Development of Cognitive Linguistic Assessment Protocol for Children

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Abstract

Our verbal behavior is determined by what we know, by what we perceive and think in a given circumstance and by the cognitive operations in production and comprehension. The cognitive processes are usually described in terms of discrete units of attention, perception, memory, concept formation and representation. There is an intricate relationship between cognition and language, especially the cognitive processes like attention, memory and organization are important for comprehending and producing language. Therefore a speech pathologist plays a very important role to assess these cognitive linguistic skills and to render appropriate intervention for the clinical population lacking these skills. The aim of the present study was to develop a cognitive linguistic assessment protocol for children. The domains involved in assessment of cognitive linguistic skills are attention, memory, problem solving. Each domain was assessed in two modalities - auditory and visual modality. It was found that the development of cognitive linguistic skills in children follows a developmental trend. The results also suggested that as the complexity of the stimulus advanced there was a decline in the performance of the children. The present study therefore was an attempt towards this direction in the Indian context. The study was aimed to develop an assessment protocol to assess the cognitive linguistic abilities in Kannada speaking children.

Introduction

Language is one of the most mysterious products of human mind. It is a means of communication and socialization as well as a vehicle for thought. Bloom (1988) defined language as a code by which ideas about the world are represented through a conventional system of arbitrary signals of communication. Owens (1992) defined language as a socially shared code or conventional system for representing concepts through the use of arbitrary symbols and rule governed combinations of these symbols. Thus to understand this complex human behavioral system of language it is important for speech language pathologist to study and integrate its characteristics in terms of four major dimensions:

1. The cognitive dimension
2. The linguistic dimension
3. The dimension of language performance
4. The dimension of communicative environment.

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In order for an individual to be able to communicate with others in his linguistic environment he must master the rules that govern the linguistic code. However as the language code passes through each individual's cognitive filter the resulting effect is the unique style of using language. Cognition has historically been considered the base upon which the language develops. Cognitive processes specifically the symbolic thought make language possible and precede language development (Piaget, 1970; Brown 1973). Cognition constitutes foundations or underpinning for language (Bloom, Lahey & Muma 1978).

Piaget's model of cognition tries to integrate the process and products of cognition with language in various stages of early development (Inhelder & Piaget 1958; Piaget, 1969). Piaget identified four distinct intellectual structures that form an invariant developmental sequence. Cognitive processes exhibit enormous changes from infancy to adulthood. Theorizing about cognitive development is dominated by the views of Piaget who argues that the growing child passes from stage to stage during development with each stage characterized by different set of cognitive processes. As language development proceeds children appear to move from receptive phase to more productive phase; this transition appears to depend on the development of cognitive skills.

Thus there is an intricate relationship between cognition and language especially the cognitive processes like attention, memory and organization are important for comprehending and producing language (ASHA 1987). Moreover the higher level cognitive processes like reasoning, problem solving and meta-cognitive thinking are largely mediated by language. Therefore a speech pathologist plays a very important role to assess these cognitive linguistic skills and to rendered appropriate intervention for the clinical population lacking these skills. There are many tests to assess these cognitive linguistic skills in children e.g., Stanford-Binet test or Stanford-Binet intelligence scale (Binet & Simon 1905), Bayley scales of infant development (Bayley, 1969), Griffith's mental development scale (Griffiths, 1954) and the Weschler intelligence scale for children (Weschler, 1949) etc.

In the Indian context one test which tries to assess cognitive linguistic skills is *Cognitive Linguistic Assessment Protocol for Adults* (Kamath, 2001). Most of these tests concentrate on one or few cognitive linguistic domains or tests the global cognitive or global linguistic domains. Norms of these are restricted to western population. Not much substantial work is done in Indian context. The present study therefore is an attempt the move towards this direction. The study was aimed to develop an assessment protocol to assess the cognitive linguistic abilities in Kannada speaking children.

Attention is the cognitive process of selectively concentrating on one thing while ignoring other things. Examples include listening carefully to what someone is saying while ignoring other conversations in the room (e.g. the cocktail party problem). Attention is the process of stimulus selection (Neisser, 1967) or selective perception (Gibson, 1969). Attention is central to the linguistic or cognitive processing. The ability to process language may therefore be limited by attentional capacity available to the individual (Maxim, 1999). Impaired attention can lead to subjects missing out on information in spoken discourse or in written material which may have impact on their responses and cause communication breakdown (Boyle & Strikowsky-Harvey, 1999).

Memory is one of the most important concepts in learning; if things are not remembered, no learning can take place. Furthermore memory has served as a battleground for opposing theories and paradigms of learning (e.g., Adams, 1967; Ashcraft, 1989; Bartlett, 1932; Klatzky, 1980; Loftus & Loftus, 1976; Tulving & Donaldson, 1972). Memory plays a basic or critical role in language acquisition and learning process. Memory impairments however would result in poor communicative skills in children thus resulting in communication breakdown. Children with poor memory skills in turn may not be able comprehend and may be not able to produce longer utterance due to limited memory span capabilities. Bearing this in mind a speech language pathologist plays a vital role in the study of these developmental trends which would further help in diagnosing and planning for intervention for children with cognitive linguistic impairment.

Problem solving involves a variety of cognitive processes and the importance of any process varies from one problem to another (Metcalfe & Wiebe, 1987). Problem solving strategy consists of the following steps:

- Identify the problem
- Define and represent the problem
- Explore possible strategies
- Act on the strategies
- Look back and evaluate the effects of your activities

In other words problem solving involves one to understand it, generate possible solutions, overcome possible obstacles and evaluate alternatives. Problem solving is the foundation of a young child's learning. Information processes involved in problem solving are attention, memory, concept organization, memory, language and social cognition. These information-processing abilities have been reported to be impaired in children with developmental disabilities like learning disability, ADHD, autism, hearing impaired, etc. Therefore assessment of these skills in children becomes very important for a speech language pathologist.

Cognitive linguistics skills in children in the Indian context are not widely explored. There are few tests available in western contexts. One test which is assesses the cognitive linguistic skills in adults is Cognitive linguistic assessment protocol for adults Kamath.A (2001)

Tests available to assess the cognitive linguistic skills in children:

- Stanford- Binet test or Stanford– Binet intelligence scale (Binet & Simon, 1905)
- Bayley scales of infant development (Bayley, 1969)
- Griffith's mental development scales (Griffiths, 1954)
- The Weschler intelligence scale for children (Weschler, 1949)
- The Weschler preschool and primary scale intelligence scale (Weschler, 1968)
- Reynell- Zinkin scales, part 1 - mental development (Reynell, 1979)
- The Kaufman Assessment Battery for children (Kaufman & Kaufman, 1983)
- Cognitive abilities test (CAT) (Robert L, Thorndike & Elizabeth Hagen, 1978)
- Cognitive linguistic improvement program (Ross-Swain, 1992)

Most of these tests concentrate on one or few cognitive linguistic domains or test the cognitive or global linguistic domains. Norms of these are restricted to western population. Not much substantial work is done in Indian context. Therefore considering the above notes the aim

of the present study was to develop an assessment protocol to assess the cognitive linguistic abilities in Kannada speaking children.

Aim of the study

The aim of the study was to construct a cognitive linguistic assessment protocol for children.

Method

Material

As this study aimed to construct a cognitive linguistic assessment protocol for children (4 to 8 years) the review constituted a vital part and the first step of the study.

Item pooling

A review about the cognitive linguistic developmental trends observed in children, the different cognitive linguistic assessment tools used by different authors to study disordered population, different assessment formats/protocols, journal articles and web based search was employed. All these items pooled from literature were classified under different domains Viz. attention/discrimination, memory and problem solving.

Subjects

Normal children within the age range of 4 to 8 years were taken up for the study. The subjects were further divided into four subgroups viz., 4 to 5 years, 5 to 6 years, 6 to 7 years and 7 to 8 years. Equal number of males and females were considered in all the subgroups. Subjects were sub grouped as given in the table 1.

Table 1: Demographic data of subjects sampled

Sl No.	Age (in years)	No. of Males	No. of Females
1	4-5	3	3
2	5-6	3	3
3	6-7	3	3
4	7-8	3	3

Criteria for selection of subjects

The following criterion was considered for selection of subjects:

1. The subjects should be able to speak, read and write Kannada
2. The subjects should not have any significant deficit in hearing sensitivity for speech and should have normal/corrected vision
3. The subjects should be physically fit during the testing period

Procedure

The method included three phases:

Phase I:

This phase included developing an assessment protocol. The cognitive processes most often employed in linguistic communicative tasks were considered for the protocol. This was done based on the nature of cognitive communicative tasks used by various authors in studying the different disorders. Thus based on Best's (1999) original list consisting of memory, organization of knowledge, language, reasoning, problem solving, the following were taken up as the core cognitive abilities which support language development.

1. Attention/discrimination
2. Memory
3. Problem solving.

The testing was done on both the sensory modalities i.e. auditory and the visual modality as both these sensory modalities differ in several fundamental ways.

Phase II:

Following the development of the protocol a pilot study was undertaken in which this protocol was administered on normal Kannada speaking children within the age range of 4 years to 8 years. This age range was further divided into subgroups as shown in the table 1 above. Equal number of males and females were selected for the study.

The subjects selected were taken from the normal schools in Mysore. All the children had Kannada as their mother tongue. They were seated comfortably and were tested in a room with minimum external noise. The testing was carried out in one session and it took 45 minutes to administer the whole protocol and the child's responses were scored. Every correct response was given a score of 1 and every wrong response was given a score of 0.

Table 2: The total scores of each task under each domain

Sl No	Auditory Mode	Score	Visual Mode	Score
I	Attention/Discrimination			
a)	Digit count test	5	Odd one out test	5
b)	Sound count test	5	Letter cancellation	5
c)	Auditory word discrimination	10	Visual-word discrimination	10
Total Score		20		20
II	Memory			
a)	Digit forward span	5	Alternate sequence	5
b)	Word recall	5	Picture counting	5
c)	Digit backward span	5	Story sequencing	5
Total Score		15		15
III	Problem Solving			
a)	Predicting the outcome	10	Association task	5
b)	Predicting the cause	10	Overlapping test	5
c)	Compare and contrast	10	Mazes	5
Total Score		30		15

Phase III:

The items selected in phase two were modified and the hierarchy was altered according to the results of the developmental trends observed. The most answered levels were shifted to the first levels and the least responded levels were shifted as higher levels.

Results and Discussion

The data obtained was appropriately tabulated and was subjected to qualitative and quantitative analysis. At the outset a descriptive analysis of the performance of all the subjects on each task in all the domains was done. The tasks in each domain were arranged in the order of difficulty such that with every presentation the complexity of the task increased. Therefore to analyze the levels suitable for a particular age group a criteria was set such that all the subjects or greater than or equal to 50% of subjects should pass on that particular level, thus indicating that the level is suitable for that age group. In view of this the performance of all the subjects on each task in each domain was evaluated.

I. Attention/ Discrimination

a. Auditory mode

All the four groups were able to satisfy the level I of digit count test and sound count test. However there is a difference observed across different age groups as the complexity of the task increased. Performance declined as the level advanced from level I to level V with none of the subjects from this age range performing well. The present findings on the tasks on digit count and sound count test reveal that the attentional abilities of children improve as a function of age. Ten word pairs were used to assess auditory discrimination abilities of children. The complexity of the words was hypothetically arranged. After administering the test on all the age groups this word list was modified according to the responses.

b. Visual mode

In the visual mode it was found that the first two levels of the odd one out test and letter cancellation task were attained by all the four age groups. However drop in the number of subjects performing on the higher tasks was observed as the levels advanced from level I to V. It was found that only 7-8 years old children were able to perform on higher levels. In the visual word discrimination task also the performance of all the subjects was better on all the word pairs. Yet it was observed from the first age group (4-5 years old) could not meet the criteria for the word pair VWD-4 and hence this was shifted to the end of the list.

In elaboration the present findings suggest that the attentional skills develop as a function of age. It is also evident from the results that 100% of children from the first age group were able to achieve the level I of all the tasks used to assess attention. Nonetheless it was found that as the density of the tasks increased the performance trimmed down. It can be suggested that the higher levels involved required greater selective or sustained attention span. And thus as the age increases the attention span of children also increases which is very well evident from the result.

II. Memory

The performance of the number of subjects on each of the task involved to assess memory was compared for each task across all the levels.

a. Auditory mode:

The performance of each age group varied across each level. All the subjects from all the four groups were able to attain the first level of the task. However as the levels advanced the performance declined from level I to level II. Only children in 7-8 years age were able to attain the level III on digit forward and reached till level V on word recall task. But they also could not attain the higher levels and also the performance was poor on digit backward task. In contrast the younger children could not reach the level III thus indicating that the number of items recalled improves as the age increases.

b. Visual mode:

These tasks involved alternate sequencing, picture counting and story sequencing which showed developmental trend. Level II was attained only by children from 5-8 years of age. Further as the complexity increased only the older children were able to reach level IV. However none of the groups reached till level V on alternate sequencing and picture counting tasks.

Given this information from the tasks it can be suggested that memory plays an important role in the language development. A systematic increase in chronological age brings about an increase in memory span. These results are also supported by number of studies done to assess memory span in children (Brown, 1973; Brown & Fraser, 1963). One information from this study is that the digit span improved with an increment in the age. The results also throw light on the inter relationship of attention and memory. It can be ascertained from the results that the higher level tasks involve the role of attention to recall the longer strings of digits or words and thus development of attention also parallels the development of memory. Therefore these cognitive skills appear to be inter-dependent on each other.

III. Problem solving

a. Auditory Mode:

There was a marked variation in performance of the older children from that of younger children. The number of items responded correctly were considered in the initial position of the list and the one which were difficult to answer were considered to be the higher level. This modification of the list was done subsequently to the administration of the protocol to all the age groups. The tasks involved were predicting the out come, predicting the cause, compare and contrast. It was found that the performance of children varied across the items.

b. Visual Mode:

The results of association task, overlapping test and mazes reveal that the ability to solve the visually presented stimuli improves as the age increases. As the age range increased there was an enhancement in the ability to associate two or more than two from a picture array till level III. The older age groups were able to associate the pictures till level V. However the younger age groups could not attain the higher levels, thus indicating that this ability to visually

solve the problem improves as the child gets older. Similar results were found for mazes and overlapping test. In essence the results of this domain reveal that the problem solving abilities involving reasoning, thinking, etc., are attained as a child grows older. The environment to which the child is exposed also plays an important role in the acquisition of these skills. It is very well established that these problem solving abilities also aid in language development. This in turn would result in better scholastic performance.

In essence the results of the study suggest that the as the child grows older there appears to be developmental pattern observed in cognitive-linguistic processes like attention, memory and problem solving. These cognitive linguistic skills also aid in the language acquisition. The obtained results with respect to the acquisition of cognitive-linguistic skills would be helpful in assessing the cognitive-linguistic disabilities in children with language disorders. In this perspective the present study serves as a preliminary or screening tool to assess the cognitive-linguistic impairments in children. In addition the skills enlist a developmental order which would help the speech language pathologist to frame appropriate goals for intervention of children with cognitive-linguistic impairment.

Conclusions

The results of this study reveal several points of interest. It was found that the development of cognitive linguistic skills in children tested on this assessment tool follows a developmental trend. The results also suggested that as the complexity of the stimulus advanced there was a decline in the performance of children. However it was found that as the age increased the performance on the higher levels was superior. Thus the results indicated that the cognitive-linguistic skills follow a developmental continuum.

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