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Token Test - A Screening Tool For Children With Reading Disability

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Abstract

Aim: The aim of the study was to compare reading and listening comprehension in typically developing children and children with reading disability using the Token Test.

Method: Two groups of children, 48 typically developing children from Grade III and IV (Group I) and 6 children with the diagnosis of 'learning disability' (Group II) who manifested disabilities in reading were recruited from two English medium schools.

Procedure: Listening comprehension and reading comprehension skills of the participants were assessed using the Token Test (De Renzi & Faglioni, 1978). The participants were tested individually in a quiet room.

Results: A marked discrepancy between listening comprehension and reading comprehension was observed between Group I and II with moderate correlation between the two skills for Group I.

Conclusion: The Token Test may be adopted as a screening tool to identify children with reading disability. The test differentiated among children with decoding, auditory perceptual and language based comprehension problems. The test may be translated into other languages without cultural constraints.

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Keywords: Token Test, reading comprehension, listening comprehension, children, cognition

Introduction

Language is a system of arbitrary verbal or non-verbal symbols used for communication within a particular community. Shared experiences of persons are coded as symbols and the consolidation of experiences that is built into memories over time are conceptualized for communication purpose. The foundation of language, therefore, is the formation of concepts the majority of which is universal. The depth of understanding of concepts for communication refers to comprehension.

It is well known that development of comprehension starts at infancy that continues through adulthood (Antonucci & Alt, 2011). Development of comprehension in infants is deeply rooted in sensori-motor experiences with the objects and people in its environment (Piaget, 1952). The emergence of object-permanence heralds the awakening of comprehension in an infant. During this process comprehension evolves from the simplistic understanding to mature understanding of concepts. Comprehension skill is a pre-requisite for the acquisition of spoken language and therefore, it appears much before the child is able to name or label the objects and people in its environment.

In the course of development of spoken language words appear in the first year followed by phrases and sentences in the subsequent years. This blossoming of language gives further impetus to the development of comprehension as well. At this juncture the interdependence of language and cognition each contributing to the development of the other in a cyclic manner (Vygotsky, 1978) becomes evident during the preschool years of children.

Successful transition to schooling happens through language and listening skills that children acquire through play activities. Preschool period in particular, is very crucial for children to expand their linguistic, cognitive and cognitive-linguistic abilities. The linguistic abilities being - phoneme awareness, phonics, fluency, vocabulary and language; the cognitive ability being short-term memory, episodic memory, meta-cognition and world knowledge; and the cognitive-linguistic abilities consists of making inferences, use of meta-linguistic skills, and reading strategies.

Children gradually move from the ‘learning to read’ phase to the ‘reading to learn’ (https://www.readingrockets.org/article/learning-read-reading-learn.phase). They are also introduced to print from kindergarten where they are taught decoding strategies which leads to fluency in reading, generally achieved by third grade. Children’s listening comprehension that is often ahead of reading comprehension determines the success of the transition to the stage of ‘reading to learn’. Studies have indicated that while the relationship between listening and reading comprehension is weak in primary grades for expository than for narrative texts,

reading comprehension is higher than listening comprehension irrespective of text type by eighth grade. However, after seventh grade, when decoding becomes automatic reading comprehension parallels listening comprehension (Diakidoy, Stylianou, Karefilidou, & Papageorgiou, 2005).

Listening and reading are not simple acts supported by the sensory system. Both are products of information processing mechanism as described in cognitive psychology. The significance of attention and memory (short term memory, episodic memory, and semantic memory) cannot be ignored in the mechanism of information processing discourse in particular. The Construction Integration Model by Kintsch (1998), which is a hybrid model, a combination of connectionist bottom-up theory and hierarchical top-down theory, proposes a theory for the comprehension of discourse. The model suggests that comprehension of discourse takes place independent of modality of input be it, listening or reading. According to the Construction Integration Model, the text is represented at three levels, the text base, the propositional base and the situational base. At the text level the words are decoded, and their surface structure is extracted. At the propositional level meaning, both the linguistic and inferential, is extracted along with related factual information, past experiences, etc. and held active in the working memory. These two levels constitute the micro-structure. At the third level a mental representation or image of the text is created through the integration of the information within and between levels. The flexibility of the model allows mental representation to be updated as new information is processed.

It is evident that the mechanism of information processing is extraordinarily complex, where information enters at the input stage of the system through the senses that gets processed with the help of the memory systems in the second stage. At the output stage it is reflected in the form of speaking and writing. In view of its complex nature, children with reading disability (the term 'Reading Disability' is used in this paper instead of 'Dyslexia' and 'Learning Disability' to denote disabilities seen in all the skills associated with learning to read and write) face challenges with comprehension of information.

Children with reading disability are described along many dimensions to highlight their characteristic features. A mismatch between intellectual potential and reading performance has emerged as a common feature that is included in the discrepancy definition. Due to the drawbacks of this definition and high variability across children (Aaron, 1991; Stanovich, 1991, among others), listening comprehension replaced intelligence consequent to which several authors advocated the use of both listening comprehension (abbreviated as LC) and reading comprehension (abbreviated as RC) abilities to identify children with difficulties in reading and writing (Badian, 1999, among others).These studies undertook comparing LC and RC using sentences (Bedford-Feuell, Geiger, Moyse &Tunmer, 1995), short passages (Elbro, 1998) or with whole texts (Nielsen & Petersen, 1992) with different types of linguistic complexities.

Spring and French (1990) examined LC and RC in two groups of fifteen children with dyslexia and fifteen normal readers, from grades four to six, using the Peabody Individual Achievement Test (PIAT) (Markwardt,1970). They reported that while both the groups performed similarly on LC, the dyslexics performed significantly poorer on RC. The discrepancy between the two skills clearly indicated large modality effect in their results. In a longitudinal study on the development of LC and RC from first to fourth Grade, Juel (1988) reported that poor reading may have detrimental effect on LC at text level. Snyder and Downy (1991) found that the disparity between good readers and poor readers retelling of stories increased between nine years eleven months and twelve years six months. Bedford-Feuell, Geiger, Moyse and Tunmer (1995) studied the differences between LC and RC in five groups of ten children aged between 9-10 and 13-14 years of age using Sentence Verification Test (SVT) (Royer, Greene & Sinatra, 1987). The groups comprised of children with moderate learning disabilities, children with dyslexia and a group of normal controls aged between nine and ten years. The results showed that the dyslexics obtained poor scores in RC, but, on LC better scores were observed in both normal controls and dyslexics. Thus, dyslexics were identified by the large discrepancy between LC and RC, and the children with moderate learning disability showed a smaller discrepancy and performed poorly in both the skills, but much poorer on RC. Varghese and Rao (2000) used the Token test on three groups of children to compare LC and RC. Forty eight typically developing children from third and fourth Grade and six children with the diagnosis of learning disability in the age group of 8-9 years along with six teacher identified children with reading disability of sixth and seventh Grade. The findings revealed a marked discrepancy between the skills in children with learning disability, minimal discrepancy with below grade level performance for the teacher identified children with reading disability and insignificant discrepancy between the skills for the typically developing children group. Therefore, majority of studies that investigated LC and RC produced mixed results (Bedford-Feuell, Geiger, Moyse & Tunmer, 1995 among others). The reasons for equivocal results are attributed to the study population with reference to nature of disability, age, Grade, test materials, the nature of response elicited and above all, the discrepancy criteria between potentials and performance adopted in the studies. It is known that the goal of LC and RC is comprehension of the message received and perceived through the oral or written mode. Any problems at the input stage or at the processing stage of the message in either mode would lead to problems at the output. Since the capacity to comprehend correlates with the intelligence level of an individual, the discrepancy construct holds good in the case of children with reading disability who manifest higher intelligence, but not for those with lower intelligence. Children with lower intelligence manifesting reading disability experience a host of linguistic and cognitive-linguistic deficits. Since acquisition of reading skills facilitate the development of cognitive structures that lay the foundation for successful reading at more advanced levels (Stanovich, 2016), comparing LC and RC appears to be the best way to identify children with all types of reading disability, be it with lower or higher intelligence levels.

Generally, the ability to comprehend in children with lower intelligence is below that of children with higher intelligence. This could offer a fair explanation for the discrepancy between LC and RC in children with different levels of intelligence. Children with reading disability alone with specific decoding problems without problems in listening skills encounter problems at the input level, i.e., reading. On the other hand, children with reading disability coupled with lower intelligence often do not manifest decoding deficits but evidence poor comprehension due to generalized processing deficits. Therefore, performance of such children on comprehension whether the input is through listening or reading would be equally poor, while the good readers without any difficulty in decoding or auditory perceptual issues with adequate processing capacities perform comparably well in both the modalities. In order to assess these skills, tests for LC and RC have been developed for children and adults like the Sentence Verification Test (SVT) (Royer, Greene, & Sinatra, 1987); Peabody Individual Achievement Test (PIAT) (Markwardt, 1970); and Profiles in Listening and Reading (PILAR) (Carlisle 1989a). However, the reports of these tests are often inconsistent owing to high variability in the test items used. Therefore, the debate on the usefulness of the two parameters - LC and RC - for identification of children with reading disability has remained unsolved.

A study on LC and RC reports moderate correlation between LC and RC among Indian typical readers of third and fourth grades (Mullimani, 1997). Research on dyslexia and learning disability from other disciplines also discuss the challenges involved in the diagnostic process (Ramaa, 2000; Venkatesan, 2017), and yet other research has focussed on the impact of orthography on reading through cross-linguistic studies (Karanth, 2003).

Given the intricacies in identification of children with reading disability, it appears logical to compare LC and RC in children with all types of reading disability. Varghese and Rao (2000) used the Token Test (DeRenzi & Faglioni, 1978) to compare LC and RC performance in three groups of children as detailed earlier. The original test was developed by DeRenzi and Vignolo (1962) to examine subtle receptive language deficits in persons with aphasia. Over the years, the Token Test has been modified, adapted and translated (Gallardo, Guàrdia, Villaseñor, & McNeil, 2011) for several clinical applications. Persons with aphasic or non-aphasic focal damages, right hemisphere brain damage, dementia (Fontanari, 1989), children with specific language impairment, learning disability and typically developing children (Amorosa, Kleinhans-Lintner & Von Bender-Fisser, 1980; DiSimoni & Mucha, 1982; Cole & Fewell, 1983; Willinger, Schmoeger, Deckert, Eisenwort, Loader, Hofmair, & Auff, 2017) have been assessed on several adapted versions of Token Test. It was also reported that a strong correlation exists with Preschool Language Scale Scores (PLS) (Zimmerman, Steiner & Pond, 1979; Cole & Fewell, 1983) and language and cognitive section of Memphis Comprehensive Developmental Scale (MCDS) (DiSimoni & Mucha, 1982) when Token test was administered on typically developing children. Hence, the Token Test is recommended for use as a part of the standard pre-school admission test battery. Willinger, Schmoeger, Deckert, Eisenwort, Loader, Hofmair & Auff (2017) observed that performance on Token Test was related to both the verbal and non-verbal intelligence scores on Wechsler-Preschool-and-Primary-Scale-of-

Intelligence (WPPSI) (Wechsler, 1967). The tasks are said to involve the ability to receive verbal information, process it in working memory and execute the instruction. Therefore, Token Test serves as an indicator of intellectual development besides receptive language skills. The Token Test consists of coherent set of instructions which can be used to compare the performance on LC and RC skills, and where the response is execution of instructions through specific actions. Further, the test is designed to tap LC, and is also standardized with established validity and reliability. Token Test is not influenced by the culture or language, as the stimuli are designed with decontextualized language. Hence, it appears suitable for use in the multi-cultural and multi-linguistic Indian context.

Given the scope to utilize the Token Test for comparison of LC and RC and the reported drawbacks of other tests with reference to stimulus type and responses, the present paper is a report of part of the study that was carried out earlier (Varghese and Rao, 2000). The paper describes the possibility of using the shortened version of the Token Test (DeRenzi & Faglioni, 1978) to identify children with reading disability.

Background Information for the Present Study

The inherent potential in comparing LC and RC in children with reading disability warrants a tool that is sensitive, cost and time effective for use with young children. Hence the objective of the study was to examine the feasibility of application of Token Test (DeRenzi & Faglioni, 1978) as a screening tool for children with reading disability in speech-language clinics and primary schools.

The study employed a cross-sectional correlation design with random sampling. The participants consisted of two groups of children:

a) Participants

Group I: 48 typically developing children, 24 boys and 24 girls from Grade III and IV studying in an urban English medium school coming from middle socio-economic background. The mean age of the participants in Grade III and Grade IV was 8 years and 9 years respectively.

G*roup II*: Consisted of six children 3 boys and 3 girls in the age range of 8 to 9 years identified as children with learning disability (reading disability) by the school clinical psychologist from an integrated English medium school, in an urban area (Table 1)

Table 1: Age, gender and Grade of participants of Group I and Group II

	Group I		Group II	
Gender	Grade III	Grade IV	Grade II	Grade III
Boys	12	12	**	3
Girls	12	12	1	2
Age (years)	8	9	9	8*

*****One participant was 9 years old

** There were no boys in Grade II, Group II

b) Test Materials

The short version of the Token Test (DeRenzi & Faglioni, 1978) was used in the study. The test consists of thirty six commands distributed across six subsections. Although the level of difficulty within each subsection is uniform, the difficulty level of items increases across the subsections. The total number of items in the Token test was divided into two equal sets, one set was used to measure LC and the other set to measure RC.The test material consists of twenty tokens comprising ten circles and ten squares with five small and five big tokens of each shape. Each set of shapes is depicted in five colours - red, yellow, green, black, and white. The test comes with a set of thirty six commands divided into six subsections. A sample of the questions from each subsection is shown in Table 2. The responses are scored on a fifteen point scoring system, where fifteen represents full score.

Table 2: Number of commands in subsections with examples

Sl No	Subsections	No of Commands	Examples
1	i	7	Touch a **square**. Touch a **green** one.
2	ii	4	Touch the **black circle**.
3	iii	4	Touch the **large yellow square**.
4	iv	4	Touch the **red circle** and the **green square**.
5	v	4	Touch the **small black circle** and the **large yellow square**.
6	vi	13	Put the green square **next to** the red circle. Touch the black circle **with** the red square

The test was administered individually in a quiet room in a single session lasting for about fifteen minutes for each participant. The performance was assessed on a fifteen point scoring system. The scores obtained by each participant on the eighteen test items were added. The compiled scores of the two groups on both the tests for LC and RC were subjected to statistical analysis. The data was subjected to descriptive statistics. The mean, standard deviation for Group I was obtained. The t-test of significance of difference in means and Pearson's correlation coefficient were also computed.

Results

The aim of the study was to compare LC and RC in children from Grade III and Grade IV (Group I) and in children with a diagnosis of learning disability (reading disability) (Group II) from Grade II and Grade III using the Token Test.

Performance on Token test by Group I children

The mean scores and standard deviation for LC and RC of typically developing children (Group I) are tabulated in Table 3 and depicted in Figure 1.

Table 3: Mean scores and SD on LC and RC

Sl.no.	Gr.	Gender	Skill	Mean Max.15	SD	Gender	Skill	Mean Max. 15	SD
1	III	B	LC	12.84	0.85	Both B & G	LC	12.9	0.82
2			RC	11.72	0.94				
3		G	LC	12.96	0.79		RC	12.04	0.88
4			RC	12.36	0.82				
5	IV	B	LC	13.13	1.08	Both B & G	LC	13.13	1.26
6			RC	12.5	1.43				
7		G	LC	12.82	1.43		RC	12.63	1.28
8			RC	12.77	1.13				

LC = Listening Comprehension; RC= Reading Comprehension
B= Boys; G=Girls

Table 3 shows that the performance of Grade III and Grade IV children was better on LC (12.9 for boys and 13.13 for girls) than on RC (12.04 for boys and 12.63 for girls). Results on the t test for significance of difference between the mean scores for LC and RC showed no significance (0.23 and 0.57 respectively, $p > 0.05$, 2-tailed test,).

Figure 1: Performance of Group I on the subsections of the Token Test

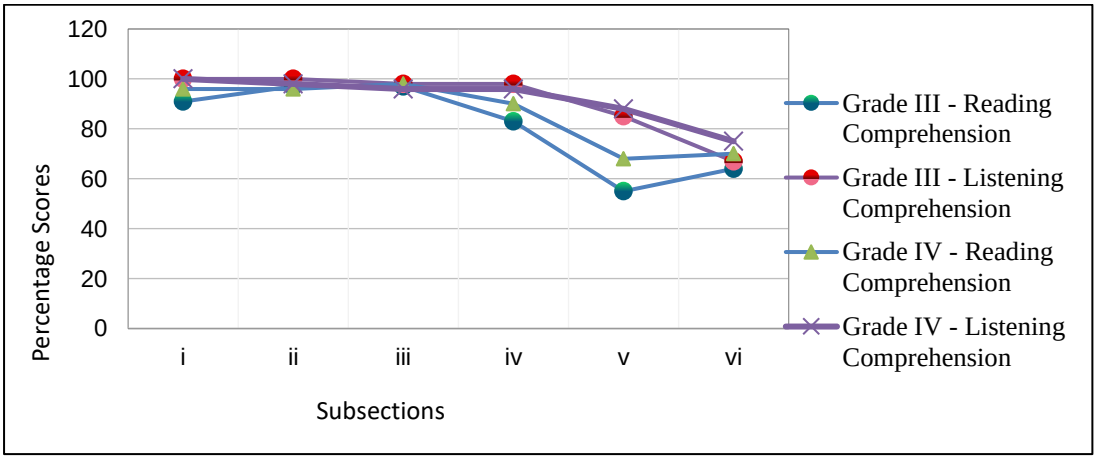

Figure 1 shows the performance of typically developing children on the subsections of the Token Test as it traces an interesting path. On the subsections 1, 2, and 3 the scores on LC and RC reached ceiling (100, 100 and 98 respectively) suggesting that the task was easy for the children of both the Grades. Although a difference in scores on LC and RC was observed on subsection 4 and 5 in both the Grades, scores on subsection 5 was poorer on RC compared to LC for both the Grades. On subsection 6, scores showed slight improvement.

Further, Pearson's correlation analysis was carried out to explore the relationship between LC and RC which revealed a moderate correlation (0.473, 2-tailed) (Table 4).

Table 4: Pearson's correlation coefficient between LC and RC.

	Parameter	LC	RC
Pearson's correlation	Reading Comprehension	0.473	1.00
Significance (2 tailed)	Listening Comprehension	1.00	0.473

Performance on Token test by Group II

The mean scores for LC and RC of children with reading disability (Group II) are tabulated and depicted as shown in Table 5.

Table 5: Grades, ages and scores on LC and RC for Group II participants

S. No	Gender	Age (years)	Grade	LC (Max 15)	RC (Max 15)
1	G	9	II	10.77	0
2	G	8	III	12.11	10.22
3	G	9	III	10.44	0
4	B	8	III	11.72	8.66
5	B	8	III	9.88	11.11
6	B	8	III	11.44	9.94
Average for Group I participants				12.9	12.04

Table 5 presents the performance of Group II, children with reading disability (learning disability identified by the school clinical psychologist). The participants 1 and 3 scored zero on RC but fairly good scores on LC, while the participants 2, 4, 6 performed better on LC (12.11, 11.72 and 11.44 respectively) than on RC (10.22, 8.66, and 9.94 respectively), while

participant 5 performed better on RC (11.11) compared to LC (9.88). The results indicate that Group II has variants of children with reading disability despite having been diagnosed with a label of learning disability.

Consolidating the findings of the study, although the study is very preliminary with a small sample, the potential of the Token test as a screening tool cannot be undermined. Subsections one, two, and three consist of simple questions involving one, two or three linguistic concepts such as shape, size and colour. Therefore, scores on these three subsections were closer to ceiling level in both LC and RC for children from Grade III and IV. Whereas subsections four, five and six appear to place demand on verbal short term memory with increase in syntax complexity with multiple conceptual units in the sentences. The scores for both LC and RC declined for both the Grades, but the decline was more for RC and therefore, a considerable discrepancy between the two skills on these subsections in both the Grades was evident. These subsections appear to be sensitive to the second stage of information processing i.e., the stage in which information that has been received through the senses is processed with the help of the memory. Impaired comprehension on subsection four, five and six may be reasoned out as selective impairment of syntax due to short-term memory impairment for verbal units. The percentage error on the syntactic markers of subsection six of the Token test by Group I indicated in Table 6 suggests that poor comprehension of complexities in syntactic units could be an indicator of poor verbal short-term memory. The findings are in consensus with Barnes, Wang, Swanson, Dardick, Li, Tao and Peng (2017) who reported a strong relation between reading and short-term memory in children of Grade four and below.

Table 6: Percentage error on the syntactic markers of subsection 6 by Group I

Listening Comprehension				Reading Comprehension	
Sl No	Syntactic Marker	Percentage Error	Sl No	Syntactic Marker	Percentage Error
1	Away from	77.08	1	With	97.91
2	Next to	56.25	2	If	89.58
3	Between	37.5	3	Or	50
4	No!	31.25	4	Slowly/Quickly	37.5
5	On	18.75	5	Instead	31.25
6	In addition	16.66	6	Except	18.75
7	And	8.33		*	

*The syntactic marker ‘and’ was not used in RC stimuli.

To summarize, the aim of the study was to compare the performance of typically developing children and children with a diagnosis of reading disability on LC and RC using

the Token Test. The results show that the short version of the adapted Token Test has the potential to identify children with RC problems based on the discrepancy between the two skills or the lack of it.

The results of Group I participants revealed a moderate correlation between LC and RC, and a minimal discrepancy between the two skills. Overall, the children performed better on LC compared to RC, though the differences were not statistically significant. The performance of Grade IV participants was better than Grade III participants suggesting progress with increase in Grade.

The results of Group II identified only two children, participants 1 and 3 as being typical children with reading disability as there was a considerable discrepancy between LC and RC. The performance on RC was very poor (zero) indicating a large modality effect. Similar findings have been reported in earlier studies (Spring and French, 1990; Royer, Greene & Sinatra, 1987). The other four children of Group II appear to be variants of reading difficulty probably due to environmental, socio-emotional, or educational factors. The sensitivity of the Token Test is reflected in the identification of two children from among the six children of Group II.

Listening permits a direct access to the meaning from sounds, while reading requires a two-step process for accessing meaning from print. As a result, the syntactic complexity of commands increased the load on verbal short-term memory in subsections 4, 5, and 6. These subsections appear to be sensitive to cognitive-linguistic abilities such as verbal short-term memory and adequacy in syntactic skills.

Conclusion

It is important that children comprehend what they are taught in schools, aurally or through the written mode, by their teachers in each subject of the curriculum for academic success. Sometimes comprehension of educational material is impeded due to issues decoding the written material or due to poor auditory processing issues or because the decoded message is processed poorly due to inadequate linguistic skills. It is important to be able to identify the point at which comprehension breaks down in order to remediate it effectively. The Token Test differentiated among children with decoding, auditory perceptual and language based comprehension problems in Group II. Thus, the Token Test stands out as a sensitive tool for screening reading disability by comparing the performance on LC and RC. In the multi-cultural and multi-linguistic Indian context, it offers a promising outlook to be a screening tool that can be translated into other languages without linguistic and cultural constraints in both English language medium schools and in schools that offer other Indian languages as medium of education. Further studies can be carried out to establish norms across larger and wider population of children.

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