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# Construction and Standardization of the Metacognition Scale

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## Abstract

The present study aimed to construct and standardize a Metacognition Scale specifically designed to assess the metacognitive abilities of Under Graduate students. Grounded in both classical and contemporary theoretical frameworks, the scale was developed to encompass four key dimensions of metacognition: Knowledge of Cognition, Regulation of Cognition, Control of Cognition, and Experiences of Cognition. Each dimension was operationalized through clearly defined sub-dimensions, reflecting the multifaceted nature of metacognitive processes, including planning, monitoring, adaptability, and self-reflective awareness. The item pool was generated through an extensive review of literature and refined with the input of educational experts to ensure content relevance, linguistic clarity, and cultural appropriateness. Following pre-try-out and try-out stages, the scale underwent item analysis using the upper (27%)-lower (27%) group method and t-tests, leading to the retention of 36 effective items, balanced across the four dimensions. These were formatted into a five-point Likert scale, including both positive and negative statements to mitigate response bias. Reliability testing through the test-retest method indicated a statistically significant but weak negative correlation ($r = -0.247$, $p = 0.039$), suggesting a need for further refinement in temporal stability. However, the scale demonstrated strong content, face, and internal validity, confirmed by expert judgment and statistical analysis. By addressing gaps in existing tools and integrating underexplored dimensions such as control and experiences of cognition, this instrument offers a comprehensive, psychometrically sound means of evaluating metacognitive development in Under Graduate students. The scale holds promise for use in educational diagnostics, intervention planning, and further academic research.

**Keywords:** Metacognition, Under Graduate Students.

## 1. Introduction

The construction of a Metacognition scale required the researcher to identify and include relevant areas that could comprehensively represent the dimensions of metacognition. This process was essential to ensure the test's validity and relevance in assessing the metacognitive abilities of Under Graduate students. Metacognition broadly defined as “awareness and control of thinking for learning” is fundamental to effective self-regulated learning. It empowers students to intentionally plan, monitor, regulate, and evaluate their cognitive processes, fostering deeper comprehension and academic achievement (files.eric.ed.gov). Pioneering frameworks (Flavell, 1979; Brown, 1978; Schraw & Dennison, 1994) typically conceptualize

metacognition across two core components knowledge of cognition and regulation of cognition. However, contemporary scholarship argues for expanded models, introducing aspects such as control of cognition and experiences of cognition, which encompass students' capacity to shape their learning environment and reflect on metacognitive phenomena through lived experience (link.springer.com). Knowledge of cognition refers to an individual's declarative, procedural, and conditional knowledge about cognition knowing what one understands, how strategies operate, and when to deploy them. Meanwhile, regulation of cognition encompasses strategic planning, ongoing monitoring, and evaluative adjustments during task execution (researchgate.net). Expanding these foundations, control of cognition involves the active manipulation and modification of cognitive and environmental parameters such as time management, strategic modulation of difficulty, and selective attention that influence learning outcomes (files.eric.ed.gov). Complementarily, experiences of cognition refer to the subjective phenomenological aspects of metacognition: the internal awareness of confusion, certainty, cognitive ease or difficulty that accompany distinct learning episodes. Recent psychometric reviews emphasize that truly comprehensive metacognitive assessment must encompass all four dimensions knowledge, regulation, control, and experience to capture the complexity of introspective learning processes. Against this backdrop, this study addresses the need for a robust, multidimensional metacognition scale tailored to undergraduate contexts. Specifically, it aims to operationalize and psychometrically validate four dimensions.

**1.1 Dimensions of Metacognition:** MC often described as "thinking about thinking," plays a crucial role in cognitive processes and learning outcomes. Understanding the dimensions of metacognition is essential for unravelling its complexities and implications in various domains, including education, psychology, and cognitive science. This thesis delves into the multifaceted nature of metacognition, exploring its dimensions and their significance in cognitive functioning and academic achievement. The dimensions of metacognition encompass a range of cognitive processes and skills that individuals employ to monitor, regulate, and evaluate their thinking and learning strategies.

**Dimensions of Metacognition**

**1.1.1 Knowledge of cognition:** Knowledge of cognition refers to an individual's understanding and awareness of cognitive processes, strategies, and tasks. It pertains to individuals' understanding of their own cognitive processes or cognition in general. This includes concepts related to how we think, such as self-awareness of knowledge, self-perception of intelligence, memory abilities, attentional capacities, study techniques, and other cognitive aspects.

**The dimension of metacognition related to knowledge of cognition includes several sub-dimensions:**

**i. Declarative Knowledge:** This refers to the factual knowledge about cognitive processes, strategies, and tasks. It includes understanding concepts, principles, facts, and vocabulary related to cognition. For example, knowing the steps involved in problem-solving or understanding the components of effective learning strategies.

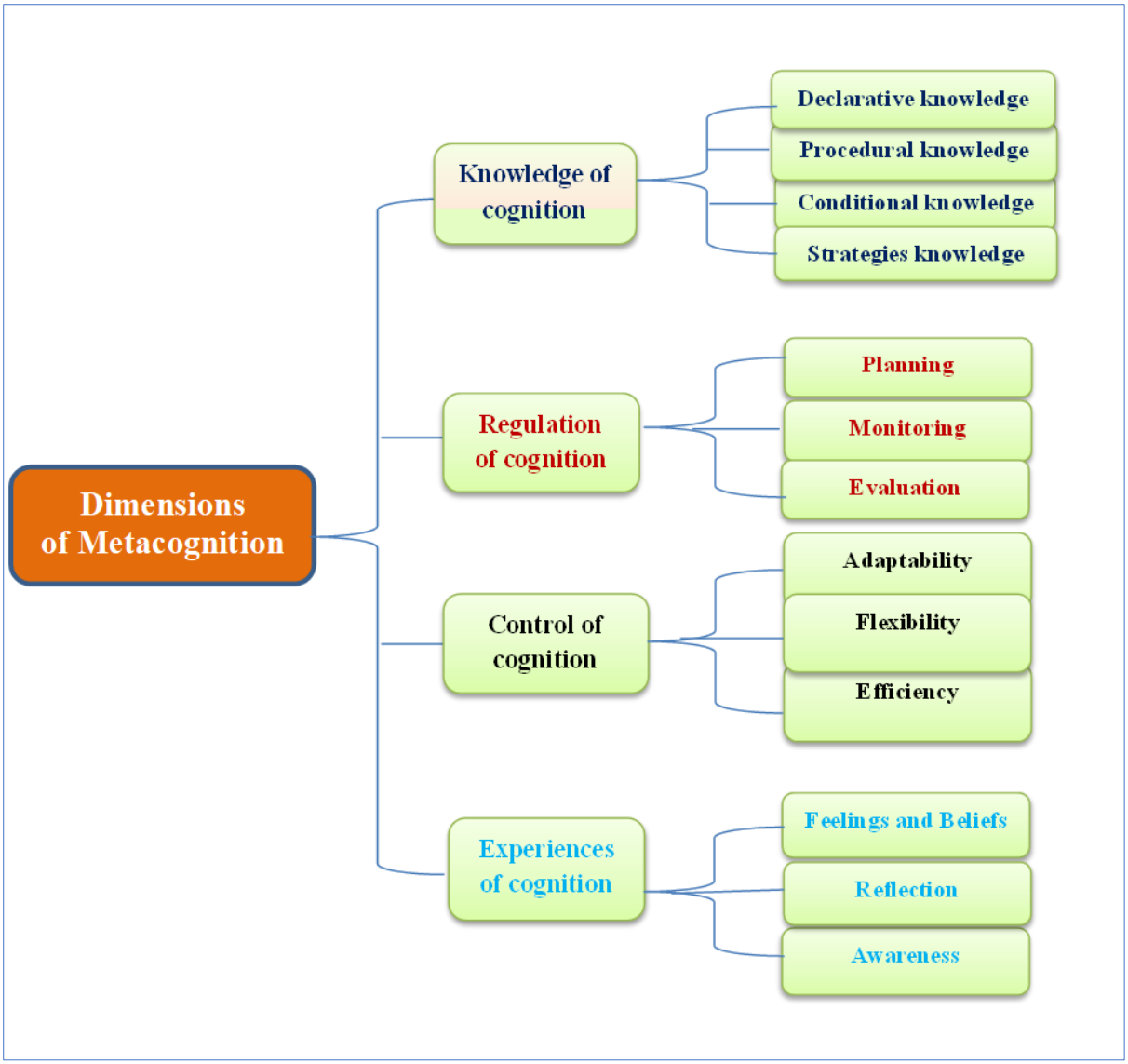


**Fig.-1: Diagram showing the Dimensions of Metacognition**

**ii. Procedural Knowledge:** This involves knowledge about how to perform cognitive tasks or use cognitive strategies. It includes knowing the steps, procedures, and sequences involved in executing cognitive processes effectively. For instance, understanding how to apply problem-solving strategies or study techniques.

**iii. Conditional Knowledge:** This refers to knowledge about when and why to use specific cognitive strategies or apply certain cognitive processes. It includes awareness of contextual factors, situational cues, and conditions that influence the selection and application of cognitive strategies. For example, knowing when to use a particular memory strategy based on the type of information being learned.

**iv. Strategies Knowledge:** This encompasses knowledge about various cognitive strategies, techniques, and approaches that can be used to enhance learning, problem-solving, and cognitive tasks. It includes knowledge of effective study strategies, memory techniques, problem-solving methods, and metacognitive strategies.

**1.1.2. Regulation of cognition:** The dimension of metacognition related to the regulation of cognition involves the processes and strategies individuals use to control and manage their cognitive activities. This dimension is essential for effective learning and problem-solving. It can be broken down into three main sub-dimensions: Planning, Monitoring, and Evaluation.

**i. Planning:** Planning involves setting goals, devising strategies, and organizing resources to achieve desired outcomes. In metacognition, planning refers to the cognitive processes individuals engage in before tackling a task or problem. Effective planning in metacognition enhances cognitive efficiency, time management, and task performance. It helps individuals stay focused, organized, and proactive in their cognitive activities.

**ii. Monitoring:** Monitoring involves on-going assessment and observation of one's cognitive processes, performance, and progress during task execution. Being conscious of one's thinking processes, strategies, and mental activities. Noticing and identifying errors, misconceptions, or inconsistencies in understanding or problem-solving.

**iii. Evaluation:** Evaluation involves critical reflection, assessment, and judgment of one's cognitive processes, strategies, and outcomes after task completion. Incorporating evaluation feedback to refine future strategies and enhance learning outcomes.

**1.1.3. Control of cognition:** The dimension of metacognition related to the Control of Cognition encompasses the ability to manage and regulate cognitive processes to achieve optimal performance. This dimension is crucial for adapting to new situations, solving problems, and efficiently processing information. It can be further divided into three key sub-dimensions: Adaptability, Flexibility, and Efficiency.

**i. Adaptability:** Adaptability refers to the ability to adjust cognitive strategies in response to changing demands and new information. The capacity to shift attention and strategies when faced with new or unexpected challenges. Applying lessons learned from previous experiences to new situations. Resilience: The ability to recover from setbacks and persist in the face of difficulties. Open-Mindedness: Being receptive to new ideas, perspectives, and approaches.

**ii. Flexibility:** Flexibility is the ability to modify one's cognitive approach to suit different tasks or problems. Using a range of cognitive strategies depending on the task requirements. Adapting problem-solving methods to fit the specific context of a problem. Considering multiple viewpoints and approaches before deciding on a strategy. Comfort with uncertainty and the ability to navigate ambiguous situations.

**iii. Efficiency:** Efficiency involves optimizing cognitive processes to achieve goals with minimal wasted effort or resources. Allocating appropriate time to tasks and managing time effectively. Using cognitive resources, such as attention and memory, effectively. Identifying and focusing on the most critical aspects of a task. Accomplishing objectives in a timely and resource-efficient manner.

**1.1.4. Experiences of cognition:** The dimension of metacognition related to the experiences of cognition encompasses how individuals perceive, reflect on, and become aware of their cognitive processes. This dimension can be divided into three main sub-dimensions: Feelings

and Beliefs, Reflection, and Awareness. Each of these sub-dimensions plays a crucial role in shaping how individuals understand and manage their learning and thinking processes.

**i. Feelings and Beliefs:** Feelings and Beliefs refer to the emotional and cognitive attitudes individuals hold about their thinking processes and learning experiences. Beliefs about one's ability to perform tasks successfully. High self-efficacy can lead to greater persistence and effort, while low self-efficacy may result in avoidance and disengagement. How confident individuals feel about their knowledge and skills.

**ii. Reflection:** Reflection involves the process of thinking critically about one's own cognitive experiences and learning processes. Evaluating one's understanding, strategies, and performance. This helps identify strengths and areas for improvement.

**iii. Awareness:** Awareness is the conscious recognition and understanding of one's cognitive processes. Awareness of one's own cognitive abilities, strategies, and the factors that influence cognitive performance. This includes declarative, procedural, and conditional knowledge.

Apart from the above four main dimensions, some psychologists have discussed two more aspects. Among them are Skills of cognition and Social of cognition. S.G.Parris and P. Winograd discuss these issues in "How metacognition can promote academic learning and instruction" in 1990, P.R.Pintrich in "The role of goal orientation in self-regulated learning" in 2000, D.F.Halpern in "Teaching critical thinking for transfer across domains: Dispositions, skills, and metacognitive monitoring" in 1998, and Meyer in "Cognitive, metacognitive, and motivational aspects of problem solving" in 1998.

By constructing and validating this scale, the current work seeks to offer researchers and educators a theoretically grounded, psychometrically sound instrument that broadens metacognitive measurement beyond existing tools. This in turn supports more effective diagnostic, interventive, and instructional practices aimed at enhancing Under Graduate learning. To ensure the test's relevance and precision, each dimension and its associated items underwent thorough evaluation by seasoned educational experts. Their insightful feedback played a crucial role in reshaping both the structure and content, thereby improving the instrument's consistency and overall effectiveness.

## 2. Review of Literature

In the present study the researcher has made use of related books, abstracts encyclopaedias, thesis, dissertations and journals in order to understand the problem "Construction and Standardization of the Metacognition Scale". Below

**Das (2023)** conducted a study on "Metacognition, locus of control, spiritual intelligence and academic achievement of the B.Ed. trainees". The main goals were to check the level of metacognition among B. Ed. trainees and look for big differences based on factors like gender, where they live, which stream they studied in, and the type of Teacher Education Institution (TEI) they were part of. The study used a descriptive survey method within a quantitative research setup. The population included all 4th-semester B. Ed. trainees from different TEIs connected with Dibrugarh University in Assam. From eight districts four Lakhimpur, Jorhat, Dhemaji, and Sibsagar were chosen randomly using a lottery method. To summarize the data,

the researcher used descriptive statistics like mean and standard deviation. To find connections between the variables, Pearson correlation was used. To see differences between the averages of the variables, a t-test was applied. Multiple linear regression was used to find out how much the independent variables affected the dependent variable. The study found that there was no big difference in metacognition levels between male and female students or between students from different areas.

**Siddiqui (2022)** conducted a study on "Metacognition, Locus of Control, Emotional Intelligence and Achievement Motivation as Correlates of Academic Achievement". The main goals were to check how academic achievement is connected with metacognition, locus of control, emotional intelligence, and achievement motivation among Class XI students. The study used a causal-comparative and correlational survey method as part of descriptive research. The population included 640 male and female students from Class XI studying in schools that follow CISCE and CBSE boards in Prayagraj city. The tools used to collect data were the Metacognition Scale by M. Singh and A. Bali, the Locus of Control Scale made by the researcher, the Emotional Intelligence Test (Student Form) by K. S. Misra, and the Achievement Motivation Scale by P. Deo and A. Mohan. For data analysis, the researcher used statistical techniques such as mean, standard deviation, skewness, kurtosis, product-moment correlation, t-test, one-way ANOVA followed by the post-hoc LSD test, and stepwise multiple regression analysis. The results showed that CBSE students scored higher in metacognition and both internal and external locus of control compared to CISCE students. However, CISCE students scored better in emotional intelligence and achievement motivation. Also, male students scored higher on the metacognitive experiences part compared to female students.

**Meher (2021)** conducted a study on "Impact of Metacognitive Interventions on Metacognitive Awareness, Self-Efficacy and Academic Achievement of Higher Secondary School Students". The study had three goals: first, to check how metacognitive interventions affect students' metacognitive awareness; second, to find out how these interventions influence students' self-efficacy; and third, to see how they impact academic achievement in the subject of Education. The research used an experimental method, specifically a quasi-experimental design. This means two groups that already existed were tested before and after the treatment. The method was based on Gay (1990). The final group had 41 students in the experimental group and 38 in the control group. Scores from other students were not included in the analysis. The results showed that metacognitive interventions had a positive effect on all three areas. These results were then compared with findings from similar studies in the same field.

**Ochilova (2020)** conducted a study on "Metacognitive Learning methods in Teaching English as a Foreign Language". The study aimed to collect many examples of metacognitive learning strategies for teaching English as a foreign language and to examine how these strategies affect students' ability to manage their own learning, their level of learner autonomy, and their overall learning potential, as well as their motivation. The research involved searching through academic databases like Google Scholar, JSTOR, and PubMed for relevant articles, books, and conference papers. Only studies that discussed metacognitive strategies and their use in vocabulary learning were included. The results showed a moderate link between emotional intelligence and academic performance. Future research should look into how other factors

influence this relationship to better understand emotional intelligence and its effect on our lives. It's important to note that learning vocabulary is a key part of language learning, and using metacognitive strategies can greatly improve how well students learn new words.

**Kalia, Saini & Vig (2016)** conducted a study on "Relationship of Metacognitive Skilfulness with Emotional Intelligence and Achievement Motivation among Adolescents". The objectives of the study were to investigate the relationship of metacognitive skilfulness with emotional intelligence and achievement motivation among adolescents. Methodology of the study was the survey based descriptive research method. The sample for the study was drawn exclusively from Ludhiana city. The sample comprised 200 adolescents (17-19 years) distributed equally across the gender (male=100 & female=100). Standardized tests namely MSCEIT-Mayer-Salovey-Caruso Emotional Intelligence Test developed by Mayer *et al* (2000), Academic Achievement Motivation Test by Sharma (1984) and Metacognitive Awareness Inventory designed by Schraw and Dennison (1994) were used to assess emotional intelligence, achievement motivation and metacognitive skills, respectively. Socio-personal characteristics of the respondents were ascertained through self-designed socio-personal information sheet. Findings of the study were found that declarative knowledge, conditional knowledge, information management strategies, debugging and evaluation sub-components of metacognition had a positive significant relationship with emotional intelligence of the adolescents. Whereas, sub-components of metacognition, viz conditional knowledge, planning, information management strategies, comprehension monitoring, debugging and evaluation were found to be significantly and positively correlated with achievement motivation of the adolescents.

**Mahasneh (2014)** conducted a study on "Investigating the Relationship between Emotional Intelligence and Meta-Cognition among Hashemite University Students". The main goal was to look at how emotional intelligence and meta-cognition are connected in university students. They selected 720 students randomly from different schools within Hashemite University. They used statistical methods like means, standard deviations, regression, and correlation to analyze the data. The results showed a strong positive link between different parts of emotional intelligence and meta-cognition. This suggests that universities should focus more on helping students develop their meta-cognition skills through both theory and practical training.

## 3. Objective of the Study

- To develop and standardize the Metacognition scale.

## 4. Research Design

The present study employed a descriptive survey design with a focus on test construction methodology. The primary objective was to develop and validate a standardized scale to measure the metacognition of Under Graduate students. The research followed systematic steps of tool construction including development of the item pool, pre-try-out, try-out, item analysis, final form of the metacognition scale, scoring, reliability and validity estimation.

## 5. Steps to construct the Metacognition Scale

The construction of a Metacognition scale required the researcher to identify and include relevant areas that could comprehensively represent the dimensions of metacognition. This process was essential to ensure the test's validity and relevance in assessing the metacognitive abilities of Under Graduate students. Key areas such as Gender, Population, Location, and divisions were identified and incorporated into the test framework. These areas were considered crucial for capturing diverse perspectives and ensuring the test's applicability across various demographic and contextual factors. To ensure the accuracy and appropriateness of the test, these areas and their corresponding items were reviewed and validated by experts in the field of education. Their feedback contributed significantly to refining the structure and content of the test, enhancing its reliability and effectiveness. Based on this rigorous process, the researcher finalized the development of the Metacognition test, incorporating the identified areas to provide a robust tool for measuring metacognition among Under Graduate students.

**5.1 Development of the Item Pool:** The researcher conducted a systematic review of relevant literature and studies related to metacognition and consulted with experts in the field. Based on these insights, a preliminary item pool was created for the Metacognition Test. Initially, a larger number of items were included in the draft than would be retained in the final version. Following expert suggestions and advice, the items were modified, necessary changes were made, and irrelevant items were removed. The revised list of items was then presented to the same group of experts for further review. This time, the experts were asked to assess whether the language of the items was easily understood by individuals from both rural and urban areas and whether the items accurately reflected the intended purpose. The experts provided constructive criticism, which was carefully considered by the researcher. Based on this feedback, the necessary modifications, additions, and changes were made to the items. The test was then revised and resubmitted to the experts for a final evaluation, focusing on the clarity, meaning, and appropriateness of the vocabulary. After this thorough review process, 52 items were retained in the final version of the Metacognition Test, ensuring that the test was clear, relevant, and appropriate for measuring metacognitive skills among Under Graduate students.

**5.2 Pre-try-out:** The initial draft of the Metacognition Scale was developed with a total of 52 statements, distributed across four dimensions of metacognition. Out of these, 19 statements were framed negatively, while the remaining 33 statements were positive. Participants were required to respond to each statement by selecting the option that best reflected their typical behavior or cognitive tendencies. The constructed Metacognition section of the questionnaire was administered to Under Graduate students from the district of Bankura in West Bengal to identify any difficulties the students encountered in responding to the items and understanding the language. Following the administration, the items were screened and edited based on the students' feedback and the researcher's judgment. Efforts were made to refine and improve the language of the items to ensure they were more easily understood by the target group. These revisions aimed to enhance clarity and ensure that the questions accurately measured the metacognitive skills of Under Graduate students.

**5.3 Try-out:** The prepared Metacognition scale was administered to a random sample of 70 Under Graduate students from colleges in the district of Bankura, West Bengal. Prior to

completing the questionnaire, students were instructed to carefully read the instructions provided on the top page. They were then asked to mark a tick against the statement that most accurately reflected their response to each item. Each statement in the Metacognition section of the questionnaire was associated with five possible response options: Always, Frequently, Sometimes, Rarely, and Never. This total score provided an overall measure of the student's metacognitive abilities based on their responses to the items in the test.

Item analysis Item analysis is a crucial step in evaluating the effectiveness and reliability of a test. After the try-out of the second draft of the Metacognition Test, it was administered to 70 Under Graduate college students. The scores obtained by the respondents were then arranged in descending order, from the highest to the lowest, based on their total scores. For the purpose of item analysis in this study, the top 27% and bottom 27% of student scores were selected in accordance with Kelly (1939). The significance of each item's value was tested using the 't' test, as recommended by Edwards (1968).

Using these total scores, 27% of the highest achievers (referred to as the Higher Group) and 27% of the lowest achievers (referred to as the Lower Group) were identified. These two groups were selected for item analysis to assess how well the test items differentiated between high and low achievers. The top 27% were considered the Upper Group, while the bottoms 27% were considered the Lower Group. For each item, the scores obtained by the students in both the Upper and Lower Groups were recorded in two separate columns. The obtained T-test values for each and every item have been shown in the table no-1.

**Table no-1: The T-Test values for all the items of Metacognition Scale and their status**

| Item No. | Upper Group | | Lower Group | | MD | $SE_M$ | T-Test Value | Significant Level (0.05) | Item Status |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | | | | |
| 1 | 3.68 | 0.597 | 3.63 | 0.885 | 0.05 | 0.121 | 0.21 | Insignificant | *Removed* |
| 2 | 4.11 | 0.809 | 3.47 | 0.495 | 0.64 | 0.114 | 2.18 | Significant | Retained |
| 3 | 4.53 | 0.696 | 3.74 | 1.256 | 0.79 | 0.178 | 2.71 | Significant | Retained |
| 4 | 3.89 | 0.737 | 3 | 1.054 | 0.89 | 0.163 | 3.03 | Significant | Retained |
| 5 | 4.21 | 0.854 | 3.42 | 1.382 | 0.79 | 0.190 | 1.55 | Insignificant | *Removed* |
| 6 | 4.89 | 0.458 | 4.47 | 0.768 | 0.42 | 0.109 | 2.31 | Significant | Retained |
| 7 | 4.58 | 0.606 | 4.16 | 0.875 | 0.42 | 0.127 | 1.94 | Insignificant | *Removed* |
| 8 | 3.74 | 0.733 | 3.13 | 1.011 | 0.61 | 0.168 | 3.86 | Significant | Retained |
| 9 | 3.95 | 0.705 | 2.84 | 0.764 | 1.11 | 0.149 | 4.63 | Significant | Retained |
| 10 | 4.58 | 0.607 | 3.95 | 1.078 | 0.63 | 0.149 | 2.22 | Significant | Retained |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 11 | 4.37 | 0.830 | 3.53 | 1.123 | 0.84 | 0.173 | 2.63 | Significant | Retained |
| 12 | 4.47 | 0.697 | 3.53 | 1.172 | 0.94 | 0.175 | 3.20 | Significant | Retained |
| 13 | 3.89 | 0.809 | 2.53 | 1.263 | 1.36 | 0.204 | 3.98 | Significant | Retained |
| 14 | 4.21 | 0.838 | 2.74 | 1.02 | 1.47 | 0.166 | 2.79 | Significant | Retained |
| 15 | 4.32 | 0.946 | 3.47 | 1.219 | 0.85 | 0.188 | 2.38 | Significant | Retained |
| 16 | 4.32 | 1.046 | 3.89 | 0.875 | 0.43 | 0.157 | 1.18 | Insignificant | *Removed* |
| 17 | 3.26 | 1.484 | 3.79 | 1.182 | 0.53 | 0.215 | 0.12 | Insignificant | *Removed* |
| 18 | 4.37 | 0.697 | 3.11 | 7.41 | 1.26 | 0.188 | 5.46 | Significant | Retained |
| 19 | 4.74 | 0.561 | 3.42 | 1.017 | 1.32 | 0.170 | 4.93 | Significant | Retained |
| 20 | 4 | 1.054 | 3.37 | 1.164 | 0.63 | 0.185 | 1.75 | Insignificant | *Removed* |
| 21 | 2.63 | 0.848 | 2.68 | 1.056 | 0.05 | 0.155 | 0.85 | Insignificant | *Removed* |
| 22 | 4.63 | 0.684 | 3.47 | 1.02 | 1.16 | 0.168 | 4.11 | Significant | Retained |
| 23 | 4.11 | 1.449 | 3.74 | 1.147 | 0.37 | 0.211 | 0.87 | Insignificant | *Removed* |
| 24 | 3.53 | 0.772 | 2.47 | 0.83 | 1.06 | 0.160 | 4.45 | Significant | Retained |
| 25 | 4.16 | 0.501 | 3.63 | 0.830 | 0.53 | 0.118 | 2.36 | Significant | Retained |
| 26 | 4.47 | 0.772 | 3.79 | 0.917 | 0.68 | 0.147 | 2.49 | Significant | Retained |
| 27 | 4.68 | 0.477 | 3.63 | 0.831 | 1.05 | 0.194 | 4.79 | Significant | Retained |
| 28 | 3.32 | 0.82 | 2.89 | 1.196 | 0.43 | 0.168 | 1.26 | Insignificant | *Removed* |
| 29 | 3.95 | 0.97 | 3.53 | 1.387 | 0.42 | 0.194 | 0.95 | Insignificant | *Removed* |
| 30 | 3.42 | 1.076 | 2.42 | 0.901 | 1 | 0.178 | 3.11 | Significant | Retained |
| 31 | 3.37 | 1.07 | 2.42 | 1.169 | 0.95 | 0.203 | 3.18 | Significant | Retained |
| 32 | 4.68 | 0.582 | 3.74 | 1.098 | 0.94 | 0.161 | 3.32 | Significant | Retained |
| 33 | 4.37 | 0.902 | 3.68 | 0.885 | 0.69 | 0.155 | 2.54 | Significant | Retained |
| 34 | 4.05 | 0.848 | 3.05 | 1.177 | 1 | 0.184 | 3.00 | Significant | Retained |
| 35 | 3.74 | 1.046 | 2.58 | 1.121 | 1.16 | 0.198 | 3.29 | Significant | Retained |
| 36 | 3.95 | 0.97 | 3.84 | 0.958 | 0.11 | 0.155 | 0.34 | Insignificant | *Removed* |
| 37 | 4.63 | 0.597 | 3.84 | 1.167 | 0.79 | 0.162 | 2.62 | Significant | Retained |
| 38 | 4.47 | 0.697 | 3.63 | 1.065 | 0.84 | 0.160 | 2.88 | Significant | Retained |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 39 | 3.32 | 0.964 | 3.16 | 1.154 | 0.16 | 0.176 | 1.52 | Insignificant | *Removed* |
| 40 | 4.21 | 1.003 | 3.21 | 1.3 | 1 | 0.201 | 2.52 | Significant | Retained |
| 41 | 3.32 | 0.96 | 3.68 | 1.15 | 0.36 | 0.171 | 0.92 | Insignificant | *Removed* |
| 42 | 4.16 | 1.065 | 4.11 | 0.876 | 0.05 | 0.157 | 0.83 | Insignificant | *Removed* |
| 43 | 4.47 | 0.697 | 3.58 | 1.017 | 0.89 | 0.158 | 3.16 | Significant | Retained |
| 44 | 4.58 | 0.841 | 3.63 | 1.011 | 0.95 | 0.166 | 2.96 | Significant | Retained |
| 45 | 4.05 | 1.078 | 3 | 1.247 | 1.05 | 0.206 | 2.78 | Significant | Retained |
| 46 | 4.42 | 0.902 | 2.63 | 1.096 | 1.79 | 0.212 | 5.17 | Significant | Retained |
| 47 | 4.05 | 1.352 | 2.95 | 1.649 | 1.1 | 0.258 | 2.26 | Significant | Retained |
| 48 | 4.11 | 0.976 | 3.63 | 1.116 | 0.48 | 0.174 | 1.70 | Insignificant | *Removed* |
| 49 | 4.47 | 0.611 | 4.16 | 0.688 | 0.31 | 0.107 | 1.49 | Insignificant | *Removed* |
| 50 | 4.16 | 0.834 | 3.32 | 1.169 | 0.84 | 0.173 | 2.24 | Significant | Retained |
| 51 | 4.79 | 0.419 | 3 | 1.41 | 1.79 | 0.228 | 5.61 | Significant | Retained |
| 52 | 4.63 | 0.597 | 3.32 | 1.31 | 1.31 | 0.194 | 3.58 | Significant | Retained |

Out of the 52 items originally included in the test, 16 items were found to be insignificant. As a result, these 16 items were removed from the final version of the scale. The remaining 36 items, which were significant, were retained. These 36 items are distributed across 4 dimensions, and include both positive and negative items, which were selected for their ability to effectively assess metacognitive abilities in Under Graduate students.

**5.4 Final form of the Metacognition scale:** The final version of the test consists of these 36 items, among these, 21 items are positive, and 15 items are negative. The distribution of item among the 4 dimensions is presented in the table-2.

**Table-2: Distribution of items among different dimensions of Metacognition scale of Under Graduate students**

| Sl No. | Dimensions | Statements | Serial no. of Items | Sub Total | Total No. of Items |
|---|---|---|---|---|---|
| **1** | Knowledge of cognition | Positive | 1,2,4,6,7,8,9 | 7 | **11** |
| | | Negative | 3,5,10,11 | 4 | |
| **2** | Regulation of cognition | Positive | 12,13,14,15 | 4 | **5** |
| | | Negative | 16 | 1 | |

| | | | | | |
|---|---|---|---|---|---|
| **3** | Control of cognition | Positive | 17,18,19,22,23 | 5 | **9** |
| | | Negative | 20,21,24,25 | 4 | |
| **4** | Experiences of cognition | Positive | 26,27,29,30,34 | 5 | **11** |
| | | Negative | 28,31,32,33,35,36 | 6 | |

**5.5 Scoring:** For positive items, numerical values were assigned from 1 to 5, where 1 represented "Never" and 5 represented "Always." For negative items, the numerical values were reversed. To calculate the score for each student, the numerical value corresponding to their response for each item was summed. The following table-3 shows the scoring scheme.

**Table-3: Scoring Scheme of Metacognition Scale of Under Graduate students**

| Statement | Always | Frequently | Sometimes | Rarely | Never |
|---|---|---|---|---|---|
| **Positive** | 5 | 4 | 3 | 2 | 1 |
| **Negative** | 1 | 2 | 3 | 4 | 5 |

**5.6 Reliability of the tools:** The researcher employed the test-retest method to assess the reliability of the test. In this approach, the same version of the test was administered twice to the same group of participants, with an interval of four weeks between the two administrations. This process generated two independent sets of scores. The degree of correlation between these sets reflects the reliability coefficient of the test. A positive and statistically significant correlation indicates that the test is reliable. To compute this correlation, the Product Moment Correlation Method was used. In the present study, the test was re-administered to a randomly selected subset of the original sample 70 participants for the Metacognition Scale drawn from the Bankura district of West Bengal.

To minimize memory effects, the second administration was conducted exactly four weeks after the initial test. The reliability coefficients, representing the correlations between the original and retest scores, were calculated. The analysis was performed using SPSS software (version 27).

The resulting reliability coefficients for the Metacognition scale is presented below.

**Table- 4: Calculation co-relations between test & retest value of Metacognition**

| Descriptive Statistics | | | |
|---|---|---|---|
| **Metacognition** | **Mean** | **Std. Deviation** | **N** |
| **Test** | 129.03 | 11.735 | 70 |
| **Retest** | 130.81 | 17.684 | 70 |

| Correlations | | | |
|---|---|---|---|
| | | **Test MCS** | **Retest MCS** |
| **Test MCS** | **Pearson Correlation** | 1 | -.247* |
| | **Sig. (2-tailed)** | | .039 |
| | **N** | 70 | 70 |
| **Retest MCS** | **Pearson Correlation** | -.247* | 1 |
| | **Sig. (2-tailed)** | .039 | |
| | **N** | 70 | 70 |
| ***. Correlation is significant at the 0.05 level (2-tailed).** | | | |

The results are presented in table -4 from the table, the Pearson Correlation coefficient between was calculated between the test and retest scores. The correlation coefficient obtained was r = -0.247, which was found to be statistically significant at the 0.05 level (p = 0.039).

**5.7 Validity of the Tools:** According to Garrett (1981)- "Validity is the most important characteristic of a scale. So, the validity of a test of any measuring instrument depends upon the fidelity with which it measures what it aims to measure." A test is considered valid only when used for a specific purpose and within a particular context. Among the different types of validity, the present test demonstrates strong content validity, as it thoroughly represents both the subject matter and the intended objectives. The test was constructed objectively, without personal bias, and with the support of a panel of subject matter experts. These experts critically reviewed the dimensions and items of the test to ensure relevance and clarity. To establish face validity, the scale was examined by five professionals in the fields of Education and Psychology, who evaluated whether the items effectively represented the constructs of Metacognition. Additionally, internal validity was confirmed using the high-low group discrimination method, which demonstrated the test's ability to differentiate between varying levels of ability. Based on these considerations, the test is assumed to possess a high degree of validity.

## 6. Conclusion

The development and standardization of the Metacognition Scale for assessing the metacognitive abilities of undergraduate students involved a thorough and systematic approach. The construction process was grounded in theoretical insights, expert recommendations, and empirical procedures to ensure the scale's relevance and effectiveness in measuring the intended constructs. At the initial stage, four key dimensions of metacognition were identified: Knowledge of Cognition, Regulation of Cognition, Control of Cognition, and Experiences of Cognition. These dimensions provided the framework for generating items, which were developed through an in-depth review of existing literature and consultation with subject matter experts. The item pool was carefully examined through multiple revisions to ensure the clarity of language, cultural relevance, and suitability for students from varied

backgrounds, including those from rural and urban areas. The scale then underwent pre-try-out and try-out phases, followed by detailed item analysis using the upper-lower group method and t-test statistics. Based on the analysis, 16 items were found to be statistically insignificant and were removed. The remaining 36 items, which demonstrated strong discriminatory capacity, were retained. These items were evenly spread across the four dimensions and included both positively and negatively phrased statements to reduce bias in responses. The finalized version of the scale comprised 36 items 21 positive and 15 negative each rated on a five-point Likert scale. Scoring was clearly defined, with reverse scoring applied to negative items. The total scores on the scale could range from 36 to 180, representing varying levels of metacognitive ability. The reliability of the scale was examined through the test-retest method over a four-week interval. Although the correlation coefficient ($r = -0.247$) was found to be statistically significant ($p = 0.039$), the negative and weak relationship suggests limited stability over time. This indicates that while the test's content and structure are well-designed, further improvements may be needed to enhance its temporal consistency. Regarding validity, the scale exhibited strong content, face, and internal validity. Expert evaluations and statistical validation, including the high-low group discrimination method, confirmed that the items effectively captured the intended metacognitive constructs. In conclusion, the developed Metacognition Scale is a structured and content-valid tool for assessing metacognitive skills among undergraduate students. Although some limitations were noted in terms of test-retest reliability, the overall instrument demonstrates strong potential for use in academic research and educational assessment.

## References

1. Das, B. (2023). *Metacognition locus of control spiritual intelligence and academic achievement of the B.Ed. trainees*. http://hdl.handle.net/10603/526893
2. Siddiqui, S. (2022). *Metacognition locus of control emotional intelligence and achievement motivation as correlates of academic achievement*. http://hdl.handle.net/10603/451015
3. Maji, S. (2021). *Effects of Motivation Socio Economic Status and Metacognition in the Second Language Acquisition among the Entry Level College Students of West Bengal*. http://hdl.handle.net/10603/315326
4. Meher, V. & R. B. S. (2021). *Impact of metacognitive interventions on metacognitive awareness self-efficacy and academic achievement of higher secondary school students*. http://hdl.handle.net/10603/354944
5. Gonzaga, E.A. & Arellano, A.R. (2021). The Influence of Motivation, Emotions, Cognition, and Metacognition on Students' Learning Performance: A Comparative Study in Higher Education in Blended and Traditional Contexts. *SAGE Publication,* pp. 01-12.
6. Kalia, P. & Saini, S. (2020). Studying the Relationship between Emotional Intelligence and its Components with Metacognitive Skilfulness in College Students. *International Journal of Current Microbiology and Applied Sciences,* *https://doi.org/10.20546/ijcmas.2020.908.227*

7. Bala, N. (2019). *Effectiveness of metacognitive intervention on achievement in mathematics among secondary school students in relation to intelligence and gender*. http://hdl.handle.net/10603/345683
8. Sindhwani, A. (2017). *Study of academic achievement in English as related to learning styles and metacognitive skills among senior secondary school students*. http://hdl.handle.net/10603/208312
9. Das, A. (2015). Relationship between Metacognitive Ability and Academic Achievement of B.Ed. Students - A Study. *International Journal of Science and Research (IJSR), pp. 1639-1642.*
10. Devi, P. (2014). *A study of academic achievement of 101 students in relation to their metacognition self-confidence and family environment*. http://hdl.handle.net/10603/39123