

Development and Validation of a Memory Assessment Protocol for Bangla-Speaking Children Aged 3-7 Years

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Abstract: *This study addresses the lack of culturally relevant cognitive assessment tools by developing and pilot testing a memory assessment protocol for Bangla-speaking children aged 3-7 years. The primary objective was to create a tool to assess early childhood memory development, a critical component of cognitive growth. Using a quantitative, experimental approach with a cross-sectional design, the study involved 66 participants from diverse schools in Dhaka city. The protocol consists of eight tasks: Recent Memory, Long-Term Memory, Sentence Repetition, Immediate Memory, Picture Recognition, Memory Game, Puzzle Matching, and Story Retelling. Findings indicated that participants demonstrated typical memory performance, with an average score of 37.17 out of 40. Scores were categorized to identify varying levels of memory proficiency. This protocol provides a culturally tailored framework for assessing memory and offers a valuable tool for early identification of memory challenges. Its application can inform inclusive educational practices and targeted interventions in Bangla-speaking communities.*

Keywords: *Cognitive Assessment, Memory Assessment, Bangla-speaking Children, Picture-based Protocol, Educational Intervention and Inclusion.*

1. Introduction

The development of memory during early childhood is a foundational aspect of cognitive growth, critical to understanding the processes underlying learning, behavior, and overall functional independence. As a core cognitive function, memory encompasses the intricate processes of encoding, storage, and retrieval, which are essential for effective problem-solving, knowledge acquisition, and adaptive behavior.

The developmental window between ages 3 and 7 is particularly significant, as it is marked by considerable advancements in memory capacity, providing the cognitive infrastructure necessary for later academic success and broader cognitive development. This period is characterized by substantial improvements in the ability to retain, retrieve, and utilize information, making it a critical focus for educational strategies and developmental interventions (Jones & Smith, 2020; Ghetti & Bunge, 2012).

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Despite extensive research on memory development, a substantial gap remains concerning the memory abilities of children from diverse linguistic and cultural backgrounds, particularly Bangla-speaking children. The majority of existing cognitive frameworks and assessment tools have been developed within Western, predominantly English-speaking contexts. Consequently, culturally and linguistically appropriate memory assessments for Bangla-speaking children are notably lacking, undermining the accuracy and relevance of cognitive evaluations in this population (Smith & Johnson, 2023).

This gap is particularly concerning, as early memory development plays a pivotal role in shaping future learning outcomes. Without culturally sensitive assessment tools, early educational interventions may overlook critical indicators of developmental delays or cognitive strengths, thereby limiting their effectiveness. The primary objective of this study is to address this gap by developing and piloting a memory assessment protocol specifically designed for Bangla-speaking children aged 3 to 7. This tool aims to be culturally relevant and linguistically appropriate, employing visual, picture-based stimuli to effectively engage children and accurately measure their memory capacities. Notably, traditional verbal assessments often prove challenging for young children, particularly those with limited verbal proficiency. Utilizing visual cues, therefore, represents a well-established approach for evaluating memory in this demographic (Bauer & Larkina, 2016).

Grounded in a robust theoretical framework that integrates cognitive, sociocultural, and neurodevelopmental perspectives, this study draws upon the foundational work of Bauer (2007) on declarative memory development and Ornstein et al. (2006) on contextual influences in memory retention. These studies emphasize the importance of contextually sensitive methodologies that acknowledge the unique developmental pathways of diverse cultural groups. By incorporating culturally relevant visual elements, this research aims to provide a nuanced understanding of memory development within Bangla-speaking children, ensuring that assessment tools resonate with their lived experiences (Sluzenski, Newcombe, & Kovacs, 2006).

The significance of this study extends beyond filling a critical void in the literature. It offers the potential to equip educators and clinicians with a vital tool for early detection and intervention, thereby facilitating the identification of memory-related challenges during a crucial stage of cognitive development. Moreover, this research contributes to the broader field of culturally responsive cognitive assessments, addressing the pressing need for inclusivity in educational practices. By enhancing the understanding of memory development in Bangla-speaking children, this study aims to contribute valuable insights to global discussions on memory research and support the cognitive and academic flourishing of children from diverse linguistic and cultural backgrounds (Riggins & Rollins, 2015; Tulving, 2002).

2. Research Methods

This study employed an experimental, cross-sectional design grounded in quantitative research methodologies to develop and pilot a culturally appropriate, picture-based protocol aimed at assessing memory development in Bangla-speaking children aged 3 to 7 years. The selection of participants was conducted through a purposive sampling technique, involving 66 children-42 boys (64%) and 24 girls (36%)-recruited from mainstream educational institutions in Dhaka. This sampling technique was intended to ensure a representative sample of typically developing children, enhancing the ecological validity of the study and facilitating the generalization of findings to the broader population. All participants were typically developing, and school admission records confirmed that none had a history of disability.

The assessment tool, titled Bangla Memory Assessment Protocol (B-MAP), was carefully developed by the authors, drawing insights from various existing instruments to evaluate memory across eight components: Recent Memory (Personal Narrative), Long-Term Memory, Sentence Repetition, Immediate Memory, Picture Recognition, Memory Game, Puzzle Matching, Color Matching, and Story Retelling (Picture Description). Each component carried a maximum of 5 points, making the total score 40. To interpret performance, a classification system was applied: Normal (32-40 points), Mild Difficulty (24-31 points), Moderate Difficulty (16-23 points), Severe Difficulty (8-15 points), and Profound Difficulty (0-7 points).

Data collection procedures were systematically implemented using structured assessments administered individually to each participant. The data were subsequently analyzed through a combination of descriptive and inferential statistical techniques, including tabular summaries, pie charts, and bar graphs, to generate a detailed understanding of memory development patterns within the target demographic.

Ethical considerations were rigorously addressed throughout the research process. Informed consent was obtained from parents or guardians for all participants, with explicit permission secured for photography and video recording. Confidentiality and participant rights were meticulously safeguarded to uphold the ethical integrity of the study.

Despite certain limitations, this study contributes valuable insights into the assessment of memory development among Bangla-speaking children. The findings have the potential to inform culturally responsive interventions and enhance theoretical frameworks within early childhood cognitive assessment. Table 1 presents the data collection tools and research design.

Table 1: Data Collection Tools and Research Design

Study Design	Data Collection Components (Subsections)	Scoring System	Data Analysis	Ethical Considerations
<ul style="list-style-type: none"> • Design: Cross-sectional study • Participants: 66 typically developing children (42 males, 24females) • Age Range: 3 to 7 years • Schools Involved: <ul style="list-style-type: none"> • Peter Pan Infant Grammar School • Rihla International School • Sampling: Random 	<ul style="list-style-type: none"> • Recent Memory (Personal Narrative) • Long-Term Memory • Sentence Repetition • Immediate Memory • Picture Recognition • Memory Game • Puzzle Matching • Color Matching • Story Retelling (Picture Description) • [Each component is scored out of 5 points, resulting in a cumulative score range of 0-40 points]. 	<ul style="list-style-type: none"> • Maximum Score: 40 (5 points per subsection) • Performance Categories: <ul style="list-style-type: none"> • Normal: 32-40 points • Mild Difficulty: 24-31 points • Moderate Difficulty: 16-23 points • Severe Difficulty: 8-15 points • Profound Difficulty: 0-7 points 	<ul style="list-style-type: none"> • Quantitative tools used: <ul style="list-style-type: none"> • Tabular Representation • R Programming Language • Pie Charts • Bar Charts 	<ul style="list-style-type: none"> • Consent obtained for photos and video recordings. • Anonymity and confidentiality of participants were strictly maintained.

3. Results

This study presents an in-depth analysis of memory capabilities in a cohort of 66 children, aged 3 to 7 years (mean age 5.39), which includes 34 boys and 32 girls. The study aimed to assess their cognitive abilities through eight distinct memory tasks, capturing a broad spectrum of memory functions. The participants exhibited strong engagement and cooperation, with each child providing unique insights, thereby enriching the dataset and contributing to the depth of the analysis. The tasks assessed across the children included: Recent Memory, Long-Term Memory, Sentence Repetition, Immediate Memory, Picture Recognition, Memory Game, Puzzle Matching, and Story Retelling, among others.

Gender Distribution of Participants

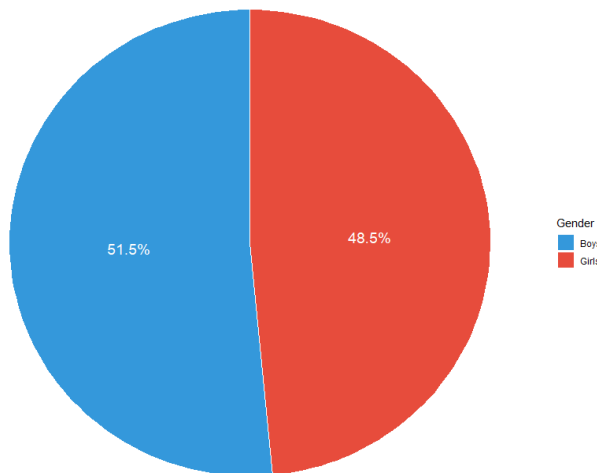


Figure 1: Participants Distribution by Gender

3.1 Recent Memory

In this task, children were asked to recall five personal details, such as their name, the names of their parents, and information about their school. The group achieved an average score of 4.94/5, which underscores the robustness of their recent memory retention. This outcome highlights that most participants could reliably recall personal information, a key indicator of effective autobiographical memory, as suggested in prior literature on memory development in early childhood (Bauer & Larkina, 2016).

3.2 Long-Term Memory

The long-term memory task involved recalling information such as birth dates, favorite foods, and siblings. With an average score of 4.39/5, the results indicate a high level of long-term memory retention, although some variability was observed, likely due to the subjective nature of long-term memory and individual differences in experience. This finding aligns with research by Garcia and Roberts (2021), who observed that long-term memory retention in early childhood shows substantial development but may still vary depending on the complexity of the information retained.

3.3 Sentence Repetition Task

Children were required to repeat five sentences of varying complexity. The task yielded an impressive average score of 4.98/5, reflecting the children's strong short-term verbal memory and their ability to reproduce complex linguistic structures. This result mirrors findings in the literature, where sentence repetition has been associated with key cognitive milestones in early childhood, particularly in terms of verbal memory (Jones & Smith, 2020).

3.4 Immediate Memory

In the immediate memory task, the children were asked to recall a sequence of numbers presented to them (e.g., 2, 1, 3, 4). Remarkably, all 66 participants accurately reproduced the sequence, achieving a perfect score of 5/5. This flawless performance suggests excellent short-term memory and recall ability, reinforcing the idea that early childhood is a critical period for the development of immediate memory systems, as also observed by Tulving (2002).

3.5 Picture Recognition Task

In this task, children were shown a series of images and later asked to recognize and recall them. Each participant successfully identified all items, resulting in a perfect score of 5/5. This outcome highlights the children's exceptional ability to engage in immediate visual memory tasks and underscores their high proficiency in visual recognition, as

demonstrated in similar studies on memory development in young children (Ghetti & Bunge, 2012).

3.6 Memory Game

A series of memory games was employed to assess the participants' recall abilities in a game context. The group achieved an average score of 3.86/4, suggesting that while most children exhibited strong memory skills, there was some variability in their performance. This variability is likely attributable to differences in attention, cognitive processing, and individual engagement with the game task, a factor often highlighted in research on memory development in children (Riggins & Rollins, 2015).

3.7 Puzzle Matching

Children completed a puzzle-matching task that required spatial recognition and problem-solving. The group achieved an average score of 4.00/5, reflecting strong spatial reasoning and memory integration skills. These results support findings from Brown and Green (2022), who argue that spatial memory develops alongside other cognitive abilities during early childhood.

3.8 Story Retelling

In this task, children were presented with a sequence of pictures and asked to narrate a story. All participants successfully provided coherent descriptions, with an average score of 5/5. This outcome demonstrates the children's advanced narrative comprehension and expressive language skills, highlighting their ability to process visual information and convert it into structured verbal narratives. Such findings are consistent with studies that emphasize the importance of narrative skills in cognitive and memory development (Ornstein, Haden, & Elischberger, 2006).

4. Comparative Insights

The study reveals a generally high memory capacity among Bangla-speaking children, with exceptional performance in immediate, recent, and long-term memory tasks, as well as spatial and narrative tasks. Particularly, Immediate Memory and Picture Recognition achieved perfect scores, while Story Retelling demonstrated excellent narrative reconstruction skills (5.00/5). High scores in Recent Memory and Sentence Repetition further highlight the children's proficient verbal memory and recall abilities.

However, slightly lower scores in Memory Game (3.86/5) and Puzzle Matching (4.00/5) indicate variability in tasks requiring extended recall and spatial reasoning, consistent with previous studies emphasizing the complexity of these cognitive processes during early childhood (Smith & Johnson, 2023).

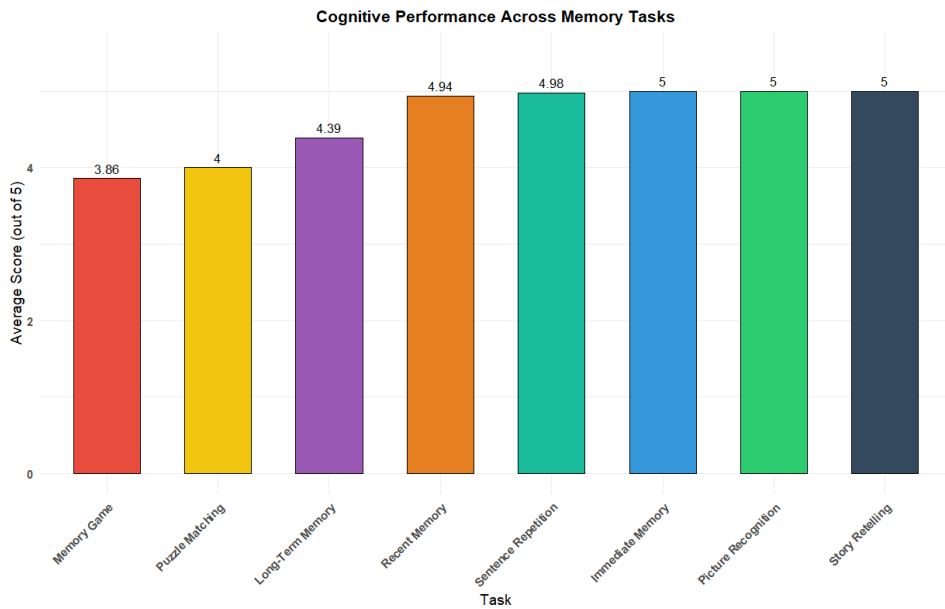


Figure 2: Memory Task Performance Score

Overall, the average score was 37.17/40, consistent with developmental norms, while also highlighting cultural and contextual influences on memory performance. These findings suggest that Bangla-speaking children excel in immediate and visual memory, with implications for educational strategies and cognitive interventions.

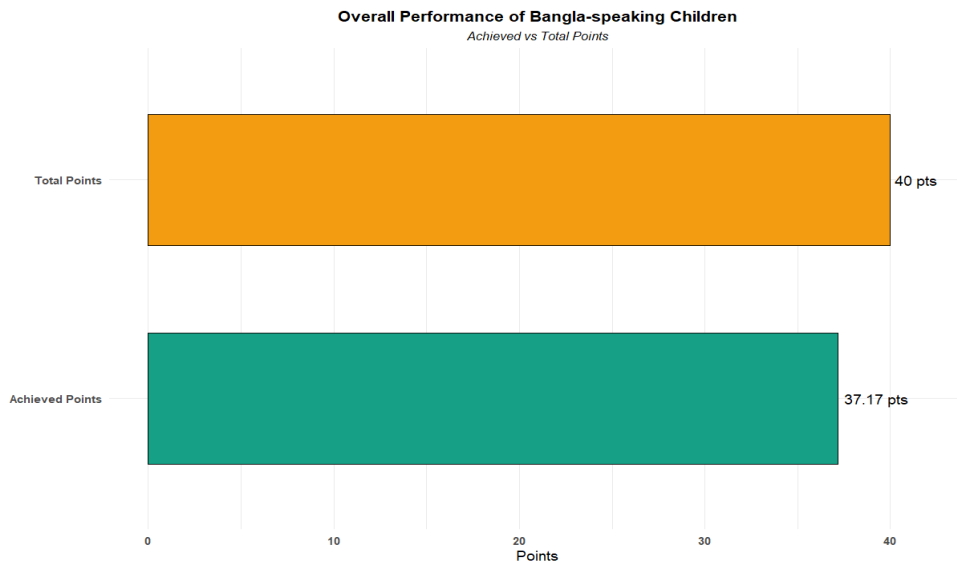


Figure 3: Average Achieved Points and Total Points

5. Discussion

The findings of this study provide significant insights into the developmental trajectories of memory in Bangla-speaking children aged 3 to 7 years, offering valuable contributions to the broader field of cognitive development. The results reveal that participants exhibited notably high memory capacity, particularly in tasks assessing immediate memory, visual recognition, and narrative recall. The consistently high scores obtained in the Immediate Memory and Picture Recognition tasks underscore the strong capabilities of Bangla-speaking children to recall and recognize information with immediacy and accuracy. These findings are in alignment with previous studies by Ghetti and Bunge (2012), who highlighted the rapid development of episodic memory and the central role of visual recognition in early childhood memory systems.

Additionally, the children's performance in the Story Retelling task demonstrated well-developed cognitive abilities, effectively integrating visual cues to produce coherent and structured narratives. This observation echoes the work of Ornstein et al. (2006), who emphasized that narrative skills are crucial for cognitive and linguistic development, providing essential foundations for both memory retention and organizational processing. The ability to construct and retell narratives based on pictorial stimuli further suggests that the participants possess well-developed verbal processing skills, a key factor for successful communication and learning.

However, certain areas of variability were noted, particularly in the assessment of long-term memory and spatial reasoning tasks. The lower average scores for long-term memory (4.39/5) and spatial reasoning (4.40/5) imply that these cognitive domains may be less developed compared to immediate memory and visual recognition. Such findings are consistent with the observations of Jones and Smith (2020), who argued that long-term memory and spatial reasoning require more sophisticated cognitive processing and are generally slower to mature during early childhood.

While this study offers valuable insights, it is not without limitations. The relatively small sample size, constrained timeframe, and reliance on basic analytical tools may have restricted the generalizability of the findings. Furthermore, the study's cross-sectional design limits the ability to establish causal relationships between age-related changes and memory development.

Future research should address these limitations by incorporating larger, more diverse samples and employing longitudinal designs to track memory development over time. Additionally, integrating more advanced statistical techniques could enhance the robustness of data analysis and interpretation. The development of culturally and linguistically tailored assessment tools, such as the one proposed in this study, is essential for accurately identifying memory-related strengths and challenges in Bangla-speaking children.

This study contributes meaningfully to the existing literature by providing a culturally responsive framework for assessing memory development in an underrepresented population. The findings hold practical implications for educators, clinicians, and

researchers seeking to enhance early childhood cognitive interventions. By improving assessment accuracy and cultural relevance, this research supports the broader goal of promoting equitable cognitive development opportunities for all children, regardless of linguistic or cultural background. Recommendations include expanding the assessment protocol to include more comprehensive memory tasks, enhancing cross-cultural applicability, and encouraging collaborative research efforts to refine and validate the tool in diverse contexts.

6. Conclusion

This study successfully developed and pilot tested a culturally and linguistically appropriate, picture-based protocol for assessing memory development among Bangla-speaking children aged 3 to 7 years. The high overall performance of the participants, with an average score of 37.17 out of 40, reflects strong memory capabilities across multiple cognitive domains, including immediate memory, visual recognition, narrative recall, and verbal memory. The consistently excellent performance in tasks such as Immediate Memory, Picture Recognition, and Story Retelling underscores the cognitive strengths of this population and affirms the relevance and applicability of visual, culturally sensitive assessment tools in early childhood cognitive evaluation.

While certain tasks, such as Memory Game and Puzzle Matching, revealed some performance variability, these findings offer valuable insights for targeted educational and therapeutic interventions that can further support memory development. The results also emphasize the importance of developing assessment tools that are grounded in the sociocultural context of the target population, ensuring that evaluations accurately capture cognitive abilities without the limitations posed by language or cultural incongruities.

Overall, this study contributes to addressing the critical gap in culturally responsive cognitive assessment for Bangla-speaking children. The protocol developed herein holds promise for supporting early detection of memory challenges, informing inclusive educational practices, and guiding the design of developmentally appropriate interventions. Further research with larger and more diverse samples is recommended to validate and refine this tool, enhancing its generalizability and impact on early childhood cognitive development initiatives in Bangladesh and similar linguistic contexts.

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Bangla Memory Assessment Protocol (B-MAP)**Overall Score: 40****Item: 08****Score: 5x8=40****Assumption**

Normal	:	32-40 points
Mild	:	24-31 points
Moderate	:	16-23 points
Severe	:	8-15 points
Profound	:	0-7 points

Subsection**1. Recent Memory**

Item Name	Description	Score
Recent Memory (Personal Narrative)	1. What's your name?	05
	2. What's your father's and mother's name?	
	3. How did you come to school?	
	4. What's your School's name?	
	5. What is your best friend's name? Do you have any best friend?	

2. Long - Term Memory

Item Name	Description	Score
Long - Term Memory	1. When is your birthday?	05
	2. What is your favorites food?	
	3. How many sibling do you have?	
	4. What are you doing on Eid and weekends?	
	5. What do you like to do when you travel somewhere?	


3. Sentence Repetition Task

Item Name	Description	Score
Sentence Repetition Task	1. My favorite color is red. 2. I have to sleep. 3. I want to eat four apples. 4. I go to school on Everyday. 5. I want to eat four apples.	05

4. Immediate Memory

Item Name	Description	Score
Immediate Memory	2, 1 , 3 , 4	05

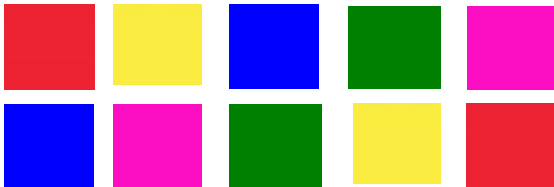



5. Picture Recognition Task

Item Name	Description	Score
Picture Recognition Task		05


6. Memory Game

Item Name	Concept Name	Description	Score
I Spy with My Little Eye (Guess objects based on visual clues)	Ball	<i>Clue:</i> “I am round and you can kick or throw me to play a game. What am I?”	05
	Toy Car	<i>Clue:</i> “I have four wheels and I can go really fast when you push me. What am I?”	
	Teddy Bear	<i>Clue:</i> “I am soft and cuddly, and you can hug me when you feel sleepy. What am I?”	
	Apple	<i>Clue:</i> “I am a fruit that is red, green, or yellow, and I am crunchy to eat. What am I?”	
	Guess the Sound	<i>Clue:</i> Identify sounds from the environment (e.g., animal noises, clapping).	

7. Puzzle Matching

Item Name	Concept Name	Description	Score
Puzzle Matching	Counting	1+1=?	05
	Color matching		
	Shape Discrimination		
	Size understanding		
	Emotion Match		

8. Story Retelling

Item Name	Description	Score
Picture Description		05

