COGNITIVE LINGUISTIC ASSESSMENT PROTOCOL

FOR CHILDREN IN MALAYALAM

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of Degree of Master of Science

(Speech-Language Pathology)

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SEPTEMBER 2023

CERTIFICATE

This is to certify that this dissertation, entitled "**Cognitive Linguistic Assessment Protocol for Children in Malayalam,**" is a bonafide work submitted in part fulfilment for the degree of Master of Science (Speech Language Pathology) of the student Registration number P01II21S0016. 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.

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CHAPTER I

INTRODUCTION

Everyone uses language as a communication tool every day to share information and make arguments with others (Rabiah, 2018). According to McLaughlin (2006), “Language is a collection of arbitrary verbal symbols arranged in a conventional code that has developed as a social tool for exchanging ideas and influencing the behaviour of others”. Language has an impact on how we perceive and think about the world. Language and cognition are inextricably linked, practically and conceptually, though experts disagree regarding the precise nature of this connection.

Cognition has historically been considered the basis upon which language develops. Cognition is the mental act or process of learning and understanding things through thought, experience, and the senses. “Attention, memory, knowledge, decision-making, planning, reasoning, judgment, perception comprehension, language, and visuospatial functions are all examples of high-level intellectual functions and processes” (Dhakal & Bobrin, 2023). Cognitive processes utilise already known information while also producing new information. Cognitive processes evolve and are interconnected over time.

Individual biological characteristics, as well as the environment in which a child grows, have significant effects on cognitive development. According to researchers, the development of language is correlated with cognitive development. Cognitive development, according to Vygotsky (2019), facilitates linguistic growth. As language development progresses, children appear to move from a receptive to a more productive phase; this shift seems dependent on cognitive skill development.

Therefore, it is critical for a speech language pathologist to understand this relationship as well as be knowledgeable about children's cognitive and linguistic development.

A Speech language pathologist plays a vital role in assessing cognitive-linguistic skills and rendering appropriate interventions for the clinical population lacking these skills. As Speech language pathologists, we can use cognitive-linguistic tools to confront mental limitations such as memory in tasks such as thinking, learning, and problem-solving. A few tests for assessing cognitive-linguistic skills in children have been developed in the Western context, with norms limited to the Western population. There are only a few Indian tests available to evaluate growing children's cognitive and linguistic abilities.

The current study focuses on the adaptation of the “Cognitive Linguistic Assessment Protocol for Children (CLAP-C)” by Anuroopa and Shyamala (2006) into the Malayalam language. The CLAP-C (Anuroopa & Shyamala, 2006) was designed to assess Kannada-speaking children's cognitive linguistic abilities. To the best of our knowledge, there are no other test materials that assess cognitive-linguistic skills in an extensive manner in Indian languages.

CLAP-C is divided into three sections: attention/discrimination, memory, and problem-solving. The items/tasks within each domain are arranged so that the task's complexity increases as the presentation level advances from level I to level III. Each domain was evaluated in both auditory and visual modes. Auditory signals are typically more transient, whereas visual stimuli reflect a greater degree of permanence. It has also been discovered that the relative dominance of these modalities varies between children. CLAP-C is a comprehensive test to assess the cognitive and linguistic abilities of children, and that too in an Indian context. The scoring of CLAP-C was also relatively easy for the clinician.

1.1 Need for the study

Due to the fact that India is a multilingual nation, using Western assessment tools on our population will cause numerous linguistic and ethno-cultural problems. Additionally, it will be difficult for the clinician to evaluate someone from a variety of ethnic, cultural, and linguistic backgrounds because most tests may not accurately reflect the population when they are standardized. Anuroopa and Shyamala (2006) developed a cognitive linguistic assessment protocol with the intention of evaluating the cognitive linguistic skills of Kannada-speaking children. This protocol was developed to identify the sequential cognitive linguistic milestones, identify and diagnose cognitive linguistic disabilities in children, and allow intervention based on the developmental schedule. Reliable test material for assessing cognitive-linguistic skills is scarce in the Malayalam Language. Therefore, there is a need to develop indigenous material for assessing the same.

1.2 Aim

The study aimed to adapt cognitive-linguistic assessment protocol for children in the Malayalam language.

1.3 Objectives of the study

1) To determine the content validity of the adapted material
2) To study the pattern of sequential development of cognitive linguistic skills in children between the age range of 4-8 years
3) To verify if any age-related or gender-related changes exist in the performance of various cognitive-linguistic skills.

CHAPTER II

REVIEW OF LITERATURE

Language has developed as a social tool to express ideas and shape other people's behaviour. It is a system of arbitrary verbal symbols organised in a standard pattern (McLaughlin, 2006). Everyone regularly communicates with others by using language to convey ideas and make arguments (Rabiah, 2018). Our perceptions and thoughts are moulded by language. Children learn the phonological, morphological, syntactic, and semantic norms of a language as well as its grammar. Along with learning the vocabulary, they also learn the pragmatic rules of the language. Language is not taught to children. Instead, they take the rules and a large portion of the lexicon from the languages they are surrounded by (Rodman & Hyams, 2007).

The process of acquisition of language has been explained by a number of mechanisms. There have been proposals for imitation of adult speech, reinforcement, and analogy. None of these potential learning mechanisms explains why kids come up with novel phrases that follow language norms or why children make mistakes that others do not make (Fromkin et al., 2007). Additionally, connectionist models of learning rely on the child receiving specifically structured input. Universal Grammar directs children as they construct grammar depending on language input.

Language acquisition occurs in stages. Children develop their linguistic sounds during the first year of life. In the beginning, they make and hear many sounds that are not present in the verbal input. Their outputs and perceptions gradually adapt to their surroundings. Babbling is a universal initial phase in language acquisition that depends on the linguistic information received. Towards the end of the first year, children utter their first words. They pick up a lot more vocabulary and establish much of the language's phonological structure throughout the second year. The first words spoken by children are single-word "sentences" (the holophrastic stage). The child begins to combine two or more words after a few months.

As the child progresses to the telegraphic stage, longer phrases, often lacking grammatical morphemes or functions, are produced. Although it still lacks many of its norms, young children's grammar is not significantly different from that of adults in terms of quality. At this age, kids show that they grasp the importance of structure by using the right words and adhering to the rules for agreement and case (Rodman & Hyams, 2007).

The interaction of cognition and language leads to communication, and cognitive processes influence how language skills are applied in communication. Piaget (1969) has proposed a model that tries to explain the intricate relationship between cognition and language. According to him, intellectual development consists of four periods, each with a distinctive mental structure. These four stages are as follows:

1. Sensorimotor period (Birth to 2 years)

2. Preoperational period (2 to 7 years)

3. Concrete operational period (7 to 11 years)

4. Formal operational period (11 years through adulthood)

Children learn the concepts of causality and object permanence while they are in the “sensorimotor stage” of development. Infants explore their environment by using their senses and motor abilities. They comprehend the idea of a cause-and-effect relationship, such as how a rattle's sound may be repeated or how an infant's crying may prompt the parent(s) to react quickly. Object permanence begins to develop at the age of six months (Malik & Marwaha, 2021).

Following that, a child enters the “pre-operational stage,” in which they can use language, symbolic thought, and mental representations. The infant learns to imitate and pretend play. He is self-centred and unable to accept that others see the world differently than he does. Infants think that everything good or bad has some connection to them. The "concrete operational stage" follows, during which the child uses analytical approaches to solve problems, such as conservation knowledge and inductive reasoning. Adolescence may utilise logical operations and abstractions at the “formal operational stage.” They understand ideas, hypotheses, and abstract concepts such as justice and love (Malik & Marwaha, 2021).

2.1 Language and Cognition

Language and cognition are inextricably linked, practically and conceptually, though experts disagree on the precise nature of this relationship. Language is the means by which we encode and express our emotions, thoughts, ideas, and experiences. Language development is not isolated from cognitive development, according to researchers (Goldstein, 2005). Cognitive development facilitates linguistic growth (Vygotsky, 2019). As language development progresses, children move from a receptive to a more productive phase; this transition depends on cognitive skill development. Therefore, a speech-language pathologist must understand this relationship and be knowledgeable about children's cognitive-linguistic development.

The relationship between language and cognition is now a well-established reality. Of course, comprehending and elucidating the essence of that relationship is a challenge because the solution is dependent, among other factors, on how we define cognition and language. “Using an equation of language ≈ cognition, the situation can be demonstrated. There are various ways to read the sign (≈). If we interpret the relationship between language and cognition as a right-pointing, one-directional arrow (language → cognition), We arrive at the Sapir-Whorf hypothesis; however, a two-sided arrow (language ↔ cognition) suggests a mutual influence. Last but not least, a left-pointing arrow (language ← cognition) considers language to be merely the result of how human general cognitive processes function; this is a sound theory that is likely rejected by everyone” (Geiger, 1993). Another option is to view language and cognition as equal: language = cognition.

The preferable choice is the arrow that points in both directions. Thought can exist independently of language and is influenced by how we speak; the precise relationship between language and thinking is yet unknown. Cognitive processes evolve and are interconnected over time. Individual biological characteristics and the environment in which a child grows significantly impact cognitive development (Kurashige et al.,2020).

Cognitive linguistics looks for explanations for the ways in which language and behaviour are related to and emerge from human cognition and experience rather than seeing them as separate phenomena. Language is viewed by cognitive linguistics as a vital component of human cognition that interacts with and operates in accordance with other cognitive abilities (Janda, 2015).

Stephen et al. (2010) assessed the cognitive-linguistic abilities of bilingual children. Twelve bilingual and twelve monolingual children between the ages of seven and eight made up the study's participants. The findings showed that “bilingual children outperformed monolingual children on all cognitive-linguistic tasks evaluated using CLAP-C”. The attention domain had the highest scores from both groups, followed by problem solving and memory. The findings showed that bilingual children clearly outperformed monolingual children in terms of cognitive and language abilities.

2.2 Role of specific cognitive processes in language processing

2.2.1 Attention

The ability to concentrate one's perception and thought on a particular task while ignoring unrelated stimuli is referred to as attention (Erbay, 2013). The selection of both external and internal stimuli for additional processing and, subsequently, the decision of which inputs call for a response are both governed by attentional processes. The process of selecting stimuli from a highly complex, continuously changing, multisensory environment is greatly affected by the personal interests, motivations, and cognitive abilities of the individual who is seeing the stimuli, in addition to the physical attributes of the stimuli themselves (Gomes et al., 2000). The attentional division is necessary for development and learning. Recognising and responding to the environment's essential components is required for learning new skills.

Arousal, orientation, selective attention, and sustained attention are the four elements that makeup attention. The methods used to decide which stimuli should be processed further are fundamental to how we conceptualise attention. This selection can be automatic, like the orienting brought on by a novel stimulus, or active, such as while performing a selective attention task and looking for a specific target among a group of stimuli. For efficient information processing and the best learning, people also need to be alert (or show at least some basic level of arousal). They also need to be able to maintain an attentional focus (Erbay, 2013). Both in first language (L1) and in second language (L2), selective attention is crucial for language comprehension (Qiu & Ismail, 2023).

The ability to maintain focus for a prolonged period of time is known as sustained attention or vigilance. Joint attention is when we devote attention to something with others (Mundy et al., 2009). As a result, joint attention enables us to collaborate effectively, coordinate our ideas and behaviours, and share our perceptions of the environment with others. It enables social learning and lays the basis for early language and social competency development (Siposova & Carpenter, 2019).

According to Richards and Turner (2001), infants are better at paying attention as they get older and spend a higher percentage of their time doing so. The general arousal/attention system undergoes substantial changes in development throughout infancy and early childhood, which is characterised by increases in the size and length of sustained attention periods (Reynolds & Romano, 2016). Several researchers have looked at how attention-executive processes evolve over time in typically developing children.

Between the ages of six and ten, attentiveness, sustained attention, and spatial orienting (visual search) improve the fastest, according to numerous studies on children's attention development (Betts et al., 2006). Zimmermann and Fimm (2002) investigated the overall attention development of healthy 5 to 12-year-old children. They found that rapid growth occurred from the ages of 5–6 to 8–9 years, followed by a developmental plateau with only minor improvement from 8–9 to 11–12 years.

Up to the second decade of life, attention regulation develops and is closely correlated with the brain’s maturation, especially the prefrontal cortex. Working memory skills improve, and children's behaviour becomes more regulated as the prefrontal cortex matures (Luna et al., 2004). As a result, there are more resources accessible to support task-relevant operations. The brain becomes more adept at protecting itself against attentional diversion during this stage (Wetzel & Schröger, 2014). According to studies, older kids are more skilled than younger kids at distinguishing across channels, concentrating on essential stimuli, and blocking the processing of distractor stimuli (Wetzel, 2014).

2.2.2 Memory

“Memory is the nervous system's ability to learn and retain practical knowledge and skills, allowing organisms to gain from experience” (Crystal & Glanzman, 2013). A model of memory was developed by Atkinson and Shiffrin in 1968. The model suggested that information is moved from one storage region into another through a series of distinct stages in memory. The model's first phase is “sensory memory”, which receives brief external stimuli. The second phase is the “short term memory”, also known as working memory, which receives some brief information from sensory memory and retains it for a short period of time (about 30 seconds). Rehearsed content and data move from short term memory to “long term memory” in the third step for relatively permanent storage (Matlin, 2003). In this hypothesis, most sensory memory data is lost until a certain level of focus and perception is present. For knowledge to be absorbed and held over time in long-term memory, rehearsal is important for short-term memory (Hamada, 2016).

a) Sensory Memory

"Sensory memory is the capacity to quickly retain the enormous amounts of information that people are exposed to on a daily basis" (Siegler & Alibali, 2005). Sensory Memory can be roughly classified into two categories:

1. Iconic Memory (visual input)
2. Echoic Memory (auditory input)

b) Short-Term Memory (STM)

Long Term Memory (LTM) and Sensory Memory are connected via Short Term Memory (STM). The short-term memory has a maximum capacity of five to nine things. Even though the STM is meant to be viewed as one unit, as indicated by Atkinson and Shiffrin, it can do two separate tasks concurrently under some circumstances. Instead of using the word "Short Term Memory", Baddeley and Hitch (1974) came up with the phrase "Working Memory" to emphasise that this type of Memory allows us to carry out several cognitive tasks simultaneously with distinct areas of the Working Memory.

According to Baddeley (2002), working memory is divided into three distinct parts.

1. Phonological Loop
2. Visuospatial Sketch Pad
3. Central Executive

The Phonological Loop is in charge of spoken and auditory information, including names, phone numbers, and general comprehension of what other people are saying. It is, generally speaking, a system designed specifically for language (Grigorenko et al., 2012). Visual and spatial data are handled in the Visuospatial Sketch Pad. This implies that data regarding the location and characteristics of objects can be stored. The Central Executive manages the coordination between the Visuospatial Sketch Pad and the Phonological Loop (Grigorenko et al., 2012). Additionally, it governs the storage of long-term memory as well as its retrieval. It also connects working memory to long-term memory.

"Working memory appears during the preschool years and develops linearly between the ages of four and fifteen, with visual-spatial working memory reaching a peak around the age of eleven" (Best et al., 2009). In a 2014 study, León, Cimadevilla, and Tascón evaluated the spatial abilities (spatial reference memory and spatial working memory) of children aged four to ten. The participants in this study were 50 boys and 50 girls. Overall, the results showed that "Four and five-year-old groups performed worse than the older groups."

c) Long Term Memory

Long-term memory refers to the system that stores memories for an extended period of time. There are two types of memory: Declarative (conscious) memory and Implicit (unconscious) memory. "Episodic and semantic Memory are the two types of declarative Memory" (Tulving, 1990). Episodic Memory is the term used to describe memories of specific events that a person has personally experienced (autobiographical information). Usually, those recollections are tied to particular moments and locations (Dickerson & Eichenbaum, 2010). On the contrary, semantic memory describes information about the outside world unrelated to personal experiences. Semantic Memory holds information like words, ideas, numbers, or facts.

All subconscious memories and specific aptitudes or talents are included in implicit memory. Knowing how to do a specific sort of action, like reading, tying shoes, or riding a bike, comes from procedural memory, a component of implicit memory. The perceptual identification of words and objects is the focus of priming, a non-conscious aspect of human implicit memory (Camina & Guell, 2017).

Memory allows for the storage and retrieval of information. It is critical to keep in mind both what was just said and any previous knowledge that might be pertinent to the conversation. Conversely, language allows you to follow along with your conversation partner, comprehend what he is saying, and respond to him in a way that makes sense. Multilingualism is a fascinating area regarding the relationship between memory and language. It has been demonstrated through experiments that bilinguals who hear words spoken in both languages have a larger capacity for remembering (Grundy & Timmer, 2017). Working memory and word learning have a fluid relationship. “The ability to keep novel phonological structures in working memory is crucial for the generation of new words throughout the early stages of language acquisition for both native and foreign language learning”(Archibald, 2017).

2.2.3 Problem solving

Al-Tarawneh (2012) defines problem-solving as "the process of recognising a problem, generating possible solution paths, and choosing a suitable course of action." A problem is a circumstance without an obvious solution. Undefined problems and well-defined problems are the two categories into which problems can be divided. In contrast to well-defined problems, which have obvious goals, solution paths, and exactly predicted solutions, ill-defined problems lack specific goals, solution paths, or anticipated solutions (Arifin et al., 2017). Well-defined problems will have the following characteristics, according to Moursund (2016):

a) The given status of the problem is precisely defined.

This could be the setup for a chess game or a formula that needs to be solved.

b) You can only apply a finite number of operators or rules to the given state.

These rules specify which piece you can move to which place, for example, in chess.

c) Lastly, the problem has a distinct objective

In order to come up with novel solutions, problem solving often calls for abstract thought and creativity. It typically incorporates semantics (understanding the meanings behind the problem) and pragmatics or logical reasoning. The steps involved in solving a problem are problem identification, often referred to as problem analysis, problem structuring (where the problem is arranged), developing potential solutions, putting those solutions into practice, and confirming the solution that was selected (Dumper et al., 2017).

Preschoolers seem to like problem solving by nature. They react differently depending on whether acts yield ambiguous or unambiguous effects. Schulz and Bonawitz (2007) discovered that when children were unsure which of two levers caused a toy to appear, they played longer with the box than when the lever function was clear. Very basic problem solving skills develop before the age of one year.

“Having relevant knowledge does not guarantee that it will be used to solve an issue. Adult input can help with knowledge transfer from one scenario to another”

(Keen, 2011). This ability to solve problems also helps with language development, which is a very well-established fact. “The preschool years are a critical time for the development of both problem-solving skills and metacognitive abilities” (Wang, 2015).

2.2.3.1 Strategies of problem solving

A problem-solving strategy is a means for finding a solution. Different strategies are coupled with various action plans. Trial and error is a popular approach. The saying "If at first you don't succeed, try again" explains trial and error well. An algorithm is a different kind of approach. “An algorithm is a problem-solving method that provides step-by-step directions to accomplish a specific result” (Kahneman, 2011). Another form of problem-solving strategy is a heuristic. “A heuristic is a general problem-solving framework, whereas an algorithm requires being executed exactly to provide the correct solution” (Tversky & Kahneman, 1974). Heuristics can be thought of as mental shortcuts for problem solving.

Gestalt psychologists developed a popular problem-solving method in the 1920s. Their idea of problem-solving focuses on conduct in circumstances demanding relatively creative ways to achieve objectives and claims that problem-solving entails a restructuring process.

2.3 Assessment of cognitive linguistic skills in children

A Speech language pathologist plays a vital role in assessing cognitive-linguistic skills and rendering appropriate interventions for the clinical population lacking these skills. As Speech language pathologists, we can use cognitive-linguistic tools to confront mental limitations such as memory in tasks such as thinking, learning, and problem-solving.

A few tests have been developed in the Western context to assess cognitive-linguistic skills in children, with the norms being restricted to the Western population. Some of these tests are given below in Table 2.1.

Table 2.1

Summary of tests available in Western context

Sl No.	Test name	Author and year	Domains/Areas
1	Stanford-Binet intelligence scale, Fifth edition	Roid,2003	Knowledge Quantitative reasoning Fluid reasoning Working memory Visual-spatial processing
2	The Weschler intelligence scale for children, Fifth Edition	Weschler,2014	Verbal Comprehension Visual-Spatial Fluid Reasoning Working Memory Processing Speed
3	The Griffith Mental Developmental Scale, Third edition	Griffith, 2016	Locomotor Personal-Social Language Eye and Hand Coordination Performance Practical Reasoning

4	The Wechsler Preschool and Primary Intelligence Scale, Fourth Edition	Wechsler, 2012	General Intelligence Verbal Comprehension Processing Speed General Language
5	Bayley Scales of Infant and Toddler Development, Fourth edition	Bayley,2019	Cognition Language Social-Emotional Motor Adaptive Behaviour
6	Cognitive abilities test	Robert L. Thorndike & Elizabeth Hagen, 1978	Verbal reasoning Quantitative reasoning Nonverbal reasoning
7	Kaufman Assessment Battery for Children, Second Edition	Kaufman & Kaufman, 2004	Short-Term Memory Learning Ability Fluid Reasoning Visual Processing Crystallised Ability
8	Cognitive linguistic improvement program	Ross-Swain, 1992	Memory Orientation Organization Abstraction Reasoning Processing
9	Developmental Assessment of Young Children, 2nd Edition (DAYC-2)	Voress &Maddox,2012	Cognition Adaptive Behaviour Communication Physical Development Social-Emotional Development

Most of these tests concentrate on only a few cognitive and linguistic domains. In the Indian context, not much substantial work is done. Indian tests available to assess adult's cognitive and linguistic abilities are shown in Table 2.2.

Table 2.2

Summary of tests available in the Indian context for adults

Sl No.	Test name	Author and year	Domains/Areas
1	Hindi Mental State Exam (HMSE)	Ganguli et al., 1995	Orientation to time Orientation to place Attention Registration Recall Repetition Naming Read and follow commands Sentence Copying
2	Cognitive-linguistic assessment protocol for adults (CLAP) in Kannada	Kamath, 2001	Attention, perception and discrimination Memory Reasoning and problem-solving Organization
3	Manipal Manual for Cognitive Linguistic Abilities	Mathew et al., 2013	Perception Memory Executive Functions
4	Montreal Cognitive Assessment (MoCA) Available in Hindi, Bengali, Telugu, Kannada and Malayalam	Kaul et al.,2022	Memory Language Executive Functions Visuospatial Skills Calculation Abstraction Attention Concentration Orientation
5	Cognitive-linguistic assessment protocol for adults (CLAP) in Malayalam	Lakshmi, 2010	Attention, Perception and discrimination Memory Reasoning and problem solving Organization
6	Cognitive-linguistic assessment protocol for adults (CLAP) in Telugu	Veena, 2010	Attention, perception and discrimination Reasoning and problem solving Memory Organization

There are a few Indian tests available to assess the cognitive and linguistic abilities of growing children, which are mentioned in Table 2.3.

Table 2.3

Summary of tests available in the Indian context for children

Sl No.	Test name	Author and year	Domains
1	Three Dimensional Language Acquisition Test (3D-LAT)	Geetha Harlekhar,1986	Reception Expression Cognition
2	Cognitive linguistic assessment protocol for children	Anuroopa & Shyamala,2006	Attention/discrimination Memory Problem-solving
3	Cognitive Linguistic Assessment Protocol for Children with Learning Disability	Kavya & Shyamala, 2007	Attention/discrimination Memory Problem-solving

The present study focuses on the adaptation of the "Cognitive Linguistic Assessment Protocol for Children (CLAP-C)" by Anuroopa and Shyamala (2006) in the Malayalam language.

CHAPTER III

METHOD

The study aimed to adapt "Cognitive Linguistic Assessment Protocol for Children" in the age range of four to eight years in the Malayalam language.

3.1 Research Design

This was a descriptive study that reported on the adaptation and preliminary validation of the CLAP-C for Malayalam-speaking children.

3.2 Participants

Forty participants were considered. The study enrolled typically developing children between the ages of four and eight years. Four subgroups of participants were formed:

1) 4 years to <5 years
2) 5 years to <6 years
3) 6 years to <7 years
4) 7 years to <8 years

In each subgroup, an equal number of males and females were considered. There were a total of ten participants (five males and five females) in each subgroup.

3.3 Inclusion Criteria

For the purpose of selecting participants, the following criteria were used:

1) Participants must be native speakers of Malayalam and studying in English-medium schools in Kerala.

2) Participants should have normal or corrected vision and no significant deficit in hearing sensitivity for speech.

3) During the testing period, participants should be physically fit.

3.4 Procedure

The research was carried out in three phases. These are as follows:

3.4.1 Phase 1

The CLAP-C (Anuroopa & Shyamala, 2006) was adapted into Malayalam in the first phase. Before adaptation, consent from the author was obtained through email. The test items consisted of the following domains, which formed the basis for CLAP-C:

a) Attention, Discrimination, and Perception

b) Memory

c) Problem-solving

The test was conducted on both the auditory and visual sensory modalities. The test was modified to include cultural and linguistic adaptations, while the general test administration method remained the same as in the previous study. Linguistic aspects of the Malayalam language were considered when adapting test material. A linguist and a speech-language pathologist assisted with the process. The adapted material was given to three experienced Malayalam speaking Speech-language pathologists (SLP) who served as judges for content validity. The material was rated using a questionnaire developed by Goswami et al. (2012).

3.4.2 Phase 2

After incorporating the SLP's suggestions, a pilot study was carried out on eight participants (two in each age group), based upon which the material was modified and finalised.

3.4.3 Phase 3

The final test material was administered to 40 participants, ranging in age from four to eight years. The participants were chosen from a regular school in Kerala. Written consent was obtained from the school authority. Children were comfortably seated and tested in a room with minimal external noise. The testing was done in one session, and it took around 45 minutes to administer the entire protocol, and then the child's responses were scored. Each correct response received a score of "1," while each incorrect response received a "0."

Table 3.1 details various tasks in the three domains mentioned above.

Table 3.1

Subsections of CLAP-C

Sl No.	Domains	Tasks given Auditory mode	Score	Tasks given Visual mode	Score
1	Attention/ Discrimination	Digit count test	5	Odd one out test	5
		Sound count test	5	Letter cancellation	5
		Auditory word discrimination	10	Visual-word discrimination	10
	Total score		20		20
2	Memory	Digit-forward span	5	Alternate sequence	5
		Word recall	5	Picture counting	5
		Digit backward span	5	Story sequencing	5
	Total score		15		15
3	Problem-Solving	Predicting the outcome	10	Association task	5
		Predicting the cause	10	Overlapping test	5
		Compare and contrast	10	Mazes	5
	Total score		30		15

3.5 Domain I

Attention / Discrimination

In this domain, both selective and sustained attention were assessed. Because attention is so crucial to the cognitive process of discrimination, it is categorized under the same domain.

Auditory Mode:

a) Digit count test

This task was chosen to assess sustained attention. The child was required to mentally count how many times the target digit appeared in the list while listening to the set of digits being read aloud to them. The number of units in each level was distributed in such a way that as one moved from level I to level V, the difficulty of the task increased.

b) Sound count test

The child was required to listen to a set of phonemes being read aloud while also keeping track in their minds of how many times the target phoneme appeared in the list. This task was designed to test sustained attention. The number of units in each level was arranged in such a way that the task's complexity increased as it progressed from level I to level V.

c) Auditory word discrimination

The purpose of including this subtest was to assess children's ability to distinguish between the presented auditory stimuli- bisyllabic words. This subtest assessed the child's ability to discriminate between two words presented auditorily by the examiner (same/different).

Visual Mode:

a) Odd-one-out test

In this subtest, the child had to scan the visual array of the stimuli and identify the odd/different stimulus among the collection of four to five pictures displayed on flash cards. Selecting the odd one out was thought to be a task requiring sustained attention. As the presentation moves from level I to level V, the stimulus complexity rises. Each level had three distinct presentations of the stimulus cards, and the correct response was defined as two out of the three presented stimuli, earning a score of "1".

b) Letter cancellation

A simple letter cancellation task required sustained attention while scanning the page and marking each instance of the letter, which is a specific alphabetic letter that appears repeatedly within a random matrix. The contingent letter cancellation task required that the prerequisite contingency be satisfied before the letter could be cancelled. Selective attention was tested using this task. The colour was also added as a distraction in the contingency letter cancellation task as the test level advanced.

c) Visual word discrimination

This subtest was added to assess children's ability to distinguish between visually presented bisyllabic word pairs. This subtest measured the child's ability to distinguish between ten pairs of words that the examiner had visually presented as either the same or different.

3.6 Domain II

Memory

Auditory Mode:

a) **Digit forward span**

The number of digits a person can take in and correctly recall in serial order after hearing them is known as their "digit span," which is a common indicator of short-term memory. Here, as in most short-term memory tasks, the participant had to retain a small amount of data for a brief period of time, and the order of recall is crucial. This subtest entailed repeating the set of digits presented by the clinician auditorily. The levels were organised in a hierarchy, with the first level of stimuli having three digits, the second having four, and so on up to level five, which had seven digits.

b) **Word Recall**

In this subtest, the child is required to repeat the words said by the clinician in the exact same order. For this subtest, the words were arranged in a hierarchical order ranging from three to seven words per presentation level. The number of words repeated was noted, and a score of "1" was assigned if they repeated all of the words at that level. For each incorrect response, a score of "0" was assigned.

c) **Digit backward span**

This subtest required the subject to repeat the digit sequence presented by the examiner in reverse order. In this test, the order of the digits in reverse was crucial.

Each correct sequence received a score of "1," while every incorrect sequence received a score of "0."

Visual Mode:

a) Simple alternate sequence

The Participant was shown a sequence or pattern of items with one blank and asked to fill in the blank. To fill in the blanks, the child's memory and attentional abilities were also tested in this subtest. Each correct response received a score of “1”, while an incorrect response received a score of “0”.

b) Picture counting

A set of pictures was shown in this task, and the child had to name each one after the examiner removed the stimulus from their field of vision. A child's visual memory span can be inferred from the number of items they can recall. This task would further assist the clinician in determining the child's dominant mode of learning because children differ in their preferred modes of learning, such as visual or auditory.

c) Story sequencing

This task required the child to sequence the story cards in the exact order according to the story. Five stories were chosen, and the children were given the task of arranging the story cards in the exact order. For the unknown stories, the examiner narrated the story to the child and then asked the child to organise the story cards. The goal of this task was to evaluate short-term memory. Every correct response received a "1," while every incorrect response received a "0."

3.7 Domain III

Problem solving

Auditory Mode:

a) Predicting outcome

Understanding the issue, coming up with potential solutions, getting past any obstacles, and weighing the pros and cons of different options are all parts of problem solving. This task involved the child reasoning out the situation and telling the possible outcomes of the situation, for example: “What will you do if you miss your school auto?” The child may respond by saying, "I will go to school with Daddy or take another car." Therefore, any answer that is relevant or nearly relevant received a score of "1," while any answer that is irrelevant received a score of "0." There were ten questions total in this subtest, which were arranged in a hypothetical progression from easy to difficult situations.

b) Predicting the cause

This task required the child to guess the possible cause of the situation as described by the clinician. "Your friend doesn't talk to you; why?" One possible explanation is for the child to say, "I had a fight with him, or I hurt my friend, and that's why he stopped talking to me."

Thus, any relevant or nearly relevant answer received a "1," while any irrelevant answer received a "0." This subtest consisted of ten questions in total, which were arranged hypothetically from easy to difficult situations.

c) Compare and contrast

In this subtest, the child was required to compare and contrast two given items, such as "Dog and Cat." This task thus required the child's critical or logical thinking or the capacity to break an idea down into its constituent parts and analyse them. Therefore, a score of "1" was given for any answer that was relevant or nearly relevant; otherwise, a score of "0" was given for any answers that were irrelevant. Ten-word pairs total were used in this subtest, and they were arranged hypothetically from simple to complex situations.

Visual Mode:

a) Association task

The child had to look through the picture array in order to choose the ones that were most related. By increasing the number of associated items in the array, the task's complexity was further elevated. In order to complete this task, the child used both logical and creative thinking. There were five levels to this task. A score of “1” for the correct answer and a score of “0” for each incorrect answer were given.

b) Overlapping task

This test also required the child to look at a picture card with different pictures overlapping, and the child had to solve the overlap and name the pictures depicted on the picture card. This subtest also had five levels that were organised in a hierarchy. Moreover, each correct answer received a "1," and each incorrect answer received a "0."

c) Mazes

In order to complete this task, the child had to navigate a maze and arrive at the clinician's designated destination. Before presenting the test stimulus, two trials were conducted to help the child become familiar with the task. The higher levels required the child to solve the maze while also making a word out of the letters scattered throughout the maze. The final point would be represented by the word made, for example: "Cat." A score of "1" was assigned for correct responses and a "0" for incorrect responses. Before beginning the test, the child was given clear instructions.

3.8 Analysis of the Data

The scores obtained after administering the protocol were totalled for each subject across all age groups for each domain. The mean scores of the children in each age group were compared and tabulated using the SPSS software (Statistical Package for the Social Sciences, Version 26) and then subjected to statistical analysis. Furthermore, the development of cognitive linguistic skills across different age groups was graphically represented.

CHAPTER IV

RESULTS

The primary aim of the study was to adapt the "Cognitive-Linguistic Assessment Protocol for Children" for Malayalam-speaking, neurotypical children. This test was aimed at assessing the cognitive and linguistic abilities of Malayalam-speaking children. The CLAP-C (Anuroopa & Shyamala, 2006) was adapted into Malayalam in the first phase. The test was modified to include cultural and linguistic adaptations, while the general test administration method remained the same as in the previous study.

4.1 Content validation of the adapted test

The adapted CLAP-C in Malayalam was subjected to content validation. Three Speech-Language Pathologists (SLPs) with at least three years of working experience who held a Master's Degree in Speech-Language Pathology were requested to validate the adapted test material. The stimuli were rated by a questionnaire that was developed by Goswami et al. (2012).

Table 4.1

Content Validation scores obtained for the overall adapted CLAP-C in Malayalam

Parameters of content validation	Very Poor	Poor	Fair	Good	Excellent
Simplicity				1	2
Familiarity			1	1	1
Size of picture				1	2
Colour and appearance				1	2
Arrangement				2	1
Presentation			1	1	1
Volume				1	2
Relevance				2	1
Complexity				1	2
Iconicity			1		2
Accessibility			1		2
Flexibility				1	2
Trainability				1	2
Stimulability				1	2
Feasibility				1	2
Generalization				1	2
Scope of Practise				1	2
Scoring Pattern				1	2
Coverage of parameters				1	2

Three Speech language pathologists did the content validation. They rated the overall test material and gave it a rating ranging from 'Fair' to 'Excellent'. The suggestions and recommendations of the SLPs were considered, and changes were made to the test. As a result, the translated test was adapted, and its content was validated. The adapted Cognitive-Linguistic Assessment Protocol for Children in Malayalam is given in detail in Appendix B.

The adapted CLAP-C in Malayalam was administered to forty participants (twenty males and twenty females). All participants were sorted into four age groups.

Table 4.2

Demographic details of the participants

Group	Age range	Number of males	Number of females	Total number of participants
1	4- <5 years	5	5	10
2	5- <6 years	5	5	10
3	6- <7 years	5	5	10
4	7- <8 years	5	5	10

Each individual's data was tabulated, and statistical analyses were carried out with the SPSS (Version 26) statistical package. The tasks in each domain were arranged in such a way that the task's complexity increased with each presentation. As a result, a criterion was established to analyse the levels suitable for a specific age group, such that all subjects or greater than or equal to 50% of subjects should pass on that level, indicating that the level is suitable for that age group. In light of this, the performance of all subjects on each task in each domain was evaluated.

The results were organised broadly under the following headings:

1. The performance of children from different age groups in each domain
2. The performance of children from different age groups across domains
3. The performance of children from different gender groups across domains

4.2 The performance of children from different age groups in each domain

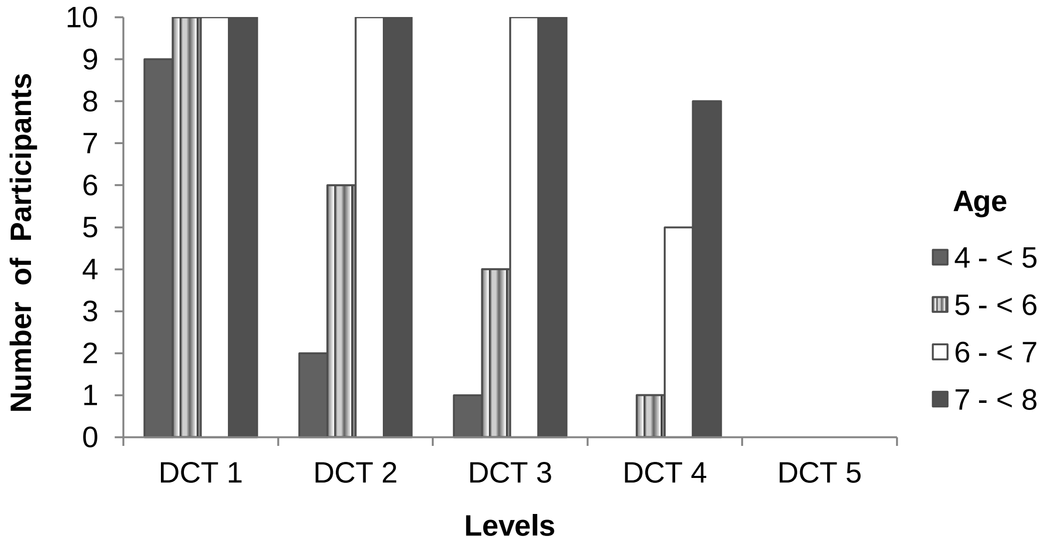
4.2.1 Attention/ Discrimination

Auditory Mode

a) Digit count test

Figure 4.1

Performance of the Participants from all four age groups across the five levels of the Digit count test

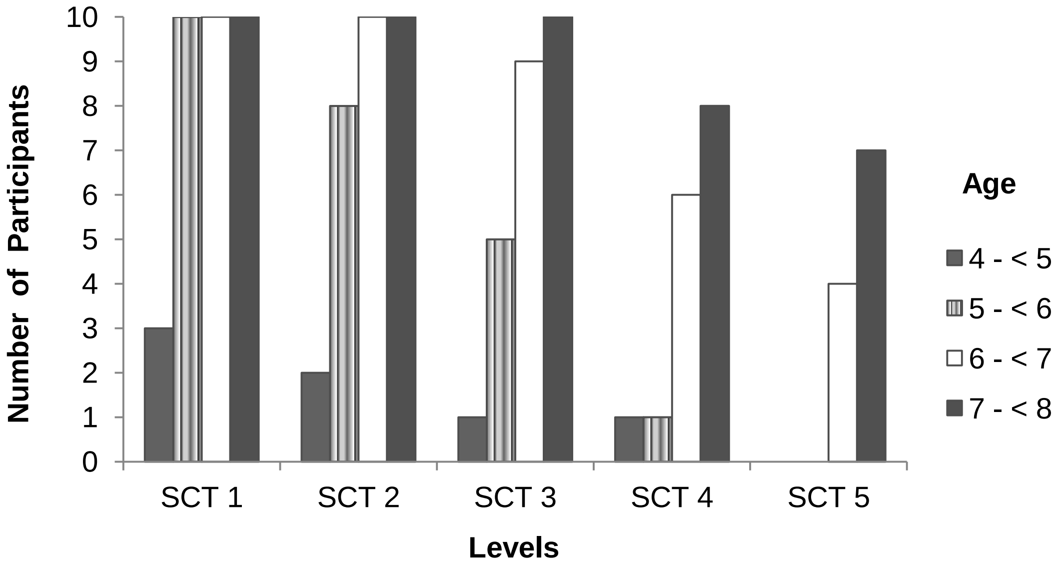


It was evident from Figure 4.1 that all four groups were able to satisfy level I of the digit count test (DCT 1). However, there is a difference observed across different age groups as the complexity of the task increased. The performance of the first group (4 - <5 years) declined as the level advanced from level I to level V. Nonetheless, a few participants from 4 - <5 years performed on DCT 2 to DCT 4, but they did not meet the criteria set. Participants from the 5-< 6-year group met the criteria for Level I and level II. Children from six to eight years of age performed well until DCT 4. None of the participants was able to attain level V of the task.

b) Sound count test

Figure 4.2

Performance of the Participants on Sound Count Test.

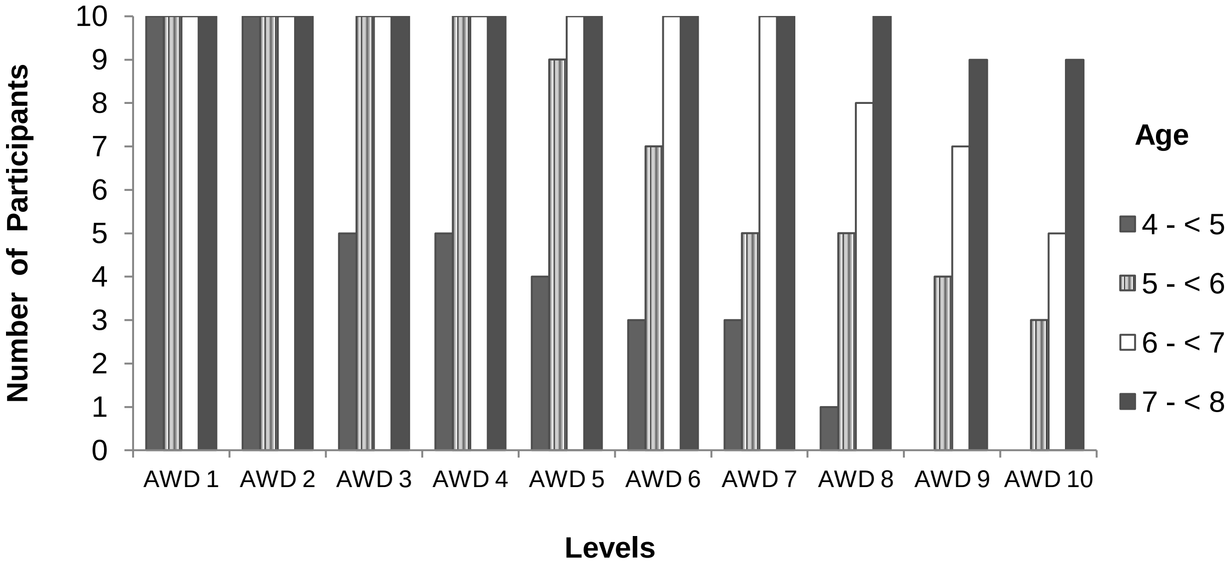


As shown in Figure 4.2, first group (4-<5 years) could not meet the criteria for level I of the sound count test, as only three participants were able to do the task. All other groups were able to accomplish level I to level III of the sound count test, and as the levels advanced, it was found that there was a change in the number of participants performing the tasks. Group two (5-<6 years) could not pass the level. Participants from 6-<7 years could not achieve level V. Seven participants from group four (7-<8 years) could perform level V and hence met the criteria for passing the level.

c) Auditory word discrimination test

Figure 4.3

Performance of the Participants on Auditory Word Discrimination



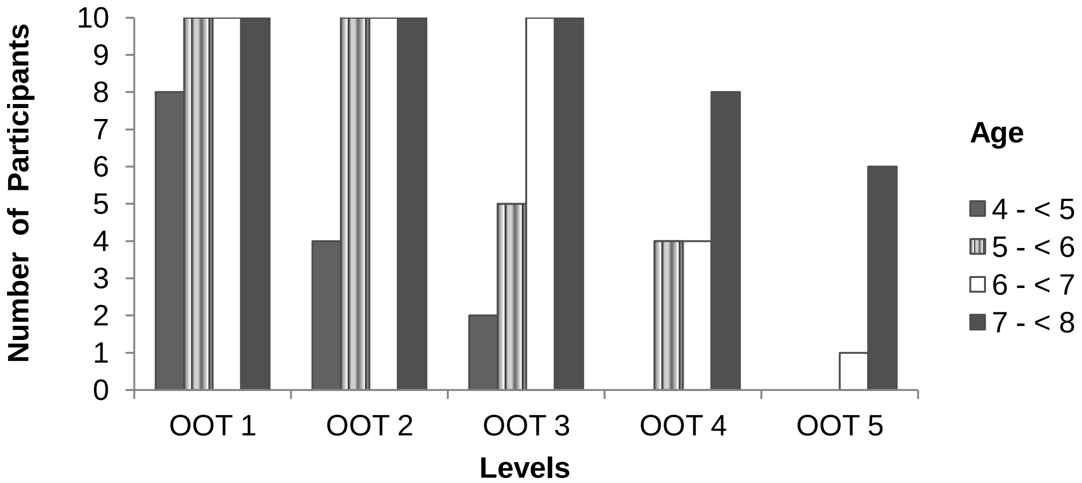
In this task, it was found that the first four levels of the task were attained by all four age groups. The age group 5- <6 years could completely attain till AWD 8. It was clearly seen that only six to eight year old children (Groups three and four) were able to attain the full levels.

Visual Mode

a) Odd one out test

Figure 4.4

Performance of the Participants on Odd One Out Task



As is evident from Figure 4.4, level III of OOT was attained by all three groups except for the first group (4- <5yrs). Level IV and Level V were attained by participants in the fourth group (7-<8 years) only.

b) Letter cancellation

Figure 4.5

Performance of the Participants on Letter Cancellation Task

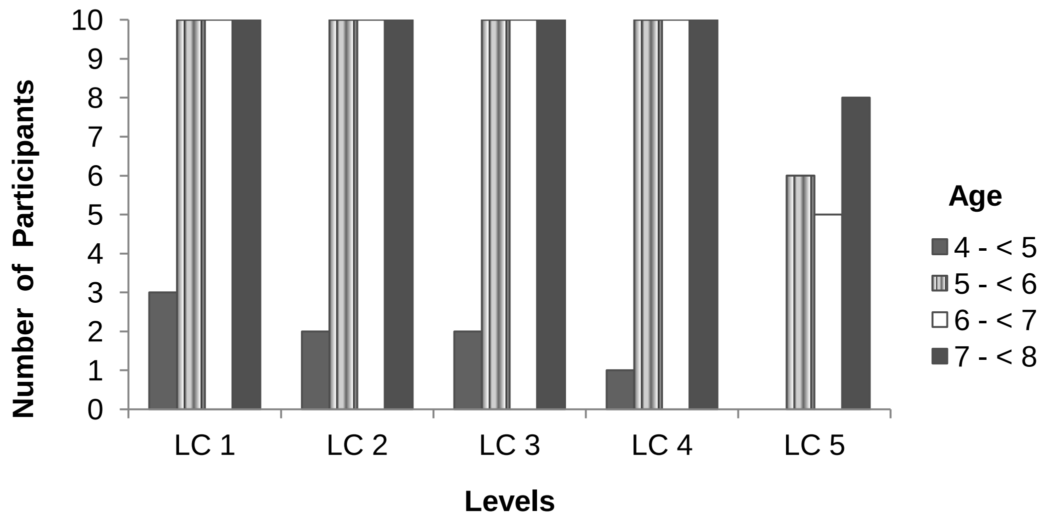
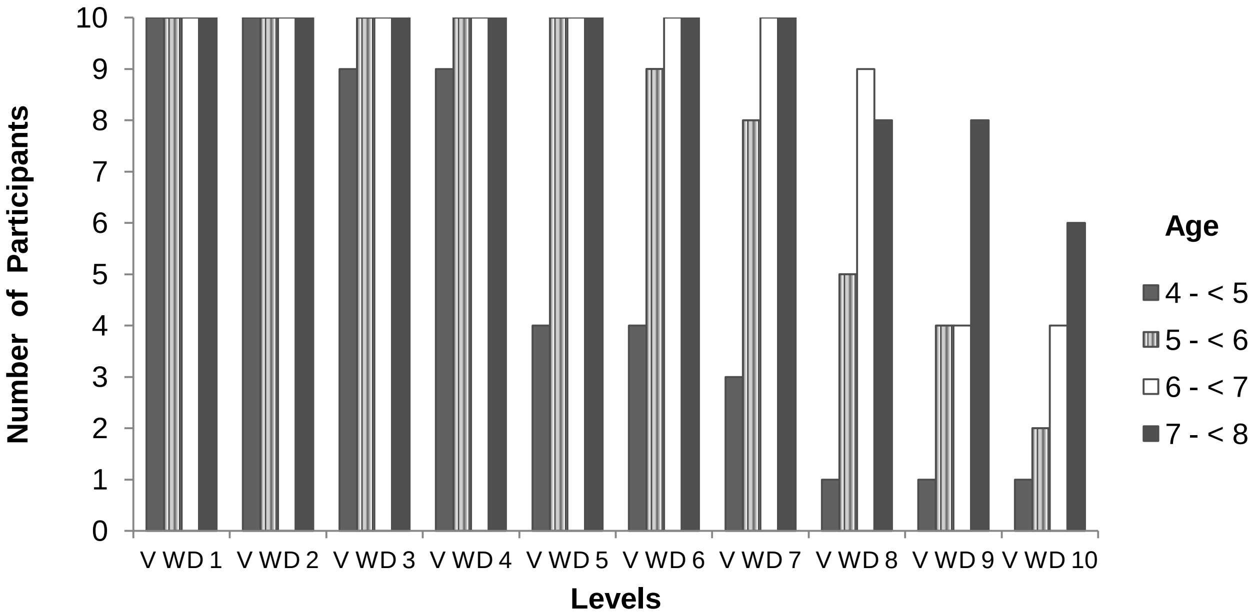


Figure 4.5 depicted that Group one was not able to achieve even Level I of the test, as only three children were able to do the task. All other age groups (Five to eight years) could attain all five levels of the task.

c) Visual word discrimination

Figure 4.6

Performance of the Participants on visual word discrimination



All four groups met the criteria for the first four levels. A gradual decline in the performance of participants can be seen after that level. First group (4-<5 years) did not meet the criteria for level V and above. Participants from age groups 5 -<6 years and 6-<7 years could attain VWD 8. Only the children aged seven to eight years old reached the criteria for the VWD 10.

4.2.2 Memory

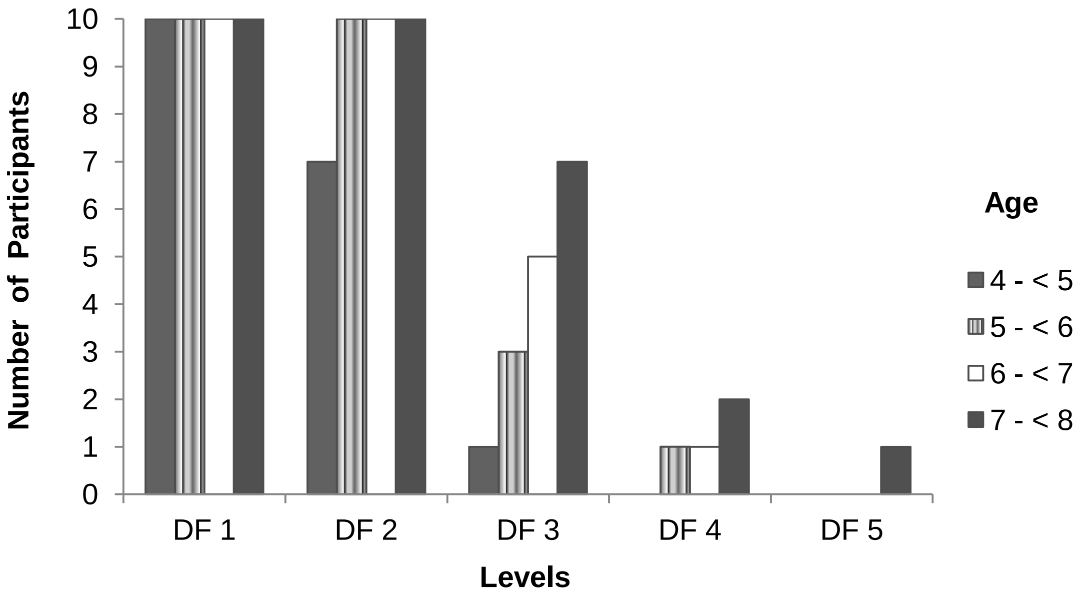
The performance of the number of participants on each of the tasks involved to assess memory was compared across all the levels.

Auditory Mode

a) Digit forward span

Figure 4.7

Performance of the Participants on Digit Forward Span

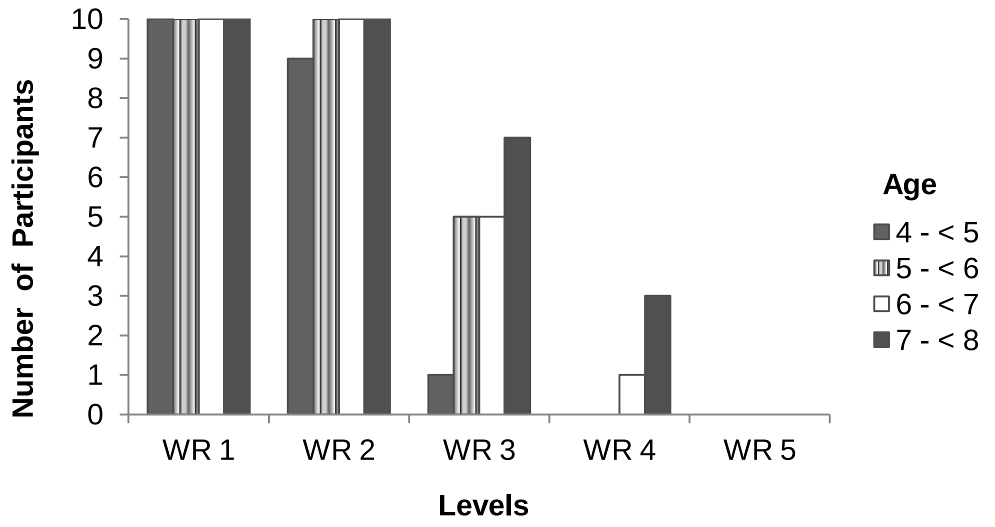


It was evident from Figure 4.7 that all the subjects from all four groups were able to attain the first two levels of the task. However, as the levels advanced, the performance of the participants declined. Groups one and two could not meet the criteria for passing Level III. Only children from six to eight years (Groups three and four) were able to attain level III. But they also could not attain the higher levels.

b) Word recall

Figure 4.8

Performance of the Participants on Word Recall

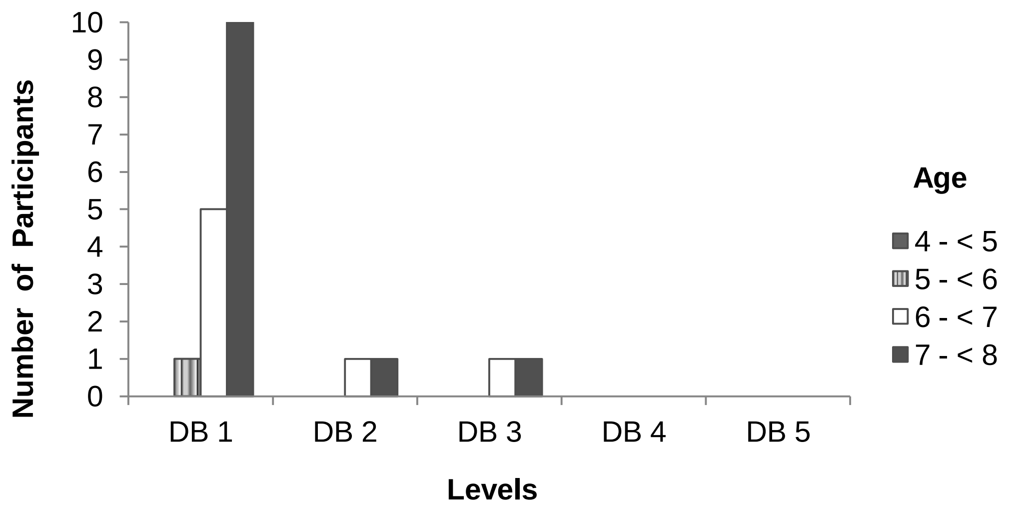


A similar trend was observed in word recall as well. All four groups met the criteria for the first two levels. Except for Group one (4-<5 years), other groups attained level III. It was found that none of the groups reached the criteria for the higher levels.

C) Digit backward span

Figure 4.9

Performance of the Participants on Digit Backward Span



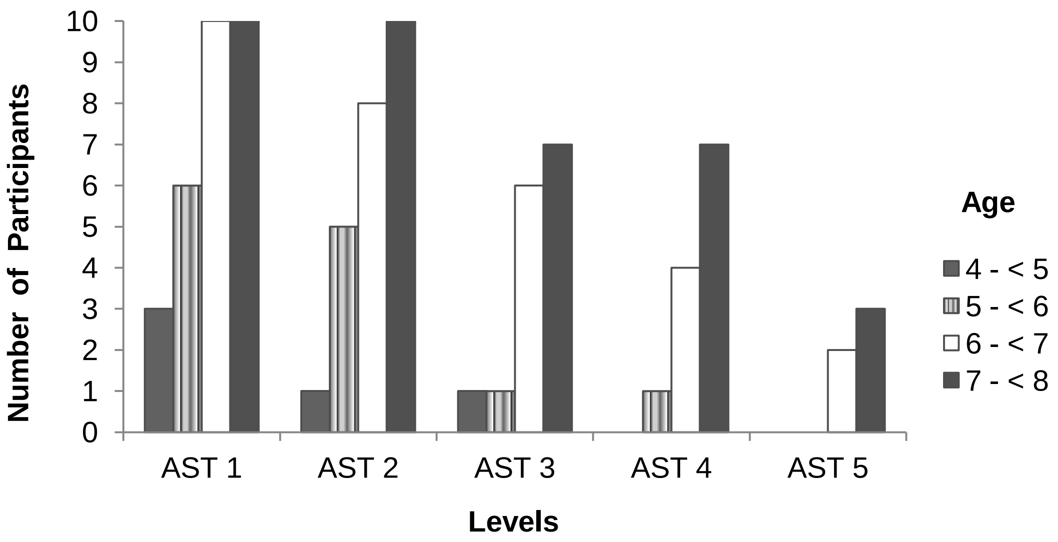
In the digit backward span task, the overall performance to recall the digits in the reverse sequence was poorer. None of the participants from first group (4-<5 years) performed the task. Groups three and four (children from six to eight years) could attain level I of the test. Other levels were not attained by any groups.

Visual Mode

a) Alternate Sequence Test

Figure 4.10

Performance of the Participants on Alternate Sequence Test



It can be seen from Figure 4.10 that only group one (4-<5 years) was not able to attain Level I of the test. Level II was attained only by children between five and eight years of age. Further, as the complexity increased, only the older children (7-<8 years) were able to reach level IV. However, none of the groups reached level V.

b) Picture counting

Figure 4.11

Performance of the Participants on Picture counting

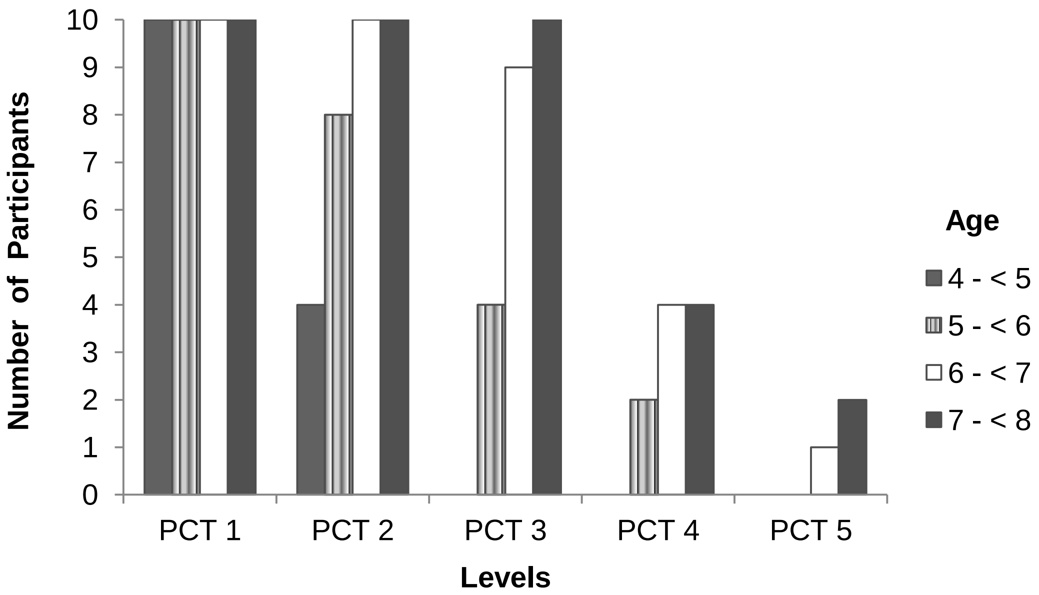
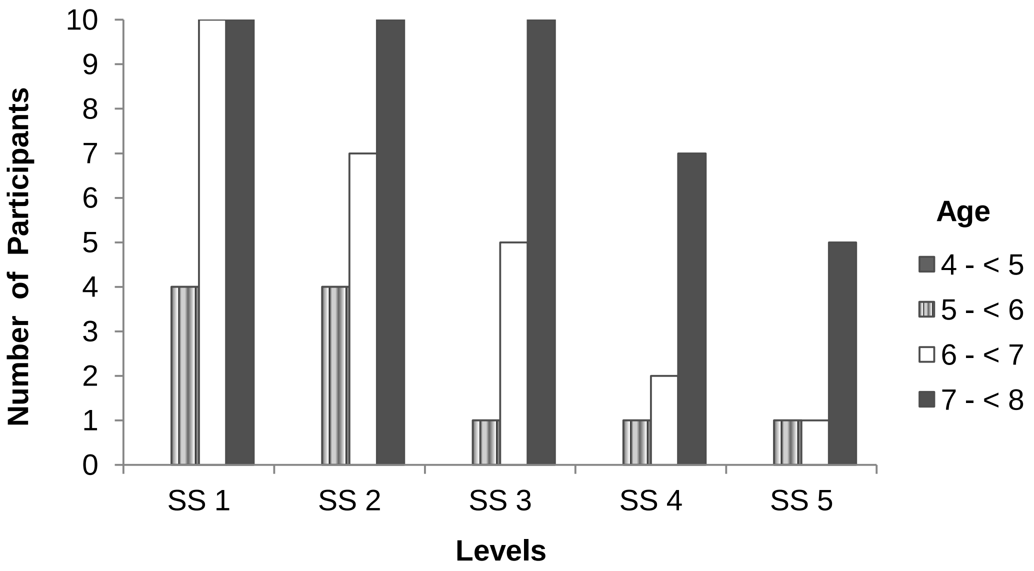


Figure 4.11 illustrated that all the groups attained level I. Groups one (4- <5 years) and two (5-<6 years) could not achieve PCT 2 and PCT 3, respectively. Results revealed that groups three and four did not depict much difference. Even though a few participants from six to eight years of age could perform level IV, the criteria set were not reached. None of the age groups could attain PCT 5.

c) Story Sequencing

Figure 4.12

Performance of the Participants on story sequencing.



Results showed that none of the participants from the first group (4-<5 years) were able to carry out story sequencing task. Group two (5-<6 years) could not attain level I and level II, although some children were able to sequence the stories. The performance of the children worsened as the length of the story increased. Participants aged 6-<7 years attained level III. Only the fourth group (7-<8 years) could successfully complete all the levels.

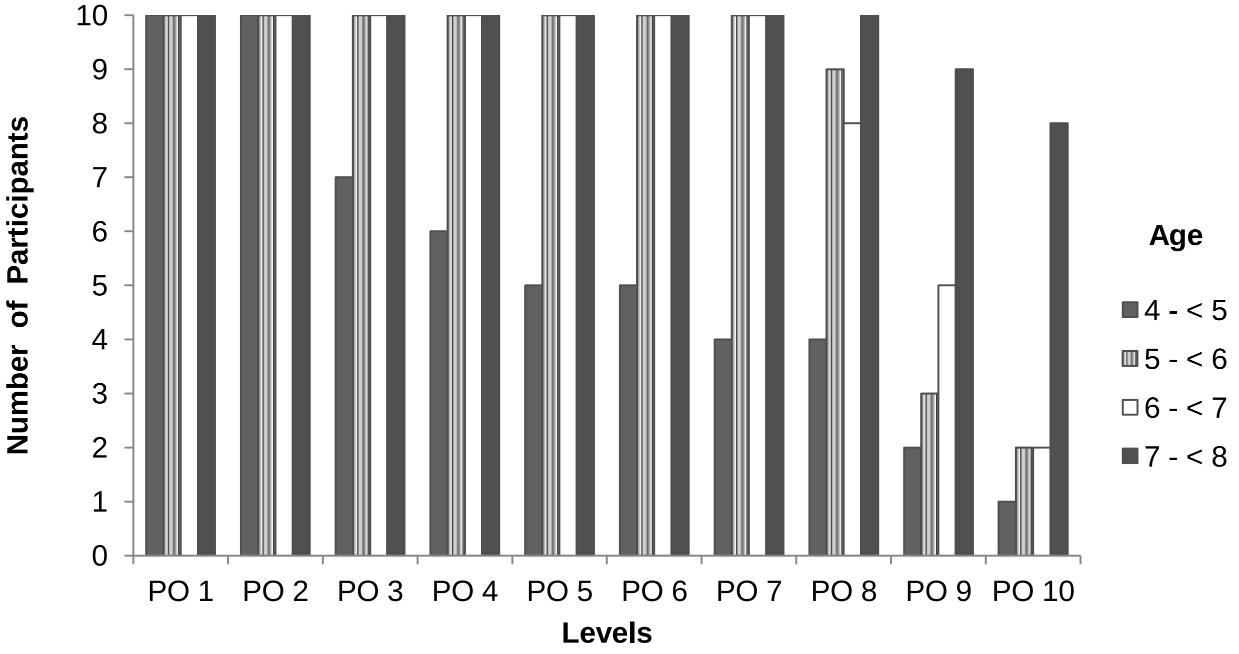
4.2.3 Problem Solving

Auditory Mode

a) Predicting the outcome

Figure 4.13

Performance of the Participants on predicting the outcome

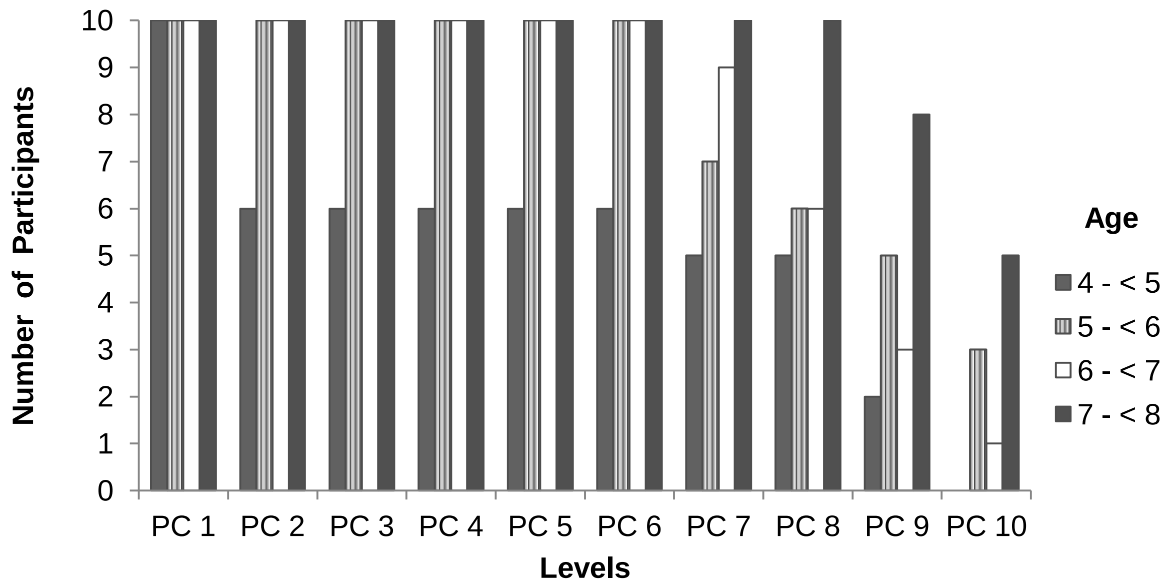


As is apparent from Figure 4.13, not all the items were achieved by all the age groups. All the groups could attain till PO 6. Participants aged 4-<5 years were not able to meet the criteria for level seven and onward. All the participants in the age range of five to eight years could achieve till PO 7, followed by a gradual decrease in performance. Only the children aged 7- <8 years were able to attain all the levels of the task.

b) Predicting the cause

Figure 4.14

Performance of the Participants on predicting the cause

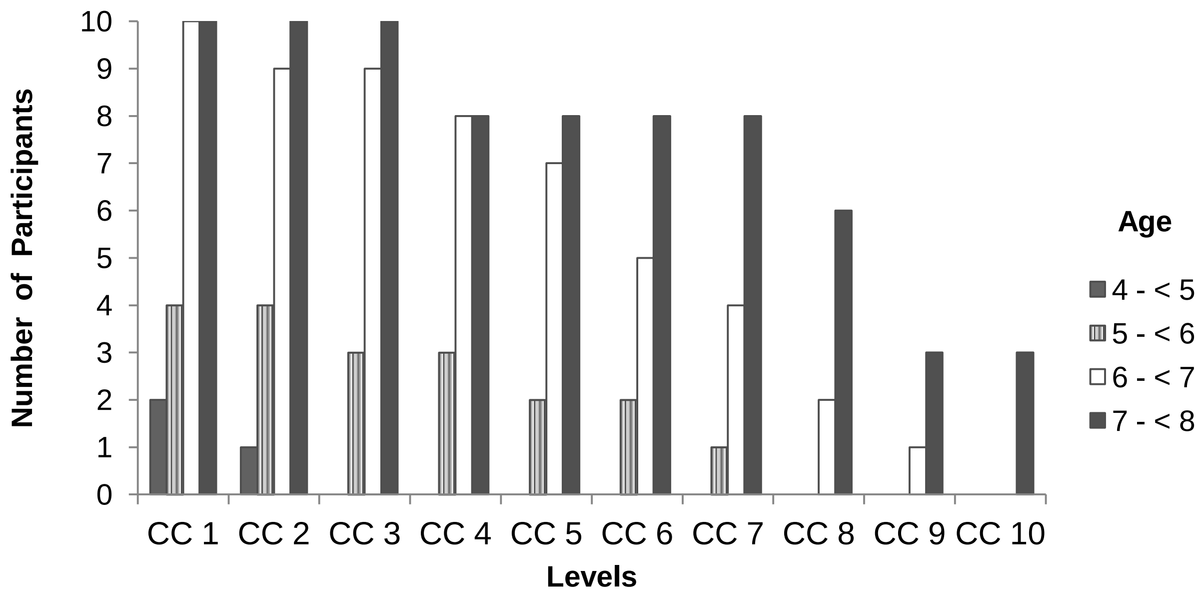


All the groups attained till PC 8. There was a discrepancy seen in the performance of children in Group two (5-<6 years) and Group three (6-<7 years) in PC 9 and PC 10. Participants in Group two performed better than participants in Group three, which is the older age group. Children of 5-<6 years could attain nine items (PC 9) of the task. The criteria for PC 9 were not met by children of 6-<7 years although some of the participants achieved it. Only the children from 7- <8 years were able to attain all the levels of the task.

c) Compare and contrast

Figure 4.15

Performance of the Participants on compare and contrast



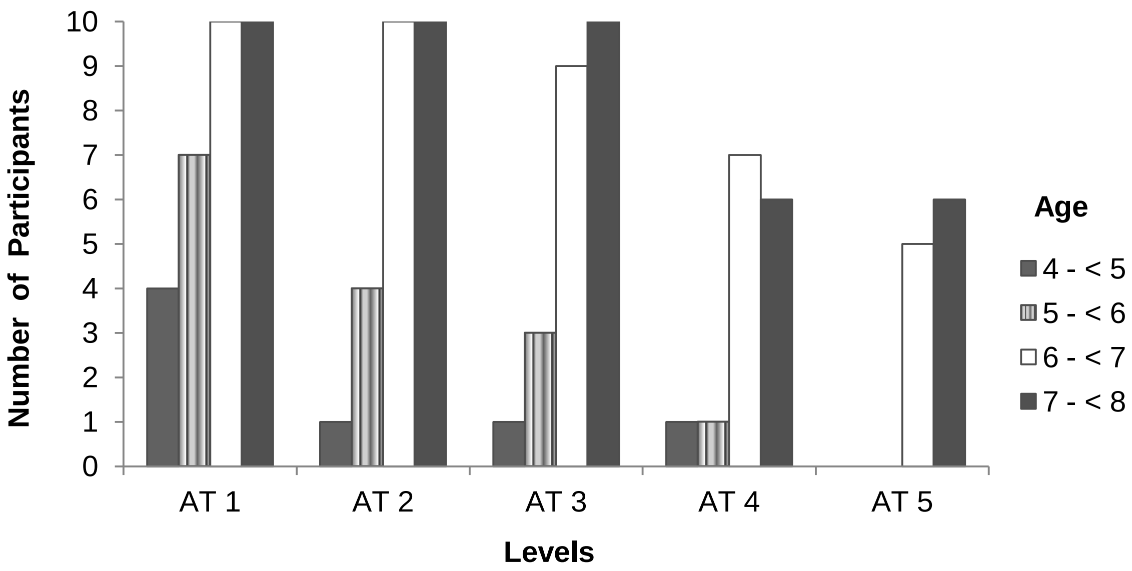
It was evident from Figure 4.15 that only two groups (groups three and four) were able to satisfy level I of compare and contrast (CC 1). Nonetheless, a few participants aged 5 - <6 years performed on CC 1 to CC 7, but they did not meet the criteria set. Group three (6-<7 years) attained CC 6. Only the children aged seven to eight years were able to compare and contrast the eight items on the list (CC 8). None of the groups reached CC 10.

Visual Mode

a) Association task

Figure 4.16

Performance of the Participants on Association Task

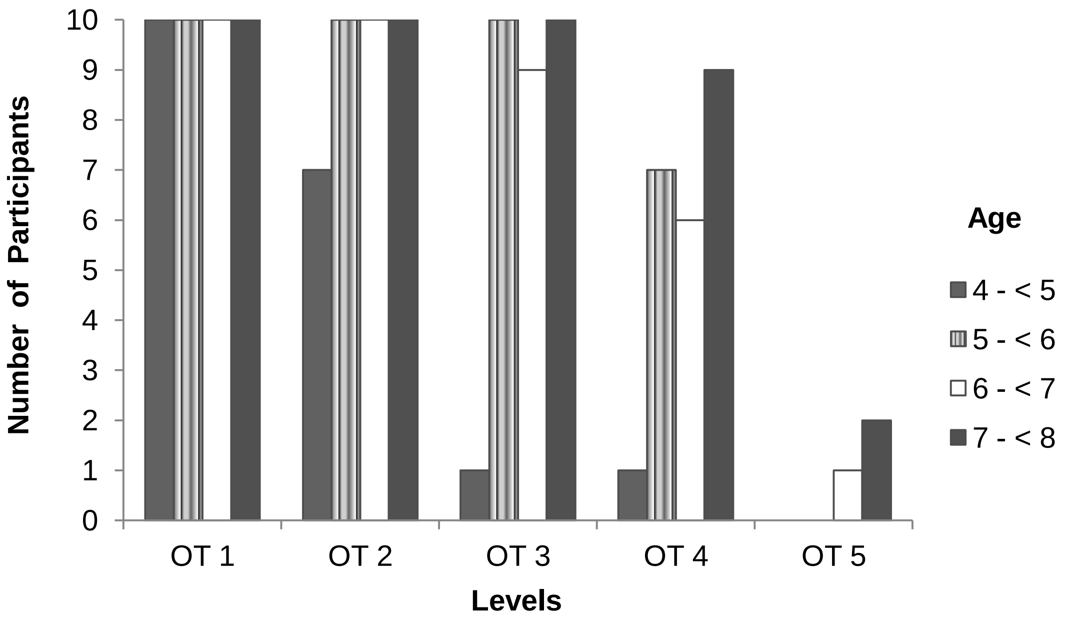


As is illustrated in Figure 4.16, all four groups except the age group 4-<5 years met the criteria for Level I. Few participants aged 5-<6 years performed Level II but did not pass the level. The older age group of six to eight years was able to associate the pictures until level V. However, the younger age groups could not attain the higher levels.

b) Overlapping test

Figure 4.17

Performance of the Participants on Overlapping Test

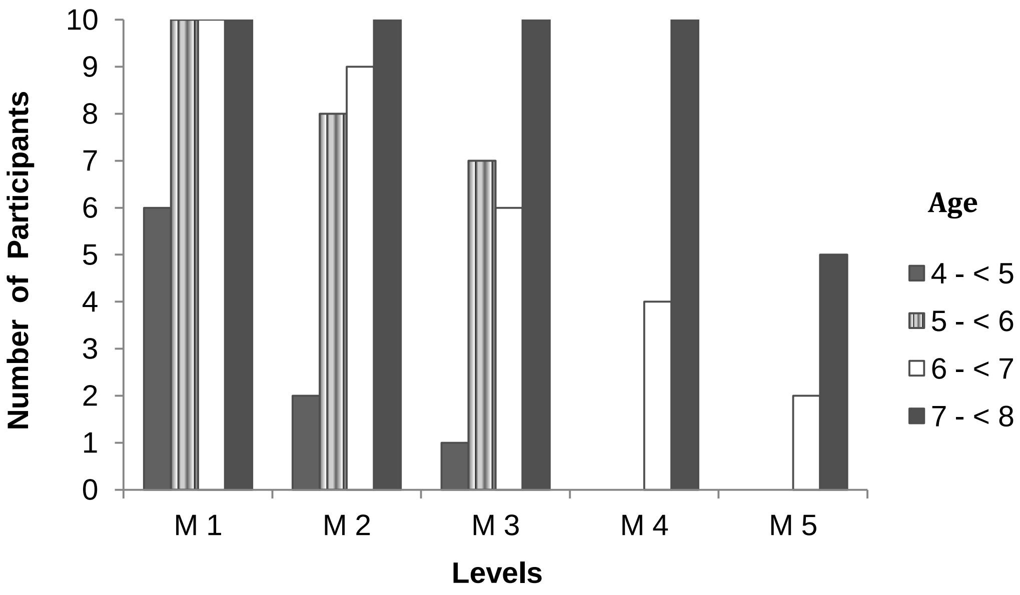


All four groups met the criteria for Level I and Level II. A sudden decline can be seen after that for group one. As it was illustrated in the graph, all four groups except for the age group 4-<5 years were able to reach Level IV. None of the groups passed Level-V of the Overlapping Test.

c) Maze

Figure 4.18

Performance of the Participants on Mazes



As was evident from Figure 4.18, all four groups met the criteria for Level I. Children aged seven to eight years performed well until level V of the task. In contrast, the children from five to seven years were able to perform only until level III of the task. These children were not able to attain the higher levels involving higher problem solving skills or highr cognitive skills.

4.3 The performance of children from different age groups across domains

Descriptive statistics were employed to describe and summarise the characteristics of the current data set. For each domain, the mean, median, and standard deviation (S.D.) were calculated, as shown in Table 4.3.

Table 4.3

The mean and the standard deviation scores of participants across age ranges for all the domains

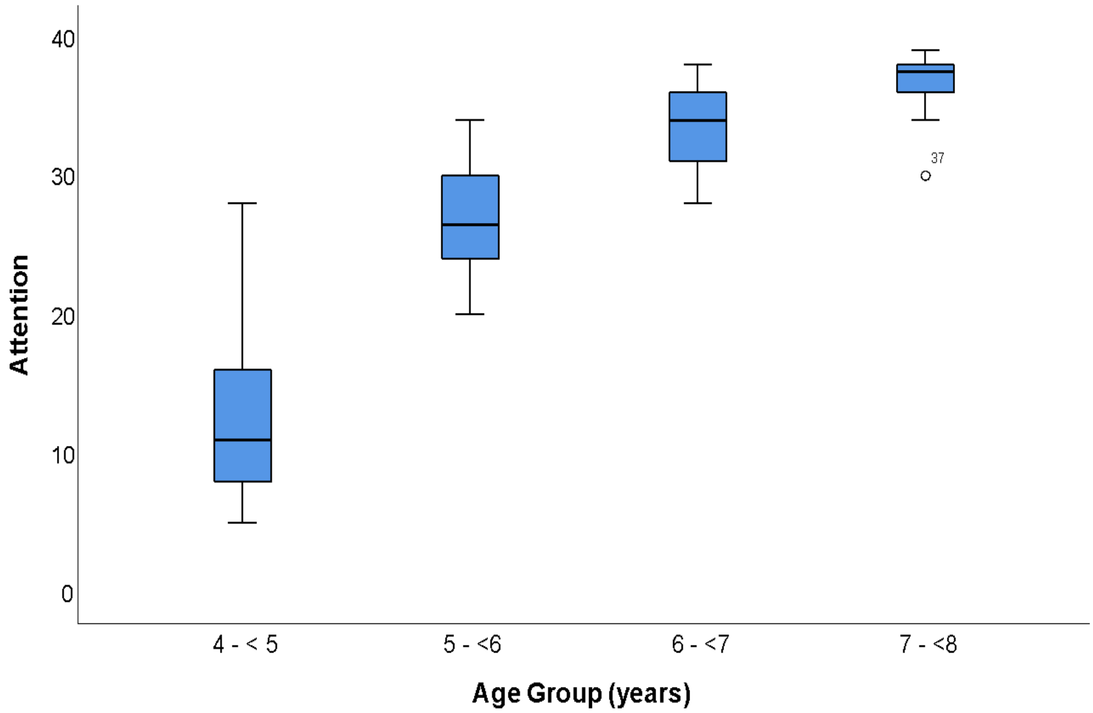
Domains	Age group (years)	Mean	SD	N
Attention (%)	4 - < 5 years	33.5000	19.26424	10
	5 - <6 years	67.0000	10.91635	10
	6 - <7 years	82.7500	8.37075	10
	7 - <8 years	91.2500	6.89706	10
	Total	68.6250	25.29284	40
Memory (%)	4 - < 5 years	19.0000	5.67646	10
	5 - <6 years	32.6667	9.78787	10
	6 - <7 years	49.3333	11.41798	10
	7 - <8 years	63.0000	12.51666	10
	Total	41.0000	19.48336	40
Problem Solving (%)	4 - < 5 years	32.0000	18.77453	10
	5 - <6 years	58.0000	8.14478	10
	6 - <7 years	72.8889	13.61029	10
	7 - <8 years	87.1111	11.02684	10
	Total	62.5000	24.37539	40

Following the computation of the mean, median, and standard deviation, a statistical test was required to determine whether there was a statistically significant difference between the groups. First, the Shapiro-Wilk normality-Axisy test was applied to the data to determine whether it followed a normal distribution or not. The Shapiro-Wilk test result indicated that the data had a normal distribution ($p > 0.05$). As a result, a parametric test was used to compare the four groups.

The Mixed ANOVA test was administered to compare the performance of individuals on the domains across age groups and pairwise comparisons among domains. The results were demonstrated in Figures 4.19, 4.20 and 4.21.

Figure 4.19

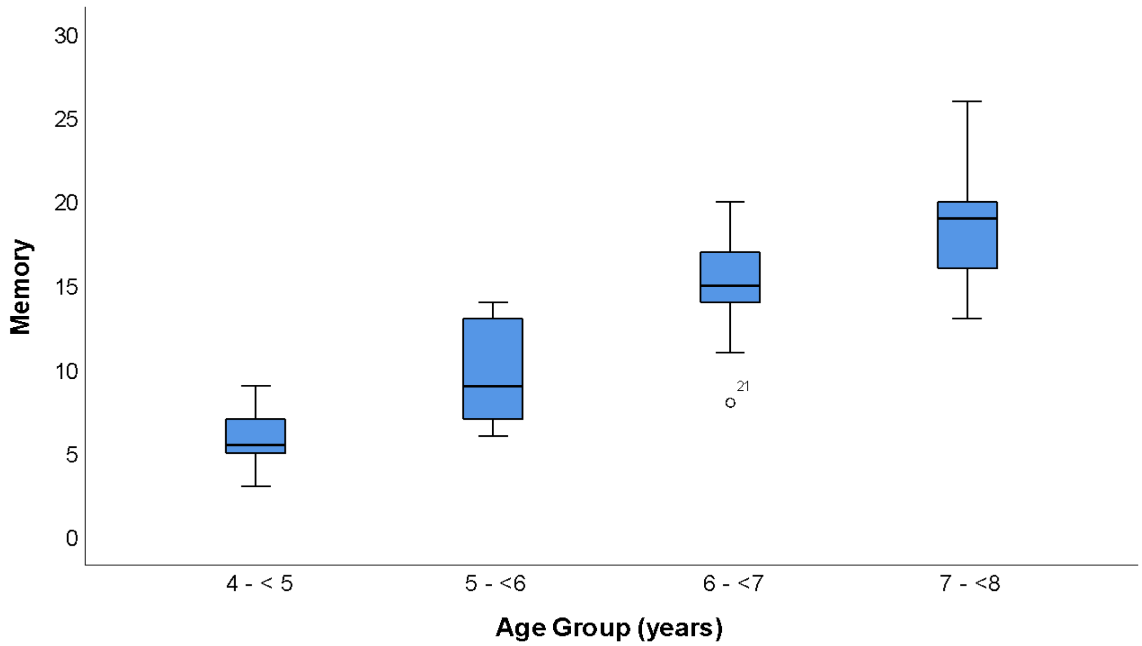
Performance of Participants in the Attention domain across age groups



*Note.*Total scores of attention tasks are displayed on the Y Axis.

Figure 4.20

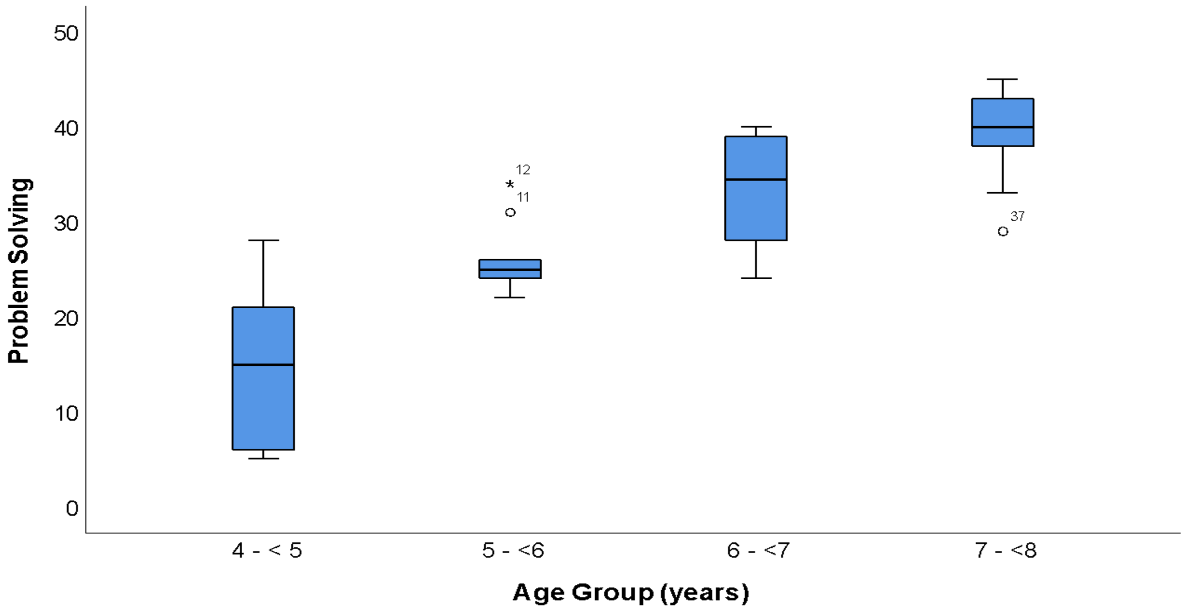
Performance of Participants in the Memory domain across age groups



*Note.*Total scores of Memory tasks is displayed on the Y Axis

Figure 4.21

Performance of Participants on Problem solving domain across age groups



*Note.*Total scores of Problem solving tasks are displayed on the Y-Axis

It can be encapsulated from Table 4.3 and Figures 4.19, 4.20 and 4.21 that the performance of the participants improved as the age range increased from 4- <5years to 7-<8 years old across all the domains. Mixed ANOVA (Repeated measures ANOVA) was done for the comparison of domains with age group as the between factor.

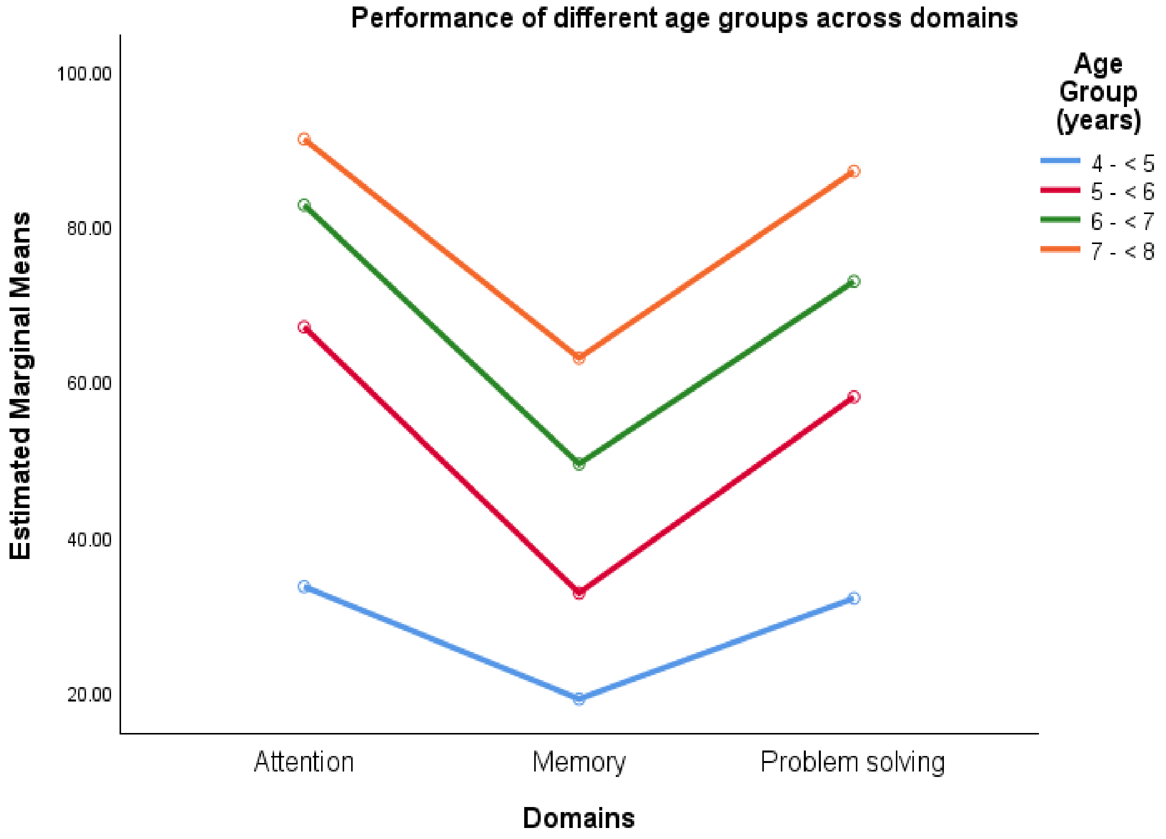
There was a statistically significant difference found for age groups across domains, with F (3, 36) = 50.403, P<0.01, η_p^2=0.808. There was a statistically significant difference found between domains as well, with F (2,72) = 125.825, P<0.01, η_p^2 (Partial Eta (partial eta squared) = 0.778.

An interaction effect was also seen between domains and age groups, with F(6,72)=3.294, P<0.05, η_p^2=0.215.This result also revealed that there is significant interaction between the three domains (Attention, Memory and Problem solving) and four age groups (Between 4 and 8 years).

In the next stage, Tukey's post hoc test was done to see where differences truly came from.

Figure 4.22

Performance of different age groups across domains



A clear-cut developmental trend can be visualised from this figure. The performance of participants in domain two, that is, memory, was reduced compared to other domains of attention and problem solving. Group one (4-<5 years) was showing a different pattern compared to the other age groups. There is not much difference between the three domains for participants aged 4-<5 years.

Repeated measures ANOVA was done to check the differences among different domains. Bonferroni's adjustment for multiple comparisons was made during pairwise comparisons.

Table 4.4

Comparison between domains

(I) Domain	(J)Domain	Mean Difference (I-J)	Std. Error	Sig.[b]
1	2	27.625*	1.933	.000
	3	6.125*	1.833	.006
2	1	-27.625*	1.933	.000
	3	-21.500*	1.715	.000
3	1	-6.125*	1.833	.006
	2	21.500*	1.715	.000

Based on estimated marginal means

*. The mean difference is significant at the 0.05 level.

b. Adjustment for multiple comparisons: Bonferroni

This showed that statistically significant differences exist in the performance of participants in different domains. P <0.05 for all the domains, which means that all domains are different from each other.

Repeated measures ANOVA was also used to check the difference among different domains in specific age groups.

4-<5 years

Table 4.5

Comparisons between domains in 4-<5 years

(I) Domain	(J)Domain	Mean Difference (I-J)	Std. Error	Sig.
1	2	14.500*	4.765	.042
	3	1.500	4.123	1.000
2	1	-14.500*	4.765	.042
	3	-13.000	4.860	.076
3	1	-1.500	4.123	1.000
	2	13.000	4.860	.076

From Table 4.5, it was evident that the mean difference between domain one (Attention) and domain two (Memory) is significant (P<0.05). There is not much difference between domain one and domain three, as well as between domain two and domain three.

F (2, 18) =6.024, P<0.05, η_p^2 =0.401

This showed that statistically significant differences exist in the performance of participants in different domains in the age group of 4-<5 years.

5-<6 years

Table 4.6

Comparisons between domains in 5-<6 years

(I)Domain	(J) Domain	Mean Difference (I–J)	Std. Error	Sig.
1	2	34.333*	3.638	.000
	3	9.000	4.113	.169
2	1	-34.333*	3.638	.000
	3	-25.333*	2.306	.000
3	1	-9.000	4.113	.169
	2	25.333*	2.306	.000

From Table 4.6, it was evident that the mean difference between domain one (Attention) and domain two (Memory) is significant (P<0.05). The mean difference between domain two (Memory) and domain three (Problem solving) is also significant (P<0.05). There was no statistically significant difference between domain one and domain three. This explains the sharp V-shaped pattern seen on Figure 4.22, which depicted the estimated marginal means in each domain. The performance of participants in the second domain, memory, was significantly reduced compared to other domains.

F (2, 18) =53.602, P<0.05, η_p^2=0.856

This showed that statistically significant differences exist in the performance of participants in different domains in the age group of 5-<6 years.

6-<7 years:

Table 4.7

Comparisons between domains in 6-<7 years

(I)Domain	(J)Domain	Mean Difference (I-J)	Std. Error	Sig.
1	2	33.417*	3.652	.000
	3	9.861	3.524	.062
2	1	-33.417*	3.652	.000
	3	-23.556*	3.067	.000
3	1	-9.861	3.524	.062
	2	23.556*	3.067	.000

From Table 4.7, it was evident that the mean difference between domain one (Attention) and domain two (Memory) is significant (P<0.05). The mean difference between domain two (Memory) and domain three (Problem solving) is also significant (P<0.05). There was no statistically significant difference between domain one and domain three. This explains the sharp V-shaped pattern seen on Figure 4.22, which depicted the estimated marginal means in each domain. The performance of participants in the second domain, memory, was significantly reduced compared to other domains.

$F(2,18) = 50.300$, $P<0.05$, $\eta_p^2 = 0.848$

This showed that statistically significant differences exist in the performance of participants in different domains in the age group of 6-<7 years.

7-<8 years:

Table 4.8

Comparisons between domains in 7-<8 years

(I)Domain	(J)Domain	Mean Difference (I-J)	Std. Error	Sig.
1	2	28.250*	3.243	.000
	3	4.139	2.722	.488
2	1	-28.250*	3.243	.000
	3	-24.111*	2.949	.000
3	1	-4.139	2.722	.488
	2	24.111*	2.949	.000

From Table 4.8, it was evident that the mean difference between domain one (Attention) and domain two (Memory) is significant (P<0.05). The mean difference between domain two (Memory) and domain three (Problem solving) is also significant (P<0.05). There was no statistically significant difference between domain one and domain three. This explains the sharp V-shaped pattern seen on the plot (line diagram), which depicted the estimated marginal means in each domain. The performance of participants in the second domain, memory, was significantly reduced compared to other domains.

$F(2, 18) = 52.454$, $P<0.05$, $\eta_p^2 = 0.854$

This showed that statistically significant differences exist in the performance of participants in different domains in the age group of 7-<8 years.

4.4 The performance of children from different gender groups across domains

Descriptive statistics were used to describe and summarise the current data set's characteristics.

Table 4.9

The mean and standard deviation scores of participants across genders for all the domains

Domains		Males		Females	
	Age groups	Mean	SD	Mean	SD
Attention	4-<5 years	11.80	8.106	15.00	7.842
	5-<6 years	26.60	6.148	27.00	2.236
	6-<7 years	32.00	4.243	34.20	2.049
	7-<8 years	37.00	1.000	36.00	3.937
Memory	4-<5 years	5.40	2.302	6.00	1.000
	5-<6 years	10.40	2.966	9.20	3.114
	6-<7 years	14.00	4.301	15.60	2.510
	7-<8 years	18.40	3.130	19.40	4.615
Problem solving	4-<5 years	14.60	8.678	14.20	9.230
	5-<6 years	28.00	4.243	24.20	1.789
	6-<7 years	33.00	6.928	32.60	6.025
	7-<8 years	40.80	2.683	37.60	6.465

A gradation was observed in the mean scores obtained by participants as age increased in all three domains. The statistical test was required to determine whether or not a statistically significant difference existed across the groups after computing the mean, median, and standard deviation. The performance of individuals from both groups was compared using the Mann-Whitney U test. The results of the Mann-Whitney U test are shown in Table 4.10.

Table 4.10

Results of Mann-Whitney U test

Domains	Age groups	Mann-Whitney U	|Z|
Attention	4-<5 years	7.000	1.152
	5-<6 years	11.000	.313
	6-<7 years	8.000	.958
	7-<8 years	11.000	.319
Memory	4-<5 years	8.500	.851
	5-<6 years	10.000	.532
	6-<7 years	12.000	.105
	7-<8 years	10.000	.539
Problem solving	4-<5 years	12.000	.106
	5-<6 years	6.000	1.379
	6-<7 years	12.000	.105
	7-<8 years	9.500	.631

The Mann-Whitney U test results revealed that the performance of children from different gender groups across domains was not statistically significantly different from each other. It was concluded that the U statistic is 6.000 or more for all the domains. The $|Z| < 1.96$ ($p > 0.05$) for all the domains, which again suggested the above findings. Therefore, it was evident that the performance of the males and females was not statistically significantly different.

To summarise the results, the present study revealed an improvement in performance on cognitive-linguistic tasks with the advancement of age. The improvement in performance was statistically significant in the age range of four to eight years. The present study does not observe a significant effect of gender on the performance of participants in different domains.

CHAPTER V

DISCUSSION

The present study focused on the adaptation of the "Cognitive Linguistic Assessment Protocol for Children (CLAP-C)" by Anuroopa and Shyamala (2006) into the Malayalam language. This protocol was developed to identify the sequential cognitive linguistic milestones, identify and diagnose cognitive linguistic disabilities in children, and allow intervention based on the developmental schedule.

The results of the present study were consistent with the findings from the original study by Anuroopa and Shyamala in 2006. In their study, they assessed the cognitive linguistic skills of twenty-four Kannada-speaking children using CLAP-C. Deterioration in the number of participants performing at the higher levels was also evident in that study. The performance of the participants improved as the age range increased from four to five years to seven to eight years across all the domains (Anuroopa & Shyamala,2006). The finding that the children performed poorer in memory tasks compared to attention and problem solving tasks was also consistent with the current study. The effect of gender was not considered in the previous study.

Overall, the findings of the current research point to a general pattern in which it is clear that cognitive-linguistic processes like attention, memory, and problem-solving follow a developmental pattern. Additionally, each domain's cognitive-linguistic performances are discussed further below.

5.1 Effect of age

5.1.1 Domain I (Attention, Discrimination & Perception)

Both sustained and selective attention were evaluated in this domain. Digit count tests, sound count tests, and auditory word discrimination were used as tasks for auditory attention. The current findings on the task digit count test revealed that children's attention abilities improve with age. However, as the levels progressed, the participants' performance deteriorated. Similar trends were discovered in the other two tasks as well.

The visual attention tasks used in this study were the odd one out test, letter cancellation , and visual word discrimination, all of which required sustained attention. A clear pattern of hierarchy was observed. When compared to lower age group children, higher age group children performed better on the more difficult items.

“The ability to perform well on a cancellation test frequently depends on the alertness, drive, and arousal of the subject as they visually scan the array and select appropriate responses while inhibiting inappropriate ones. With the help of these exercises, one can gauge their capacity for sustained attention, concentration, visual scanning, rapid response activation, and inhibition” (Sandson et al., 2000).

Between the ages of six and ten, attentiveness, sustained attention, and spatial orienting (visual search) improve the fastest, according to numerous studies on children's attentional development (Betts et al., 2006). The level of cerebral maturation has the greatest influence on attentional functions, as it does on all cognitive mechanisms. Zimmermann and Fimm (2002) investigated the overall attention development of healthy 6 to 12-year-old children. They found that, despite unavoidable interindividual differences, getting older invariably improved attentional test performance and that these levels of performance, which were at first highly heterogeneous, tended to stabilise. Flexibility, which is necessary for controlling the focus of attention, increases with child maturation.

Rapid growth occurred from the ages of 5–6 to 8–9 years, followed by a developmental plateau with only minor improvement from 8–9 to 11–12 years. “Children's sustained attention was affected by the task parameters of target complexity and display size, as expected, with performance on the high-load task being worse than on the low-load task. On the load tasks, an identical pattern of development was apparent” (Betts et al., 2006).

According to research by Posner and Rothbart in 2007, “the central executive attention network significantly improves during the preschool years”. Similar to this, preschoolers with low and high working memory spans can be distinguished based on how well they perform attention control tasks (Espy & Bull, 2005). The anterior attention subsystem, which controls the orienting subsystem in preschoolers, is maturing, and this is likely reflected in changes in preschoolers' ability to concentrate during structured tasks.

For instance, research on preschool versions of the ‘continuous performance task’ suggests that between the ages of three and five, children significantly improve in sustained attention focus (Garon et al., 2008). According to Akshoomoff (2002), even at the age of five, children still commit a lot of omission errors, indicating that at the end of the preschool stage, the capacity to concentrate and maintain attention under experimenter-demand tasks is still developing.

The development of sustained attention in a sample of 57 typically developing children aged 5 to 12 years was studied by Betts and colleagues (2006) using participants in a “game-like computer-administered battery (CogState)” with varying memory loads. The results demonstrated that until the age of ten, children's capacity to pay attention for prolonged periods of time significantly improved. Performance remained relatively stable after that age, with only minor improvements.

5.1.2 Domain II (Memory)

The tasks used to evaluate memory in the auditory modality were word recall, digit forward span, and digit backward span. The main purpose of digit span tests was to evaluate working memory. Results showed that as people get older, their ability to recall more items increases. The children were unable to recall the words as the number of units/words increased. The overall performance to recall the digits in the reverse sequence was lower in digit backward recall.

There is proof that task complexity has an impact on how well Working Memory tasks are performed (Best et al., 2009). Infants and young children can remember one or two things for a very long time, which indicates that the capacity for memory develops very early. However, it takes much longer to develop and has a much slower developmental progression to be able to hold multiple ideas in your head or perform any kind of mental manipulation (like rearranging mental images of objects according to size) (Diamond, 2013). “Working memory appears during the preschool years and develops linearly between the ages of 4 and 15, with visual-spatial WM reaching a peak around the age of Eleven” (Best et al., 2009).

No matter whether the tasks are digit or word span or object or spatial span, various cross-sectional researches have found that the “Number of items retained varies from three to five years of age. However, capacity for both digit-word and object-spatial spans improves after preschool (e.g., from 4 blocks at 5 years to 14 blocks at 11 years)″ (Garon et al., 2008). Between the ages of three and five years, the number of items that children can remember backwards expands from 1.58 to 2.88 items and beyond (Carlson, 2005). The majority of researchers concur that the development of executive functions was crucial during three to five years.

It has been suggested that “Although Digit Forward is a task of short-term auditory memory, sequencing, and basic verbal expression, Digit Backward is more sensitive to working memory deficits. Digit Forward and Digit Backward scores differed in how well they predicted attention, executive functioning, and behaviour rating measures” (Hale et al., 2002).

The digit span forward task calls for very little executive control and is classified as "passive," Other tasks involving double requests and/or control for irrelevant information, like the listening span task, require a significant amount of executive control and are classified as "active." Between active and passive are other tasks, like the backward digit span, that demand more executive resources than passive tasks but less than the most active ones (Giofrè et al.,2016).

The visual memory tasks used in this study were Alternate Sequence Tasks, Picture Counting, and Story Sequencing. The picture-counting task results indicated that the ability to recall visually presented stimuli improves with age. The outcomes of the story sequencing task demonstrated that as children get older, they get better at remembering stories and placing them in a logical order. Memory capacity increases along with a consistent rise in chronological age. These conclusions are supported by numerous studies that look at children's memory capacities. This outcome is in line with findings from other studies that indicate that digit span increases with age.

In a 2014 study, León, Cimadevilla, and Tascón used a combination of traditional psychometric tests and desktop virtual reality tasks to evaluate the spatial abilities (spatial reference memory and spatial working memory) of children aged four to ten. The participants in this study were 50 boys and 50 girls. “The Corsi Block Tapping Test”, “Digit Tests”, and “Spatial Recall Test” were classic psychometric tests used in this study. Overall, the results showed that “the four and five-year-old groups performed worse than the older groups”. Children as young as five, however, demonstrated simple spatial navigation skills with little difficulty.

Supporting the research findings on rehearsal strategies may help explain why children from older groups perform relatively well. It has been established that as children grow older, there appears to be an improvement in their recall strategies. The findings also shed light on the relationship between attention and memory. As can be seen from the results of higher-level tasks, attention is used to recall longer strings of digits or words, and thus, attention development parallels memory development. Attention and memory cannot function without one another; as memory capacity is limited, attention is required to filter what is encoded. As a result, these cognitive abilities appear to be mutually dependent (Chun & Turk-Browne, 2007).

5.1.3 Domain III (Problem-solving)

In this domain, auditory problem-solving tasks included predicting the outcome, predicting the cause, and comparing and contrasting. According to the findings of this study, there was a significant difference across age groups for all problem-solving tasks. The findings revealed that as one gets older, one's problem-solving abilities improve even more.

Association tasks, Overlapping tests and Mazes were the tasks done to assess memory in the visual modality. In essence, the findings in this domain revealed that problem-solving abilities such as reasoning, thinking, and so on develop as a child grows older. The environment to which the child is exposed is also crucial to the development of these skills. This ability to solve problems also helps with language development, which is a very well-established fact. Better academic performance would follow from this.

The majority of experimental research on planning in children has focused on navigational tasks, such as “maze and route planning exercises”, and “subgoaling exercises”, such as the “Tower of Hanoi task”. A two-dimensional maze paradigm for navigation tasks showed that “Children aged 4.5 to 7 were able to plan the entire path through the maze before making a move” (Gardner & Rogoff, 1990). Younger children appeared to exert more effort when planning, as evidenced by the fact that they paused for longer periods of time than older children. Children typically need to gather some items that are dispersed in space when planning a route. For complex problem solving, strategic planning is necessary.

Children under the age of five have a hard time following instructions when performing “tower tasks” (Baughman & Cooper, 2007) or using standard computer interfaces, like those required for “maze navigation planning tasks” (Miyata et al., 2009).

Additional research by Wellman et al. in 1985 showed that a "mixture of sighting and planning, with planning growing in dominance over the preschool years" was the best explanation for preschoolers' search behaviour. Children's search behaviour at age 5.5 could be entirely attributed to planning rather than sighting. Similar findings were made by Fabricius (1988), who discovered that children as young as five were proactively self-correcting errors and considering alternate paths before making a move. “The performance of four-year-olds, however, was best described by a mix of sighting (i.e., a proximity bias) and planning” (Völter & Call, 2014).

According to Melo (2015) and Young & Fry (2008), the years between 4 and 9 are particularly critical for the development of metacognitive skills. “The preschool years are a critical time for the development of both problem-solving cognitive skills and metacognitive abilities” (Wang, 2015). Children in preschool who had highly developed metacognitive skills performed better and more effectively on a variety of problem-solving tasks (Marić & Sakač, 2018).

5.2 Effect of Gender

In the present study, there was no gender effect observed in the performance of participants across cognitive-linguistic skills. These findings were consistent with a study done by Ardila et al. in 2011. They looked at gender differences in a sizable sample of Spanish-speaking children using the Attention, Perception, Language, Metalinguistic Awareness, Memory (Coding), Constructional, and Spatial subtests of the "Child Neuropsychological Assessment" (Matute et al., 2007). Across six age groups, from 5 to 16, the performance of boys and girls was compared in seven cognitive domains.

"Although there was a statistically significant difference between boys and girls in only three of the domains—sensory-perceptual, oral language, and spatial abilities, age had a significant impact on all of them" (Ardila et al., 2011). Boys outperformed girls in all of these areas. Total scores in the other four domains showed no discernible difference between boys and girls. The study's findings are consistent with the notion that gender differences in language and other cognitive abilities are typically negligible or insignificant.

Some of the previous literature has also put forth contradictory results. Few researches found gender differences as well: girls had quicker reaction times, but their accuracy lagged behind boys (Sobeh & Spijkers, 2012). One study found that "attention issues in boys were linked to less-developed expressive language skills, while issues in girls were associated with lower academic performance" (Zevenbergen & Ryan, 2010). Females have superior verbal abilities compared to males.

Pradhan and Nagendra (2008) conducted a study with 819 school students ranging in age from 9 to 16 years. The results showed that both sexes performed better on the cancellation task when they were older, with females scoring higher than males. For the Letter cancellation task, age was a better predictor than sex. It should be noted that gender differences in attentional performance are still unclear. The literature on gender differences is limited and primarily focuses on clinical populations.

Numerous studies have been conducted to investigate potential gender differences in memory abilities among children, and the overall consensus was that any differences that might be observed are typically minor and not consistent across different memory tasks. It is essential to consider that individual variations are more significant than any gender-related trends. Factors such as genetics, environmental influences, upbringing, and educational opportunities play a more significant role in shaping an individual's memory skills than their gender.

In a nutshell, the child develops various cognitive-linguistic skills as he or she grows older. These cognitive-linguistic abilities help with language acquisition as well. In his model, Piaget (1969) explains the complex relationship between cognition, language, and intellectual development. He explains that the developing child moves from stage to stage, with each stage characterised by a different set of cognitive processes, and that cognitive development is said to be divided into different periods, each with its own mental structure. As a result, there appears to be a refinement in linguistic skills as the child grows older, which is dependent on the child's cognitive-linguistic abilities.

CHAPTER V1

SUMMARY AND CONCLUSION

Understanding the relationship between cognition and language, as well as the pattern of development of cognitive-linguistic abilities in typically developing children, is crucial for a speech-language pathologist. Studies on cognitive and linguistic abilities in the Indian context are scarce.

The current study aimed to adapt the "Cognitive Linguistic Assessment Protocol for Children (CLAP-C)" developed by Anuroopa and Shyamala (2006), a tool that assesses children's cognitive linguistic abilities, into Malayalam. The study's goal was to adapt a protocol for cognitive-linguistic assessment that would make it easier to recognise the sequential cognitive-linguistic milestones, assist in the detection and diagnosis of children's cognitive-linguistic disabilities, and enable intervention based on the developmental timeline.

The current study was conducted in three phases. The first phase included adapting CLAP-C (Anuroopa & Shyamala, 2006) into Malayalam. CLAP-C is divided into three domains: attention/discrimination, memory, and problem-solving. The items/tasks within each domain were organized in a hierarchy so that the task complexity increased as the presentation of the levels progressed. Each domain was evaluated in both auditory and visual modes. The adapted material was given to three experienced Malayalam-speaking speech-language pathologists who served as judges for content validity.

A pilot study was carried out on eight participants (two in each age group) in the second phase. The material was modified and finalised based on this. Each correct response received a “1”, while each incorrect response received a “0”. The mastery of a level or task was investigated using the criteria of 50% or higher of subjects responding on that level. The final Protocol was administered to 40 participants ranging in age from four to eight years in the last phase. The participants were chosen from a regular school in Kerala.

The cognitive and linguistic abilities of children of various ages and genders were assessed. The collected data was properly tabulated and subjected to qualitative and quantitative analysis. Utilising the statistical package SPSS (Version 26), the statistical analysis was completed. A descriptive analysis of all subjects' performance in each domain across age groups was carried out. Graphs were created to depict the development of cognitive-linguistic abilities in normally developing children.

The findings of this study highlight several points of interest. The development of cognitive-linguistic skills in children tested using this assessment tool was discovered to follow a developmental trend. The findings also indicated that as the complexity of the stimulus increased, the children's performance decreased.

The study's outcome is the adaptation of CLAP-C, focusing on the chronological emergence of cognitive linguistic skills that can be standardised and thus used across a wide range of clinical populations, particularly developmental language disorders, thereby aiding in diagnosis and intervention. It can be concluded that the current assessment tool appropriately tests the development of language and cognitive abilities in typically developing preschool children.

6.1 Clinical Implications

1. It is presumed that CLAP-C in Malayalam will be a culturally and linguistically adapted tool that would be useful from a clinical and research point of view.

2. This assessment tool will help professionals determine the cognitive-linguistic performance of Malayalam-speaking children of four to eight years across genders in three domains: attention, memory, and problem-solving.

6.2 Limitations of the study

1. The sample size was limited because of time constraints. Nevertheless, it was good compared to the original study, which included 24 participants. However, considering the standardization of material, the sample size was limited.
2. The test-retest reliability could not be verified due to the small sample size.
3. The content validity tool could not be used as the material was only given to three speech language pathologists, which did not meet the criteria.

6.3 Future Directions

1. Administration of the test on a larger population for standardisation can be done.
2. Comparisons across different clinical populations like developmental language disorders, Autism spectrum disorder, Learning disability, Intellectual disability, Specific language impairment, Attention-deficit hyperactivity disorder (ADHD), etc., can be done.
3. The effect of different variables like bilingualism, sibling status, medium of instruction, and socio-economic status on the performance of individuals on the adapted test could be measured.
4. The psychometric properties of the adapted tool, like reliability, validity, and sensitivity-specificity, should be checked.

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APPENDIX-A

Validation form used for content validation of clap-c in Malayalam

Feedback questionnaire for treatment manual (Goswami et al., 2012)

Please put a tick (√) in the appropriate box.

Sl. No.	Parameters	Very Poor	Poor	Fair	Good	Excellent
1	Simplicity					
2	Familiarity					
3	Size of the picture					
4	Colour and appearance					
5	Arrangement					
6	Presentation					
7	Volume					
8	Relevance					
9	Complexity					
10	Iconicity					
11	Accessibility					
12	Flexibility					
13	Trainability					
14	Stimulability					
15	Feasibility					
16	Generalization					
17	Scope of Practice					
18	Scoring Pattern					
19	Publications, Outcomes and Developers (professional background)**					
20	Coverage of parameters					

(** Excluded parameters)

Any other suggestions:

Definition of the parameters

1. Simplicity: Are the test stimuli comprehendible?

2. Familiarity: Is the material familiar to the users?

3. Size of the picture: whether the picture stimuli are of appropriate size?

4. Colour and Appearance: Are the picture stimuli appropriate in terms of colour and

dimension.

5. Arrangement: whether the picture stimuli are within the visual field of the individual?

6. Presentation: Are the number of stimuli in each section placed appropriately?

7. Volume: Is the overall manual appropriate in size?

8. Relevancy: whether the test material is culturally and ethically acceptable?

9. Complexity: Is the material arranged in the increasing order of difficulty?

10. Iconicity: Does the picture stimuli appear to be recognizable and representational?

11. Accessibility: Is the test material user-friendly?

12. Flexibility: Can the stimuli be easily modified?

13. Trainability: Can the stimuli be used for intervention purposes in different milieu?

14. Stimulability: Does the stimulus material elicit responses from the individuals?

15. Feasibility: Whether the test material is viable?

16. Generalization: Can the test material be generalized to any other adult language disorders and various settings?

17. Scope of practice: Is the test material within the profession’s scope of practice or within the personal scope of practice?

18. Scoring pattern: Whether the scoring pattern followed in the resource material applicable?

19. Publications, Outcomes and Developers (Professional background): Is there any other resource material similar to this test material that you are aware of?

20. Coverage of Parameters (Reception and Expression): Does the resource material contain the essential language components to be treated?

APPENDIX B

COGNITIVE LINGUISTIC ASSESSMENT PROTOCOL FOR CHILDREN IN MALAYALAM

DOMAIN-I

ATTENTION/DISCRIMINATION

AUDITORY MODE:

1) Digit count test:

Instructions: “I am going to read some digits in a sequence. You have to listen carefully and tell me the number of times you hear the digit “9”. Also, consider the digits that have 9 in them. Listen carefully!”

നിർദ്ദേശങ്ങൾ : “ഞാൻ കുറച്ചു അക്കങ്ങൾ ക്രമത്തിൽ വായിക്കും. അത് ശ്രദ്ധിച്ചു കേട്ട്, അതിൽ എത്ര തവണ 9 എന്ന അക്കം വരുന്നുണ്ടെന്ന് പറയുക”. 9 എന്ന അക്കം വരുന്ന സംഖ്യകളും എണ്ണേണ്ടതാണ്.

Trial: 3, 6, 9, 2

Level-I 2, 9, 5, 6.,

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

Level- III 4, ബ, 3, 9, ഡ, തു, 9, ഡി, 6

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

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

2) Sound count test:

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

നിർദ്ദേശങ്ങൾ : “ ഞാൻ കുറച്ചു അക്ഷരങ്ങൾ വായിക്കും.അത് ശ്രദ്ധിച്ചു കേട്ട്, അതിൽ എത്ര തവണ “ബ” എന്ന അക്ഷരം വരുന്നുണ്ടെന്ന് പറയുക”

Level-I മ, ബ, ത

Level-II സ, ല, ബ, ര, സ

Level- III ബ, ജ, ല, ബ, പ, ബ, ഹ

Level-IV ത, ക, പ, പ, ബ, ന, ല, ര, സ

Level-V ന, ത, പ, ബ, ഹ, ന, ബ, ച, ല

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 are same or different"

നിർദ്ദേശങ്ങൾ : “ഞാൻ രണ്ടു വാക്കുകൾ വായിക്കും.അത് ശ്രദ്ധിച്ചു കേട്ട് , വാക്കുകൾ ഒന്നുതന്നെയാണോ അതോ വേറെയാണോ എന്ന് പറയുക .”

അടി- ഓടി

എലി- എലി

പല്ലി –പള്ളി

കാല്- കാല്

തടി -തട്ടി

ഓടി- ഓടി

കാല്- കാർ

വള –വള

വള – വര

പല്ലി- പല്ലി

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"

നിർദ്ദേശങ്ങൾ : "ഞാൻ കുറച്ച് ചിത്രങ്ങൾ കാണിക്കാം. അവയിൽ ഏതാണ് കൂട്ടത്തിൽ ചേരാത്തത് എന്ന് പറയാമോ?"

NOTE: SEE APPENDIX FOR ODD ONE OUT TEST

Level-I	L-Ia, L-Ib, L-Ic
Level-II	L-IIa, L-IIb, L-IIc
Level-Ill	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:

Instructions: "I will show some letters from each sequence of letters. You have to point out to the letter 'i' from that sequence."

നിർദ്ദേശങ്ങൾ : "ഞാൻ കുറച്ച് അക്ഷരങ്ങൾ കാണിക്കാം. അതിൽ നിന്നും 'ഇ' എന്ന അക്ഷരം ചൂണ്ടി കാണിക്കുക"

Instructions at Level-IV: "Now you have to show every red coloured "i" from the sequence".

ലെവൽ-IV ലെ നിർദ്ദേശങ്ങൾ : "ഞാൻ കാണിക്കുന്ന അക്ഷരങ്ങളിൽ നിന്നും ചുവന്ന ' ഇ' ചൂണ്ടികാണിക്കൂ .

Instructions at Level -V: "Now you have to show every red "i" preceding every red colour "ka".

ലെവൽ-V ലെ നിർദ്ദേശങ്ങൾ : "ഞാൻ കാണിക്കുന്ന അക്ഷരങ്ങളിൽ നിന്നും ചുവന്ന 'ക' എന്ന അക്ഷരത്തിനു മുമ്പുള്ള ചുവന്ന 'ഇ' ചൂണ്ടികാണിക്കൂ".

Level-I	മ ഒ അ ല വ യ മ വ ഇ ല സ ആ
Level-II	ട ഹ ത ഗ ഫ അ ഷ ല ജ ഇ ക ന
Level-Ill	പ വ ച അ യ അ ത ല അ വ ബ ഷ
Level-IV	സ ല ഉ സ ബ ഇ ക ഫ ര ജ അ ക ത ഹ
Level-V	ല ഉ ഇ ക ആ യ ര ക ഇ ക്ഷ യ ഇ ക ഗ സ ബ ര ഇ ത

3) Visual word 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"

നിർദ്ദേശങ്ങൾ : "ഞാൻ രണ്ടു വാക്കുകൾ കാണിക്കും. രണ്ടും ഒന്നുതന്നെയാണോ അതോ വേറെയാണോ എന്ന് പറയൂ"

പല്ലി –പള്ളി

എലി- എലി

കാശ് - കാർ

പട്ടി- പക്ഷി

ഓടി- ഓടി

ആകാശം – ആവേശം

വെള്ളം- വെള്ളം

വീട്- വീട്

മരം –മഠം

എലി- എലി

DOMAIN- II

MEMORY

AUDITORY MODE:

1)Digit forward span:

Instructions: "I am going to tell some digits in a sequence. You have to repeat after I finish”

നിർദ്ദേശങ്ങൾ : “ഞാൻ കുറച്ചു അക്കങ്ങൾ പറയും . അവ ശ്രദ്ധിച്ചു കേട്ടതിനു ശേഷം ഞാൻ പറഞ്ഞ അതേ ക്രമത്തിൽ തിരിച്ചു പറയൂ ”.

Level-I 3-6-5

Level-II 5-8-1-2

Level-III 1-8-5-2-4

Level-IV 8-2-1-9-3-7

Level-V 2-5-7-6-8- 4-9

2)Word Recall

Instructions: "I am going to tell some words. You have to repeat after I finish, irrespective of the sequence.”

നിർദ്ദേശങ്ങൾ : “ഞാൻ കുറച്ചു വാക്കുകൾ പറയും . അവ തിരിച്ചു പറയുക”

Level-I പക്ഷി ,പുസ്തകം, സോപ്പ്

Level-II പേപ്പർ ,കാർഡ് ,പേന ,റബ്ബർ

Level-Ill മരം, കല്ല്, സൂചി ,വെള്ളം ,കസേര

Level-IV പന്ത്, വാച്ച് ,ഗ്ലാസ് ,സോപ്പ്, വീട് ,പാൽ

Level-V പൂവ്, ബ്രഷ് ,സോപ്പ് ,താക്കോൽ ,പത്രം ,പട്ടി ,കാർ

3) Digit Backward:

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

നിർദ്ദേശങ്ങൾ : "ഞാൻ കുറച്ചു അക്കങ്ങൾ പറയും. അവ തിരിച്ചു നേരെ വിപരീത ക്രമത്തിൽ പറയൂ."

Level-I 2-5- 7

Level-II 9-7-1- 8

Level-III 5-4-1-6- 9

Level-IV 8-3-4-9-7- 6

Level-V 4-2 - 7-9-3-6- 2

VISUAL MODE:

1) Simple alternate sequencing:

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

നിർദ്ദേശങ്ങൾ : "ഞാൻ ചില ചിത്രങ്ങൾ അഥവാ രൂപങ്ങൾ കാണിക്കാം. ഈ കൂട്ടത്തിൽ ഏറ്റവും അവസാനത്തെ ഏതായിരിക്കുമെന്ന് പറയൂ".

NOTE: SEE APPENDIX FOR ALTERNATE SEQUENCING TASK:

Level-I	L-I
Level-II	L-II
Level-Ill	L-III
Level-IV	L-IV
Level-V	L-V

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"

നിർദ്ദേശങ്ങൾ : “ഞാൻ ചില ചിത്രങ്ങൾ കാണിക്കാം. കാണിച്ചതിന് ശേഷം ഞാൻ അവ മാറ്റും . അതിനു ശേഷം ഏതൊക്കെ ചിത്രങ്ങൾ ആണ് കണ്ടതെന്ന് ഓർത്തെടുത്തു പറയൂ”.

NOTE: SEE APPENDIX - PICTURE COUNTING

Level-I	LEVEL-I	Ia, Ib, IIc
Level-II	LEVEL-II	IIa, IIb, IIc, IId,
Level-Ill	LEVEL-III	IIIa, IIIb, IIIc, IIId, IIIe
Level-IV	LEVEL-IV	IVa, IVb, IVc, IVd, IVe, IVf
Level-V	LEVEL-V	Va, Vb, Vc, Vd, Ve, Vf, Vg

3) Story sequencing:

Instructions: "I am going to show you some story pictures; these cards are all jumbled. You have to 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 and then ask the child to arrange the cards.

നിർദ്ദേശങ്ങൾ : "ഞാൻ ചില ചിത്രങ്ങൾ കാണിക്കാം. ഇവ ഒരു കഥയുടെ ഭാഗമാണ് .ആ കഥയുടെ അതേ ക്രമത്തിൽ ചിത്രങ്ങൾ വയ്ക്കൂ."

(കഥ ഏതാണെന്ന് കുട്ടിക്ക് അറിയില്ലെങ്കിൽ, അത് വിവരിച്ചു കൊടുത്തതിനു ശേഷം ചിത്രങ്ങൾ ക്രമീകരിക്കാൻ ആവശ്യപ്പെടുക).

NOTE: SEE APPENDIX- STORY SEQUENCING

Level-I L-Ia,L-Ib, L-IIc, L-IId,

Level-II L-IIa, L-IIb,L-IIc, L-IId,

Level-Ill L-IIIa, L-IIIb, LIIIc, L-IIId, L-IIIe

Level-IV L-IVa, L-IVb, L-IVc, L-IVd,L-IVe

Level-V L-Va, L-Vb, L-Vc, L-Vd, L-Ve,L-Vf

DOMAIN-III

PROBLEM SOLVING

AUDITORY MODE:

1) Predicting outcome:

Instructions: "What will you do if...

നിർദ്ദേശങ്ങൾ : "ഞാൻ ചില അവസ്ഥ പറയാം .അങ്ങനെ സംഭവിച്ചാൽ മോൻ /മോൾ എന്ത് ചെയ്യുമെന്ന് ആലോചിച്ചു പറയൂ"

1. സ്കൂൾ ബാഗ് കാണാതെ പോയാൽ-------
2. സ്കൂൾ ബസ് മിസ്സായാൽ---------------
3. ഒരു മുറിയിൽ കുടുങ്ങി പോയാൽ---------------
4. പെട്ടന്ന് കറന്റ് പോയാൽ-----------

5. വീടിന്റെ താക്കോൽ കളഞ്ഞുപോയാൽ---------------
6. ഫോൺ കേടായാൽ----------------
7. വീടിനു തീ പിടിച്ചാൽ ---------------
8. സ്കൂളിൽ വെച്ചു ബുക്ക് മറന്നു പോയാൽ---------------
9. ആഹാരം വസ്ത്രത്തിൽ ആയാൽ-------------
10. പരീക്ഷക്കു ഉത്തരങ്ങൾ മറന്നു പോയാൽ-----------------

2)Predicting the cause:

Instructions: " Tell me why...

നിർദ്ദേശങ്ങൾ : "താഴെ പറയുന്ന കാര്യങ്ങൾ എന്ത് കൊണ്ടാണ് സംഭവിച്ചതെന്ന് പറയൂ...

1. മോന്റെ /മോളുടെ കൂട്ടുകാരൻ / കൂട്ടുകാരി നിന്നോട് മിണ്ടുന്നില്ല
2. മഴയത്തു നനഞ്ഞു
3. ഇടാനുള്ള വസ്ത്രം ഇറുകിയിരിക്കുന്നു
4. വണ്ടി സ്റ്റാർട്ട് ആവുന്നില്ല
5. വീട്ടിലെ ചെടി നശിച്ചു പോകുന്നു
6. താക്കോൽ വെച്ചു പൂട്ട് തുറക്കാൻ പറ്റുന്നില്ല
7. മോൾക്ക് /മോന് ക്ലാസ്സിലെ ബോർഡിൽ നോക്കി വായിക്കാൻ ബുദ്ധിമുട്ടാവുന്നു
8. കാറിന്റെ ടയർ പരന്നിരിക്കുന്നു .പിന്നെ കാർ മുന്നോട്ട് പോവുന്നില്ല .

9. അടുക്കളയിൽ നിറയെ പുകയാണ് .

10. മോൾക്ക് /മോന് ശ്വസിക്കാൻ കഴിയുന്നില്ല.

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 features"

നിർദ്ദേശങ്ങൾ : "ഞാൻ രണ്ടു വാക്കുകൾ പറയും .അവ തമ്മിലുള്ള ഒന്നോ രണ്ടോ വ്യത്യാസങ്ങളും സമാനതകളും പറയൂ"

1. പട്ടി- പൂച്ച
2. പാൽ -കാപ്പി
3. ഓറഞ്ച് - പഴം
4. ഫോട്ടോ- വീഡിയോ
5. ഫ്ലാറ്റ് –വീട്
6. മുറി –വീട്
7. പെൻസിൽ - പേന
8. അടുപ്പ് - ഫ്രിഡ്ജ്
9. പന്ത് - ബലൂൺ
10. പത്രം - കഥാപുസ്തകം

VISUAL MODE:

1) Association task:

Instructions: "I am going to show you a picture array from that; you have to show me two pictures that are closely associated with each other."The number of associations increases from level I to level V.

നിർദ്ദേശങ്ങൾ : "ഞാൻ ചില ചിത്രങ്ങൾ കാണിക്കും .ഇവയിൽ ഏറ്റവും ബന്ധമുള്ള രണ്ട് ചിത്രങ്ങൾ കാണിച്ചു തരൂ."

NOTE: SEE APPENDIX FOR ASSOCIATION TASK

Level-I A.T I

Level-II A.T II

Level-Ill A.T III

Level-IV A.T IV

Level-V A.T V

2) Overlapping test:

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

നിർദ്ദേശങ്ങൾ : "ഞാൻ ഒരു ചിത്രം കാണിക്കാം . അതിൽ വേറെ ചില ചിത്രങ്ങൾ ഒളിഞ്ഞിരിക്കുന്നുണ്ട്. ഏതൊക്കെ ആണെന്ന് കണ്ടു പിടിക്കാമോ?"

NOTE: SEE APPENDIX FOR OVERLAPPING TEST

Level-I OT-I

Level-II OT-II

Level-III OT-III

Level-IV OT-IV

Level-V OT-V

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"

നിർദ്ദേശങ്ങൾ : "ഒരു പോയിന്റിൽ നിന്ന് തുടങ്ങി വരികളിൽ തൊടാതെ അവസാന പോയിന്റിലേക്ക് എത്തുന്നതിനുള്ള വഴി കണ്ടുപിടിക്കുക"

At level-IV: "you have to join the letters scattered in the maze and make a word which represents the animal at the end point."

ലെവൽ-IV ലെ നിർദ്ദേശങ്ങൾ : "വഴിയിൽ ചിതറിക്കിടക്കുന്ന അക്ഷരങ്ങൾ കൂട്ടിച്ചേർത്തു അവസാന പോയിന്റിൽ മൃഗത്തെ പ്രതിനിധീകരിക്കുന്ന ഒരു വാക്ക് ഉണ്ടാക്കുകയും വേണം."

At level V: "You have to join the same-coloured letters scattered in the maze and make a word which represents the animal at the endpoint."

ലെവൽ-V ലെ നിർദ്ദേശങ്ങൾ : "വഴിയിൽ ചിതറിക്കിടക്കുന്ന ഒരേ നിറത്തിലുള്ള അക്ഷരങ്ങൾ കൂട്ടിച്ചേർത്തു അവസാന പോയിന്റിൽ മൃഗത്തെ പ്രതിനിധീകരിക്കുന്ന ഒരു വാക്ക് ഉണ്ടാക്കുകയും വേണം."

NOTE: SEE APPENDIX FOR MAZES

LEVEL-I M-I

LEVEL-II M-II

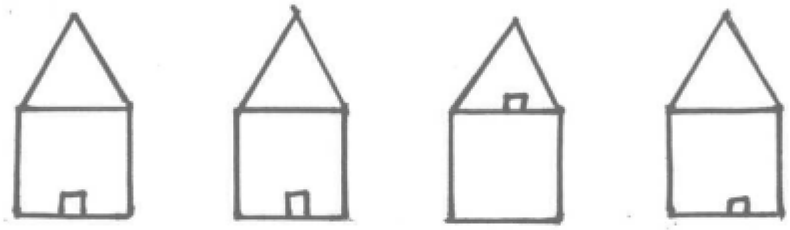
LEVEL-III M-III

LEVEL-IV M-IV

LEVEL-V M-V

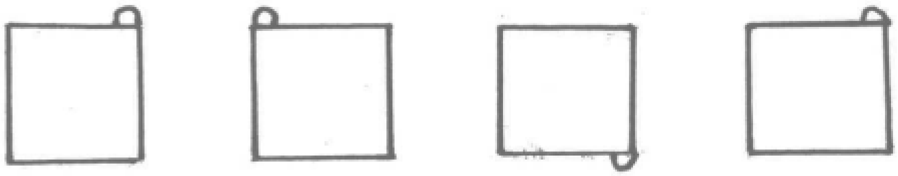
APPENDIX C

ODD ONE OUT:



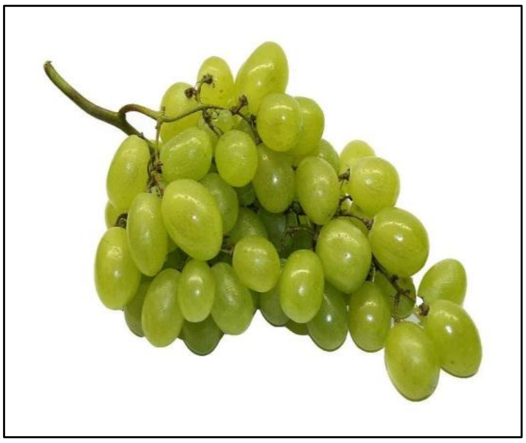
L-Ia

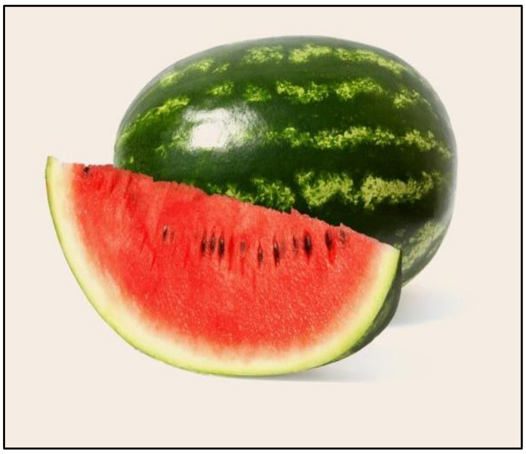
L-Ib



L-Ic

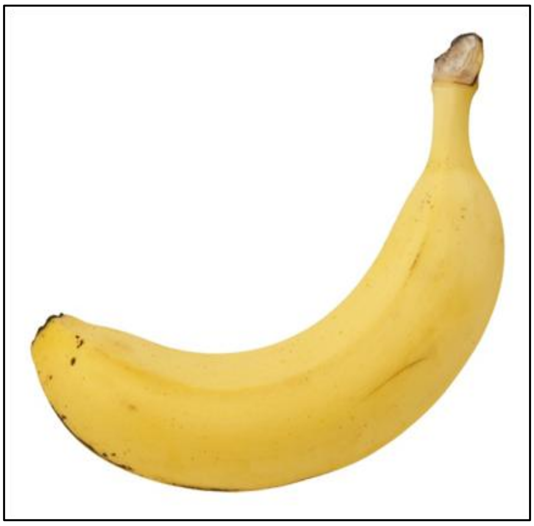
L-II a

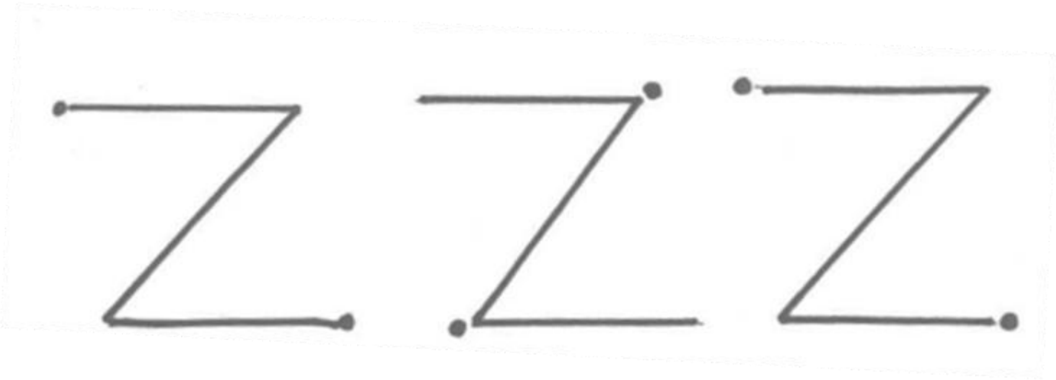




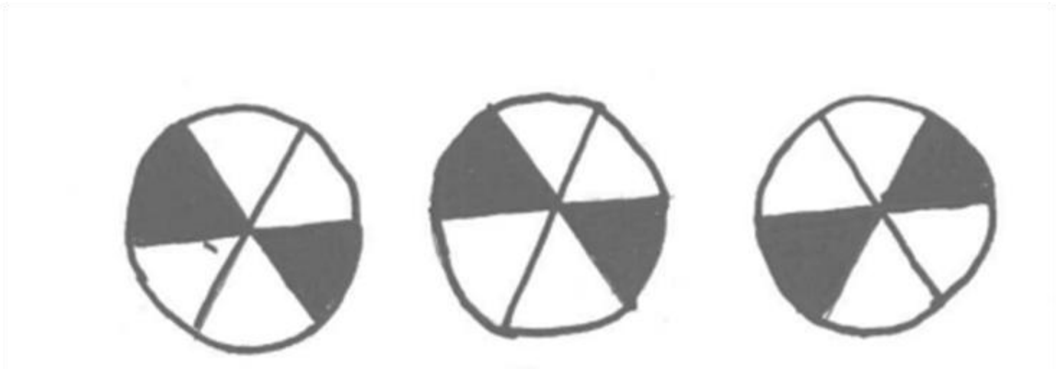
L-IIb

L-IIc



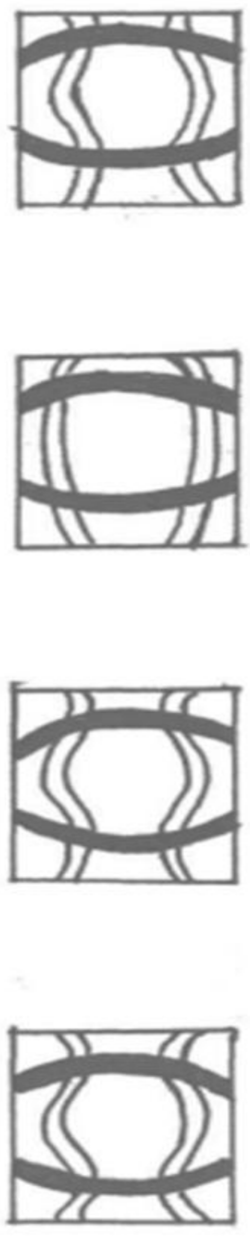


L-IIIa

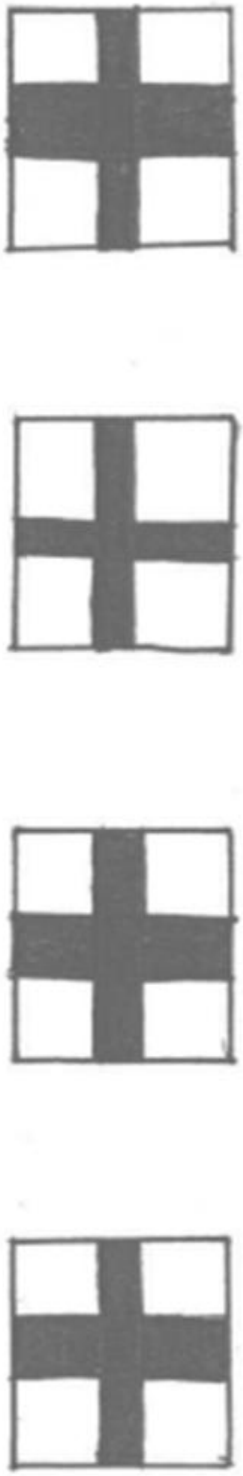


L-IIIb

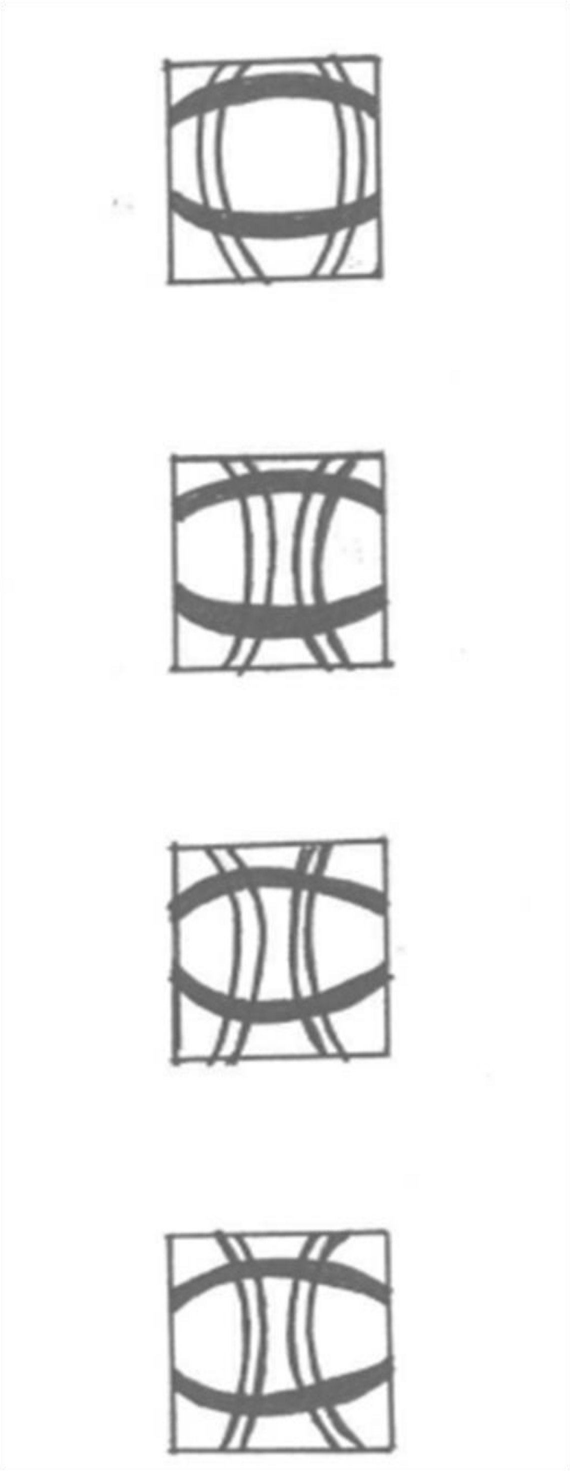
L-IIIc



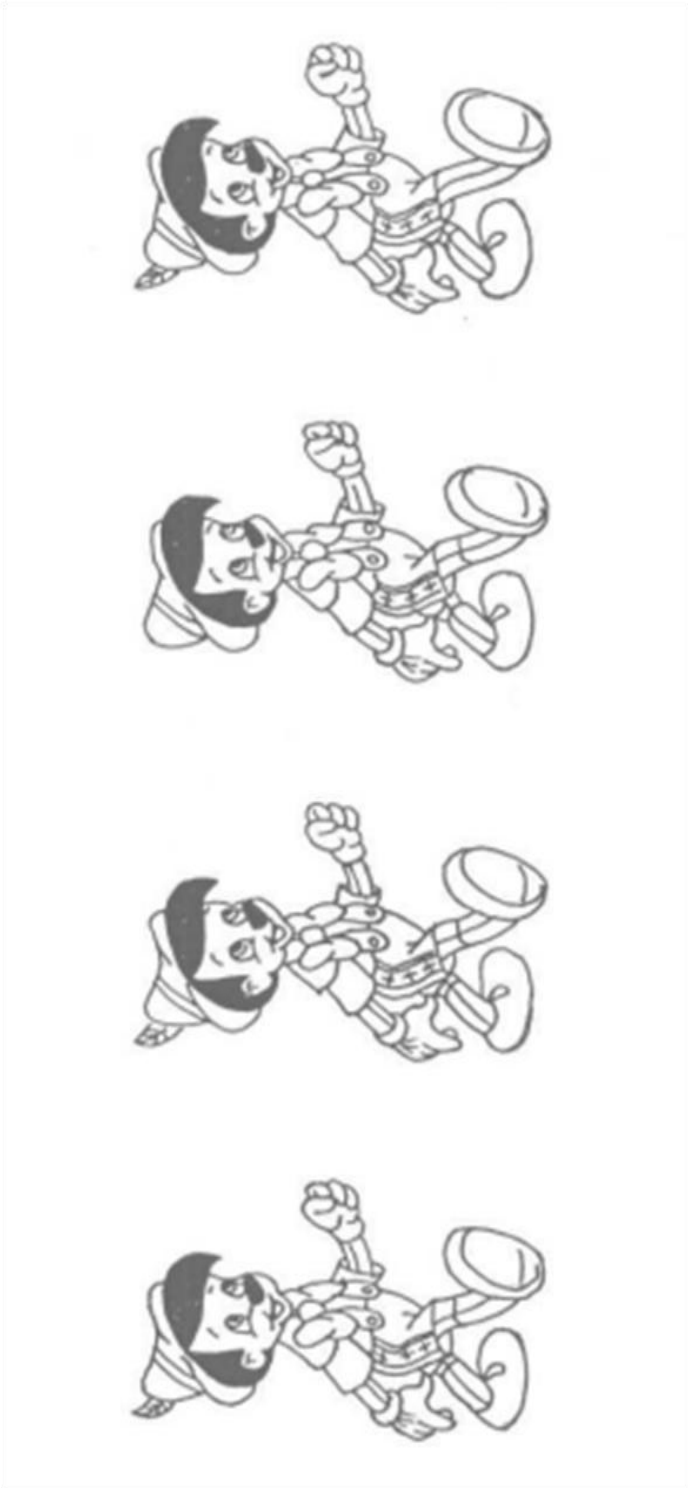
L-IVa



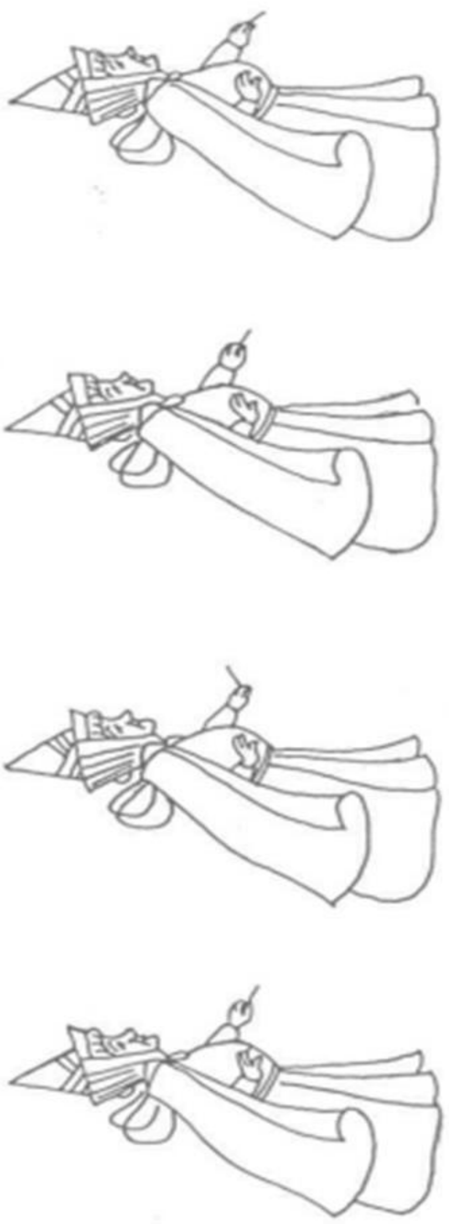
L-IVb



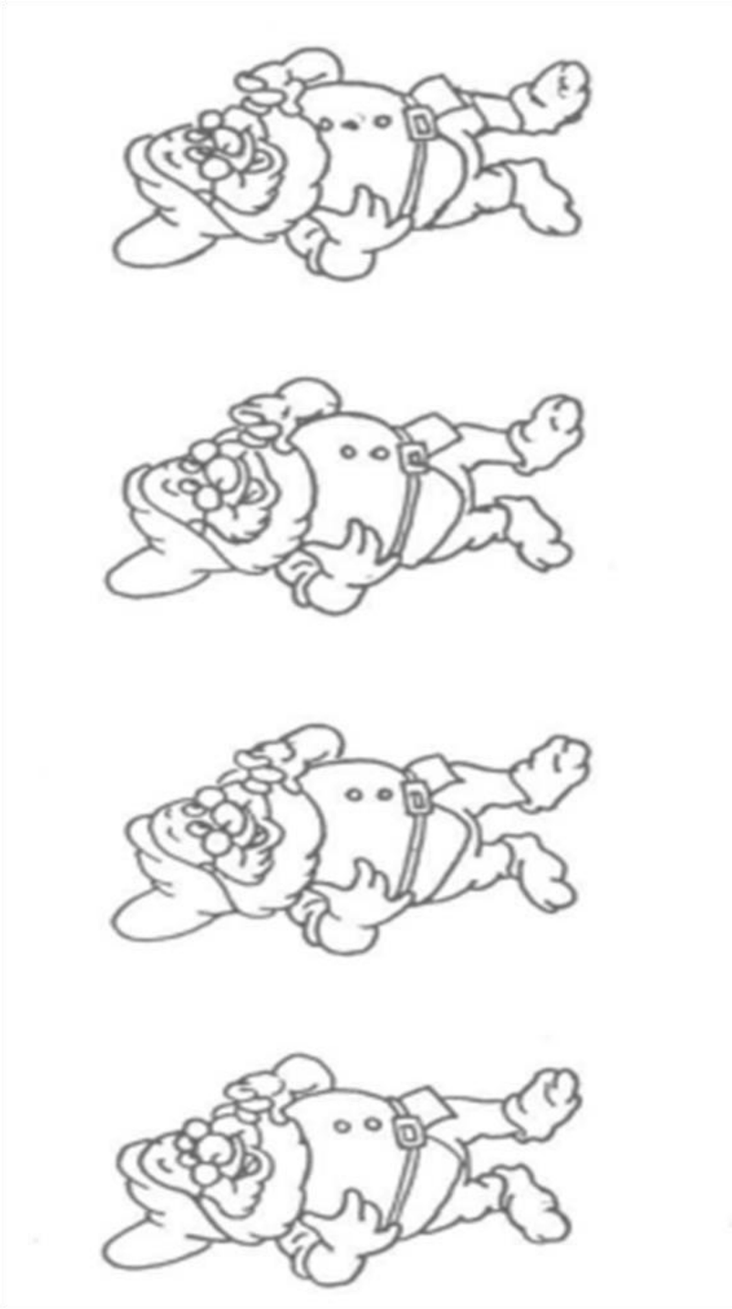
L-IVc



L-Va



L-Vb



L-Vc

SIMPLE ALTERNATE SEQUENCING:

L-I

L-II

L-III

L-IV

ക വ , ക വ ഗ , ക വ ഗ------

L

PICTURE COUNTING:

LEVEL-I

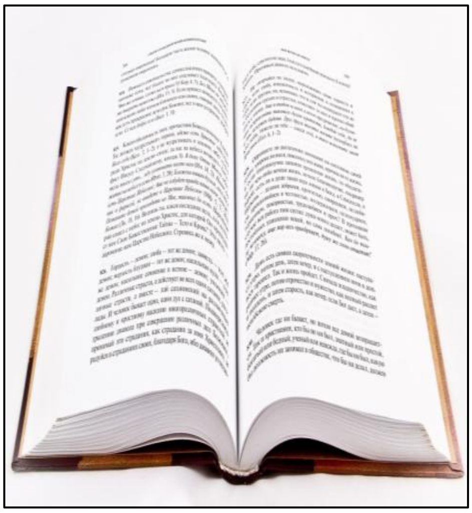
Ia

Ib

IIc

LEVEL- II

IIa **IIb**



IIc **IId**

LEVEL- III

IIIa

IIIb

IIIc

IIId

IIIe

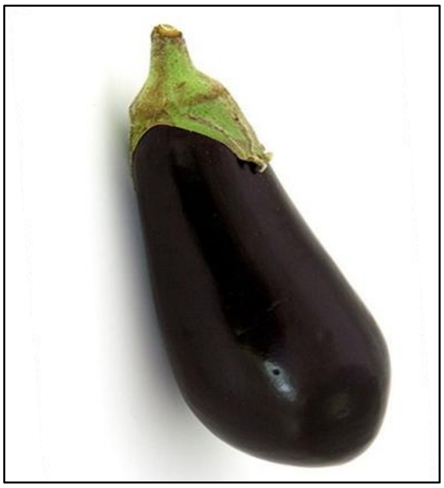
LEVEL- IV

IVa

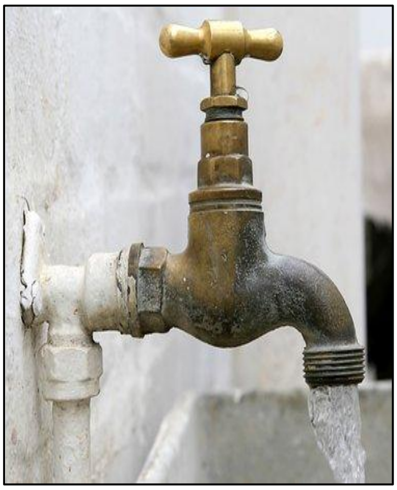
IVb

IVc

IVd



IVe



IVf

LEVEL- V

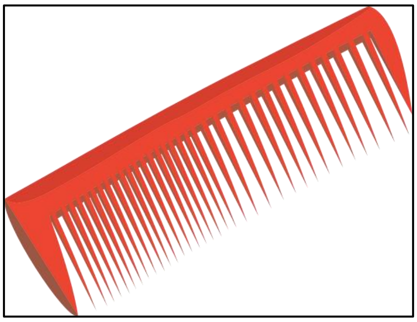
Va

Vb

Vc

Vd

Ve



Vf

Vg

STORY SEQUENCING:

L-Ia

L-Ib

L-IIc

L-IId

L-IIa

L-IIb

L-IIc

L-IId

L-IIIa

L-IIIb

LIIIc

L-IIId

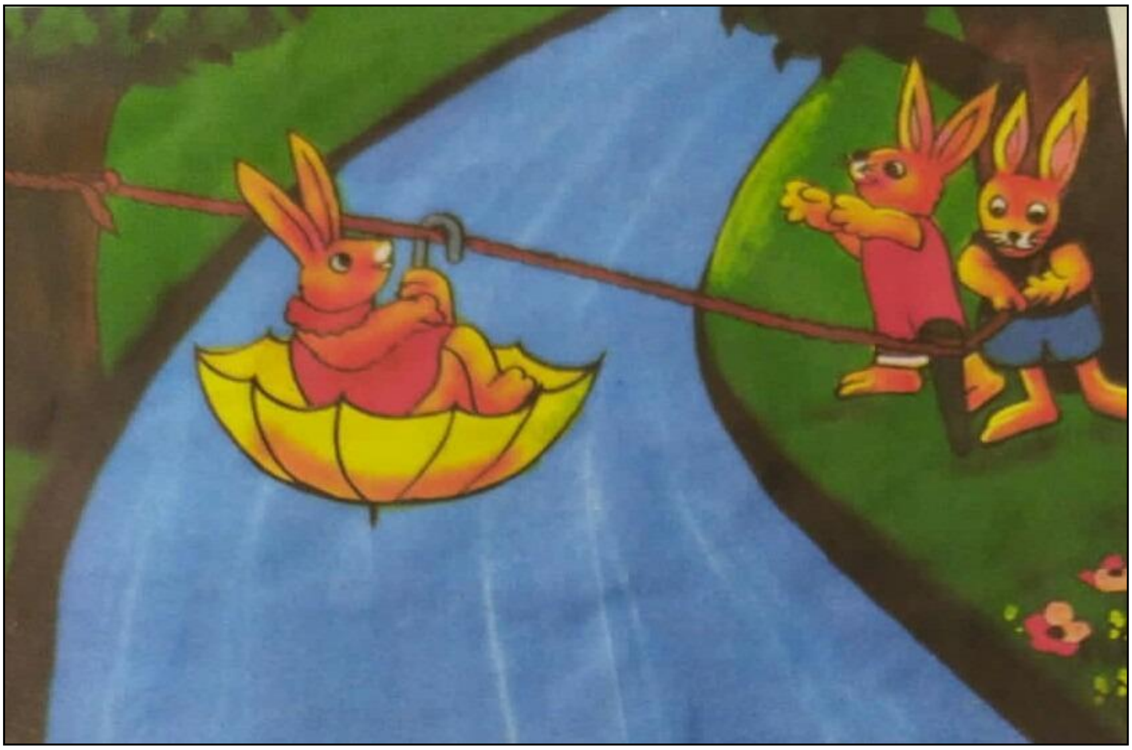
L-IIIe

L-IVa

L-IVb

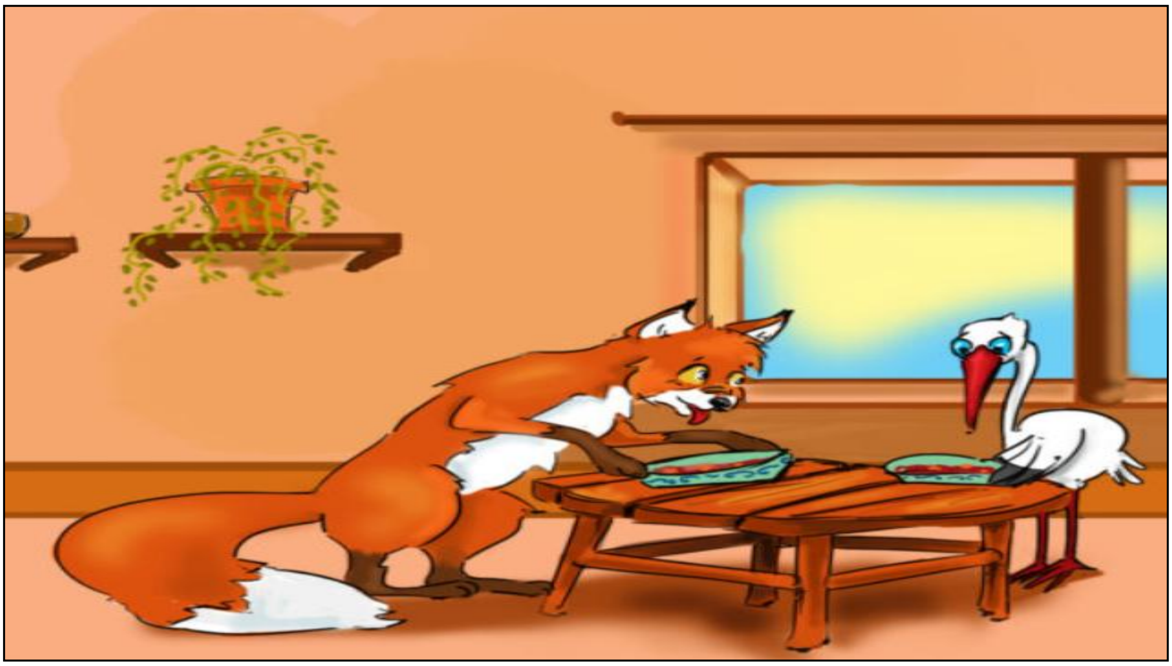
L-IVc

L-IVd



L-IVe

L-Va

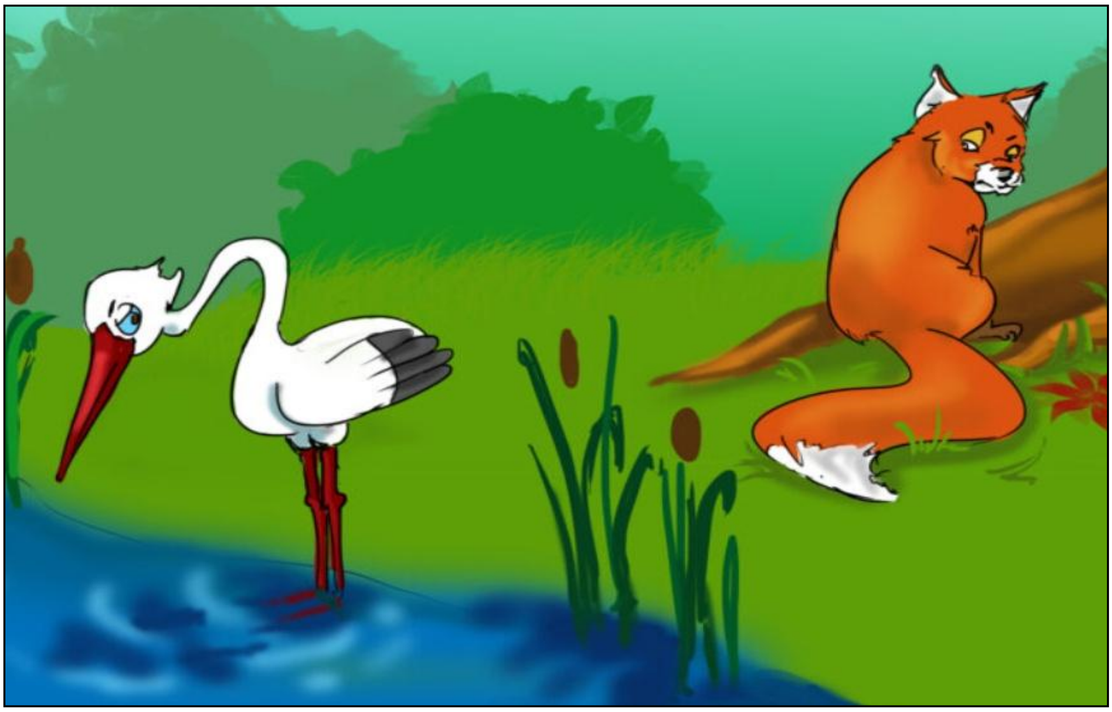


L-Vb

L-Vc

L-Vd

L-Ve



L-Vf

ASSOCIATION TASK:





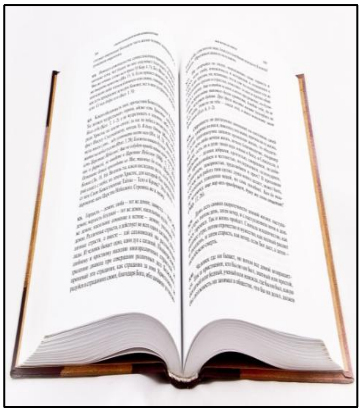

A.T I

A.T II







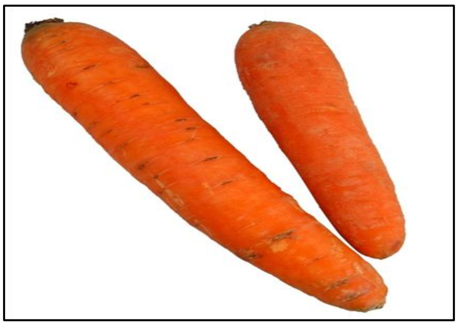
A.T III

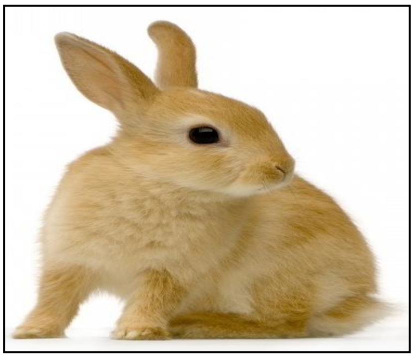


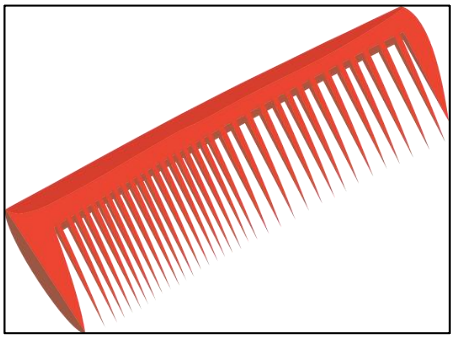




A.T IV

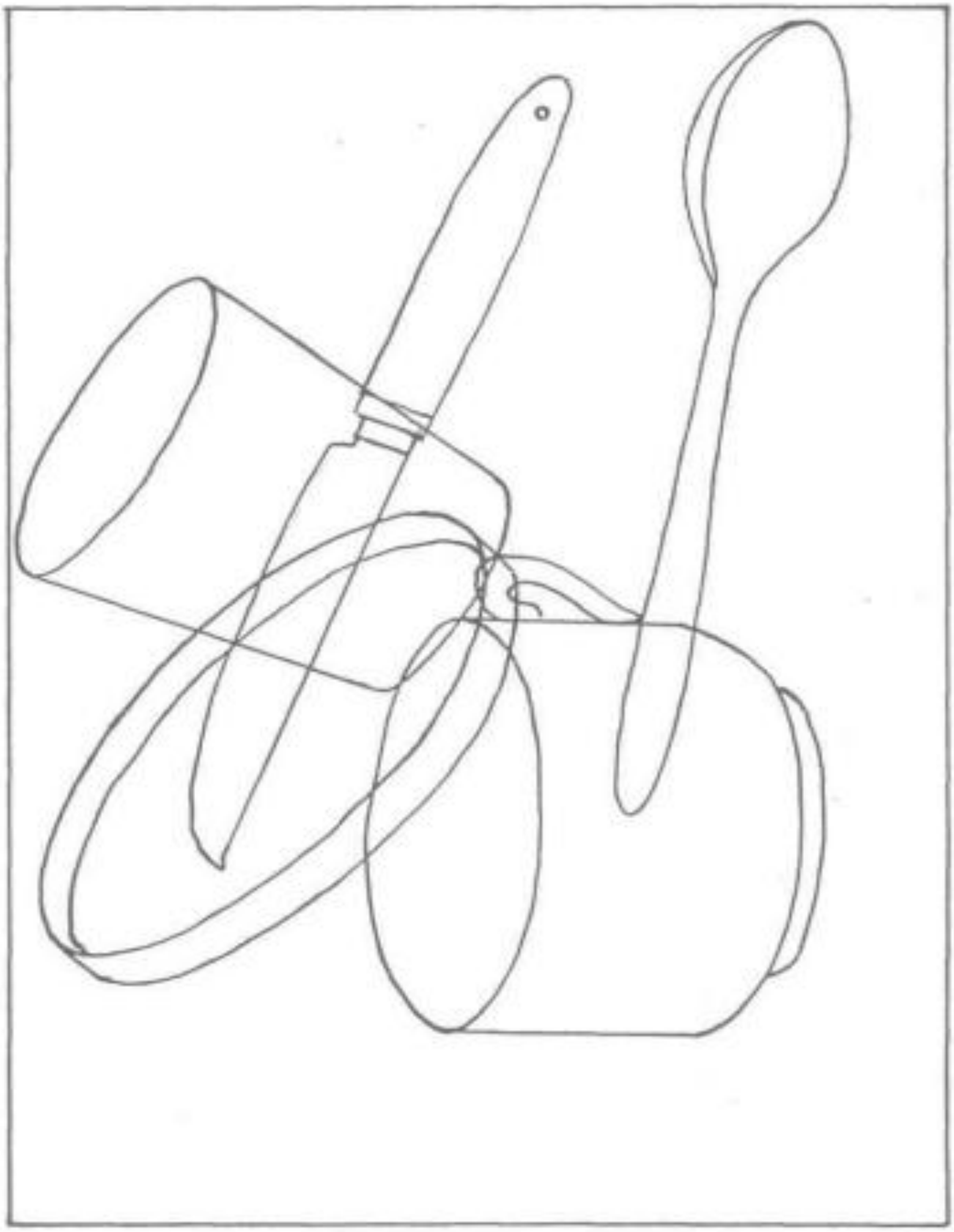




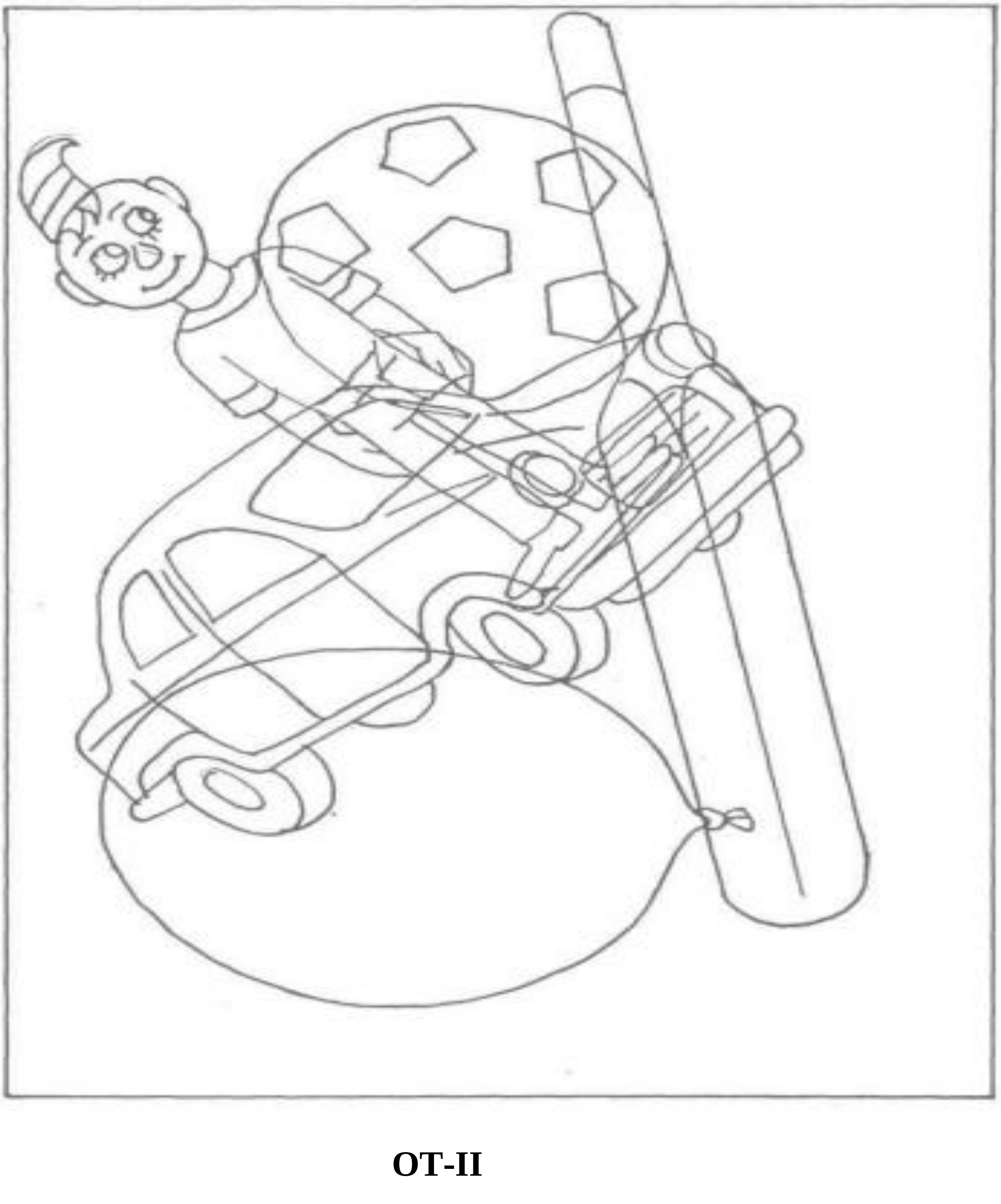


A.T V

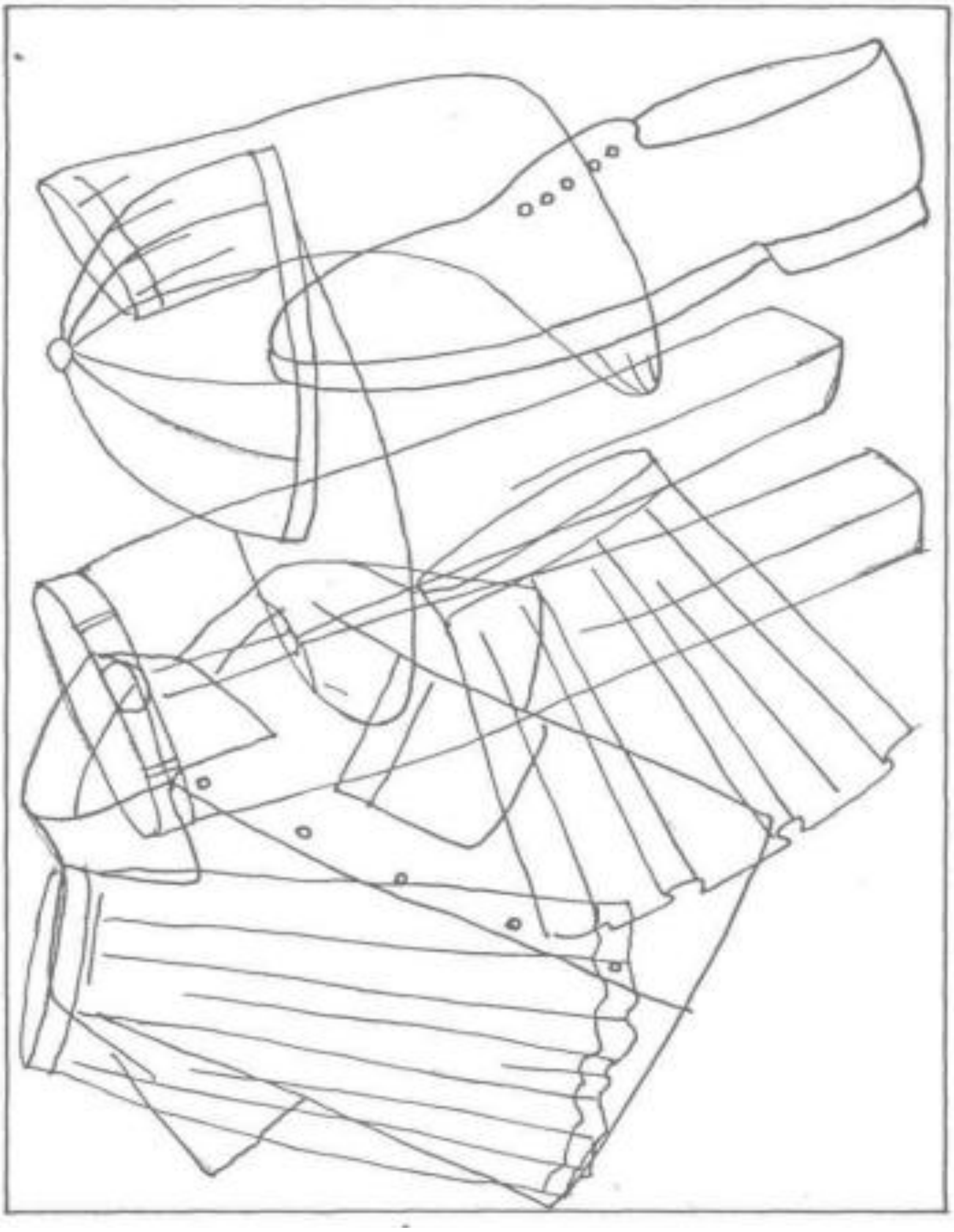
OVERLAPPING TEST:



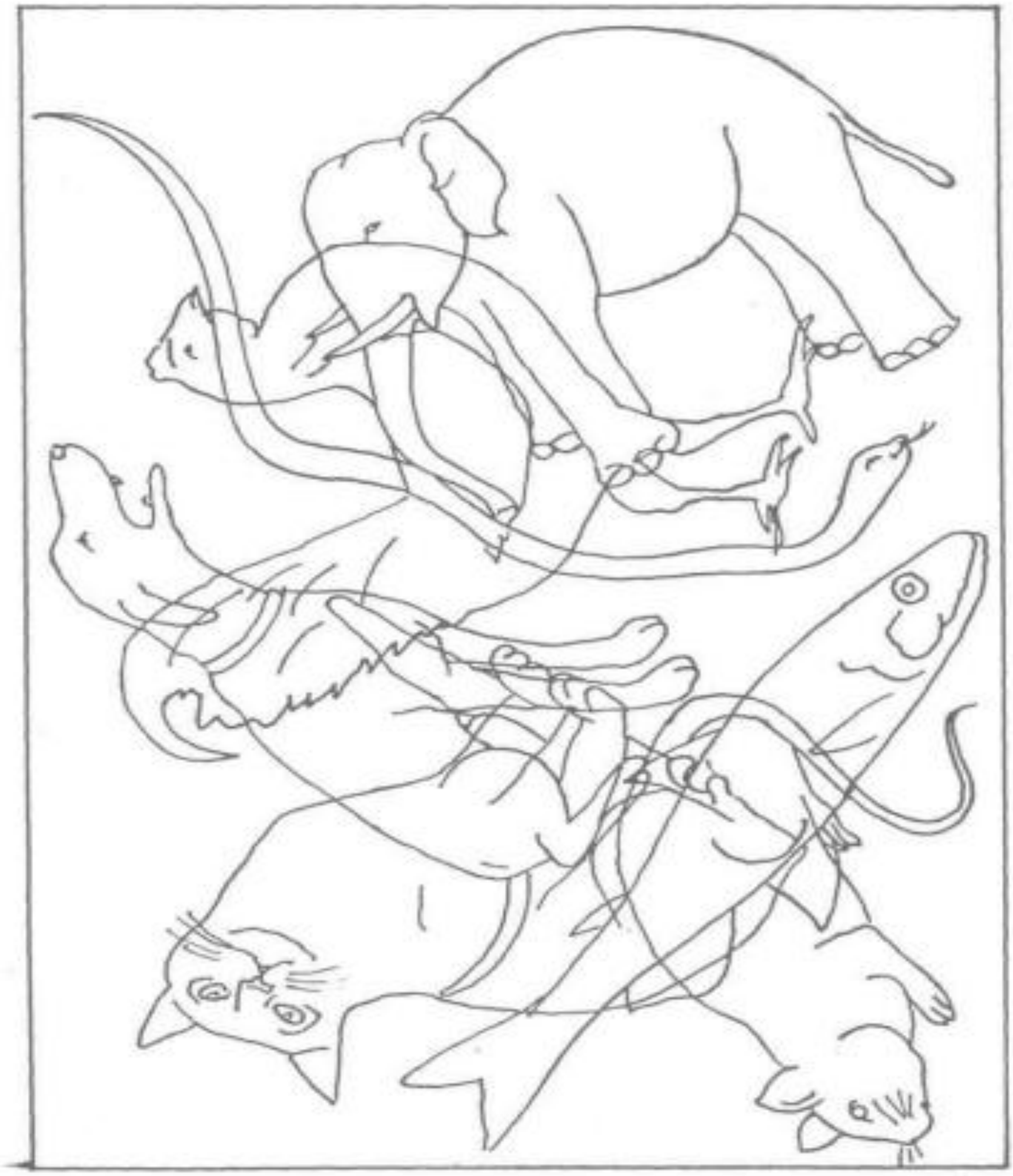
OT-I



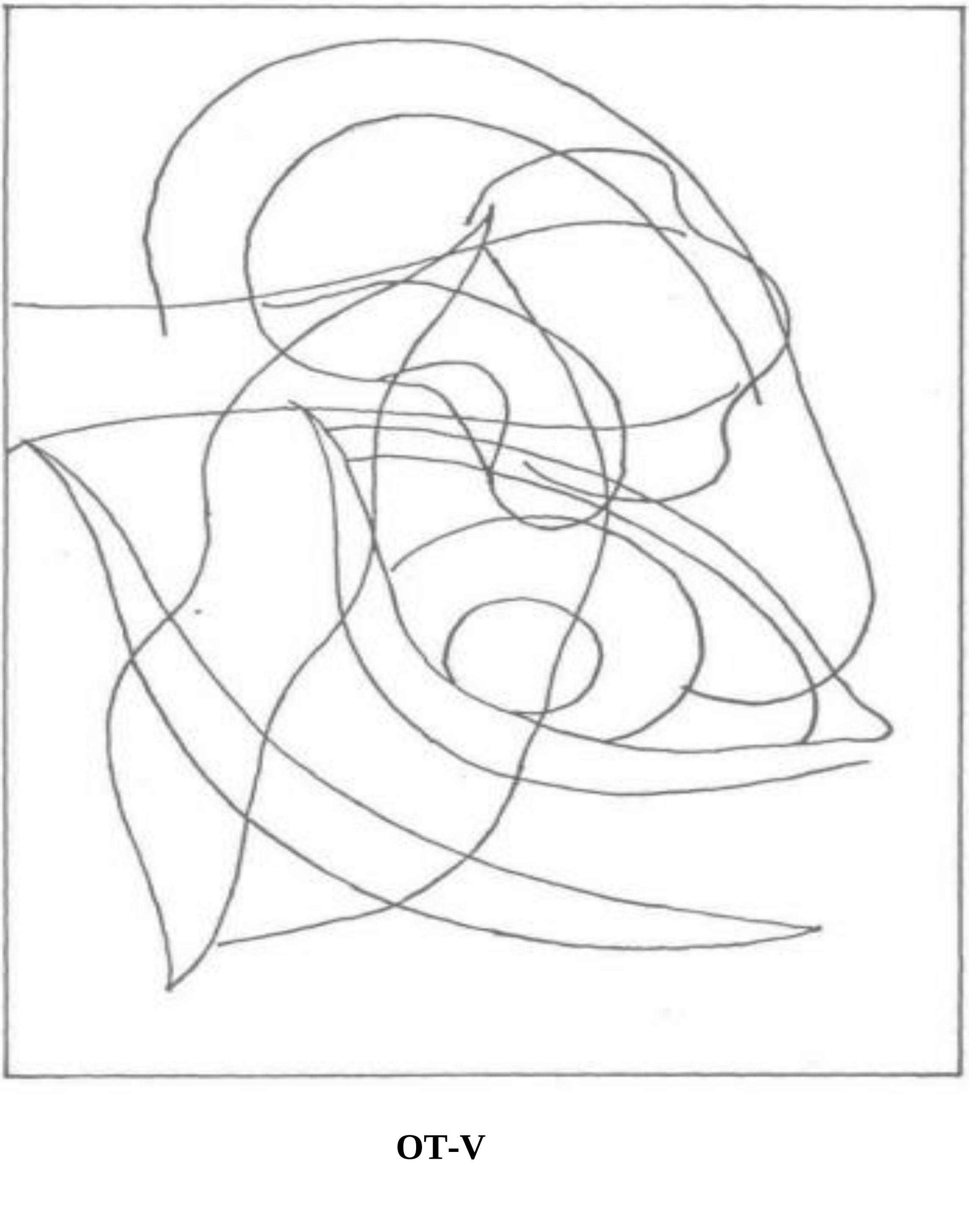
OT-II



OT-III



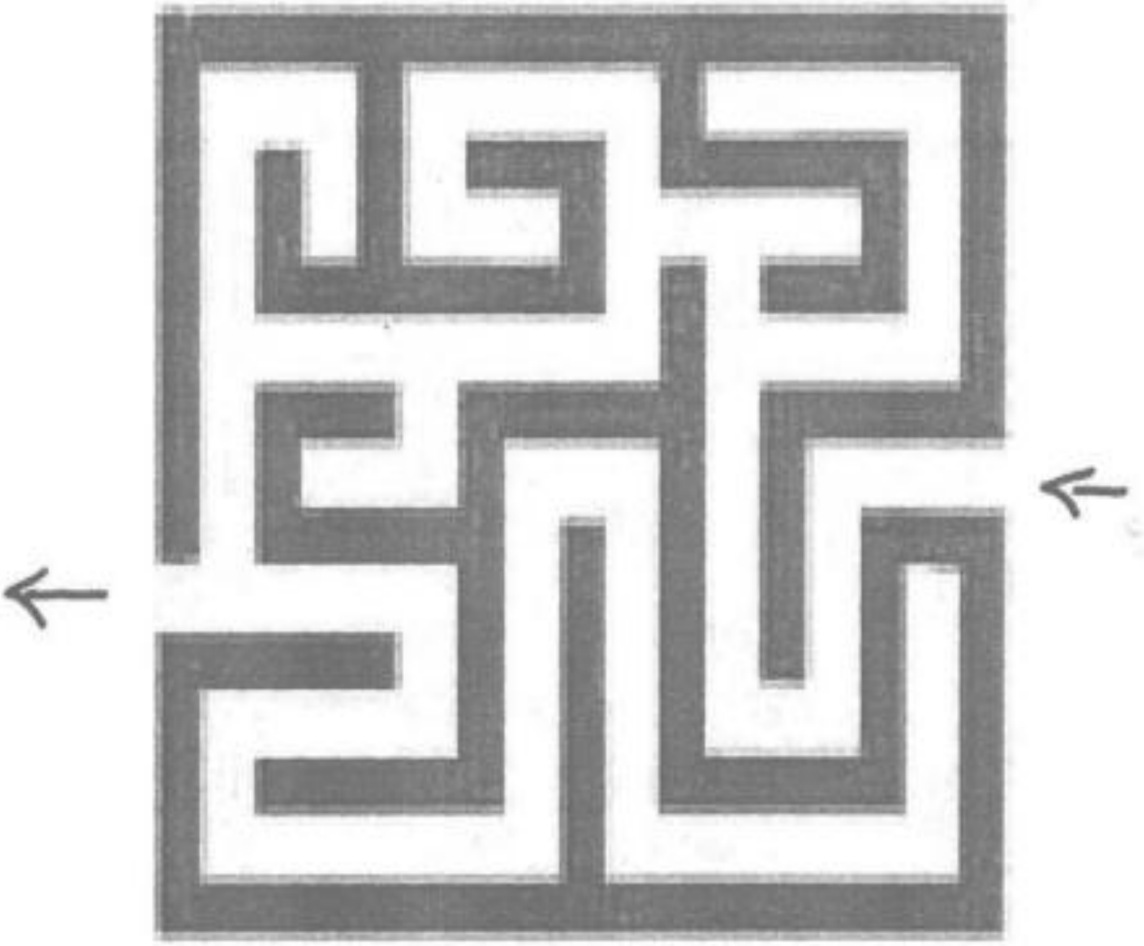
OT-IV



OT-V

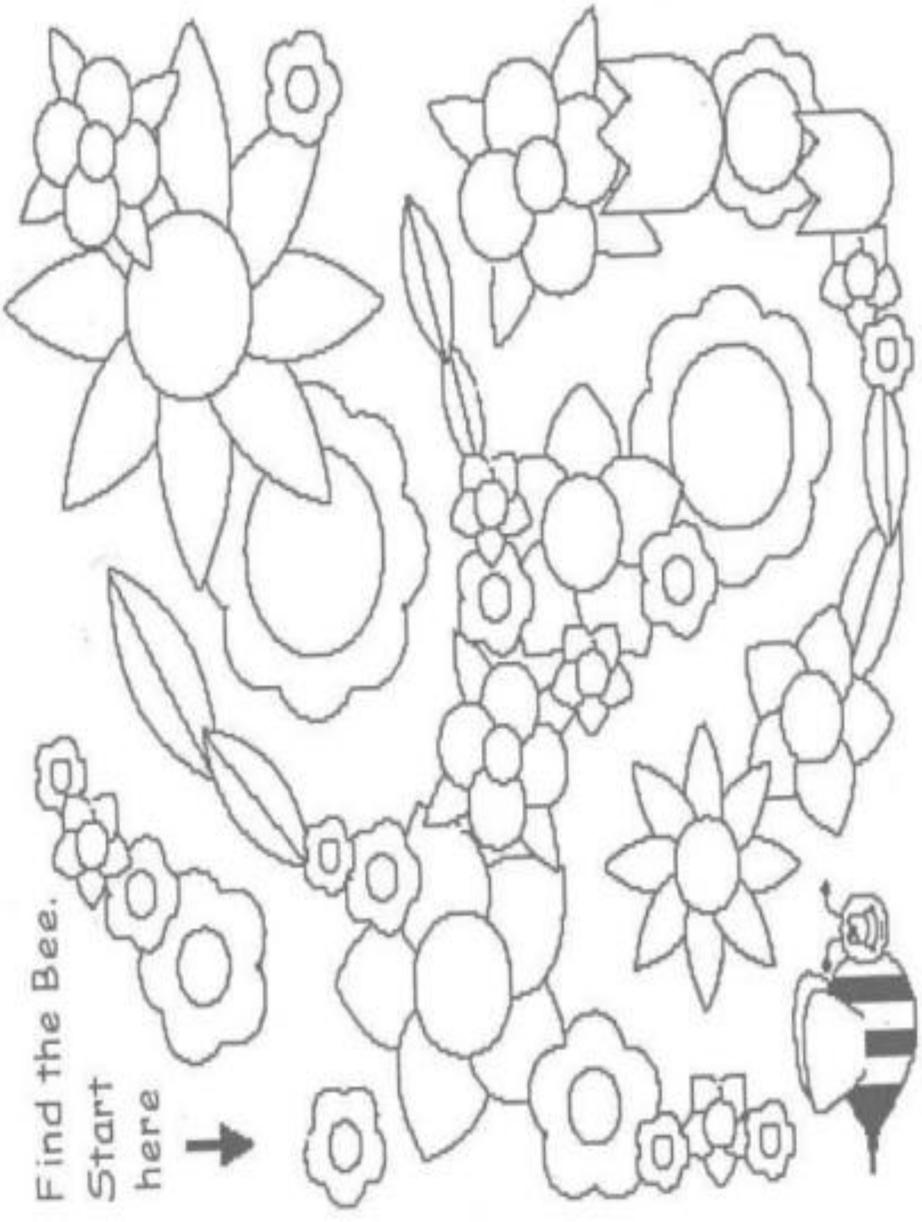
MAZES:

LEVEL-I



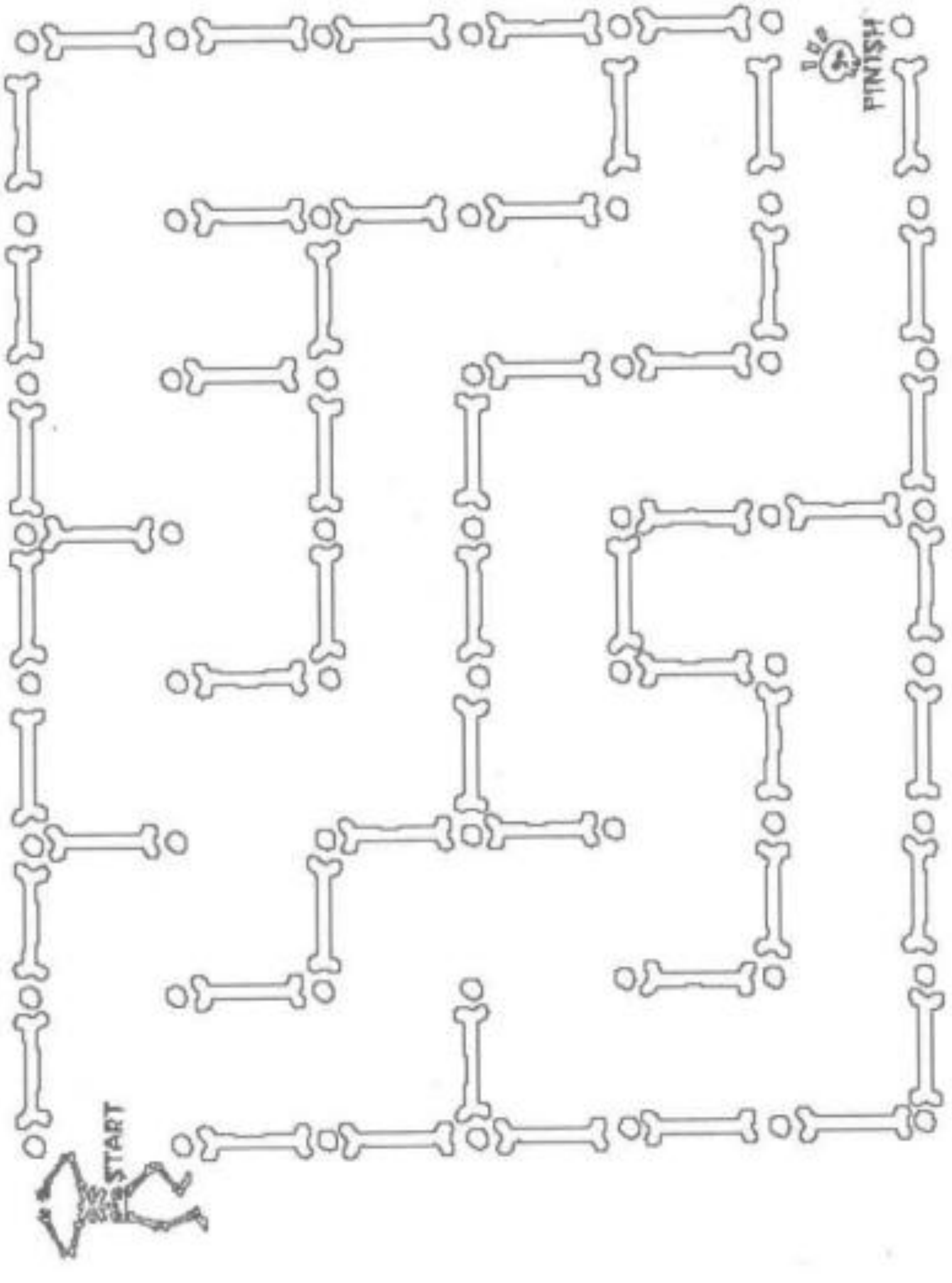
M-I

LEVEL-II



M-II

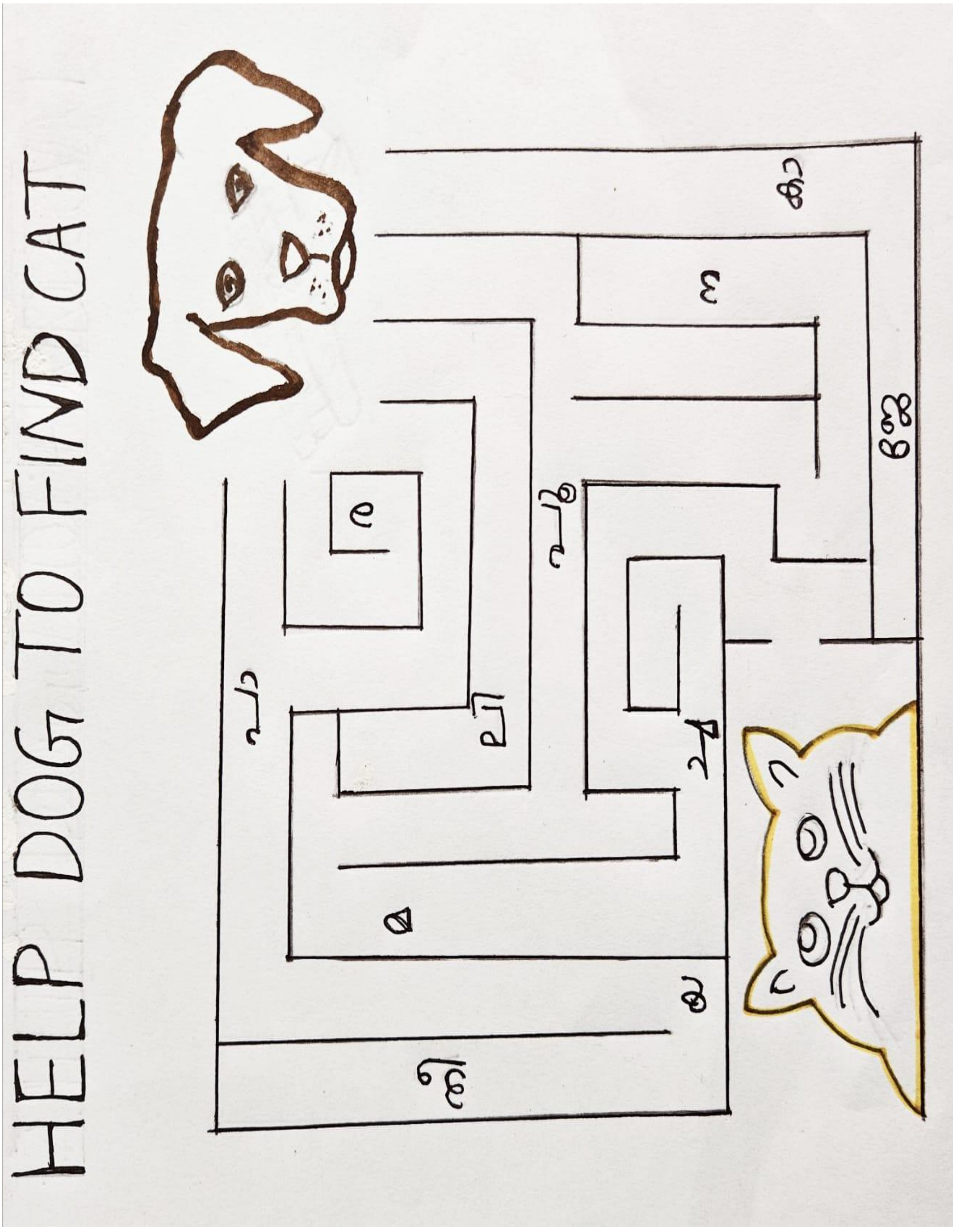
LEVEL-III



M-III

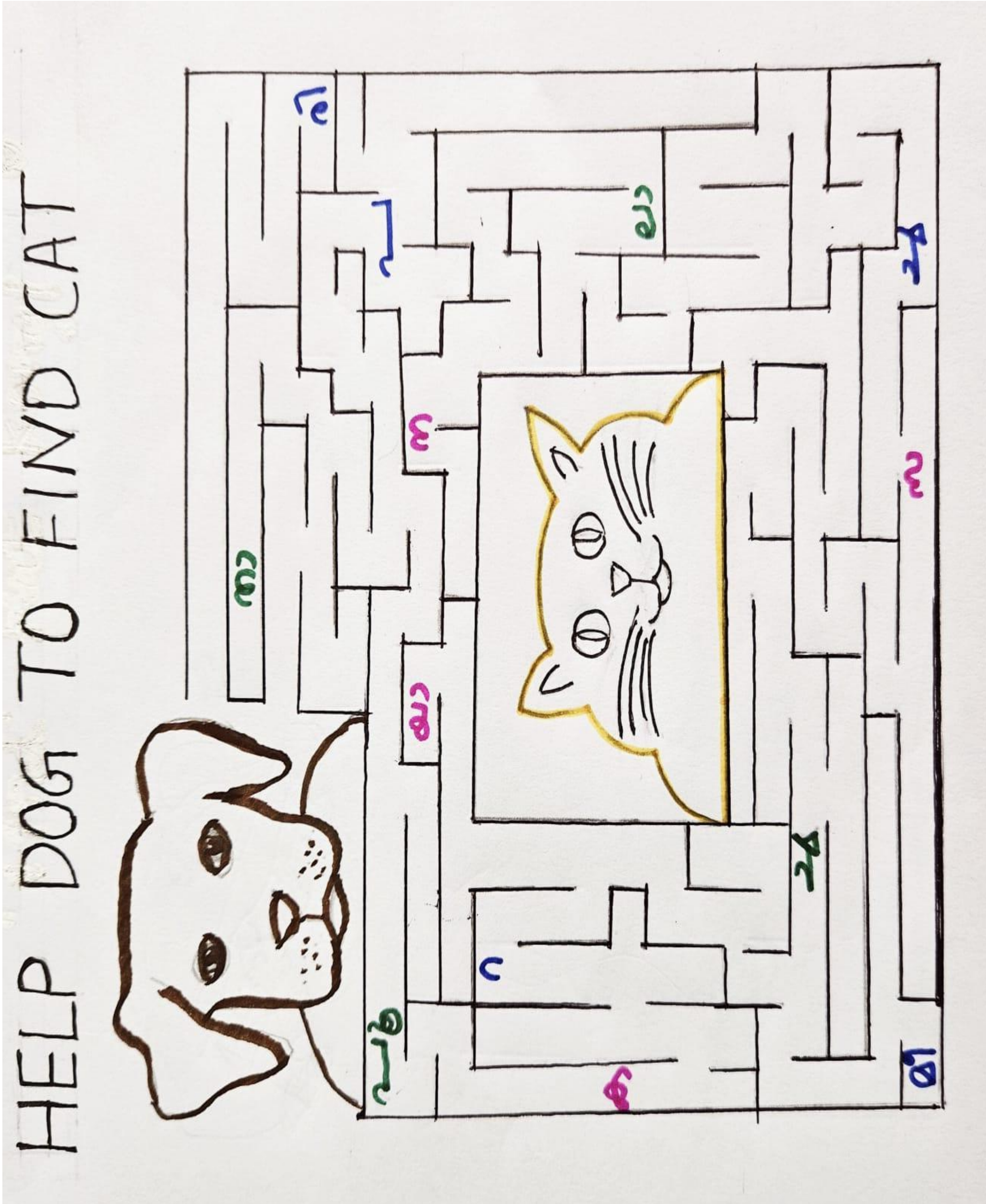
LEVEL-IV

പൂച്ചയെ കണ്ടെത്താൻ പട്ടിയെ സഹായിക്കൂ ...



LEVEL-V

പൂച്ചയെ കണ്ടെത്താൻ പട്ടിയെ സഹായിക്കൂ ...



APPENDIX D

SCORE SHEET

Name: Date:

Age/Gender: Grade:

SL NO.	AUDITORY MODE	SCORE	VISUAL MODE	SCORE
I	**ATTENTION/DISCRIMINATION**			
	Digit count test	/5	Odd one out test	/5
	Sound count test	/5	Letter cancellation	/5
	Auditory word discrimination	/10	Visual-word discrimination	/10
	TOTAL SCORE	/20		/20
II	**MEMORY**			
	Digit forward span	/5	Alternate sequence	/5
	Word recall	/5	Picture counting	/5
	Digit backward span	/5	Story sequencing	/5
	TOTAL SCORE	/15		/15
III	**PROBLEM- SOLVING**			
	Predicting the outcome	/10	Association task	/5
	Predicting the cause	/10	Overlapping test	/5
	Compare and contrast	/10	Mazes	/5
	TOTAL SCORE	/30		/15

Notes: