DEVELOPMENT OF COGNITIVE LINGUISTIC SKILLS IN KANNADA SPEAKING CHILDREN BETWEEN 6-8 YEARS

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May, 2016

CERTIFICATE

This is to certify that this dissertation entitled **"Development of cognitive linguistic skills in Kannada speaking children between 6-8 years"** is a bonafide work in part fulfillment for the degree of Master of Science (Speech Language Patholgy) of the student with Registration No. 14SLP030. This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysuru
May, 2016.

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CERTIFICATE

This is to certify that this dissertation entitled **"Development of cognitive linguistic skills in Kannada speaking children between 6-8 years"** has been prepared under my guidance. It is also certified that this has not been submitted earlier in other University for the award of any other Diploma or Degree.

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DECLARATION

This dissertation entitled **"Development of cognitive linguistic skills in Kannada speaking children between 6-8 years"** is the result of my own study under the guidance of **Dr. R. Rajasudhakar**, Lecturer in Speech Sciences, Department of Speech Language Science, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysore, **Register 14SLP030**

May, 2016

DEDICATED TO LORD GANESHA AND TO MY GRAND MA...

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The first step in truly loving others is to acknowledge them in the some way you would like to be acknowledged

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Chapter I

INTRODUCTION

Language plays an important part in our life because of familiarity, people rarely observe it and taking it rather granted as they do breathing or walking. The effects of language are remarkable and include much of what distinguishes man from animals; language also is a creation our social need. Language has been defined as ‘a code where by the idea about the world is represented through conventional system of arbitrary signals for communication (Lahey, 1978). Two major functions of language are communicative and cognitive. In communication, language functions to realize intended messages in social interaction. Cognition main function of language is to represent experience in usable ways (representational function) and to assist thinking (meditational function). These distinctions have become helpful in appreciating various cognitive precursors to early language acquisition and the distinctions between early cognitive and communicative comments. Language is the hidden cognitive process that resists systematic investigation. Cognition influences the acquisition, storage transformation and the use of knowledge (Matlin, 1983). Cognition involves some of the mental process like attention memory, pattern recognition, organization of knowledge, language, reasoning, problem solving, classification, concepts and categorization (Best, 1999), which are highly interrelated to each other. Cognition indeed refers to the mental process by which external or internal input is transformed, reduced, elaborated, stored, recovered, and used. As such, it involves a variety of functions such as perception, attention, memory coding, retention, and recall, decision making, reasoning, problem-solving, imagining, planning and executing actions (Neisser, 1967).

Cognitive development underpins most of the aspects of development as children start to explore and make sense of the world around them. It also highly linked to the development of language and communication skill as children interact with people around them. There are numerous theories on cognitive development and language and communication. One of the major models of cognition by Piaget's correlates the every stage of cognitive process development with the various stages of language development. In first stage sensorimotor period**,** Infants develop the ability to use primitive symbols and form enduring, mental representations. This stage is associated primarily with the beginnings of insight, or true creativity. Second stage is the pre operational stage, where play activities will helps to develop the social function of language. Egocentrism, play, symbolic representation, animism, artificialism also helps in language development. Third is the Concrete operational stage where child uses language to concrete and specific facts in which the narrative skills like story telling will be developed. In the final stage, that is, formal operational stage child learn to use language for the debate and to express other abstract concepts. Piaget believed these stages promote the cognitive and linguistic skills in children. As child passes from each stage during development, with each stage consisting by different set of cognitive processes. In acquiring a language, children must ultimately attend to all the distinctions relevant in that language. This includes the ability to take diverse perspectives on the same event or the same object. However, as linguistic representations capture only certain aspects of cognitive representations, both types of representation remain crucial, not only during language acquisition, but also on other occasions when children and adults alike need to draw on non-linguistic as well as, or instead of, linguistic categories (Clark, 2004). Higher-level cognitive process such as reasoning, problem solving and meta - cognitive thinking skills are greatly mediated

by language, therefore speech language pathologist plays crucial role to assess these cognitive linguistic skills and to provide appropriate intervention for the clinical population in which these skills are lacking. The major cognitive processes involved in the development of language are: Attention, memory and problem solving.

1.1. Attention

Attention has been used to refer to all those aspects of human cognition that the subject can control and to all aspects of cognition having to do with limited resources or capacity, and methods of dealing with such constraints. Attention is cognitive process closely related to the other cognitive processes like learning. DeGangi and Porges (1990) illustrate only "when a person is actively engaged in voluntary attention, functional purposeful activity and then only learning can occur." Poor attention is often a key symptom of behavior of learning disorders. Attention functions as the gateway to a simpler representation of the world, the attended part of it. This simplification is put to good use in higher levels of processing, rather than requiring the subjects brain to work all the time with full complex total world review. This leads to specific position that attention is the gateway to cognition.

1.1.1. Types of attention

James W, (1892) identified two types of attention based on effort involved in their use as involuntary attention and voluntary.

Involuntary/passive attention refers to attention that requires no effort at all, such as when something interesting or exciting happens and we look to discover. Thus, stimuli used have direct exciting quality like strange things, novel things, and bright light, loud sounds. Involuntary attention can elicit Startle response trigged by loud unexpected sound and orienting response triggered by new stimulus/alterations in the properties of a present stimulus.

Voluntary/directed attention is intentional, effortful and directed by task demands. Limited in capacity and tends to decay over time without continual effort. There are varieties of active attention and subtypes are Selective, Sustained, and Divided attention.

Selective attention*:*

Selective attention refers to the ability to focus on some information from a mass of data (Allport, 1993).

Sustained attention:

sometimes called concentration/vigilance, is the ability to self-sustain mindful, conscious processing of stimuli whose repetitive, non-arousing qualities, would otherwise lead to habituation and distraction by other stimuli' (Robertson et al., 1997).

Divided attention:

Divided attention is the highest level of attention and it refers to the ability to respond simultaneously to multiple tasks or multiple task demands. Examples: Driving a car whilst carrying on a conversation with a passenger and eating dinner whilst watching TV. The selective attention that is early selection theories (Broadbent, 1958) argue that selection occurs at an early stage in perceptual processing and direct attention to a particular location or object typically enhances information processing at that location or for the object. Late selection theories argue that selection occurs after identification of stimuli to choose appropriate action or response (Deustch & Deutsch, 1963). Treisman (2006) has discussed the significance of two types of distinct attentional allocations that lead to differences in processing, with focused attention enabling detailed analysis of specific features and objects and distributed attention facilitating global registration of scene properties. Focused and

distributed attention differs in terms of differences in information processing but also may result in differences in awareness.

At birth an infant appears to have only low level of attention and it extends to minutes as infant grows older. This period of attention, coincide with that of attention by mother to the child, so that joint attention processing occurs. At the age of 2 months, attention differentiality by 4 months gazing for longer time. At the age of 28 months gaze for longer period with distraction establishes, by the age of 4 years, novelty is no longer the major determination of attention, Grabbe and Campione (1969) show that in a discrimination learning task children look not at the novel stimuli but what has been previously been rewarded. Also by this age, a familiar environment is scanned systematically and with less tendency to fixate on the most salient points with increasing age this becomes more securely establishes as strategy of sampling stimuli. Wright and Vlietstra (1975) present evidence for this view and show how perceptual exploration gradually gives way to active, logically organized search. Such procedure is independent of the salience of the environment, systematic and flexible.

According to Pick, Frunkel and Hess (1975) attention is treated not as an isolated function but as an ongoing part of perception. The ability to process language may therefore be limited by attentional capacity available to the individual (Maxim, 1999). Poor attention skills 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).

1.2. Memory

Memory is the one of the components of cognition. Memory is defined as serial process where in we store whatever we are learnt, this information is retained

based on the amount of rehearsals and can be recollected from the store whenever required. Organizing the process of memory in four aspects includes learning, aggregation, storage and retrieval. First new information will be perceived through brain from different senses and which will be entered to memory system next to facilitate storage of information into long term memory and there in organization of perceived information takes place. Formation of permanent representation of the concept takes place (storage).

Dynamic model of working memory by Baddeley (2000) involves "phonological loop", "central executive", "visuo-spatial sketch pad" and the episodic buffer. Interaction of these components provides comprehensive work space for various cognitive abilities. **Phonological or articulatory loop**, specializes in processing linguistic information, particularly in the early childhood years. It may also be vital for learning a second language. The phonological store acts as an 'inner ear', remembering speech sounds in their temporal order, whilst the articulatory process acts as an 'inner voice' and repeats the series of words (or other speech elements) on a loop to prevent them from decay phonological information is devoted to processing of acoustic information while **visuo-spaital sketch pad** processes spatial information and play a key role in the acquisition of vocabulary. Thus each system operates on a specific code; the phonological unit on the acoustic code and the sketch pad on a visual code. **'Episodic buffer'** links information across domains to form integrated units of visual, spatial, and verbal information with time sequencing such as the memory of a event. It also links to long-term memory and semantic meaning and also greatly involved in reading and writing. The "**central executive** "is a flexible system responsible for the control and regulation of cognitive processes. It has the following functions in binding information from a number of sources into

coherent episodes, coordination of the slave systems, shifting between tasks or retrieval strategies, selective attention and inhibition and also it is highly involved in problem solving and decision making skills. **Long-term memory** consists of three main processes that take place consecutively: encoding, storage, and retrieval (recall) of information.

Working memory capacity is one cognitive process that is positively associated with speech communication abilities (Pisoni & Geer 2000; Cleary, Pisoni & Geers, 2001). Phonological working memory is important source of individual differences in learning to read (Wagner & Torgesen, 1987). Lower order executive functions such as inhibition and rapid automatic switching and higher order functions such as planning and problem solving contribute to the reading writing success in third and fifth graders (Altemeier, Jones, Abbott, & Berninger, 2006). Thus, memory plays a very important role in the development of higher language skills.

1.3. Problem Solving

Problem solving can be defined as successfully searching for an operation or a series of operations in order to transfer the given actual state of the system to a goal state (Newell & Simon, 1972; Dunbar, 1998). A problem is said to be present when we does not know to reach the goal. It acts as barrier between given situation and desired goal state. Problem solving is an inquiry learning where existing knowledge is applied to a new or unfamiliar situation in order to gain knowledge (Killen, 1996). It includes higher order thinking skills and sometimes it is considered as strategy which is used to develop the reasoning skills in learners as it involves research to identify problem, analyzes the various perspective of problem, and evaluation of the different

perspective and synthesize findings. Conceptual understanding of systems, higher order thinking skills, more holistic point of view leads to mastery of problem solving.

Vygotsky (1962) have brought the important relation of language and thought process, in the first stage language and through process are totally unrelated so it results in pre intellectual speech and preverbal thought. In the second stage they both develop parallelly but very little impact is present. But, in the third stage thinking and problem solving will be assisted by environmental stimulation of speech and private speech. It in turn helps in mutual understanding at later stage. Thus, the private speech we use in daily routine will help in the development of problem solving skills. So the language helps in the development of thinking and acts as central to the cognitive development.

Language and cognition linked with each other. Developments of these skills in child ren are very rapid. As many research findings states cognitive linguistic skills develop throughout the childhood rapidly and it also influenced by other environmental factors, cultural factors. So there is need of the research to know about the development of the cognitive linguistic skills in children of specific age and culture.

Hence, the present study aimed to understand the cognitive linguistic development in 6-8 years Kannada speaking children. Study consisted of 100 participants, 50 in each age group that is 6 to 6.11 years and 7 to 7.11 years. Equal number of boys and girls were considered in both the age group. Cognitive Linguistic Assessment Protocol for Children (Anuroopa, 2006) was administered. The results of the present study shown cognitive linguistic skills increase as a function of age.

Aim

To study the development of cognitive linguistic skills in Kannada speaking children between 6-8 years.

Objectives

- To observe the cognitive linguistic skills in children between 6-6.11,and 7-7.11 years.
- To compare performances the cognitive linguistic abilities between 6-6.11 years to 7-7.11 years
- To compare the gender difference (if any) on cognitive linguistic performances

Implications of the present study:

- The study results augment the understanding of cognitive linguistic abilities in younger children and how it develops as age increases. That is, developmental trend can be established in that age ranges (6-8years).
- Results helps in better understanding of the difference between performance of cognitive linguistic skills in boys and girls.
- The results of the present study will highlight about the modality differences in terms of cognitive linguistic skills between 6-8 years of children.

Chapter –II

REVIEW OF LITERATURE

2.1 Attention

In the first textbook on psychology, attention was referred as the "searchlight of consciousness". Meaning attention involves scanning the environment and focusing on selected items (James, 1890). Attention is akin to a beam of light in which the central brilliant part represents the focus (Hernandez & Peon, 1964)

According to Levine (2002) attention involves a six steps in which alertness is the first step. When individual has to do something, or want to listen other's, has to be alert and aroused for comprehending the things. The second step is called selectivity. In environment, If different stimuli distract attention it is difficult to appear every stimuli, that time individual has to be decide which stimuli is important. The third is focal maintenance (Levine, 2002) also called attention duration. The next step is called previewing. Previewing is the supposition of reproduction and planning. Self monitoring or self-regulation is the last step in the process of attention, which involves a checking of the task improvement, measuring the progress, and creating modifications if required.

Many studies have made an attempt to study about the development of attention in children across various languages. One of such study was done in Finnish. Finnish version of the NEPSY was standardized by Klenberg, Korkman, & Lahti-Nuuttila, (2001). It was done by recruiting 400 Finnish children from 3 to12 years. In every age group 38-41 participants were incorporated. Test consists of 10 subtest namely, statue, semantic fluency, visual search, knock and tap, auditory attention, visual attention, auditory response set, tower, and design fluency subtests, phonemic fluency subtest. All age groups were significantly differed in all subtests. Statue

subtest was the first one to have plateau in the age of 6 years since it does not require processing of visual and verbal stimuli instead inhibition of movements was required. Second, in the knock and tap subtest, at 7 years of age. That demanded the working memory process such as inhibition and shifting to get the accurate responses. Next for Tower subtest at 8 years, this required most of the sub functions such as attention, inhibition, working memory and visual spatial skills. In the subtests visual search, auditory response set, visual attention, auditory attention and semantic fluency reached the plateau at 10 years of age. It was observed that rapid increase in the performance of attention which occurred between 8 and 10 years of age. 10 to 13 years children were observed to have gradual pattern of development in some subsections. Verbal fluency tasks were the last to have rapid increment at 11 years of age since it demands ability to utilize of strategies. Significant gender difference was observed for only 3 tasks namely Auditory Response subtest, Phonemic Fluency subtest and Visual Attention subtest. Interactions among age and parent education level and design fluency subtest was noted. Boys' outperformed girls when parents' education was lower, but girls' performance tends to be higher with the higher education of the parents. No gender differences were found in the group of medium education level. On the Statue subtest, girls of 3 to 5 years made fewer errors than boys. At 6 years, there was no gender difference present. It indicates that inhibition and impulse control will be matured in girls first and boys cover this difference at the age of 6 years, At the preschool years boys gives more attention to the motor activity than for the task oriented activities however in the school age they managed to have equal importance for both the tasks. So at this age both gender has similar inhibitory skills. Parental education had strong correlation with executive functions indicating these tasks are more influenced by environmental factors and learning, but earlier

matured performance in attention and inhibition process is because of earlier neural maturation.

Visual search engage both serial and parallel processes. The other one is, feature search which includes identifying target among distracters differing in single feature (a blue target among red items) but in conjunction search target and non targets differed in terms of its feature. In a study by Hommel, Li, & Li (2004), both the condition such as feature and conjunction search were measured across life in 1,920 participants in the age of 6 to 89 years. In the first condition that is feature-search, displayed distracters were of unfilled white circles size being similar to target. In the second condition conjunction search, along with same distractors consisted filled white squares were added additionally. Stimulus display consisted of 2, 8, or 14 distractors and 1 distractor was replaced by the target. Reaction time for the search of target was measured. There was decrement in reaction time as age increased from 6 years to 23–33 years but increased after 33-40 years. Increased RTs in younger groups was attributed to the fact that inefficiency to ignore distractor and limited inhibitory control in the children also the selective attention may imitate the neural pathway myelinisation. Increased RTs in older group was- related to the fact that cognitive decline during aging also declines in neuromodulatory mechanisms which impacts information processing.

Complex cognitive processes like, language, categorization, comprehension, and reasoning requires sustained attention to the selected object. Previous studies on sustained selection shows that fifty percent of the three and half year-old children were not successful to complete sustained attention tasks, signifying difficulty in sustaining their attention if they sustain their also more errors were present (Akshoomoff, 2002). Four and five years of age children shows significant

improvement in task completion and its accuracy. Suggesting development with the voluntary control of selectivity. Exogenous factors of stimulus such as brightness and complexity of stimulus has less effect on focused attention than endogenous factor such as internal state of infant these factors plays important role in allocating attention (Tellinghuisen, Oakes, & Tjebkes, 1999).

Fisher (2010) developed a new task of sustained selective attention for which suitable task to examine the mechanisms of sustained selective attention in typically developing children of 3 to 5 years. Also the influence of endogenous and exogenous factors to sustained selective attention in these children was also studied. Object tracking tasks was developed such a way that 3X3 box was created where in child has to track the red circle which is on object inside grid until it moves to different object there and to tell the last grid visited by target object. Simultaneously two condition such as two same distracters (both distracters being small square) and two different distracters (different) were presented in experiment 1. In experiment 2 number of distracters were increased to 6 in both same and different conditions. Experiment 1 and experiment 2, the results suggested that accuracy of object tracking of heterogeneous distractors shows more delayed development than homogenous distracters. In both experiments there was developmental tendency of accuracy was noticed from 3 year old children to 5 years old children. In experiment 2, accuracy decreased regardless of condition whether it was same or different type of distracters. 5 year-old children also did not exhibit any significant differences in tracking accuracy. In the meantime, controlling attention voluntarily continues to develop well beyond the preschool years (Trick & Enns, 1998; Casey, Tottenham, & Fossella, 2002). Hence there is possibility of emergence difference in tracking accuracy in five year children with the increase of task difficulty. The primary outcome of the study

indicated that preschool children are better at focusing on the target when homogeneous distracter than with heterogeneous distracters. Because of the less competition for attentional resources in condition homogenous distracter amplifies the attention properties of the target. So, development of exogenous attention leads the development of endogenous attention.

Dye and Bavelier (2010) investigated the differential development of attention in school going typically developing children and in typical adults. The speed of maturation of the spatial visual attention, the temporal dynamics of visual attention and multiple object tracking abilities were assessed in 7-22 years video game players and non video game players. Useful Field of View paradigm (UFOV) was adapted to examine spatial visual attention in which participants are asked to find a target shape amongst several distractors. Temporal aspects of visual attention employed attentional blink task where shapes were presented rapidly on screen with distracters participant were asked to identify the target. Tracking of number of multiple moving objects was also assessed. There was no effect of age spatial aspects of visual attention that is in UFOV task suggests that visual attentional skills which are required for this task are stabilized before children enter to the elementary school. More objects were tracked by the older participants compared to the younger groups; this implies that object-based attention development continues till early adulthood. Since different aspects of visual attention shown dissimilar pace of development, with improving performance in different ages, gives support to the proposal that these various aspects of visual attention depends upon different neural resources

Heim, Wirth, and Keil, (2011) studied the resource allocation to targets by embedding rapidly presented distracters through attentional blink experiment and psychometric assessment. There were two groups younger and older group; Younger

group consisted of 21 participants of 6-7 years children and older group consisted of 24 participants of 10-11 years children. For attentional blink task, both non verbal and verbal stimuli were considered. Non Verbal stimuli consisted of a set of means of transport and shapes, verbal stimuli consisted of alphabets and letters. These two target stimuli appeared in green colour with white colour shape as distractors in certain lag on black computer screen. Participants were instructed to name the two targets (T1 and T2) Inter target intervals varied (i.e., Lag 1 to Lag 8). In the psychometric assessment, for younger children colored form of Raven's Progressive Matrices (CPM),Older children standard form of the Matrices (SPM) was given, test of forward digit span and test of backward digit span was carried out for both groups. Results reveled that older group performed better than younger group in identifying T1 and T2 accurately in both verbal and non verbal tasks. T2 identification accuracy was improved with the lag2 (232ms) to lag8 (928ms). Psychometric assessment revealed no significant difference for groups for Raven's Progressive Matrices. In Digit forward and backward span test, older children outperformed the younger children. Digit forward was recalled better than digit backward. Mean Digit forward and backward was 3.11 years for younger, 4.37years for older group respectively, which were more pronounced for the younger children. Pattern of findings indicated that younger children have overall less ability for processing quickly the presented visual information than the older students. In the older group however, superior capacity for a specific set of target features comes at the cost of higher sensitivity to intervening distractors or to a second target. Preschool children tend to attend the most salient characteristics of the stimulus, to position cues, and to random items. Between 5 and 7 years of age, children scan a visual array more systematically, though scanning is still impulsive. Around 8 years of age, children can direct attention

toward a recognized goal. Older children, 10 to 14 years of age performed better in instrumental or instructional learning and recall more central or task-relevent information (Hagen & Kail, 1975).

In general, most of the authors concluded that processing of global characteristics to more specific attributes occurs with development. This was referred to as attention by Neisser (1976), or selective perception by Pick (1975), reflecting the interrelationship between attention and perception. The most prevalent view, with respect to the role of perceiver, was that stimulation was perceived and processed by active participant rather than a passive observer.

2.2 Memory

Memory is defined as representation of stored information which involves a process of encoding, storing, memorizing and retrieving the information. This help to acquire knowledge to learn and manipulate the information in the surrounding. The first process is encoding followed by the storage and retrieval of the information Chapey (2001). Attention and memory are different but related process fundamental to learning. Attention to stimulus allows it to be more fully and permanently entered into memory, whereas unattended input is fleeting and may be lost. Memory enables the past to be recorded and accessed so that it may affect the present.

The logic for relating attention and memory was established by William James. In his chapter on attention (James, 1890), he wrote that the immediate effects of attention are to make us perceive, conceive, distinguish and remember better than we could otherwise. Years later, (Hebb, 1949) commented that “no learning is possible without intention to learn, no memory of a sensory event is possible unless it was attended to at the time of its occurrence.

Stages for processing of information from sensory memory to long term memory

Sensory memory:

It holds the information for few seconds after perceiving the stimulus. It is of three types that is iconic memory, echoic memory and haptic memory.

Transformation of information from sensory memory to short term memory:

This transformation process assumed to be controlled by the process of pattern recognition and attention. Pattern recognition is the process of recognizing that information in the sensory register is familiar or meaningful. If the information is recognized, it is transferred into short term memory. The control process of attention governs which information will pass from the sensory register to short term memory. Thus we are able to attend to only one channel of information at a time.

Short term memory

Short-term memory is considered as an experimental space where storage, processing and manipulation of the information takes place. It has a capacity of holding information upto seven chunks even lesser, in active state so that it is readily available to the user at any point of time. Limitation in the duration of short term memory and the rate at which material is forgotten. Grouping information allows more to be stored in short-term memory. Meaningful information is more easily stored than non meaningful information. Short term memory is limited by the amount of information that can be stored and also by its duration. This is also referred as working memory.

Long term memory

Long-term memory (LTM) is the storage of information, which is considered to be permanent as long as the brain is free of pathology. The information that is stored is primarily semantic. Transfer of the information from short-term to long term

is governed by a control process, referred to as elaborative rehearsal. The meaning of new information is analyzed by comparing the related information that is already in long term memory is stored through semantic coding –that is, by remembering the general meaning of a word or sentence. A second way to encode meaning is by imagery, that is, by creating a mental image of object or scene.

Development of memory

Memory is the process which starts develops in the age of two years. In this age child can get the information, memorize and recall the past experiences and is able to express this experiences in relative to present situation. As age increases child ability to recall and remember the things for long periods is increases (Gathercole, 1998).

Chevalier, James, Wiebe, Nelson and Espy (2014) studied the 123 children longitudinally at 7 points of time from 3 years through 8 years of age and adults of 21 years of age. At the age of 3, 4 and 5 years of age working memory was examined using Nebraska Barnyard test or scale (Hughes, Dunn, & White, 1998). Which required to recall the animal names in the same sequence and matching them with their colour squares where the animals were present before they disappear on the touch screen**.** At 6, 7 and 8 years and for adults E-prime software was used where animals name were presented in the software itself**.** Preparatory interval was measured, wherein it is the time taken from the end of the auditory item sequence and the first picture press. Item recall time is the time taken to recall the each item, Span length which is the highest sequence of animals that the subjects correctly recalled in the correct sequence were measured. Results revealed that sequence length increased from younger age to adult 3 years children could recall 3 items, 4-6 years children could recall 4 items and 7 years children could recall 5 items and above 7 year

children and adults could recall 6 items in correct sequence. Till 5 years of age preparatory interval was reduced. Children were more reactive than the following the proactive pattern (planning the response). The switch from reactive to proactive patterns was observed between 5 years to 7 years of age. But 7-10 years children and adult showed more proactive pattern. This implied that younger children were not able to plan the sequence or response but the older children and adults could plan their upcoming responses.

Vaz, Cordeiro, Macedo, and Lukasova, (2010) examined 103 elementary school going children from 1st to 6th grade. They were individually assessed 2 items from test of Forward span and Backward span of digits such as Wechsler Intelligence Scale for Children and Brown-Peterson task. Brown-Peterson task comprised of 20 test items of different consonants trigrams with less phonological similarity. Part I goals to immediate recall of consonants and In part II 3, 9 or 18 seconds of delay was given. In the interval delay children were asked to do backward counting of two digits presented by investigator. The results indicated that children's working memory improves progressively across the age. This attributed to the fact that maturation of neural areas such as frontal and prefrontal cortex which are interrelated with working memory and executive functions. Remarkable improvement was found in two age ranges from 1st to 2nd grade and from 5th to 6th grade children.

As Brocki and Bohlin (2004) highlighted some of the methodological drawbacks in Research which are examining executive functions mainly in children such as less construct validity. Which means the chance of executive tasks being influenced by the multitude of executive as well as nonexecutive, cognitive processes so it's hard to identify the development of individual process. In the view that single test results may be because of task dependent, authors conducted study on 92

participants, in the age of 6 to 13.1 years. By dividing them into four groups based on age (6–7.5 years, 7.6–9.5 years, 9.6–11.5 years, and 11.6–13.1 years). The tasks administered were as follows, non verbal working memory consisted of Kaufman Assessment Battery for Children (K-ABC), Hand Movements test (Kaufman & Kaufman, 1983) where child has to imitate the hand movements which are demonstrated by experimenter and time reproduction task (Cappella, Gentile & Juliano, 1977; Zakay, 1992) is a task that assess the child's sense of time. Second is the working memory through verbal modality consisted of two tasks such as digit forward and digit backward, task was regarding verbal fluency that is Controlled Oral Word Association Test (COWAT) (Gaddes & Crockett, 1975) consisted of semantic fluency and phonemic fluency as subtasks. 3rd task was about inhibition in which computerized go/no-go task include. A computerized version of the Continuous Performance Task (CPT) (Rosvold, Mirsky, Sarason, Bransome, & Beck, 1956) was administered. Go and no go task assess the child's ability to quickly distinguishing and shifting between target stimuli. In CPT paradigm, continuance of alertness to effortless stimuli also the inhibition of responses to contending stimuli over a extended period of time is necessary. Results revealed that peak shift in the dishinibition at the age of 7-8 years. Main gain in development of speed and arousal increases at the age of 6 to 7.5 years of age but first developmental spurt for working memory task was at the age of 8 years and second was at the age of 12 years. First developmental spurt reflects the developmental transform in the coding of nonverbal stimuli. This implies that young kids be likely to code the information visually. Conversely, after the age of 8 years, children tend to use a more phonological approach for processing the nonverbal stimuli. Those children who make use a phonological code has better recall than the perform children who do not use

phonological, indicating phonological coding improves recall. They concluded that main stage of maturation was at 6-8 years and 9-12 years and younger children has poor ability to stop the ongoing response to decide for the right answer also they have increased impulsivity to respond for stimuli compared to older children. Gender effect was present only for speed and arousal task where girls performed poorer than boys. This was attributed to the fact that girls have a tendency to use careful approach while selecting the answers. Time constrained task may result in less accurate responses in girls. Hence, use of different tests to assess different domains of executive functions (EFS) provides the developmental trend in different domains of Executive Functions. This information enhances the understanding of the typical and atypical development of executive functions.

Riggs, McTaggart, Simpson, & Freeman, (2006) investigated the visual working memory in 5-, 7-, and 10-year-old children using Luck and Vogel change detection paradigm. Children were asked to compare the stimulus on the screen with the previously presented stimuli. Stimuli were presented to 500 ms and array size was increased from simple to difficult level. Results indicated improvement in the performance across the age and which was ascribed to the fact that, better sustained attention and concentration, better verbal recoding or rehearsal of the visual stimuli in elder children, also increased speed of processing by ten folds from five years to ten years of age in young children. Also, they noticed that expansion in the capacity of visual working memory by two items to four items from 5 years to 10 years of age. Other studies of visual memory also pointed that 10 or 11 years of age children performed similarly to that of adults (Wilson et al., 1987; Logie & Pearson, 1997).

Miller (1956) reported that the number of items recalled by children improved as function of age with the average score for 4 year old being about four items,

whereas for 9 year old it is 6 items and 7 or higher items for children above 12 years. Ornstein, Naus and Liberty (1975) have established that as children grow older, there appears to be an enhancement in the recall strategies used by them. The younger subjects tend to recall the item presented recently (primacy effect) and the older subjects tend to use cumulative rehearsal strategies such as sub vocal rehearsal, chunking, mnemonics etc. which in turn results in integrated units and a better recall.

Cromer, Schembri, Harel, and Maruff, (2015) assessed the rate and accuracy in the cognitive process such as attention and memory that was measured longitudinally using Cogstate Brief Battery (CBB). 5788 individuals were participated in the study. Task given to assess the attention was, to answer 'yes' or 'no' questions which is related to the picture presented in the screen. Working Memory was measured by asking the participants to compare the previously presented stimulus with the ongoing stimulus. Results suggested that with increase in age, both speed and accuracy of the performance increased and the rate of improvement was more at younger age that is 10-11, 11-12 years than in the older age group i.e., 17-18 years. It was assumed that changes in these age group is due to increased gray matter in the region of prefrontal cortex (PFC), additional improvements throughout adolescence are reflection of the synaptic pruning (Nagy et al., 2004; Casey et al., 2005; Bunge & Wright, 2007; Luna, 2009). Findings were also suggested that the attention task matured first than working memory. No gender effect was seen in the study.

Soltanlou, Pixner, and Nuerk, (2015) studied the role of working memory by assessing multiplication skill in 77 children belonged to grade 2 and grade 3 children. They were assessed in two processes such as short term memory and working memory in two domains, First in verbal and second visuo-spatial domain. For the short term verbal memory children were asked to recall the letters in the same order

presented by the experimenter. In visuo spatial short term memory they were asked to tap the block in the same order. In order to assess the working memory, same tasks were given but children were asked to say the letter and tap the block in reverse order. Multiplication task consisted of simple one digit and two digit multiplication where in children were asked to judge whether the given answer is correct or not. Correct answer condition were considered as solution and incorrect answer condition was considered as distracter condition. Reaction time and accuracy was measured in both the condition. Results differed significantly between grade 2 and 3. Children of grade three performed better in both the type of working memory. Same results were found in multiplication task. These findings were explained with the fact that older children have faster processing and use strategies to verify the solution. During this stage, developmental shift from the verbal to visuo-spatial working memory happans. This results suggested that verbal STM influences multiplication abilities in early learning phase specially in grades 2 and 3, multiplication problems may be more auditorily and verbally trained as the complexity of the problem increase in older age group, problems are more often solved visually. This study did not differentiate the contribution of WM and STM separately even though the tasks were considered separately.

Imbo and Vandierendonck (2007) examined the influence of short term memory to the arithmetic skills through digit span test in 10-12 year old children. There was number correlation was found between these two factors. It was assumed that no of items in the memory does not play any role in arithmetic problem solving. The span length did not vary significantly in all 3 groups children that is 10, 11 and years, and number of items in the memory are same. So the results might not have showed any correlation.

Bilvashree, (2013) developed a test for assessing word level and sentence level working memory for typically developing children belongs to 6 to 9 years. Test was field tested with 30 males and 30 females in each age range that is 6-7,7-8,and 8-9 years of age. Test consisted of 4 subtests such as non word repetition, digit back ward, letter retrieval, word backspell for word level and 3 subtests such as sentence repetition, sentence comprehension, and answering according to the direction for sentence level working memory. Age and gender effect was calculated for all subtest. The entire subtest showed significant effect of age. Developmental pattern in Digit backward was present because as this task demands both the verbal execution process, storage and retrieval process, flexibility between these processes are important. This flexibility is mediated mainly by phonological loop. As age increase activation of phonological loop activation through sub vocal rehearsal increases, this also improves the ability to register the digits one by one in echoic short term memory. So these children develops flexibility also improves. Developmental pattern in letter retrieval was attributed to the fact that improved ability of retrieving chunks develops as children moves to higher grade. Developmental pattern in sentence repetition and comprehension skills was ascribed to the fact that limited capacity of number of chunks available in working memory for younger children and comprehension is the higher cognitive skill which develops across the age. Comparison of word level and sentence level working memory revealed that superior performance in word level task compared to sentence level. The authors explained that the word level working memory associated with word learning which is the early stage of development and sentence level working memory is influenced by text reading comprehension and decoding that develops later.

2.3 Problem solving

Hayes (1978) defined a problem as gap that separates us from the present state "problems come in many different forms and there is no single, clearly defined cognitive operation called "problem solving" rather problem solving involves a variety of cognitive process and the importance of any process varies from one problem to another. The behaviorist tradition studied problem solving from the perspective of analyzing it into simple processes of learning responses to stimuli and achieving the solution incrementally. Finally the computer-influenced information-processing tradition has dominated recent research.

The entire problem situation may be sub divided into:

(a) Understanding the problem: Considering a problem as a sequence of continually changing states from the start to the finish, there are several aspects to understanding the problem. The initial situation (start state) of the problem must be understood. Another important aspect of understanding is the defining the goal state. Problem solving must be goal directed, even though the goal may not always be achieved

(b) Solving the problem: The actual solution of the problem may be viewed as searching through "problem space" for a "solution path", a path connecting the start state and the goal state. Procedures used in solving problems may be either algorithms or heuristics.

   a. Algorithms are strategies guaranteed to produce an answer to the problem. Algorithms may not always be efficient, but they always work. They are most useful for well-defined, high structured problems

b. Heuristics are rules of thumb that have been developed from experience in solving problems. Heuristics involves using hunches, good guesses, practical knowledge and experience.

Abstraction can be defined as two forms; first it can be defined temporally as: abstract thoughts. There are thoughts which are related to long term events such as past, or to the future events. Secondly abstraction can defined relationally as abstract thoughts are those that focus on the relationships between representations rather simple stimulus features (Nee et al., 2014). Some of the cognitive processes are required highly for the manipulation of abstract thoughts, for example retrieval of thoughts and memories require episodic memory for the manipulation of ongoing task (which can be related or unrelated) requires relational reasoning ability also. For the processing of linking thoughts to the future demands planning, prospective memory is important. As Badre, 2008 noted rostro lateral pre- frontal cortex (RLPFC), anterior lateral prefrontal cortex, showed amplified activations while performing cognitive tasks. The tangential parts of RPFC (RLPFC) seems to hold up the ability to detach oneself from the surroundings, to evaluate also to maintain the information and abstract rules this area involved in problem solving, reasoning and more generally nonfigurative thinking (Koechlin et al., 2003; Amati and Shallice, 2007). RPFC as other parts of the frontal cortex and the temporal cortices, shows prolonged structural development in the period of during adolescence (Dumontheil et al., 2008).

Analogical Problem solving skills requires the transformation of initially learnt strategies or solutions to the different context. Problem solving skill begins as early as infants and to solve the problem, they are able to apply the analogy from previously learnt strategy (Holyoak et al., 1984) and as age increases children are more efficient in differentiating similiarities and dissimilarities between old and new

problems (Chen & Daehler, 1992; Daehler & Chen, 1993). According to hypothesis of relational shift, interpretation of the metaphors and analogy is through object similarity in younger children, as age increases they gain the ability to respond through relational similarity and adult uses both of these strategies for comparison (Rattermann & Gentner, 1998). To reason out relationally and to get correct answers for the problem one has to consider variation sources and possible dimensions of the problem. Children below age of 5 years were capable of solving maximum one relational problems (Halford et al., 1998). Additional improvements throughout childhood and adolescence, is due to improved relational knowledge and or improved capacity of working memory capacity (Crone et al., 2009; Richland et al., 2006). Hence, for logical reasoning or relational reasoning, working memory is considered to play an essential part in upholding of numerous abstract thoughts to permit their contrast and integration.

Long-standing development of the relational reasoning into adolescence was studied by Rosso et al, (2004) by considering the 179 females in the age range of 7-27 years. Shape task was administered to the subjects where in they have to match the dimension and texture of shapes. And in no match condition they have to identify the differences. Relational integration was compared in one relation condition texture (processing of shape or) and two relation condition (processing of both texture and shape) the results showed a non-linear pattern of improvement in accuracy across age. The results indicated non linear pattern of development for accuracy. After an early improvement in accuracy, with 9–11-year olds performed similar to adults levels. Again in 11 to 14 years there was dip in the performance was observed. Gradual improvement like to adult levels was seen throughout adolescence. Further analysis of these data using a combined measure of reaction time over accuracy to take into

account a potential speed-accuracy trade-off suggests that in fact 2-relational vs. 1-relational performance in this task improved progressively during late childhood and mid-adolescence, with a significant improvement between the 7–9 and 14–17.

Vera-Estay, Seni, Champagne, & Beauchamp, (2016) studied the correlation of age and executive functioning and with Moral reasoning (MR) in typically developing children in the age range of 6-12 years. Inhibition and verbal fluency task from NEPSY-II battery (Korkman et al., 2007). Cancellation subtest from and various social scenarios were played and then children were asked to judge the behaviour. Moral reasoning was rated on nine point ration scale. There was strong correlation found between and executive functioning and with Moral reasoning (MR) skills. Strong correlation of age to the moral reasoning was attributed to the reason that better biological and cognitive but also greater opportunities and exposure of many social situations. In the period of school years, children take part dynamically in the construction of social relations and learn to regulate their behaviour for better interaction. Executive function such as attention and inhibition plays major role in encoding relevant stimuli and inhibiting irrelevant information and also to inhibit own perspective thinking by considering others perspective in order to make good correct decision.

In the other study, difference in problem-solving skills between monolinguals and bilinguals were assessed through sorting out images first by shapes and then by colour. It was found that young children faced difficulty in sorting the images according to new dimensions which suggests that they limits in intentional actions for focused attention. To classify same stimuli according to new feature they should ignore the previous feature even though it is present significantly. One must focus on

the new differentiating dimension to classify the stimulus differently (Zelazo & Frye, 1997).

2.4 Cognitive linguistic development

Cognitive flexibility may be defined as the capacity to concurrently consider numerous contradictory representations of a solitary object or event also flexibly to shift between these representations in reply to changes in the surroundings (Jacques & Zelazo, 2005b). During preschool and early-school days, inner speech may be concerned in selecting and activating the appropriate task and it acts as means to signify the rules, correct mode of responding to the stimulus in diverse contexts. Moreover, if the task differs in a expected fashion, inner speech can be utilised to maintain way of the sequence. Ultimately, inner speech helps to retrieve the attention and to direct the ones attention to the suitable method of responding. Dea´k, Ray & Pick (2004) noted that young children may not automatically make use of inner speech to maintain shifting performance but motivating and scaffolding these skills may by telling them to ‘‘think about the rule’’ may guide the cognitive flexibility skills in children.

Majerus, Heiligenstein, Gautherot, Poncelet, & Van der Linden (2009) aimed to study the correlation between auditory selective attention verbal short-term memory (STM) by using Raven’s matrices and vocabulary development in 6-7 year old children. Auditory selective attention was measured by asking participants to select the target picture whenever they hear the target word and verbal short term memory was assessed by asking participants to immediately recall the presented animals name and arrange picture card in same sequence. Knowledge of vocabulary was examined by using the (EVIP) Echelle de vocabulaire en images Peabody scales (Dunn, Thériault-Whalen, & Dunn, 1993). which is French adaptation of the Peabody

Picture Vocabulary Test (Dunn & Dunn, 1981). They found that high correlation between auditory selective attention, verbal short-term memory, Raven's matrices (STM) and vocabulary development. Taking into account of this finding, sustained attention, focused attention, short term memory, working memory, and long term memory leads to vocabulary development. Correlation between auditory selective attention with the verbal short-term memory (STM) and Raven's matrices suggest that problem solving skills requires controlled attention and serial order processing. Logical mental operations have to be executed in an organized and structured logical sequence.

Segers & Verhoeven (2016) explored the correlation of the logical reasoning to the reading comprehension. Totally 146 children of 4^{th} grade were considered. Raven's Standard Progressive Matrices (Raven, Raven & Court, 1998) was used to assess Nonverbal reasoning. In order to examine decoding speed children were instructed to find out the pseudo words from the word list. Measuring of Syllogistic reasoning included answering various types of questions such as easy, logical reasoning and more complex that is elaborative inferencing by reading short stories. Results indicated that the reading comprehension requires the higher order thinking process such as syllogistic reasoning.

Anuroopa (2006) clearly tracked the development of cognitive linguistic skills in, 4-8 years old children using cognitive linguistic assessment protocol. Children were divided in to 4 groups according to the age that is, 4-5, 5-6, 6-7, and 7 to 8 years of age. Performance in the each domain was measured. 50% criteria was included, i.e., 50% of children passing that level in each range. In the entire attention domain it was observed that older children performed better than younger ones. As the task difficulty was increased, meeting 50% criteria by younger children decreased. It was

difficult for younger kid to perform the complex tasks. In attention domain some of the tasks reached the ceiling level at the age of 5-6 years for auditory discrimination and visual discrimination tasks. Also 7-8 years old children met ceiling score for odd one out task. For remaining other tasks none of the group reached ceiling score indicating these skills develop even after 7-8 years of age. In the second domain memory similar trend of development was seen as it was for attention. Only word recall reached to the ceiling score that is 100% score in every level at the age of 7-8 years. All other tasks in these domain children could not get 100% score implying that these skills are to be improved in the adolescence period. These results indicates that memory plays major role in the development of the language. "Recalling of the items" improved as age increased because employ of rehearsal strategies like sub vocal rehearsal, chunking, and mnemonics by the older children and younger children tend to recall the words which are more recently presented (Primacy effect). The more complex memory tasks needed more attention, due to the lack of increased attention in younger group compared to older group that resulted in the poor performance in memory skills in younger group compared to older group. Increased length of items in the recall across age suggests that memory plays an important role in language development. In third domain problem solving, the higher age group that is 7-8 years could not meet 50% criteria for many levels in many subtests. Only in association task these group of children were able to get 100% score in all the levels. As seen in attention and memory domain, this domain also in line with those by showing effect of age across the group. In the essence, the results of this domain revealed that problem solving abilities such as reasoning, thinking are higher cognitive skills, which develops as age increases. These problem solving skills enhances the language development which is reflected in the scholastic performance also. These skills have

major influence on environment for which child is exposed. Overall, results indicated the developmental patterns of cognitive linguistic skills across the age. This study did not consider the gender effect across age group, modality differences across domains. Also sample size was less in each group.

2.5 Cognitive linguistic skills in bilinguals

Steby, Sindhupriya, Rupali, and Swapna (2010) enquired the cognitive-linguistic abilities in bilingual children. The main aim of the study was to examine the performance of the bilingual children on cognitive-linguistic tasks and to look if any bilingual advantage is present. The authors considered 12 monolingual and 12 bilingual children in the age range of 7 to 8 years. Equal number of boys and girls were taken by the authors. Where monolingual children who speaks Kannada and bilingual children speaks Kannada- and English languages. Cognitive-linguistic abilities was assessed using the Cognitive Linguistic Assessment Protocol for children (CLAP-C) developed by Anuroopa (2006). Comparison of group and gender differences were made within each domain. Bilingual children showed significantly better performance than monolinguals in all three domains but there was no significant gender effect reported. The bilingual advantage was attributed to three reasons 1) that integration and organization of the information which is taking place in bilingual children, 2) they learn to reduce the interferences between their two languages, 3) bilingualism helps in training children to focus their attention on the important variables in the situation. Domains were compared within each group, results indicated that both the groups performed superiorly in attention/discrimination followed by memory and problem solving skills. This was associated to the fact that attention is the prerequisite skill which is necessary for other domains to develop. All subtasks were compared within in each domain and across groups. In attention

domain significant difference was found only in digit count test, through this it can be inferred that bilinguals have better inhibitory control for perception of unwanted information and good selective attention for the wanted stimuli. In the domain of memory, bilinguals performed better than monolinguals but significant difference was noticed only in visual tasks, it was in line with the study by Feng, Bialystok and Diamond (2009) who indicated bilingual advantage in visual-spatial working memory but not on verbal-auditory working memory. It can be inferred that bilingual children have a stronger visual memory than auditory memory. In problem solving skills except visual association task all other tasks showed significant difference between monolinguals and bilinguals. This was ascribed to the fact that early experience to more than one language may promote the inhibition and working memory skill necessary for cognitive flexibility in a variety of problem-solving situations. Some of the tasks did not show difference between monolinguals and bilinguals this may be because of limited subject sample, monolinguals were also exposed to some extent of English language, and bilinguals dominant language was their first language. Bilinguals performed better in all cognitive linguistic tasks than monolinguals. The authors concluded that the early exposure to two languages enhances the cognitive linguistic skills of child.

Videsott, Della Rosa, Wiater, Franceschini, and Abutalebi, (2012) evaluated the influence of language on the attention network in 118 multilingual children of 10.9 years of age. Language proficiency of different languages was measured through self evaluation questionnaire which is completed by children themselves and evaluation by the teachers was also considered. Based on questionnaire analysis subjects were divided into two groups that is high performance children and low performance children. Both the groups were performed attentional network test in

which they have to detect the direction of the arrow. Reaction time and accuracy were measured. Multilinguals with high language proficiency performed better than the low proficient speakers. It was noticed that bilinguals have smaller vocabulary size of two languages but faster shifting between them. It helps to control and enhance the non executive functions like the selectively attending to the important stimuli by inhibiting the irrelevant information & also to shift between two languages. Similarly Daniels et al., (2006) also pointed that linguistic and cognitive systems has to integrate to manage the competing linguistic representations. Processes which are necessary for controlling language in bilinguals are attention, monitoring and switching, inhibition. Language modifies the development of executive functions in bilinguals. In several studies, it is noted that problem solving capacity is more efficient in bilingual children than monolinguals (Bialystok, 1999; Bialystok & Martin, 2004).

Bialystok, Barac, & Poulin (2010) investigated The consequence of bilingualism on the cognitive skills in 162 304,5 year old children through examining their executive functions. English and French monolinguals were compared with bilinguals of both languages. Task involved were Luria's tapping task which measures response inhibition, second in reverse categorization task they were made to classify the objects to congruent category followed by incongruent categories. Bilingual group performed better than the monolingual group. The bigger gain of the bilingualism in the Lurias tapping task and reverse categorisation task was found to be higher in bilingual younger children, which was speculated because of the requirement withholding of habitual response once this control of motor responses are achieved there will not be greater difference between younger and older children. And better performance by the bilinguals in reverse categorisation suggest that switching to new rule is difficult in this level it may not be possible for children to

achieve plateau so significant difference between monolinguals and bilinguals in both the age groups was obtained . The authors concluded practice of building two linguistic systems and using the these two systems in different linguistic environments, managing between linguistic contexts alters the cognitive linguistic development.

2.6 Gender differences in cognitive linguistic skills

Lowe, Mayfield, and Reynolds (2003) studied the gender difference in the children between the age of 5 and 18 years was assessed through Test of Memory and Learning (TOMAL). This test consisted of, memory for stories, digits forward , object recall, word selective reminding, paired recall, facial memory, abstract visual memory, visual selective reminding, memory for location and visual sequential memory. Results indicated that out of these subtest Word selective reminding and Object Recall was performed better by females than males, (as previous finding, verbal performance is good in females) but in pure spatial memory tasks such as abstract visual memory and memory for location males outperformed the females.

Gur et al., (2012) constructed the new neurocognitive battery which measures the response time and accuracy of executive control, spatial cognition, complex cognition, social cognition ,episodic memory , and sensori motor speed domains. measures of performance for executive-control, episodic memory, complex cognition, social cognition and sensorimotor speed domains. Adolescents from 8 to 21 years were considered. There was improvement seen in both speed and accuracy of attention, memory task and across age groups since the maturation happens in frontal systems. Female outperformed the males in verbal memory tasks than spatial memory tasks. Also males performance was better in spatial memory tasks compared to verbal memory tasks.

Another study by Li et al., (2016) about gender differences in school going children of rural china between 7-10 year old by using Wechsler Intelligence Scale for Children (WISC-IV). Sections under this tests were Full-Scale IQ (FSIQ), Processing Speed Index (PSI), Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI). There was no gender differences observed in 7, 8, and 9 year children in any of the tasks. But at 10 years of age boys performed stupendously than girls in VCI, FSIQ and PRI. Also girls performed remarkably better than boys PSI and WMI. These performance discrepancies between boys and girls were accredited to the fact that earlier maturation of the brain for girls. Intelligence of girls correlates with white matter volume of the brain and boys' intelligence strongly correlates to that of gray matter volume in of the brain. Superior performance in boys is because of increased male preference in rural china in terms of early experience of education and nutrional care throughout the prenatal to childhood which is essential period for cognitive development. Additionally environmental and socio economic status aspects are also most imperative contribution to the development of cognition. It is known that girls in rural china were observed to have underweight. Comparing to Studies in urban children intellectual development, rural children of china with poor socio economic status have poor cognitive development, because the children with higher socioeconomic status might have more exposure to new things and the rural children may not able to access to different and new items, also very minimal educational opportunities for rural children. Another justification that insufficient time for educational aspect for girls, since they are more skilled in household works like responsibilities of taking of younger siblings.

2.7. Modality differences

Children's memory for auditory and visual information on television Kindergarten children were tested for modality differences (auditory and visual) in information processing through television task. Children were asked to watch the cartoon video which is familiar to all of them. Attention was measured by calculating the watching time of the audio. There were four conditions in which stimuli presented. Auditory visual match, auditory visual mismatch, audio only and visual only. Comprehension questions were asked based on the audio and video mode separately for all conditions. On comparison of attention mode, visual attention was significantly lower for audio only followed by visual only and audio visual mismatch condition. In audio video mismatch condition children tend to relay on visual information so visual comprehension scores in this condition were significantly higher than auditory comprehension scores. Advantage of video material over the audio material resulted in better memory (Pezdek & Stevens, 1984).

The well established fact about the immediate recall of the picture in the typically developing children is that older children make use of the mnemonic strategies like sub vocal rehearsal of the presented picture stimuli (Kail, 1984) and older children performance decreased but younger children did not show such trend even after the manipulation Conrad (1971). Study by the Hitch and Halliday, (1983) noticed that elder children utilize the phonological storage system which is unavailable for the younger children. Superior response for the picture stimuli is due to rapid access of the semantic codes (Potter & Faulconer, 1975). As working memory model (Baddely & Hitch, 1974) suggests the faster coding for visual stimuli is due to automatic and direct feeding of the information to visuo spatial system wherein phonological system requires the sub vocal rehearsal of the information to

store in it. Hitch, Halliday, Schaafstal, and Schraagen, (1988) studied the hypothesis that if the older children are depending on the phonological systems are they coding information only in terms of phonological systems or they use the visual coding also. In order to know about this question 5 years children were compared with the 10 years old children through two set of visual items. Set one consisted of visually similar items arranged in the same direction and which are phonologically different items. Set two consisted of phonologically similar items but visually different. For 10 year old children there were two groups, one being without articultory suppression and other with articulatory suppression. With articulatory suppression, subjects were made to say the word "THE" for every 2 second once. 5 years old had difficulty in recalling visually similar items. This suggest that they don't make much use of phonological systems for storage even though sub vocal rehearsal is necessary and also they rely more on visual spatial system. Among ten year old children, the performance in phonemically similar items had better recall when they do no articualatory suppression was present. When the older children introduced to the articulatory suppression, visually similar items were recalled better. Similar performance like 5 years children was observed. These results imply that older children make use of the visual component while recalling. Visual short memory storage is extensively incorporated when phonological storage is disrupted. Similar finding was reported by Hitch, Woodin, and Baker (1989) where they suggested that performance of 5 year old children were at visually similar items but 10 year children showed poorer performance for phonologically similar items.

There is limited empirical data available on cognitive linguistic performance in children, particularly in Indian context. Similarly, on the developmental trend of cognitive linguistic abilities of Kannada speaking children are limited. Hence, it is essential to know about the developmental pattern in them. Since the major domain such as attention, memory and problem solving underpins the development of cognitive linguistic abilities of the child, there is necessity for the assessment of all these domains. Modality of learning may differ the performance of the child, and the comparison of the different modality is crucial. Hence there is a need to study and understand the development of cognitive linguistic abilities of different modalities (auditory and visual modality).

Objectives

- To observe the cognitive linguistic skills in children between 6-6.11,and 7-7.11 years.
- To compare performances the cognitive linguistic abilities between 6-6.11 years to 7-7.11 years
- To compare the gender difference (if any) on cognitive linguistic performances

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Chapter III

METHOD

3.1. Participants

Two groups of typically developing children participated the study. Group I included 50 typically developing children in the age range of 6-6.11 years. Group II consisted of 50 typically developing children in the age range of 7-7.11 years. Equal number of boys and girls (25 in each) was considered in each group. Table 3.1 shows the details of participants.

Table 3.1:

Participant's details

Groups	Age	No. of Boys	No. of Girls	Total
Group I	6-6.11 years	25	25	50
Group II	7- 7.11 years	25	25	50

Selection criteria of participants

1) The participants should have normal history of speech and language development.

2) The participants should not have any significant deficit in hearing sensitivity, mental retardation, neurological disorders, and vision problem. This would be ruled out using 10 questions screening for disability detection by Singhi et al. (2007)

3) Participants of middle and higher socio economic status were selected for the study using NIMH Socio-economic status scale by Venkatesan (2011).

4) The participants should be physically fit during the testing period

3.2. Procedure

3.2.1. Material used:

The present study used Cognitive Linguistic Assessment Protocol for Children (CLAP-C) developed by Anuroopa.(2006). It consists of three domains such as a) Attention/discrimination, b) Memory and c) Problem solving. The details about the task and its domains are described in table 3.2.

Table 3.2

Domains and tasks in CLAP-C

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 discrimination	10	Visual Discrimination	10
	Total score	20	Total score	20
II	***MEMORY***			
a)	Digit forward span	5	Simple alternate sequencing	5
b)	Word recall	5	Picture counting	5
c)	Digit backward	5	Story sequencing	5
	Total score	15	Total score	15
III	***PROBLEM SOLVING***			
a)	Predicting outcome	5	Association task	5
b)	Predicting the cause	5	Overlapping task	5
c)	Compare and contrast	5	Mazes	5
	Total score	15	Total score	15
	Grand total	50	Grand total	50

The test assesses the cognitive –linguistic performance in children through auditory mode and visual mode. Each domain in the test has three subsections separatively for auditory and visual mode.

3.2.2. Test administration

Parents/ school authorities/ teachers were explained about the objectives of the study and written consent was obtained from them. Children were seated comfortably on a chair and tested individually by using CLAP-C. The children were instructed to carry out the tasks from domain I to III separately for auditory and visual mode. Break of 5 minutes was provided if the child gets bored/distracted otherwise the data collection /test administration was carried out in a single sitting.

The study consisted of two phases.

In phase 1, adaptation of CLAP-C and pilot study was conducted. The phase II of the study included the actual administration of the CLAP-C test on 100 participants. Many of the picture stimuli were not identified by children between 6-8 years due to black and white line drawings. Hence, in phase II, a slight modification was done by adding colour to the picture stimuli of CLAP-C of Anuroopa (2006).

There are mainly three domains in the CLAP-C and detail description about each domain, scoring of the test is explained below;

3.2.2.1 Domains

Domain I: Attention

It has three subsection and it checks for selective attention, sustained attention and discrimination skills. Attention domain is assessed in two modalities that is, auditory and the visual modes**.**

Auditory mode

In auditory mode of attention there were three sub sections such as

a) Digit count test

This test requires the sustained and selective attention to complete it. There are five levels, in which complexity was increased from level one to level five. To carry out the test child was instructed to count the number of times target (single digit 9) appears from the set of other digits which is presented auditorily by clinician. For every correct answer child was scored '1' if the answer is incorrect or even if child missed one number means the score was considered as '0'.

b**) Sound count test**

This test also requires the sustained and selective attention to complete it. There are five levels, in which complexity was increased from level one to level five. To carry out the test child was instructed to count the number of times the target the sound /b/ appears from the set of other syllables which is presented auditory by clinician. For every correct answer, child was scored '1' if the answer is incorrect or even if child missed one sound, also the score was considered as '0'.

c**) Auditory discrimination:**

Since the auditory discrimination requires the selective and sustained attention to the stimuli it was considered under attention domain. In this test, two pair of words, which are bisyllabic and differ only by one phoneme were considered. Children were asked to say "yes or similar " if they hear same words and to say "no or different" if they hear different words. Total 10 pair of words was presented. For every correct answer child was scored '1' if the answer is incorrect or even if child missed one sound then the score was considered as '0'.

Visual mode

In visual mode of attention there were three Sub section included such as

a) Odd one out test:

This task measures the visual sustained attention and selective attention. It has 5 levels. Set of 4 pictures in which 3 similar pictures and one different pictures were presented in the test. Task was to scan the array of set of 4 pictures and identify which is different/odd among four pictures. If the picture is said as different then reason for telling that particular picture as different was elicited verbally. The task complexity increases from level I to level V and each level consists of three set of picture stimuli. A score of 0.5 is given if the child says 2 correct answers. Full score that is 1 was given only when child answers all 3 answers correctly. For total score sum of score of all the 5 levels were considered.

b) Letter cancellation:

This task requires the visual selective attention and inhibition in order to give correct answer. Sequence of letters was given and the child was asked to find out the red /i/ which is before red /ka/. Complexity was increased by introducing distracters. For every correct answer child was scored '1' if the answer is incorrect or even if child missed one number also the score was considered as '0'.

c) Visual Discrimination:

The visual discrimination requires the selective and sustained attention. In this test, two pair of words which are bisyllabic and differ only by one phoneme were shown. Children were asked to say yes or similar if the words are same and to say no or different if these words are different. Total 10 pair of words were presented. For every correct answer child was scored '1' if the answer is incorrect or even if child missed one sound then the score was considered was '0'.

Domain II: Memory: The memory domain also consists of assessing through auditory and visual mode.

Auditory mode:

a) **Digit forward span**

To assess the short term memory, as the recalling of digits mainly involves remembering small amount of information for shorter duration. Child will be asked to repeat back the digits in the same sequence which is read out by the clinician. Correction repetition of all numbers with same sequence was considered as correct answer. Every wrong sequence and repetition of wrong numbers were considered as incorrect. Score 1 was allotted for every correct answer and, 0 score was given for every wrong answer.

b) **Word recall**

This subtest includes the child to repeat the words presented by the clinician in the same sequence. This subtest involves the hierarchical arrangement as mentioned above that is the word are arranged in order of three words to seven words in each presentation level. The children were asked to repeat the words presented in each level. The numbers of words repeated were noted and a score of "1" was given if they level. The numbers of words repeated were noted and a score of "1" was given if they repeated all the words in that level. And score of "0" was given for each incorrect response.

c) **Digit backward**

This subtest included that subject to repeat back the sequence order of digit (in the reverse order) presented by the examiner. The backward sequence of the

digits plays an important role in the test .a score of 1 is given for the correct sequence and a score of 0 was given for incorrect sequence.

Visual mode:

Consists of three subtests such as:

a) Simple alternate sequencing:

A sequence or a pattern of items was presented to the child with one blank and the child was asked to fill the gap. The complexity of the task was further increased by adding color and number of distracter. Every correct response was scored as"1" and incorrect response was scored as "0" .

b) Picture counting:

In this task a series of pictures are presented visually and the child has to name all the pictures presented after the stimulus was removed from the visual field by the examiner. The number of items recalled by the child tells the visual memory span of the child. As children differ the modality of learning that is visual or auditory, this task would further help the clinician to identify the dominant modality of learning used by the child. Every correct response was scored as"1" and incorrect response was scored as "0".

c) Story sequencing:

This task involves the child to arrange the story cards in a sequence as per the story. Five stories were selected and the children were asked to arrange the story cards as per the story sequence . For unknown stories examiner would narrate the story to the child and then ask to arrange the story cards. This task was selected to evaluate the short term memory. A score of **"**1" for the correct sequence and a score of "0" was given for each incorrect sequence.

Domain III: Problem solving

It has three subsections such as predicting a cause, predicting outcome and compare and contrast under auditory modality.

Auditory Mode:

a) Predicting outcome

This task involves the child to reason out the situation and to tell the possible outcome of the situation for example: "What will you do if you lost your key?" the possible answer can be the child would search for key or he /she can go for spare key. Thus a score of "0.5" will be awarded for any relevant or near to relevant answer otherwise a score of "0" will be given for incorrect answers. The test included a total of ten questions arranged in a hypothetical order from simple to complex situation.

b) Predicting the cause:

This task involves the child to predict the possible cause for the situation given by the clinician. For example, "your friend does not talk to you, why?"and the possible answers for this can be the child saying that he/she had a fight with him /her or I had hurt my friend that's why he/she stopped talking to me."A score of "1" will be awarded for any relevant or near to relevant answer otherwise a score of "0" will be given for relevant answers. This subtest included a total of ten questions arranged in a hypothetical order from simple to complex situation.

c) Compare and contrast:

This task includes the child to compare and contrast between two items. For example: "pen and pencil". This task taps the child's critical, or logical thinking that is ability to break an idea into its parts and analyze them. A score of "1" will be awarded for relevant answer and "0" for irrelevant answers. This task has a total of ten word pairs arranged in hypothetical order from simple to complex situation.

Visual mode

Under visual mode, the problem solving domain has three sub tasks:

a) Association task:

This task requires logical thinking and reasoning and also inhibition of wrong association for reaching the solution. Here, child has to scan through the array of pictures and match the most associated picture. The task was arranged from Level I-Level V (simple to complex). Every correct association scored as"1" and incorrect association was scored as "0".

b) Overlapping task:

This task involves the child to look at the picture card. The picture card has different pictures/photo of different items that are overlapped over one on the other. The task here is, child has to name the pictures overlap depicted in the picture card. This subtest consisted of five levels arranged in hierarchy. A score of "1" for correct and a score of "0" for each incorrect answer was given.

c) Mazes:

This task requires the child to solve the maze and reach the destination point. Starting point and ending point was shown to the child. He/ she was asked to reach final point along with collecting the letters on the path. Also, to make a meaningful word with the letters collected. A score of "1" for correct and a score of "0" for each incorrect answer was given. Complexity was increased from maze I to maze IV. Child was given proper instruction before starting the test.

Statistical analysis

Statistical analysis was done using SPSS (vesion 20) software. Mean, median and standard deviation values were obtained for all the tasks. Shapiro Wilks test for normality was carried out. None of the measures were normally distributed. Hence,

non-parametric tests- Mann-Whitney U test were performed to compare between groups and gender for all the domain, Friedman's test and Wilcoxon Signed-rank test were carried out within group comparison of all domains. Test –Retest reliability was done to check the reliability measurement for the scores on all domains by re-administering on 10% of the total participants.

Chapter-IV

RESULTS

Total of 100 subjects (25 girls and 25 boys in each age group) participated in the study. Development of cognitive linguistic skills was assessed by using the cognitive linguistic assessment protocol for children (CLAP-C) (Anuroopa, 2006). All the sections were scored based on the instruction given in the test. Statistical analysis was done using SPSS software. Mean, median and standard deviation values were obtained for all the tasks. Among them, none of the measures were normally distributed. Hence, non-parametric tests- Mann-Whitney U test, Friedman's test and Wilcoxon Signed-rank test were carried out.

The results of the present study are discussed under the following headings;

4.1 Comparison of results between groups

a) Attention

Mean, median and standard deviation values were obtained for all the domains for both groups and gender. Results are as follow. Table 4.1 shows the mean, median, & standard deviation for attention values between two groups and gender.

Table 4.1

Mean, median and standard deviation (SD) values for attention across two groups and gender

Group	**Gender**		**Domain**		
			AA	VA	ATTOTLL
	Boys	Mean	17.40	17.04	34.48
		Median	18.0	17.00	34.00
Group I		SD	1.41	1.29	2.37
	Girls	Mean	16.88	16.90	33.84
		Median	17.00	17.00	33.50
		SD	0.83	0.82	1.45
	Boys	Mean	18.76	19.12	37.92
		Median	19.00	19.50	38.00
Group II		SD	1.01	1.08	1.53
	Girls	Mean	18.84	19.20	38.08
		Median	19.00	19.50	38.00
		SD	1.02	0.750	1.40

(Auditory Attention Total: AA; Visual Attention Total: VA; Attention Total: ATOTAL)

The median values for the auditory attention of boys in group I (AA= 18) was higher than the girls (AA = 17) and it was similar between boys and girls in group II (AATTOATL Boys:19; girls:20).In visual attention tasks, both boys and girls performed similarly (VA Boys: 17, VA Girls = 17) in Group I also in Group II (VA Boys: 19; VA Girls = 19). In general, group II had higher attention scores than group I (ATOTAL for group I = 34, ATOTAL for group II = 38).

b) Memory:

The mean, median and standard deviation values of the domain auditory memory and visual memory were obtained for both age groups and gender are shown in table 4.2.

Table 4.2

Mean, median and standard deviation values for memory across two groups and between gender

Group	Gender		Domain		
			AM	VM	MTOTL
Group I	Boys	Mean	4.96	9.40	14.44
		Median	5.00	9.00	14.00
		SD	0.61	1.82	2.10
	Girls	Mean	5.08	9.60	14.60
		Median	5.00	9.00	14.00
		SD	.862	1.58	2.27
GroupII	Boys	Mean	6.64	12.04	18.68
		Median	7.00	12.00	19.00
		SD	1.28	1.30	1.99
	Girls	Mean	7.84	12.20	20.04
		Median	8.00	13.00	20.00
		SD	1.17	1.52	2.47

(Auditory Memory total: AM; visual Memory Total: VM; Memory Total: MTOTAL).

In group I, boys and girls auditory memory is similar (AM boys = 7, AM girls = 7). In group II, girls performed better in auditory memory (AM girls = 7.8) than boys (AM boys = 7.2). Visual memory performance of boys and girls in group I was similar (VM boys = 9, VM girls = 9) but in group II, girls performed better (VM girls = 13) than boys (VM boys = 12). In general, group II performed better in memory (MTOTAL, group II = 20) than group I (MTOTAL, group I = 14). Participants in both group performed better in visual memory than auditory memory (VM group I = 9.5, AM group I = 5, VM group II =13, AM group II = 7)

C) Problem solving:

The mean, median and standard deviation values of the domain auditory problem solving and visual problem solving were obtained for both age group and gender are presented in table 4.3.

Table 4.3

Mean, median and standard deviation (SD) values for Problem solving across two groups and between gender

Group	**Gender**		**Domain**		
			APS	VPS	PSTOTL
Group I	Boys	Mean	11.20	9.88	21.12
		Median	11.00	10.00	21.00
		SD	1.01	1.69	2.47
	Girls	Mean	11.82	10.28	22.14
		Median	11.50	10.00	22.00
		SD	1.107	1.36	2.048
Group II	Boys	Mean	13.26	13.04	26.30
		Median	13.50	13.00	26.50
		SD	0.855	1.24	1.93
	Girls	Mean	13.38	13.04	26.46
		Median	13.50	13.00	27.00
		SD	1.16	1.098	1.87

(Auditory Problem Solving Total: APS; Visual Problem Solving: VPS; Problem Solving Total: PSTOTL).

Boys performed relatively lower on auditory problem solving (APS = 11) in group I compared to girls (APS = 11.5). In group II, both boys and girls performed similarly (APS Boys = 13.5, APS Girls = 13.5). Auditory problem solving had higher scores in group II (APS =13.5) than group I (APS = 11.5).Visual problem solving was performed similarly by both the genders in both group I (VPS Boys =10, VPS Girls = 10) and group II (VPS Boys =13, VPS Girls = 13). Auditory problem solving was better than visual problem solving in group I (APS group I = 11.5, VPS group I = 10) and group II (APS group II =13.5, VPS group II = 13). In general group II performed

better than group I in problem solving (PSTOTL group I = 21.5, PSTOTL group II = 26.5).

4.2 Gender comparison

Mann Whitney U test was carried out to compare the gender differences on all domains in both groups. Results are depicted in table 4.4.

Table 4.4

Results of Mann Whitney U test for gender difference in group I and group II

Domains	**Group 1**		***Group II***	
	/Z/	Asymp. Sig. (2-tailed)	/Z/	*Asymp. Sig. (2-tailed)*
auditory attention total	1.58	1.58	1.58	*0.78*
visual attention total	0.11	0.11	0.11	*0.88*
attention total	1.17	1.17	1.17	*0.85*
auditory memory total	0.26	0.26	0.26	*0.00**
visual memory total	0.62	0.62	0.62	*0.49*
memory total	0.15	0.15	0.15	*0.02**
auditory problem solving total	1.71	1.71	1.71	*0.67*
visual problem solving total	0.82	0.82	0.82	*0.71*
problem solving total	1.47	1.47	1.47	*0.79*
grand total	0.61	0.61	0.61	*0.62*

(* indicates significant at 0.05 level).

Table 4.4 indicates the results of Mann Whitney U test to compare between the genders in group I and Group II across age groups. Comparison between boys and girls using Mann Whitney U test across all sub domains did not exhibit significant differences in any in group I but group II had significant differences only in the sub section auditory memory($|Z|= 3.085$, $p= 0.002$) and memory total ($|Z|= 2.192$, $p< 0.028$).

4.3. Group comparison

Table 4.5
Results of Mann Whitney U test for comparing group difference

Domains	/Z/	Asymp. Sig. (2-tailed)
Auditory attention total	6.094	0.000*
Visual attention total	7.363	0.000*
Attention total	7.327	0.000*
Visual memory total	6.439	0.000*
Auditory problem solving total	6.769	0.000*
Visual problem solving total	7.383	0.000*
Problem solving total	7.557	0.000*
Grand total	7.752	0.000*

(* indicates significant at 0.01 level).

Table 4.5 indicates the results of Mann Whitney U test to compare between the age. There was significant group difference ($p< 0.01$) present between Group I and Group II. The parameters like auditory memory and memory total did not included for group comparison.

4.4. Domain comparison with in group

Friedman's test was carried out to compare the different domains such as, attention, memory and problem solving, since the scoring across the section were not equal, raw scores were converted into percentage.

Table 4.6

Results of Friedman's test for comparing different domain with respect to age groups and gender

Friedman's Test scores	**GroupI**		**GroupII**	
	Boys	Girls	Boys	Girls
χ^2	48.08	44.72	48.08	45.96
Sig	0.000*	0.000*	0.000*	0.000*

(* indicates significant at 0.01 level).

Results of Friedman's test is depicted in table 4.6 which showed that these domains –attention, memory and problem solving are significantly different from each other between boys and girls in group I and as well as in group II. By looking at the tabular column values Table 4.1, 4.2, and 4.3 all the domains such as attention, memory and problem solving are significantly different from each other in group I among both boys and girls. Similar results revealed for Group II also. Attention scores were better and at younger age ceiling scores were achieved. Next in problem solving domain children performed better. In Memory domain children performed poorly compared to other two domains. Among attention, memory and problem solving; attention had the highest scores followed by problem solving skills and then followed by memory domain.(attention> problem solving> memory).

4.5 Modality differences

Results of Wilcoxon signed rank test is given in table 4.7, which revealed that there was significant (at 0.05 level) difference in visual memory and auditory memory in group I among boys and also same was found among boys and girls in group II. In group I, visual problem solving skill is significantly different from

auditory problem solving skills among boys and girls. The same was found in girls of group II at 0.05 level of significance.

Table 4.7
Results of Wilcoxn-signed rank test for pair wise comparison for modality differences in different domains.

Group	Gender		Domain		
			visual attention total percentage - auditory attention total percentage	visual memory total percentage - auditory memory total percentage	visual problem solving total percentage - auditory problem solving total percentage
Group I	Boys	Z	1.78	4.38	3.47
		Sig	0.07	0.000*	0.001*
	Girls	Z	0.31	4.39	3.52
		Sig	0.75	0.000*	0.000*
Group II	Boys	Z	0.37	4.38	1.24
		Sig	0.16	0.000*	0.21
	Girls	Z	1.55	4.39	1.12
		Sig	0.12	0.000*	0.25

(* indicates significant at 0.01 level).

4.6 Test-restest reliability

The CLAP-C was readministered on 10% of the population that is on 10 participants within the gap of 15 days to check test-retest reliability. Table 4.8 shows the results of test retest reliability.

4.8: Results of Test retest Reliability

Domains	Reliability
Auditory attention	0.95
Visual attention	0.92
Attention	0.99
Attention memory	0.92
Visual memory	0.93
Memory	0.94
Auditory problem solving	0.98
Visual problem solving	0.80
Problem solving	0.92
Total	0.94

From the above table,the Cronbach's alpha coefficient varies between 0.8 to 0.9 indicating high test –retest reliability on all domains.

Table 4.9 depicts the Mean, median and standard deviation (SD) values for total scores of CLAP-C in group I and group II between boys and girls are depicted in table 4.9. Median values for group 1 ranges from 65 to 75 with SD +/- 5, Group II mediam varies from the 80-90 with SD +/- 5.Median score of group II was more than the group I. The below table 4.9 served as normative data clinically.

Table 4.9

Mean, median and standard deviation (SD)values for total scores of CLAP-C

	Grand Total					
	Group I			Group-II		
	Boys	Girls	Total	Boys	Girls	Total
Mean	70	71	70	83	84	83
Median	69	69	68	84	86	85
SD	5.71	4.74	5.2	4.97	5.22	5.05

Chapter IV

DISCUSSION

The aim of the present study is to study the development of the cognitive linguistic skills in Kannada speaking children between 6-8 years of old. 50 children (25 each in boys and girls) in the age range of 6-6.11 years & 50 children (25 each in boys and girls) in the age range of 7-7.11 years participated as group I and Group II, respectively in the study. They were administered Cognitive Linguistic Assessment Protocol for Children (CLAP-C) developed by Anuroopa, (2006). The results are tabulated and analyzed using statistical tests.

The results of the present study revealed several points of interest;

First*, Group II performed significantly better on all cognitive linguistic domains such as attention, memory, problem solving than group I.*

That is, younger age group (6-6.11 years) performed significantly lower on all cognitive linguistic domains than older age group (7-7.11 years).This result supports the earlier findings, such as accuracy of voluntary control of attention improves significantly at 4-5 years of age (Tellinghuisen, Oakes, & Tjebkes, 1999). Dye & Bavelier (2010) reported that visual attention increases from younger age to older even in the presence of distractor. Another study by Hagen and Kail, (1975) which states that children improve from systematic scanning of information (at 5-7 years) to directing their attention towards goal (10 years) as age increases. Even in the 3 ½ years of age only 50 % children can sustain their attention. Inhibition is necessary to ignore distracters and to concentrate on only selected information. Decrement in the reaction time as age increased from 6-33 years of age is due to better mylinization in

older group (Hommel, Li, & Li, 2004). From the above studies, it can be clearly seen that, attentional capacity improves as age increases.

In memory domain also, the developmental trend was observed as like in attention. Older children performed significantly better than younger children, The results of the present study is in consonance with the study by Vaz, Cordeiro, Macedo, and Lukasova, (2010) who exhibits significant development observed from first to second grade on memory skills & this was due to maturation of frontal and prefrontal areas. Developmental pattern in working and short term memory (retrieval tasks) was attributed to the fact that improved ability of retrieving chunks & sub vocal rehersal develops as children moves to higher grade (Bilvashree, 2013). Also, likewise in the study by Ornstein, Naus and Liberty (1975) older children are capable to make use of several strategies simultaneously which results in better recalling ability by older, younger children lacks in this skill. Soltanlou, Pixner, and Nuerk, (2015) found the one more factor that is faster processing of information by older children (7-10 years) than younger children (5-7 years) who are slow at processing so, they are more reactive. But older children show their proactive behaviour that is planning the response before they respond which minimizes the error in responses. Another finding by Anuroopa (2006) shows developmental trends in cognitive linguistic skills across age. Also, improvement in the memory skills attributed to the development of recalling strategies, sustained attention and also the language skills across age. Hence improved performance on memory domain task by older children (7-7.11 year) is probably because of use of sub vocal rehearsal, mnemonics, better attention, and language in older children compared to younger children.

The problem solving is the higher order cognitive skills which require many cognitive processes. Like the results in the present study for attention, memory and problem solving skills also develops as a function of age. This finding is concurrence with Anuroopa (2006) states problem solving abilities such reasoning, thinking are higher cognitive skills, which develop as age increases. These problem solving skills enhances the language development which is reflected in the scholastic performance also. Younger children face difficulty in making use of relational analysis that is thinking about the problem in terms of its relations. As the children develops they make use of relations (Halford et al., 1998). Additional improvements throughout childhood and adolescence is due to improved relational knowledge and or improved working memory capacity (Richland et al., 2006; Crone et al., 2009). Majerus, Heiligenstein, Gautherot, Poncelet & Van der Linden (2009) found a correlation between auditory selective attention with the verbal short-term memory (STM) and Raven's matrices suggest that problem solving skills requires controlled attention and serial order processing. Logical mental operations have to be executed in an organized and structured logical sequence. Improved performance on problem solving skills by older children (group II) is attributed to improved attentional and working memory capacity. This present finding supports the results of (Richland et al. 2006; Crone et al., 2009).

Second, ***No significant gender difference observed in any of the cognitive linguistic tasks except auditory memory task.***

It was in line with the findings by Li et al., (2016) who examined various tasks though Wechsler Intelligence Scale for Children (WISC-IV). There was no gender differences was observed in 7, 8, and 9 year children in any of the tasks. Some findings of the study, Nyborg (2005) suggest that lower economic status & parental education influence the gender differences. In the present study, factors like lower socio economic status & education of parents were not considered. Gender difference in auditory memory remains unclear in the present in the present study. Hence further research need to be done by considering these factors.

Third, ***Participants in both groups (I & II) performed better on attentional skills followed by problem solving skills.***

They performed poorly on problem solving skills. Both the group I and group II children performed better in attention, followed by problem solving skills then followed by memory skills. The difference in the performance is because attention develops from the infancy and children acquire memory and problem solving skills relatively later that is from early childhood. Problem solving tasks in the present study consisted of questions regarding the solving problems in daily life situation so it is mainly depended on the exposure to situations. But working memory demands use of strategies, sustained attention and selective attention along with the storage of information for period of time, manipulation of the response. These strategies strengthen the phonological loop and visuo-spatial sketchpad as its use increases. So it might be difficult for children to make efficient use of strategies, which resulted in poor memory skills in younger age group (group I).

Fourth, Memory skills were better through visual mode than auditory mode.

This finding is in accordance with the previous research by Baddely and Hitch (1974) suggested that faster processing of information taken place through visual modality as it is automatic & activates visuo- spatial system. On the other hand, stimulus processing through auditory modality is slightly delayed as it is activating sub vocal rehearsal and Phonological loop. Pezdek and Stevens (1984) also found the advantage of video material over the audio material for better memory and recall tasks. Hence, the results of the present study supports the previous findings of Baddely and Hitch (1974); Baddely and Hitch (1984) who reported better performance through visual modality. For problem solving skills, the present study found that auditory mode is better than visual modality. This might be because of children solves the problem through auditory mode in daily situation by listening and thinking. But, the visually they learns to solve the problem only when they start their schooling. Another reason for poor performance in problem solving skills in visual mode is, children ready exposed to visual mode to solve problems than auditory mode is the natural reasoning situation.

To summarize, present study found that there is a group difference on cognitive linguistic tasks indicating developmental trend. And no gender difference on most of the cognitive linguistic tasks. Also, visual mode is better for memory domain & auditory mode is superior for problem solving skills. That is, participants in the present study performed better through visual modality. Participants scored highly on tasks such as picture counting, story sequencing and simple alternate sequencing than auditory mode such as word recall, digit forward and backward span.

Chapter VI

SUMMARY AND CONCLUSIONS

Since many years researcher have contributed to the literature of cognitive linguistic development in typically developing children, using variety of tasks to tap the different components of the cognition. They have also explored the possible trend of developmental aspects of cognitive linguistic skills with respect to age, gender, environmental factors. Since, there is a dearth of literature to support the developmental trend in cognitive linguistic skills of typically developing children in Indian context.

Hence, present study made an effort to study the developmental pattern in cognitive linguistic skills of typically developing children. Pilot study was carried out initially using the well known comprehensive Indian tool that is Cognitive Linguistic Assessment Protocol for Children (Anuroopa 2006). According to the observation of that, stimulus in visual mode was modified by adding colors to it. In the present study, 100 children of 6-6.11 years (Group I) and 7-7.11 years (Group II) were considered. In each age group, equal number of boys and girls were participated CLAP-C was administered and the responses were scored using scoring sheet. Data was analyzed using SPSS software.

Statistical analysis was carried out to see the developmental trend of cognitive linguistic skill across age and to see the developmental trend of cognitive linguistic skill between gender. Test of normality was carried out. Since the data did not satisfy the criteria for normal distribution, non-parametric tests such as Mann whitney U test was carried out for group and gender difference Further data was analyzed for within

group comparison to see the modality differences using Friedman's test and Wilcoxon pair-wise test to see the pair-wise comparison. Also, test re-test reliability was done for reliability check. The results of the present study are as follows;

a) There was developmental pattern seen for all the domains across groups. Older children (Group II) performed better than younger children (group I).

b) There was no gender differences found in both the age groups except auditory memory tasks. Generally, girls outperformed boys in many of the cognitive-linguistic tasks.

c) Modality differences were found only between visual and auditory mode of memory in both groups. Only younger children of group I showed differences in problem solving domain on modality. That is, visual modality was better than the auditory modality in problem solving domain. Whereas, no modality differences was found for group II in problem solving domain.

d) Test- retest reliability of CLAP-C (Anuroopa, 2006) was found to be high (Cronbach's alpha coefficient is 0.8 to 0.9).

Implications of the present study

- The study results augment the understanding of cognitive linguistic abilities in younger children and how it develops as age increases. That is, development trend can be established in that age ranges (6-8years).
- The results of the present study will highlight about the modality differences in terms of cognitive linguistic skills between 6-8 years of children.
- Results helps in better understanding of the difference between performance of cognitive linguistic skills in boys and girls.

Limitations of the study

- In the present study only two age groups were considered.
- Children belonging to only middle and high socio economic status were considered.
- Other factors such as parent's education, duration of language exposure of the child, cultural variations were not controlled in the present study.

Further research direction

- This study can be regarded as preliminary attempt; hence it can be standardized across different ages and gender by incorporating the regional and cultural differences.
- Future studies can be focused to investigate the cognitive linguistic skills in typically developing children with 3 or 2 years of age intervals unlike 5 years age interval in the present study.
- To investigate the cognitive linguistic skills among children with communication disorders.

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APPENDIX I

COGNITIVE LINGUISTIC ASSESSMENT PROTOCOL FOR CHILDREN

I. DOMAIN I

ATTENTION/DISCRIMINATION

AUDITORY MODE:

1. Digit Count Test:

Instructions: “I am going to present you some digits in a sequence, you have to listen carefully to them and tell me the number of time you heard the digit ‘9’. Listen Carefully!”

ನಾನು ಕೆಲವು ಸಂಖ್ಯೆಗಳನ್ನು ಹೇಳುತ್ತೇನೆ, ನೀವು ಅವುಗಳಲ್ಲಿ ಎಷ್ಟು ಬಾರಿ ಒಂಭತ್ತು ಎಂಬ ಸಂಖ್ಯೆಯನ್ನು ಕೇಳುವಿರಿ ಎಂದು ಲೆಕ್ಕ ಹಾಕಿ ಹೇಳಿ."

Level- I- 2, 9, 5, 6

Level II- 21, 19, 9, 10, 7, 9

Level III- 4, ba, 3, 9, da, tu, 9, di, 6

Level IV- 9, 19, 29, 9, 15, 69, 8, 9, 7

Level V- 21, 9, 65, 99, 3, 9, 89, 12, 90

2. Sound Count Test:

Instructions: “I am going to present you some sounds in a sequence, you have to listen carefully to them and tell me the number of times you hear the sound “ba”. Listen carefully!

ನಾನು ಕೆಲವು ಅಕ್ಷರಗಳನ್ನು ಹೇಳುತ್ತೇನೆ,ನೀವು ಅವುಗಳಲ್ಲಿ ಎಷ್ಟು ಬಾರಿ 'ಬ' ಅಕ್ಷರವನ್ನು ಕೇಳುವಿರಿ ಎಂದು ಲೆಕ್ಕ ಹಾಕಿ ಹೇಳಿ."

ಮ, ಬ, ಟ

ಸ, ಲ, ಬ, ರ, ಸ

ಬ, ಜ, ಲ, ಬ, ಪ, ಬ, ಹ

ಟ, ಕ, ಪ, ಪ, ಬ, ನ,ಲ, ರ, ಸ

ನ, ಟ, ಪ, ಬ, ಹ, ನ, ಬ, ಚ, ಲ

3. Auditory Word Discrimination:

Instructions: "I am going to present you few word pairs you have to listen carefully and tell me if the words in the word pair are same or different"

ನಾನು ಎರಡು ಸಮನಾಗಿ ಕೇಳಿಸುವ ಶಬ್ಧಗಳನ್ನು ಹೆಳುತೇನೆ, ನೀವು ಆ ಶಬ್ಧಗಳು ಒಂದೇ ರೀತಿಯಾಗಿ ಕೇಳಿಸುತ್ತದೆಯೇ ಎಂದು ಹೇಳಿ."

ಓದು-ಊದು

ಇಲಿ-ಇಲ್ಲಿ

ಹಲ್ಲಿ-ಹಳ್ಳಿ

ಕಾಲು-ಕಾಲು

ಇಲಿ-ಇಳಿ

ಓದು-ಓದು

ಕಾಲು-ಕಾರು

ಬೀಗ-ಬೀಗ

ಬೀಗ-ಬೀಜ

ಹಲ್ಲಿ-ಹಲ್ಲಿ

VISUAL MODE

1. Odd One Out Test:

Instructions: “I will be showing you some set of pictures you have to tell me which one of those is an odd one or which one of it is different”

ನಾನು ಕೆಲವು ಚಿತ್ರ ತೋರಿಸುತ್ತೇನೆ, ಅವುಗಳಲ್ಲಿ ಬೆರೇ ರೀತಿ ಇರುವ/ಗುಂಪಿಗೆ ಸೇರದ ಚಿತ್ರ ಗುರುತಿಸಿ ಹೇಳಿ."

Level-I	L-Ia, L-Ib, L-Ic
Level-II	L-IIa, L-IIb, L-IIc
Level-III	L-IIIa, L-IIIb, L-IIIc
Level –IV	L-IVa, L-IVb, L-IVc
Level –V	L-Va, L-Vb, L-Vc

2. Letter Cancellation:

Instruction: “ I will show some letters from each sequence of letter, you have to point out to the letter ‘i’ from that sequence.”

ಇಲ್ಲಿ ಕೊಟ್ಟಿರುವ ಪದಗಳಲ್ಲಿ "ಇ" ಎಂಬ ಅಕ್ಷರ ಇದೆಯೇ ಎಂದು ತೋರಿಸಿ."

Instruction at Level- IV: “now you have to show every red colored ‘i ‘ from the sequence”

"ಈಗ ನೀವು ಕೇವಲ ಕೆಂಪು ಬಣ್ಣದಲ್ಲಿ ಬರೆದಿರುವ ’ಇ’ ಶಬ್ಧವನ್ನು ತೋರಿಸು

Instruction at Level- V: “now you have to show every red colored ‘i’ preceding every red colored ‘ka’ from the sequence

"ಈಗ ನೀವು ಕೆಂಪು ಬಣ್ಣದಲ್ಲಿ ಬರೆದಿರುವ ’ಇ’, ಕೆಂಪು ಬಣ್ಣದಲ್ಲಿ ಬರೆದಿರುವ ’ಕ’ ಮುಂಚೆ ಬಂದರೆ ಮಾತ್ರ ತೊರಿಸಿ."

3. Visual Discrimination:

Instructions: “ I am going to show you some word pairs; you have to tell me if these word pairs appear same or different to you”

"ನಾನು ಎರಡು ಸಮಾನವಾಗಿ ಇರುವ ಎರಡು ಶಬ್ಧಗಳನ್ನು ತೋರಿಸುತ್ತೆನೆ, ಅವು ಸಮಾನವಾಗಿದೆಯ ಅಥವ ಬೇರೆ ಬೇರೆಯದಾಗಿದೆಯ ಎಂದು ಹೇಳಿ."

ದಣಿ-ಧಣಿ

ಕಸ-ಕಸ

ಹಣ-ಹಟ

ನೀನು-ನೀವು

ರಾಶಿ-ರಾಶಿ

ಅಗಸ-ಅಗಲ

ದಾರ-ದಾರ

ಮನ-ಮನ

ಮರ-ಮಠ

ಕಸ-ಕಸ

Domain II

Visual Mode

1. ***Digit forward span:***

   Instructions: “I am going to tell you some digits in a sequence, you have to repeat me back after I finish”

   "ನಾನು ಕೆಲವು ಸಂಖ್ಯೆಗಳನ್ನು ಹೇಳುತ್ತೆನೆ, ನೀವು ಅದೇ ಸಂಖ್ಯೆಗಳನ್ನು ಪುನಃ ಹೇಳಬೇಕು.**"**

2. ***Word Recall:***

   Instructions: “I am going to present you some words in sequence, you have to recall the words in the same sequence”

   ನಾನು ನಿಮಗೆ ಕೆಲವು ಶಬ್ಧಗಳನ್ನು ಹೇಳುತ್ತೇನೆ, ನೀವು ಅದೇ ಸಾಲಿನಲ್ಲಿ ಹೇಳಬೇಕು."

   ಹಕ್ಕಿ, ಪುಸ್ತಕ, ಸೋಪು

   ಪೇಪರ್, ಕಾರ್ಡ್, ಪೆನ್ನು, ರಬ್ಬರ್

   ಮರ, ಬಂಡೆ, ಮೊಳೆ, ನೀರು, ಕುರ್ಚಿ

ಗಂಟೆ, ವಾಚು, ಚಮಚ, ಸೋಪು, ಮನೆ, ಹಾಲು

ಹೂವು, ಬ್ರಷ್ಃಉ, ಸೋಪು, ಕೀ, ಬಾಚಣಿಗೆ, ನಾಯಿ, ಕಾರು

3. Digit Backward:

Instructions: "I am going to present you a sequence of digits you have to repeat back in a reverse order"

ನಾನು ಕೆಲವು ಸಂಖ್ಯೆಗಳನ್ನು ಹೇಳುತ್ತೆನೆ, ನೀವು ಅದೇ ಸಂಖ್ಯೆಗಳನ್ನು ತಿರುಗಿಸಿ

(ಕೊನೆಯಿಂದ ಮೊದಲಿಗೆ) ಹೇಳಬೇಕು."

Domain II

Visual Mode

1. Simple Alternating Sequencing:

Instructions: "I will be showing you some pictures/ shapes you have to tell what will come next in the blank"

"ನಾನು ಕೆಲವು ಚಿತ್ರಗಳನ್ನು ತೋರಿಸುತ್ತೇನೆ, ನೀವು ಬಿಟ್ಟ ಚಿತ್ರವನ್ನು ಹೇಳಬೇಕು."

2. Picture Counting:

Instructions: "I am going to show you some pictures in sequence, after I remove them you have to recall and name them back"

ನಾನು ಕೆಲವು ಚಿತ್ರಗಳನ್ನು ತೋರಿಸುತ್ತೇನೆ, ಅವುಗಳನ್ನು ತೆಗೆದ ಮೇಲೆ ನೀವು ಯಾವುದೆಲ್ಲ

ಚಿತ್ರಗಳನ್ನು ನೋಡಿದ್ದೀರೆಂದು ಹೇಳಬೇಕು.

3. Story Sequencing

Instructions: “I am going to show you some story pictures, these cards are all jumbled; you have arrange these cards according to the story”

If the child is not aware of the story the examiner can narrate the short story to him/her and then ask the child to arrange the cards

ನಾನು ಕೆಲವು ಕಥೆಗಳ ಚಿತ್ರಗಳನ್ನು ತೋರಿಸುತ್ತೇನೆ, ಅವು ಒಂದೇ ಸರಣಿಯಲ್ಲಿಲ್ಲ. ಅದನ್ನು ನೀವು

ಕಥೆಯಲ್ಲಿರುವ ಸರದಿಯಲ್ಲಿ ಇಡಬೇಕು

DOMAIN III

Problem Solving

AUDITORY MODE

1. Predicting Outcome:

Instructions: “What will you do if ….”

"ನೀನು ಏನು ಮಾಡುವೆ ಒಂದು ವೇಳೆ:.....

೧. ನೀನು ನಿನ್ನ ಸ್ಕೂಲ್ ಬ್ಯಾಗನ್ನು ಕಳೆದುಕೊಂಡರೆ

೨. ನೀನು ಶಾಲೆ ರಿಕ್ಷವನ್ನು ಮಿಸ್ ಮಾಡಿಕೊಂಡರೆ

೩. ನೀನು ಒಂದು ಕೋಣೆಯಲ್ಲಿ ಸಿಕ್ಕಿಬಿದ್ದರೆ

೪. ಒಂದು ವೇಳೆ ಕರೆಂಟು ಅಕಸ್ಮಿಕವಾಗಿ ಹೋದರೆ

೫. ನೀನು ನಿನ್ನ ಮನೆಯ ಕೀಲಿ ಕಳೆದುಕೊಂಡರೆ

೬. ನಿನ್ನ ಟೆಲಿಫೋನು ಕೆಲಸ ಮಾಡದಿದ್ದರೆ

೭. ನಿನ್ನ ಮನೆಗೆ ಬೆಂಕಿ ಬಿದ್ದರೆ

೮. ನೀನು ನಿನ್ನ ಪುಸ್ತಕಗಳನ್ನು ಶಾಲೆಯಲ್ಲಿ ಮರೆತರೆ

೯.ನೀನು ಕಾಫಿ ಅಥವ ತಿಂಡಿಯನ್ನು ನಿನ್ನ ಬಟ್ಟೆ ಮೇಲೆ ಬೀಳಿಸಿದರೆ

೧೦. ನೀನು ಪರೀಕ್ಷೆಯಲ್ಲಿ ಉತ್ತರಗಳನ್ನು ಮರೆತರೆ

2. Predicting the cause:

Instructions: “Tell me why …”

"ಯಾಕೆ ಎಂದು ಹೇಳು:.....

೧. ನಿನ್ನ ಗೆಳೆಯ/ಗೆಳತಿ ನಿನ್ನ ಜೊತೆ ಮಾತಾಡಲ್ಲ

೨. ನೀನು ಮಳೆಯಲ್ಲಿ ನೆನಿತೀಯಾ

೩. ನಿನ್ನ ಬಟ್ಟೆ ನಿನಗೆ ಟೈಟಾಗುತ್ತದೆ

೪. ನಿನ್ನ ಗಾಡಿ ಓಡಲು ಶುರುವಾಗಲ್ಲ

೫. ನಿನ್ನ ಗಿಡ ಸತ್ತುಹೋಗುತ್ತೆ

೬. ನಿನ್ನ ಕೀಯಿಂದ ಲಾಕ್ ತೆಗೆಯಲು ಆಗಲ್ಲ

೭. ನಿನಗೆ ಬೋರ್ಡ್ ನೋಡಿಕೊಂಡು ಓದಲು ಕಷ್ಟ ಆಗುತ್ತೆ

೮. ನಿನ್ನ ಕಾರಿನ ಚಕ್ರ ಚಟ್ಟೇಯಾಗಿದೆ ಮತ್ತೆ ಕಾರು ಮುಂದೆ ಹೋಗಲ್ಲ

೯. ಅಡಿಗೆ ಮನೆ ಹೊಗೆಯಿಂದ ತುಂಬಿದೆ

೧೦. ನಿನಗೆ ಉಸಿರಾಡಲು ಆಗಲ್ಲ

3. Compare and Contrast:

Instructions: “I will tell you two word pairs; you have to compare and contrast between those both at least by one or two feature”

"ನಾನು ಎರಡು ಪದಗಳನ್ನು ಕೊಡುತ್ತೆನೆ, ನೀನು ಈ ಪದಗಳಲ್ಲಿ ಸಮಾನತೆ ಮತ್ತು ವ್ಯತ್ಯಾಸಗಳನ್ನು ಹೇಳಬೇಕು."

೧. ಬೆಕ್ಕು ಮತ್ತು ನಾಯಿ

೨. ಹಾಲು ಮತ್ತು ಕಾಫಿ

೩. ಗೋಲಿ ಮತ್ತು ಬಾಲು

೪. ಫೋಟೊ ಮತ್ತು ಚಲನಚಿತ್ರ

೫. ಅಪಾರ್ಟ್ಮೆಂಟ್ ಮತ್ತು ಮನೆ

೬. ಕೋಣೆ ಮತ್ತು ಮನೆ

೭. ಪೆನ್ಸಿಲ್ ಮತ್ತು ಪೆನ್

೮. ಸ್ಟೊವ್ ಮತ್ತು ಫ್ರಿಡ್ಜ್

೯. ಬಾಲು ಮತ್ತು ಬಲೂನು

೧೦. ಕಥೆ ಪುಸ್ತಕ ಮತ್ತು ನ್ಯೂಸ್ ಪೇಪರ್

VISUAL MODE

1. ***Association Task:***

   Instructions: “I am going to show you a picture array; from that you have to show me two pictures which are closely associated to each other.”

   The number of associations increases from level-I to level-II

"ನಾನು ಕೆಲವು ಚಿತ್ರಗಳನ್ನು ತೋರಿಸುತ್ತೆನೆ, ಅವುಗಳಲ್ಲಿ ಹೊಂದುವ ಚಿತ್ರಗಳನ್ನು ತೋರಿಸಬೇಕು."
ಉದಾ: ಕುರ್ಚಿ ಮತ್ತು ಟೇಬಲ್

2. ***Overlapping:***

   Instructions: “I am going to show you some pictures which are overlapping, you have to identify the pictures and name them.”

   ನಾನು ಕೆಲವು ಚಿತ್ರಗಳನ್ನು ತೋರಿಸುತ್ತೆನೆ, ಅವುಗಳು ಒಂದರ ಮೇಲೆ ಒಂದು ಇವೆ. ಆದರೆ

   ನೀನು ಅದರಲ್ಲಿ ಯಾವ ಯಾವ ಚಿತ್ರಗಳು ಇವೆಯೆಂದು ಹೇಳಬೇಕು."

3. ***Mazes:***

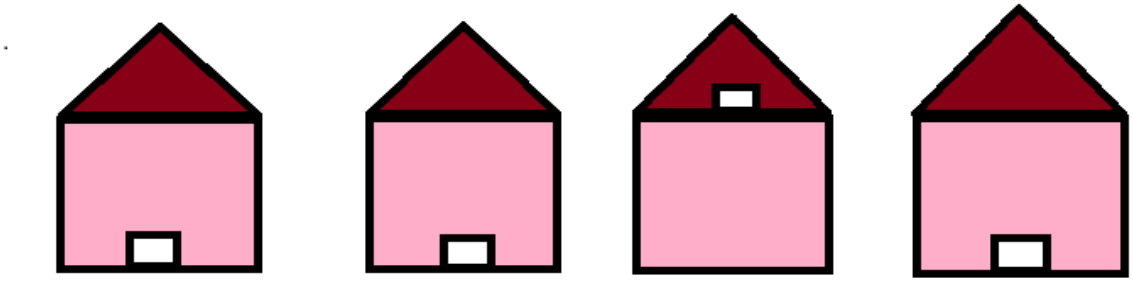
   Instructions: “I will show you some mazes you have to start from one point and come to the final point without touching the lines.”

"ನಾನು ಕೆಲವು ಚಿತ್ರಗಳನ್ನು ತೋರಿಸುತ್ತೆನೆ, ಅವುಗಳಲ್ಲಿ ನೀನು ಒಂದು ಸ್ಥಳದಿಂದ ಇನ್ನೊಂದು ಸ್ಥಳಕ್ಕೆ ಗೆರೆಗಳನ್ನು ಮುಟ್ಟದಂತೆ ತಲುಪಬೇಕು."

Appendix-ii

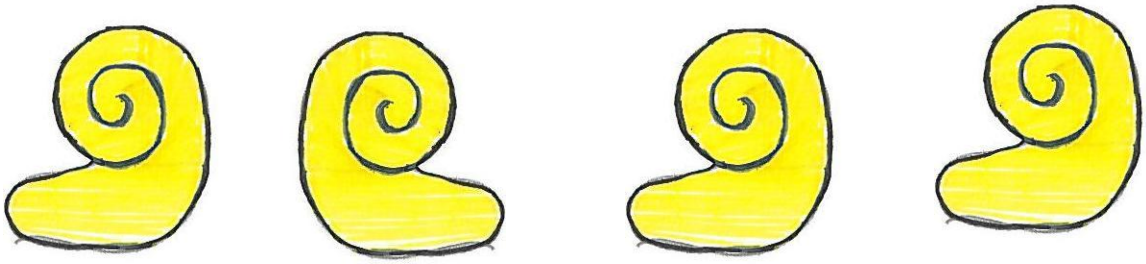
Visual Stimulus of CLAP-C

Odd One Out -Level I



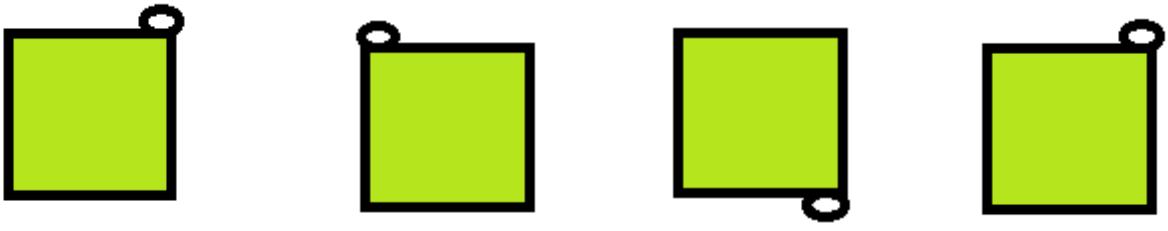
L-I a(i) L-I a(ii) L-Ia(iii) L-I a(iv)

L-I(a)



L-I b(i) L-I b(ii) L-Ib(iii) L-I b(iv)

L-I(b)



L-I c(i) L-I c(ii) L-Ic(iii) L-I c(iv)

L-I(C)

ODD ONE OUT : LEVEL-II (a)

L-II a(i)

L-IIa(ii)

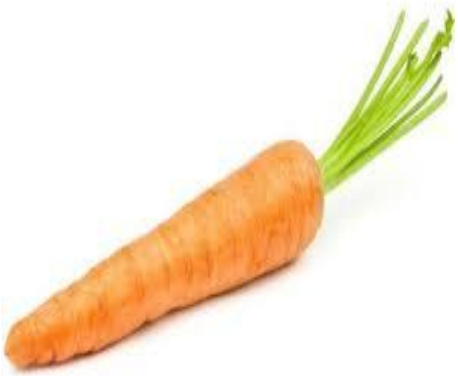
L-IIa(iii)

L-IIa(iv)

ODD ONE OUT :LEVEL-II (b)

L-II b(i)

L-II b(ii)



L-II b(iii)

L-II b(iv)

ODD ONE OUT :LEVEL-II(C)

L-II c(i)

L-II c(ii)

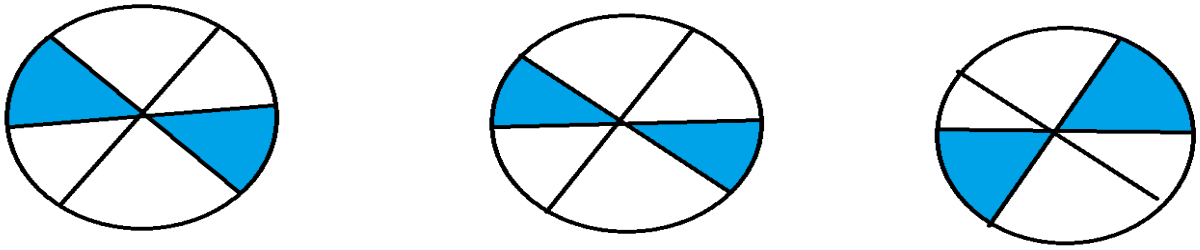
L-II c(iii)

L-II c(iv)

ODD ONE OUT :LEVEL-III

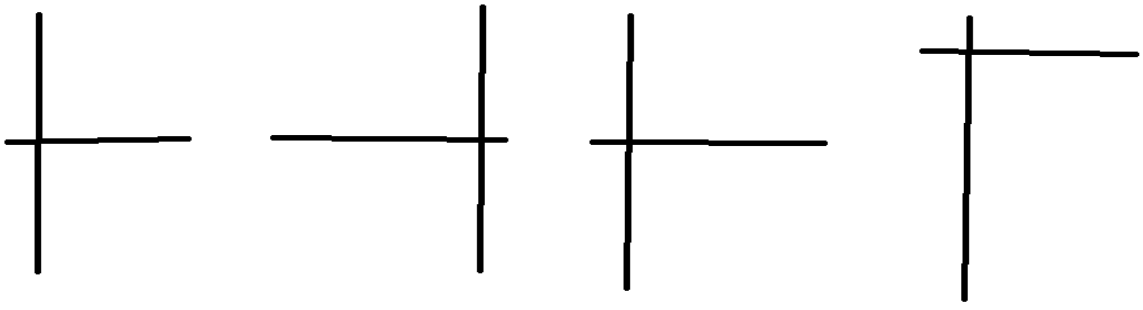
L-III a(i) L-III a(ii) L-III a(iii)

L-III(a)



L-III b(i) L-III b(ii) L-III b(iii)

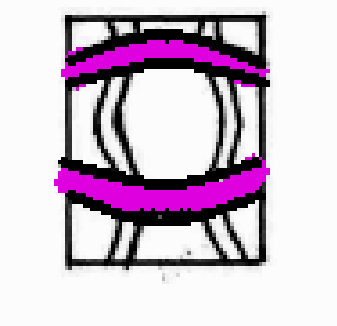
L-III(b)



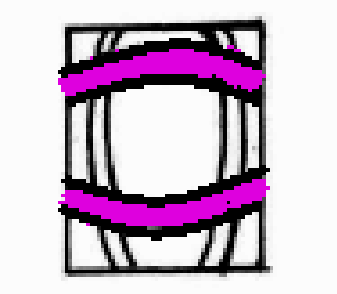
L-III c(i) L-III c(ii) L-III c(iii) L-III c(i)

L-III(c)

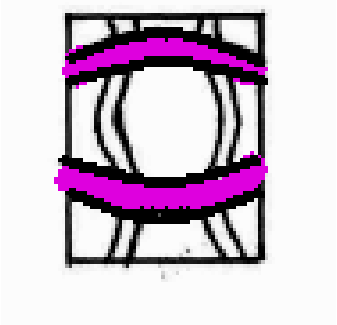
ODD ONE OUT : LEVEL-IV (a)



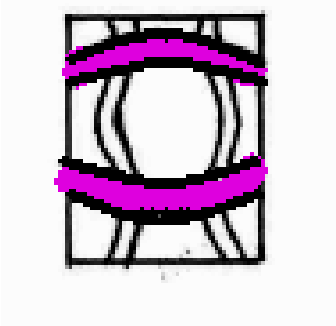
L-IVa(i)



L-IV a(ii)

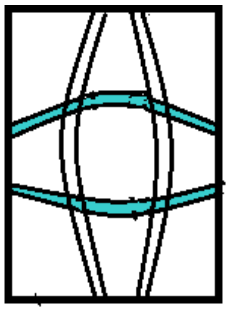


L-IV a(iii)

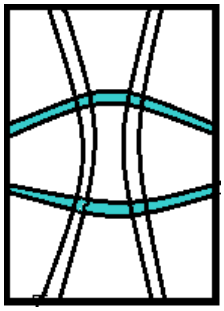


L-IV a(iv)

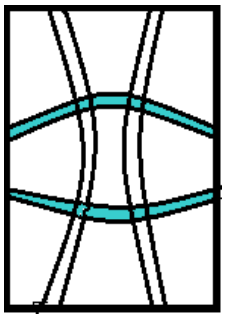
ODD ONE OUT : LEVEL-IV (c)



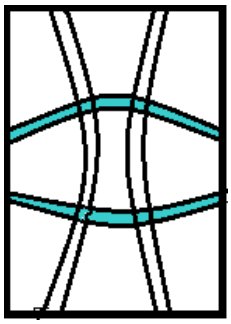
L-IVc(i)



L-IV c(ii)

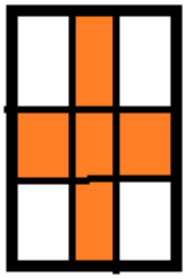


L-IV c(iii)

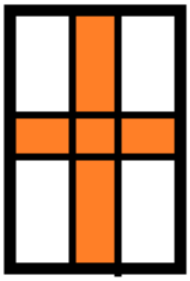


L-IV c(iv)

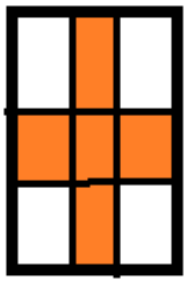
ODD ONE OUT : LEVEL-IV (b)



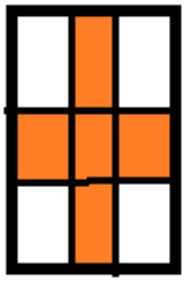
L-IVb(i)



L-IV b(ii)



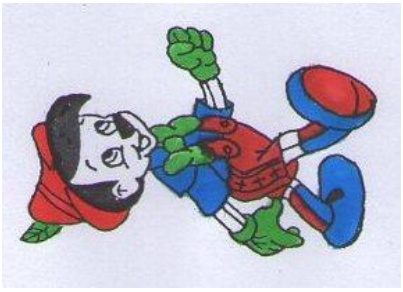
L-IV b(iii)



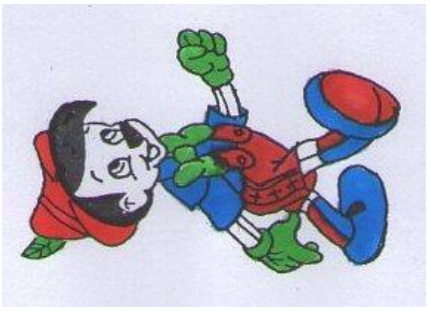
L-IV b(ii)

ODD ONE OUT : LEVEL-V (a)

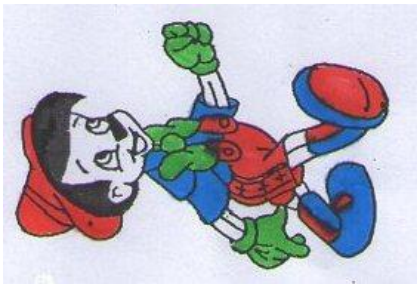
(i)



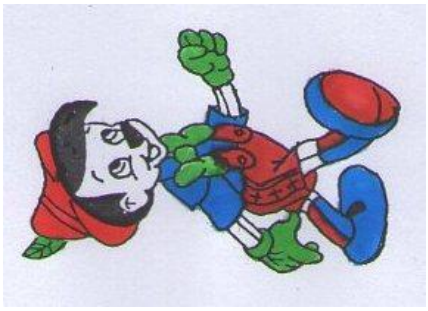
(ii)



(iii)

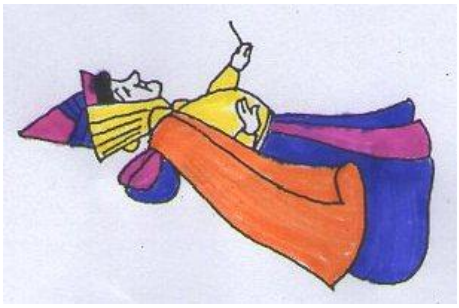


(iv)



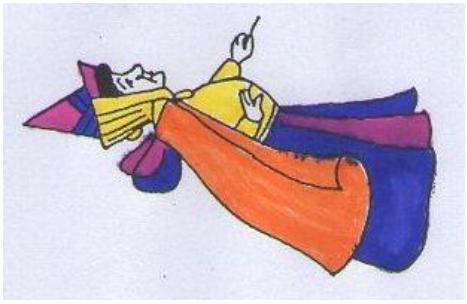
ODD ONE OUT : LEVEL-V (b)

(i)



(ii)

(iii)



(iv)

ODD ONE OUT : LEVEL-V (C)

(i)

(ii)

(iii)

(iv)

Letter Cancellation

L-I : ಮ ಓ ಎ ಇ ವ ಕ ಲ ಸ ಆ

L-II: ಡ ಹ ತ ಗ ಇ ಎ ಶ ಯು ಇ ಕ ನ

L-III: ಪ ವ ಚ ಎ ಯ ಎ ಯ ಎ ಟ ಲ ಎ ವ ಬ ಶ

L-IV: ಸ ಇ ಲ ಸ ಬ ಇ ಕ ಫ ರ ಯು ಎ ಕ ತ ಹ

L-V: ಳ ಲ ಇ ಕ ಅ ಯ ರ ಕ ಇ ಗ ಯ ಇ ಕ ಗ ಸ ಬ ರ ಇ ಕ ಲ

Visual Discrimination

i. ದಣಿ-ಧಣಿ

ii. ಕಸ-ಕಸ

iii. ಹಣ-ಹಟ

iv. ನೀನು-ನೀವು

v. ರಾಶಿ-ರಾಶಿ

vi. ಅಗಸ-ಅಗಲ

vii. ದಾರ-ದಾರ

viii. ಮನ-ಮನ

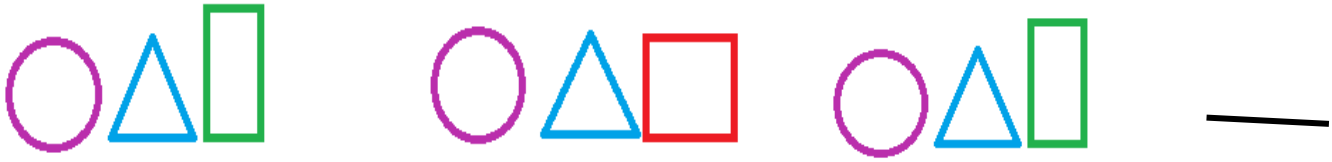
ix. ಮರ-ಮಠ

x. ಕಸ-ಕಸ

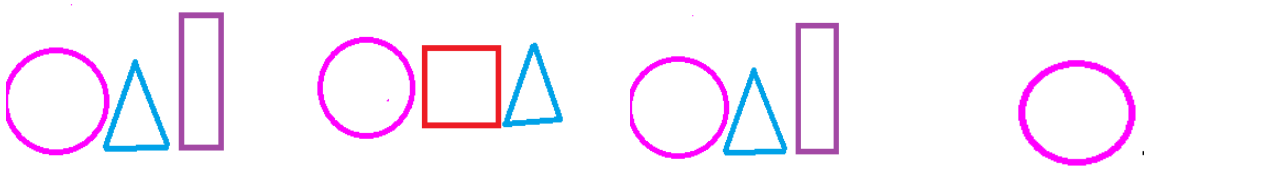
Simple Alternate Sequencing

L-I

L-II



L-III



L-IV

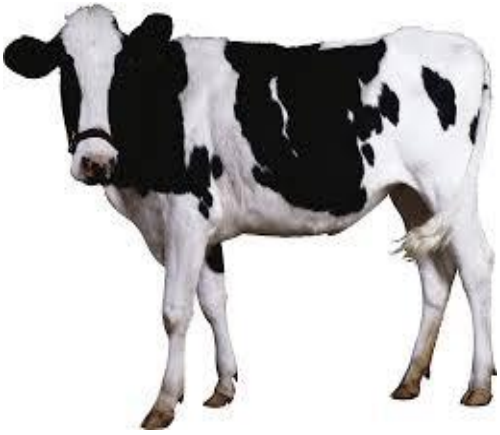
ಕಗ, ಕಗಳ್, ಕಗಳ್

L-V

PICTURE COUNTIN: Level-I

I(a)

I-(b)



I-(c)

PICTURE COUNTING : Level-II

II-(a)

II-(b)

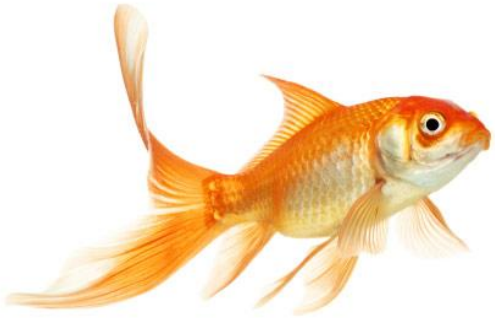
II-(c)

II-(d)

PICTURE COUNTING : Level-III

III-(a)

III-(b)



III-(c)

III-(d)

III-(e)

PICTURE COUNTING : Level-IV

IV-(a)

IV-(b)

IV-(c)

IV-(d)

IV-(e)

IV-(f)

PICTURE COUNTING: Level-V

V- (a)

V -(b)

V -(c)

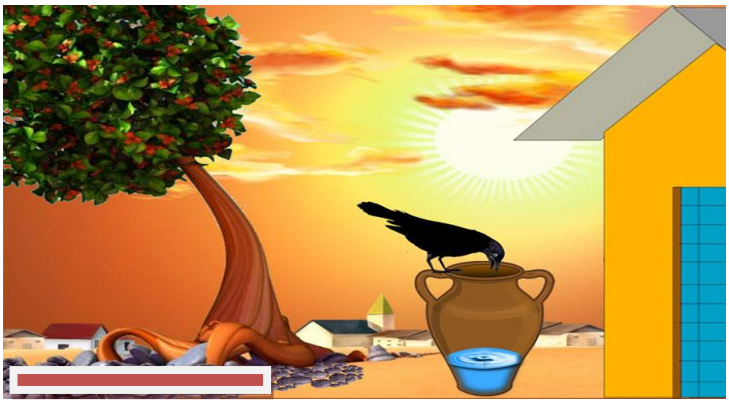
V-(d)

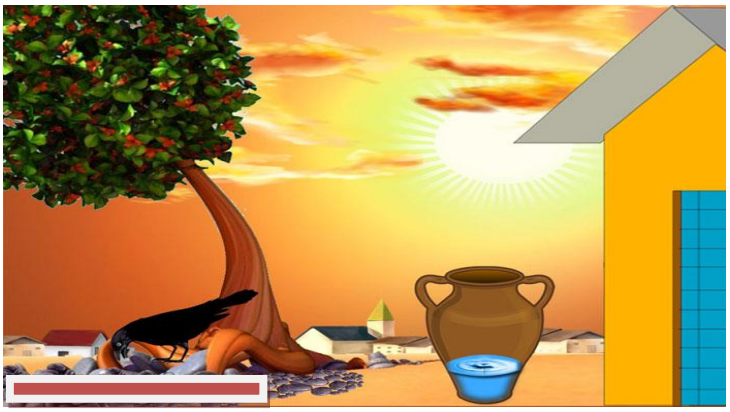
V-(e)

V-(f)

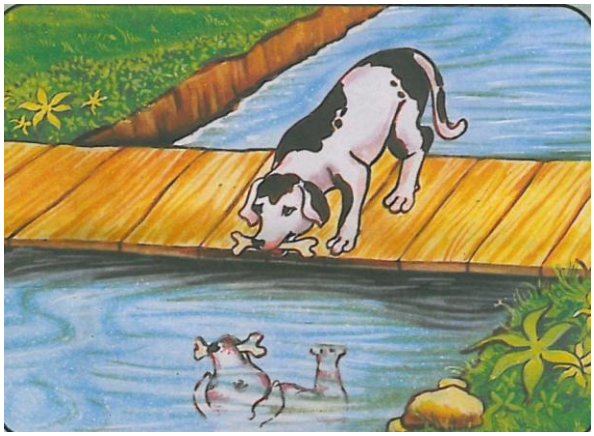
V-(g)

Story sequencing - Level-I





Story sequencing-Level-II



Story sequencing-III

(1)

(2)

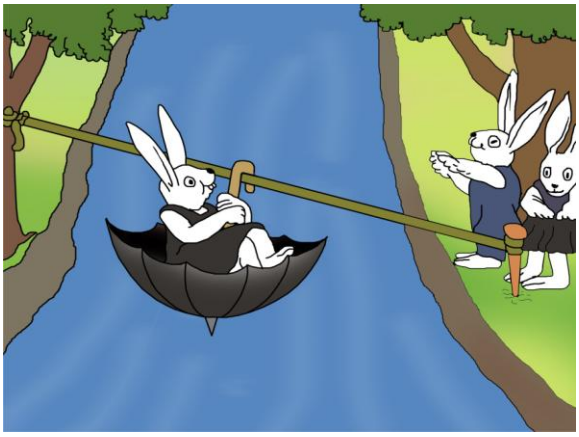
(3)

(4)

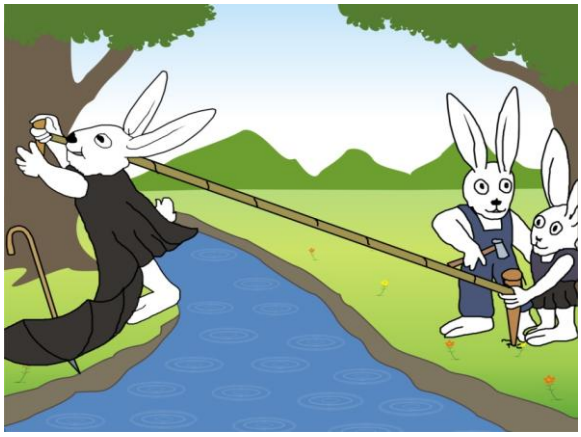
(5)

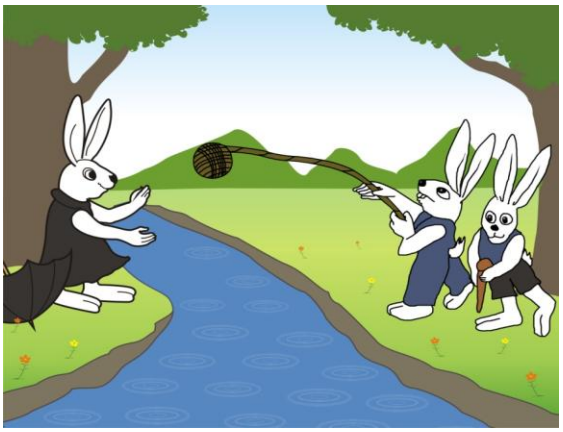
Story sequencing- Level IV

(1)



(2)





(3)

(4)

(5)

Story sequencing- V

(1)

(2)

(3)

(4)

(5)

(6)

ASSOCIATION : LEVEL-I

L-I(a)

L-I(b)

L-I(c)

L-I(c)

L-I(d)

L-I(e)

ASSOCIATION : LEVEL-II

L-I(a)

L-II(b)

L-II(c)

L-II(d)

L-II(e)

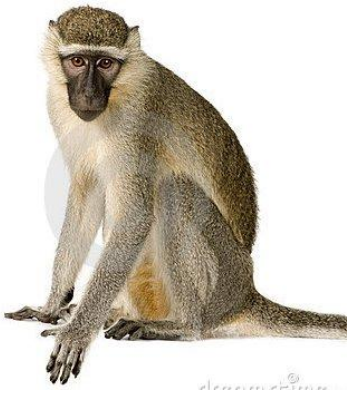
L-II(f)

ASSOCIATION : LEVEL-III

L-III(a)

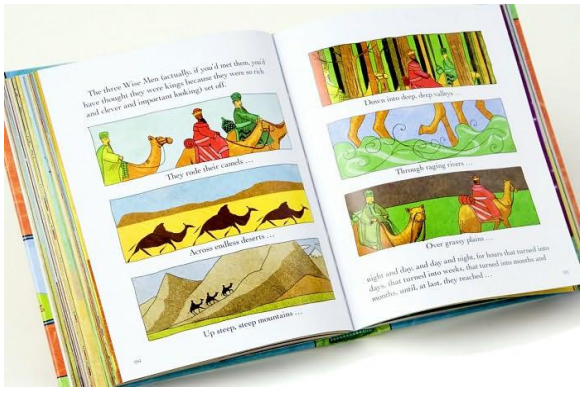
L-III(b)

L-III(c)



L-III(d)

L-III(e)

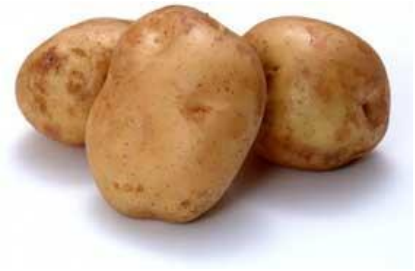


L-III(f)

L-III(g)

ASSOCIATION : LEVEL-IV

L-IV(a)



L-IV(b)

L-IV(c)

L-IV(d)

L-IV(e)

L-IV(f)

L-IV(g)

ASSOCIATION : LEVEL-V

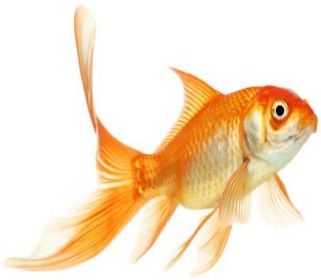
L-V(a)

L-V(b)

L-V(d)

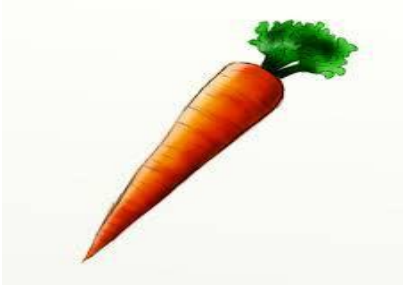
L-V(c)

L-V(f)



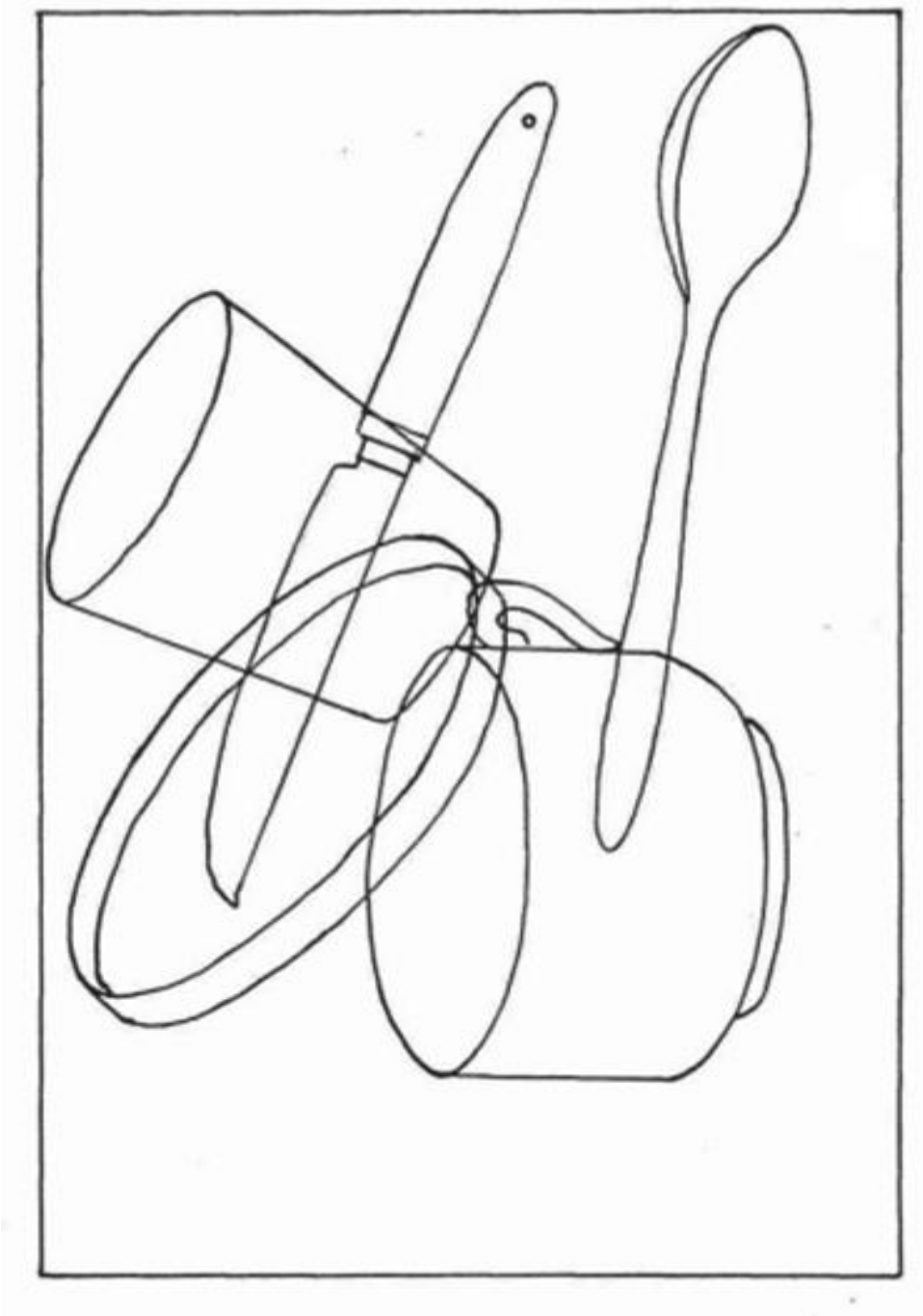
L-V(g)

L-V(h)



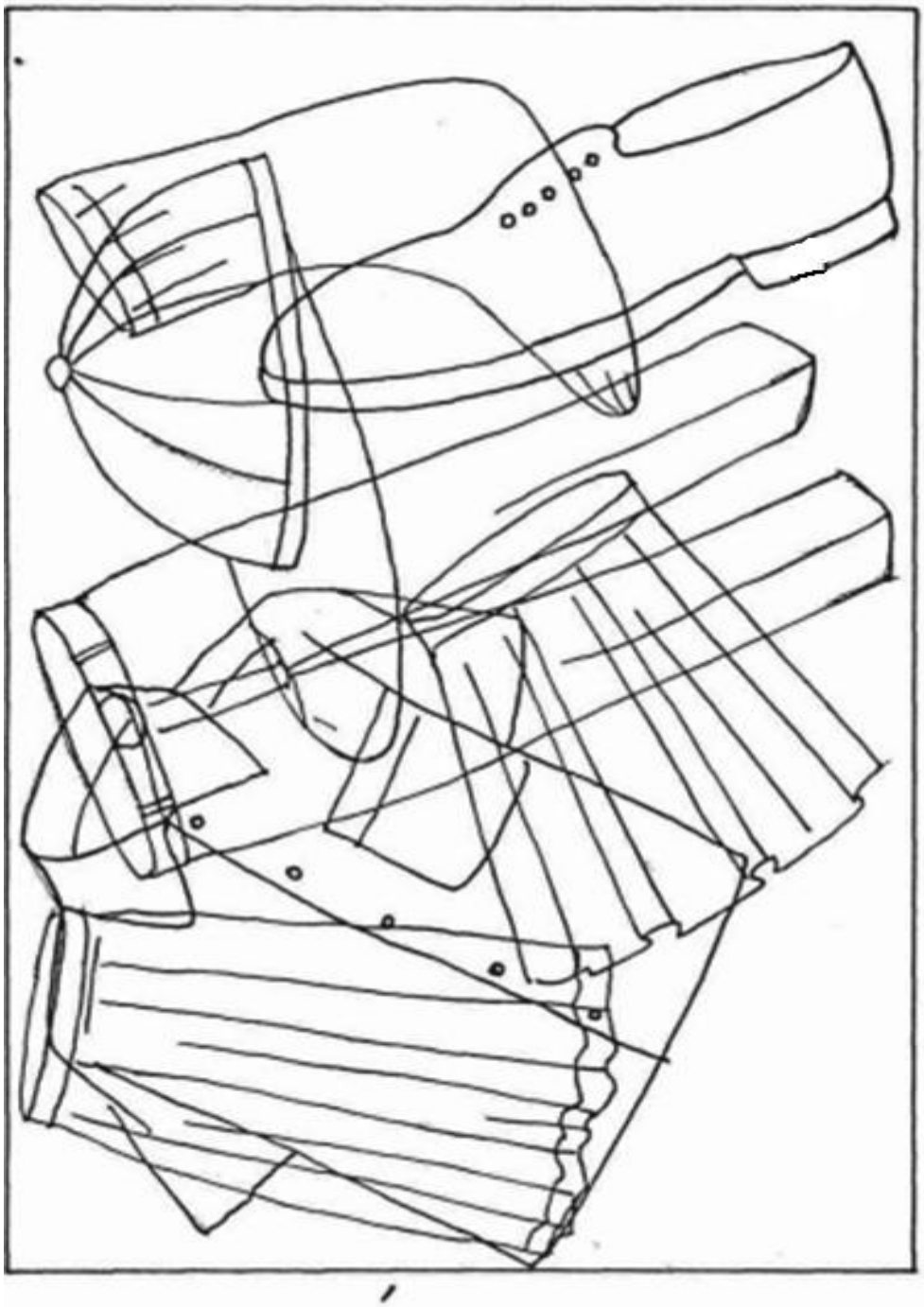
L-V(i)

OVERLAPPING- LEVEL-I

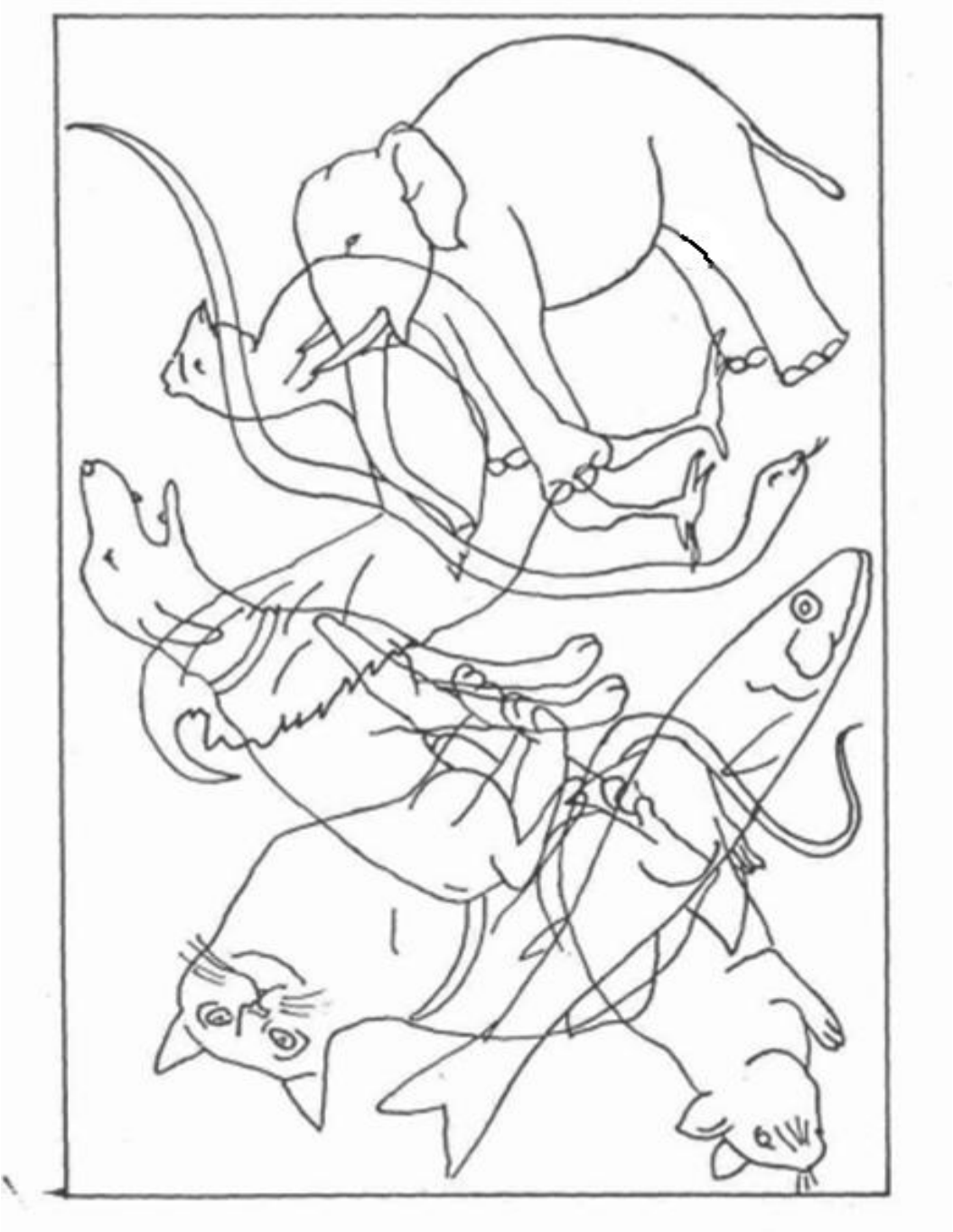


OVERLAPPING- LEVEL-II

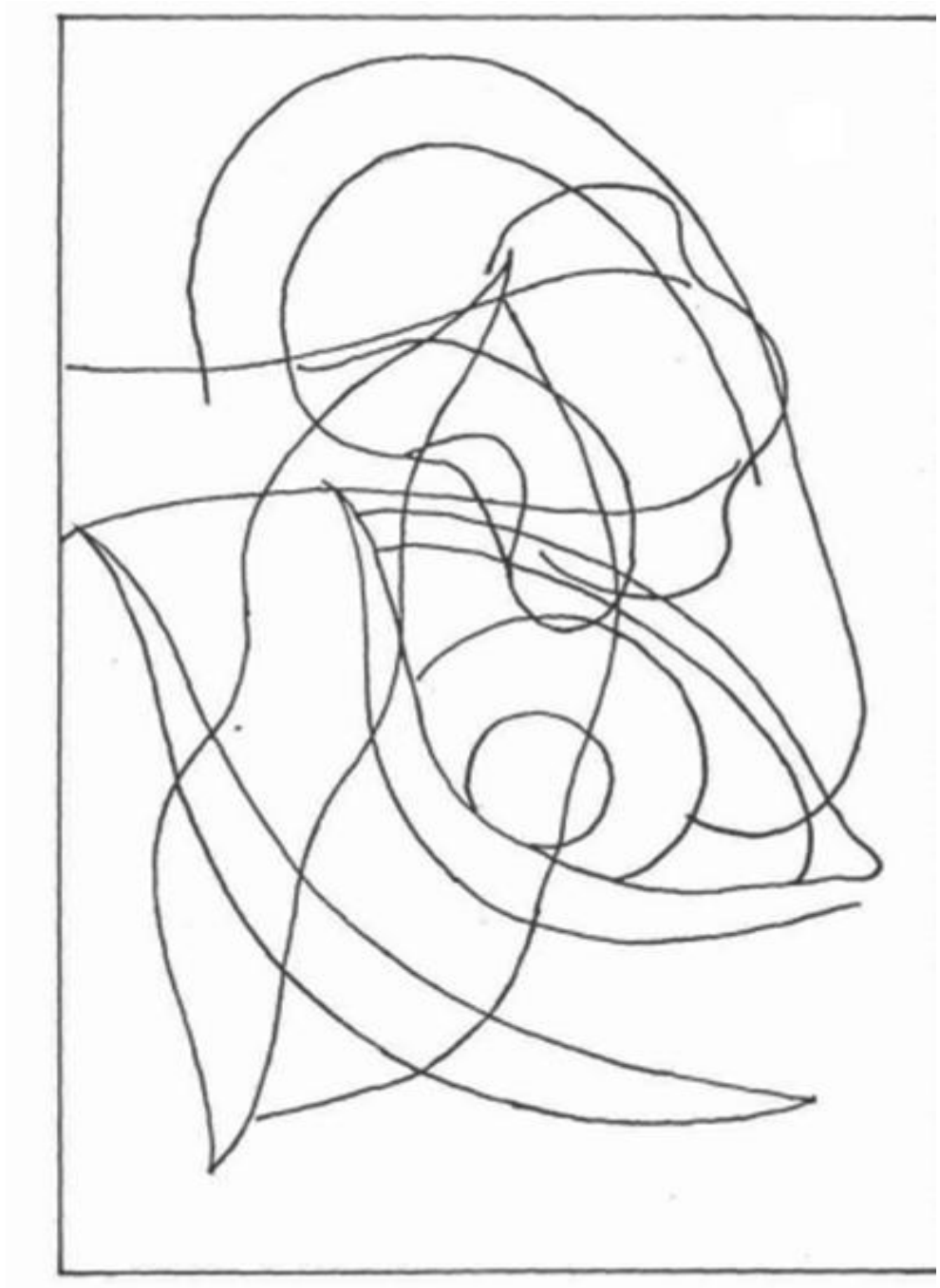
OVERLAPPING- LEVEL-III



OVERLAPPING- LEVEL-IV

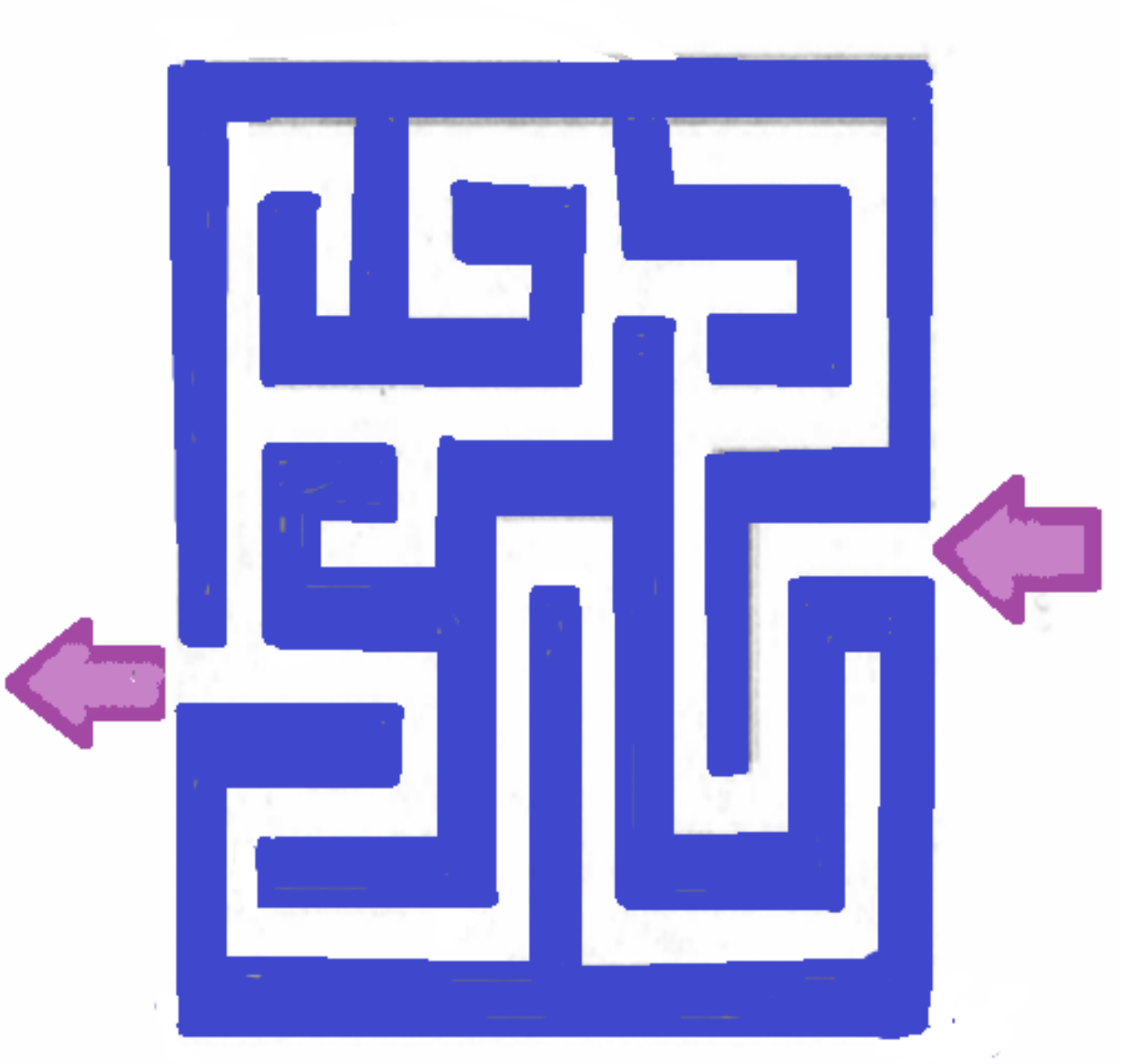


OVERLAPPING- LEVEL-V



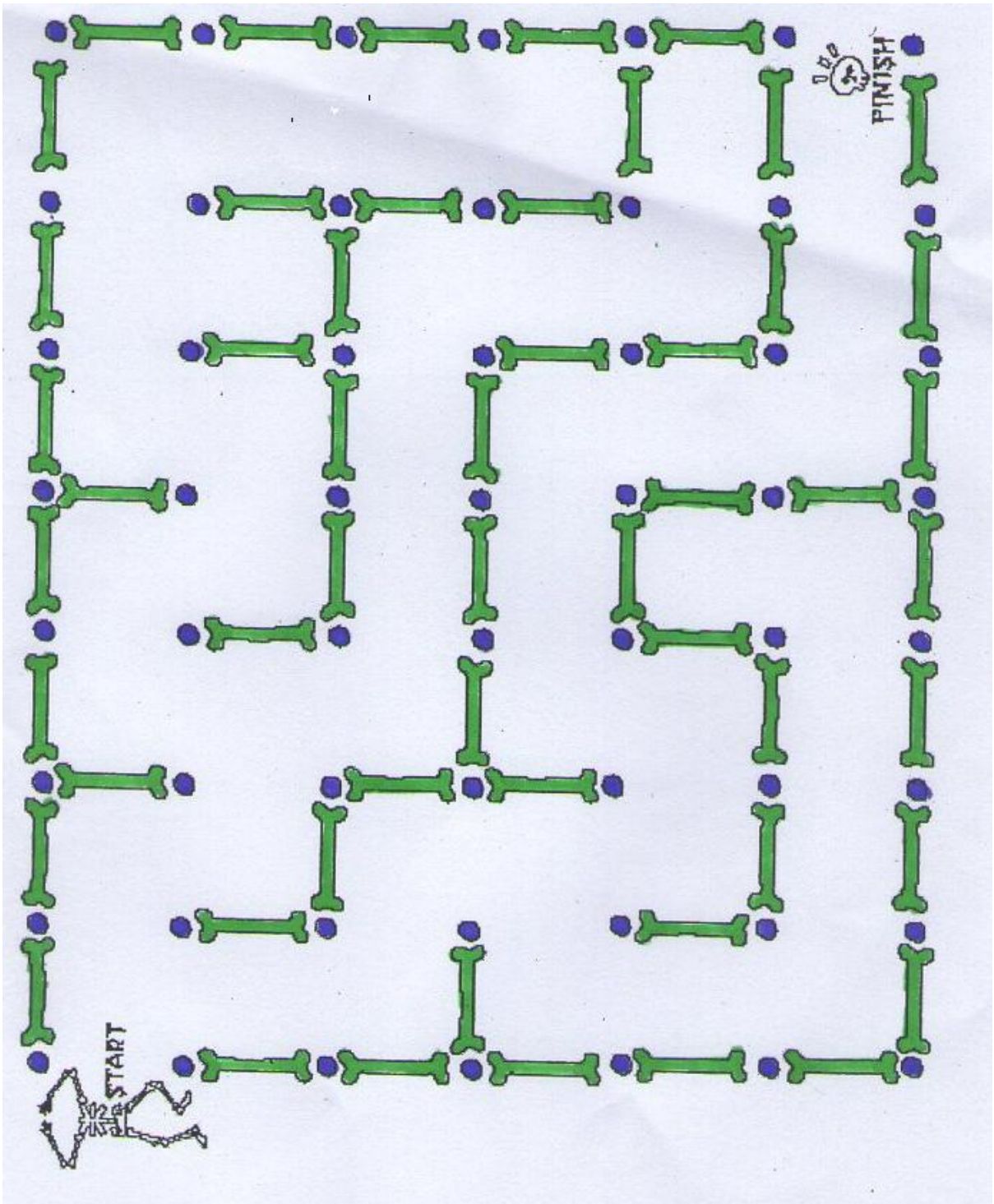
MAZES

L-I



Level-II

Level-III



Level-IV

Level-v