential suitability of semantic fluency—an auditory-only measure—for assessing children whose access to visual information is either compromised or absent.

Our results suggest that the presence of a vision impairment does not necessarily impact semantic fluency. Patterns of retrieval were relatively consistent across both samples. Incorrect responses (out of category responses, repetitions) were minimal, indicating that participants understood the task instructions. We found a wide variation in the number of correct responses produced by both the VI and sighted groups, which was not surprising given the wide age range. For both groups, the number of correct responses correlated moderately with age, indicating that the task is sensitive to development for children with VI just as it is for sighted children. Importantly, there were no differences between the groups on any of our outcome measures: The children with VI produced similar numbers of clusters, clusters of similar size, and a similar number of switches compared to the sighted children, indicating similar patterns of lexical retrieval. These findings are consistent with the smaller scale study of semantic fluency in 16 older children with VI (11- to 18-year-olds) by Wakefield et al. (2006). Further, with respect to the severity of the vision impairment, our data showed that this factor did not affect overall productivity or patterns of lexical retrieval either. This means that semantic fluency could be a suitable addition to the tools that speech-language pathologists use to assess vocabulary abilities in children with VI.

However, it should be noted that our analysis was run on participants who produced at least one item in the semantic task. As mentioned in the method section, six children with VI were omitted from the analysis as they were either non-verbal (three children), were not able to produce any responses to this task (two children), or required verbal reassurance from the test administrator (one child). This is arguably representative of the greater variability that is inherent in VI groups (Warren, 1994). However, a limitation of our study is that the data we drew on were part of a larger study (Hayton et al., 2021) examining sleep in children with vision impairment. We did not consider a post hoc power analysis appropriate, owing to the data having been collected via availability sampling. As language was not the focus of that larger study, we do not have any additional language measures that would help us to understand whether the participants who were unable to complete the task despite being verbal had a likely language difficulty or language delay. Nor do we have information on whether participants used any languages at home other than English, and we only administered the task in English. Information about the home context of the participants may have enabled us to better understand media and cultural influences on semantic retrieval (e.g. McGregor et al. [2018] found retrieval of animals from the Chinese zodiac in their sample of children with a Taiwanese background).

A further limitation of our study—which again comes as a result of drawing on data from a larger study with different aims—is that we used just one semantic category, albeit one of the most widely employed and most appropriate for this age group (animals). We therefore do not know whether the VI participants' performance on this category is representative of their performance on other categories. Nor do we know whether productivity for the animals category correlates with performance on other language assessments, including assessments of vocabulary. These are important avenues for future research.

Notwithstanding these limitations, the findings of our study offer an initial response to concerns raised by Rose et al. (2022), who called for suitable language assessment measures for children with VI but did not mention the semantic fluency task. Our results support the utility of this task for children with VI, despite their different sensory experiences compared to sighted children. Although this was only an exploratory study and our findings are preliminary (and need replicating in other languages and in larger and more diverse samples, employing a prospective power analysis), our findings do suggest that speech-language pathologists can be confident in using semantic fluency tests with VI children.

Notes

1. In total, 10 phonological clusters were coded. Within the VI group, six phonological clusters were coded, whereby four participants produced one phonological cluster and one participant produced two phonological clusters. Within the sighted group, four phonological clusters were coded, whereby two participants produced one phonological cluster and one participant produced two phonological clusters. Therefore, our findings are consistent with the literature demonstrating the rarity of phonological clusters in the semantic fluency task.
2. The Shapiro-Wilk test just crossed the threshold of normal distribution. To be conservative, we also ran non-parametric Mann-Whitney U tests and the pattern of results was identical. We therefore present just the results of the *t*-tests here.

Acknowledgements

The authors thank the children and families who participated in this project.

Ethical approval

The project received ethical approval from UCL Institute of Education Research Ethics Committee.

Patient consent statement

All participants and their parents gave written consent and verbal assent to anonymised/depersonalised data being presented in this manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The parent project (Hayton et al., 2021), under which these data were collected, was funded by the BA/Leverhulme Small Research Grant SRG18R1/181296.

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Data availability statement

The data generated for this study will not be made publicly available. The ethics form states that only processed data will be presented in manuscripts. Data are not available to maintain anonymity and confidentiality of participants.

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