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Effectiveness of Mindfulness-Based Interventions to Improve Reasoning Skills among Higher Secondary Students

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Abstract

Mindfulness involves the practice of attentively and non-judgmentally focusing on the present moment. Research has shown that it can enhance attention, emotional regulation, and cognitive functions, including reasoning abilities. This study aimed to evaluate the effectiveness of mindfulness-based interventions in improving reasoning skills among higher secondary students. A total of 30 students were selected using a convenient sampling technique, and a single-group pre-test and post-test experimental design was utilized. Participants engaged in structured mindfulness activities, after that their reasoning abilities were assessed using the Test of Logical Thinking (TOLT) before and after the intervention. The mean pre-test score was 22.57, which increased significantly to 41.77 in the post-test. A paired sample t-test revealed a statistically significant difference ($t = -30.50$, $p < 0.01$), while the Pearson correlation coefficient ($r = 0.763$) indicated a strong positive relationship between the pre- and post-test scores. The findings of this study suggest that mindfulness-based practices can significantly enhance reasoning skills among adolescents. Therefore, it is recommended that mindfulness strategies be incorporated into the school curriculum to promote cognitive development and academic success for higher secondary students.

Keywords: *Mindfulness, Reasoning Skills, Mindfulness-Based Interventions, Higher Secondary Students, Cognitive Development.*

1. INTRODUCTION

In the rapidly evolving educational landscape, cognitive abilities play a crucial role in student success, particularly at the higher secondary level, where academic expectations and pivotal career decisions intersect. Among these cognitive abilities, reasoning skills emerge as a fundamental component. Reasoning involves the

mental processes of analyzing information, making logical connections, drawing conclusions, and solving problems. This includes both inductive reasoning—drawing generalizations from specific observations—and deductive reasoning—applying general rules to derive specific outcomes.

For higher secondary students, reasoning is not merely an academic requirement; it is an essential life skill. It underpins success in subjects such as mathematics, science, and social sciences, and serves as a core component of competitive examinations, career aptitude tests, and higher education entrance exams. Beyond academics, reasoning equips adolescents to make informed decisions, resolve conflicts, and think critically in real-world situations.

However, the pressures of adolescence, combined with academic demands, often hinder students' reasoning performance. Stress, anxiety, and distraction—common experiences among higher secondary learners—can significantly impair attention span, working memory, and cognitive flexibility, all of which are vital for effective reasoning.

In this context, mindfulness-based interventions (MBIs) have emerged as a promising method to enhance cognitive functioning. Mindfulness entails purposeful and non-judgmental awareness of the present moment. Research has demonstrated that mindfulness practices improve attention regulation, reduce anxiety, and strengthen executive functions—factors that directly influence reasoning ability **(Zenner et al., 2014; Gotink et al., 2020; Zuo & Tang, 2023)**. Despite the growing global evidence, the integration of mindfulness strategies to enhance reasoning in Indian secondary education remains limited.

This study aims to explore the effectiveness of a structured mindfulness-based intervention in improving reasoning skills among higher secondary students, thereby bridging the gap between mental well-being practices and academic performance.

2. REVIEW OF RELATED LITERATURE

The increasing interest in mindfulness-based interventions (MBIs) has catalyzed a substantial body of research examining their cognitive, emotional, and academic benefits, particularly within educational contexts. This section aims to provide a comprehensive review of contemporary literature that articulates a theoretical and empirical foundation for understanding the efficacy of MBIs in enhancing reasoning skills among adolescents.

Zuo and Tang (2023) conducted a meta-analysis focused on mindfulness and its impact on the mental health of university students. While the study primarily targeted slightly more mature demographics, its findings are relevant to late adolescents in higher secondary education. The authors reported that MBIs resulted in significant reductions in anxiety ($g = 0.61$) and depression ($g = 0.37$), along with notable improvements in attention, cognitive clarity, and emotional regulation. These psychological enhancements are intrinsically related to cognitive performance, particularly reasoning, as diminished anxiety creates a conducive environment for logical reasoning and academic concentration. In a separate investigation,

Gotink et al. (2020) examined the neurobiological impacts of an 8-week Mindfulness-Based Stress Reduction (MBSR) program utilizing advanced brain imaging techniques. The findings revealed that mindfulness training instigated both structural and functional modifications in brain regions associated with executive function, notably the prefrontal cortex and hippocampus. These areas are pivotal for reasoning, decision-making, and attentional control, thus substantiating the neurological rationale for employing MBIs to augment cognitive functionality.

Schleicher (2024) advocated for the integration of mindfulness and resilience-building practices into school curricula in The Guardian. This article underscored evidence-based programs demonstrating enhancements in students' coping mechanisms, cognitive clarity, and problem-solving abilities.

By fostering emotional stability and metacognitive awareness, such programs indirectly bolster reasoning capabilities by mitigating cognitive interference induced by stress and distractions. The literature reviewed herein provides compelling evidence that mindfulness-based interventions serve as effective modalities for enhancing emotional well-being and cognitive faculties. Across various age demographics and educational landscapes, MBIs have consistently shown their capacity to reduce anxiety, improve concentration, and promote cerebral development,

all of which are essential for the enhancement of reasoning skills. This compilation of research supports the pertinence and timeliness of the current study, which aims to implement and empirically evaluate MBIs specifically targeted at augmenting reasoning skills among higher secondary students.

3. NEED FOR THE STUDY

Reasoning stands as a foundational cognitive skill crucial for problem-solving, decision-making, and academic achievement. Nonetheless, students at the higher secondary level frequently encounter elevated levels of anxiety, emotional instability, and cognitive overload, largely attributable to academic pressures. Such factors adversely affect their reasoning capabilities. Existing research indicates a positive correlation between mindfulness-based interventions (MBIs) and the enhancement of cognitive functions, particularly in domains such as attention, working memory, emotional regulation, and executive functioning **(Zenner et al., 2014; Zuo & Tang, 2023)**. Additionally, neuroimaging studies **(Gotink et al., 2020)** have illustrated that mindfulness practices induce alterations in cerebral structures linked to reasoning processes. Despite this robust evidence, the systematic adoption of MBIs within Indian educational frameworks to improve cognitive competencies, particularly reasoning, remains limited. Furthermore, empirical studies specifically targeting higher secondary students, who reside at a pivotal academic threshold, are notably scarce. This gap highlights the necessity for a structured investigation into the effectiveness of mindfulness-based interventions in enhancing reasoning capabilities within this critical population.

4. OBJECTIVES OF THE STUDY

- To assess the level of reasoning skills among higher secondary students before (pre-test) and after (post-test) the interventions.
- To identify and implement mindfulness-based interventions to improve the
- To assess the significant difference between the pre-test and post-test scores of reasoning skills among higher secondary students after the mindfulness-based interventions.
- To assess the correlation between higher secondary students' pre-test and post-test scores of reasoning skills.

5. HYPOTHESES OF THE STUDY

- The level of reasoning skills among higher secondary students before (pre-test) and after the interventions is Average.
- There is no significant difference between the pre-test and post-test scores of reasoning skills among higher secondary students after the mindfulness-based interventions.
- There is no correlation between higher secondary students' the pre-test and post-test scores of reasoning skills.

6. METHODOLOGY

The research design for this study employs a Single-Group Pre-test-Post-test Experimental Design. The sample consists of 30 higher secondary students in the 11th grade at Alagappa Matriculation Higher Secondary School in Tamil Nadu. The Purposive Sampling Technique was utilized for this study.

For the assessment of logical reasoning skills, the investigator adapted the Test of Logical Thinking (ToLT), originally developed by Lawson, A. E. in 1978. Following the administration of a pre-test, the investigator implemented a four-week Mindfulness-Based Intervention, which included three sessions per week, each lasting 30 minutes. The intervention comprised practices such as Mindful Breathing, Body Scan, Focused Attention, and Guided Visualization. Subsequently, a post-test was conducted to evaluate any changes in reasoning skills.

7. DATA ANALYSIS

7.1 Hypothesis: 1

The level of reasoning skills among higher secondary students before (pre-test) and after (post-test) interventions is Average.

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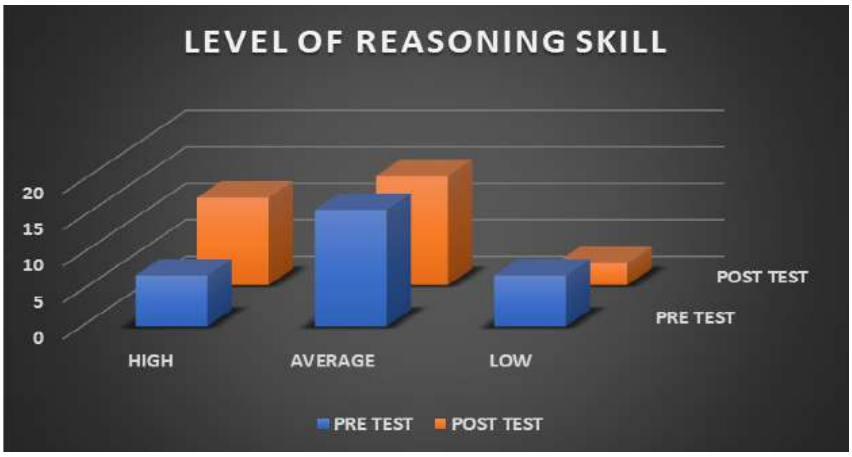
Table-1: Shows the level of reasoning skills among higher secondary students before (pre-test) and after (post-test) interventions.

LEVEL	PRE-TEST
LOW	7
AVERAGE	16
HIGH	7
TOTAL	30

The table above illustrates the reasoning skill levels among higher secondary students before and after the mindfulness-based intervention.

- **Before the Intervention (Pre-Test):** The majority of students (16 out of 30) were categorized as having average reasoning skills. Additionally, 7 students were identified at the low level, while another 7 fell into the high level category. This indicates that, overall, the group's reasoning skills were average prior to the intervention.
- **After the Intervention (Post-Test):** Post-intervention, the number of students in the low level increased to 12, and those in the high level decreased to 3. The count of students at the average level remained relatively stable at 15.

These results demonstrate a shift in the distribution of reasoning skill levels. However, to gain a clearer understanding of the overall improvement, it's essential to consider the mean scores and t-test results, which indicated a significant increase following the intervention. Therefore, despite slight changes in category distribution, the students' actual reasoning performance showed notable enhancement.



7.2 Hypothesis-2

There is no significant difference between the pre-test and post-test scores of reasoning skills among higher secondary students after the mindfulness-based interventions.

Table-2: Shows the significant difference between the pre-test and post-test scores of reasoning skills among higher students after the mindfulness-based interventions.

S.No	TEST	N	MEAN	SD	t-value	df	REMARK
1	Pre-Test	30	22.57	3.55	30.50	29	Significant
2	Post-Test	30	41.77	5.28			

(Table value of 't' at the 0.05 level of significance is 2.045)

The calculated t-value of 30.50 exceeds the critical t-value of ±2.045 in absolute terms, and the p-value is significantly below 0.05. This indicates that the difference between the pre-test and post-test scores is statistically significant. There is a notable improvement in students' reasoning abilities following the mindfulness-based intervention. Consequently, the null hypothesis is

rejected, leading to the conclusion that the intervention had a positive impact on the students' reasoning skills.

7.3 Hypothesis-3

There is no correlation between Higher Secondary Students' the pre-test and post-test scores of reasoning skills.

Table-3: Shows the correlation between Higher Secondary Students the pre-test and post-test scores of reasoning skills.

Test	N	Pre-Test	Post-Test
Pre-Test	30	1.00	0.76
Post-Test	30	0.76	1.00

The Pearson correlation coefficient between the pre-test and post-test reasoning scores is 0.763, indicating a strong positive relationship. This suggests that students who performed well on the pre-test tended to score higher on the post-test, while those with lower pre-test scores exhibited similar trends after the intervention. The robust positive correlation also implies that reasoning ability scores improved consistently across the sample following the mindfulness-based intervention. Overall, this strong correlation supports the reliability of the observed improvements and reinforces the effectiveness of the intervention.

8. FINDINGS

- **Pre-Intervention Reasoning Skill Levels**: The results from the pre-test indicated that a majority of students (16 out of 30) exhibited average reasoning skills. There were also equal numbers of students in the low and high reasoning categories, with 7 students in each, suggesting that the overall reasoning abilities of the group were moderate prior to the mindfulness-based intervention.
- **Post-Intervention Reasoning Skill Levels:** Following the intervention, the post-test results revealed a shift in the distribution of reasoning skill levels. The number of students categorized as having high reasoning skills decreased to 3, the average group remained relatively unchanged at 15, and the low category saw an increase to 12. This change suggests a realignment in category distribution, possibly reflecting adjustments in scoring thresholds.
- **Significant Improvement in Mean Scores**: Despite the shifts in category distributions, the mean reasoning score experienced a notable increase from 22.57 (pre-test) to 41.77 (post-test). This illustrates a substantial enhancement in reasoning abilities following the mindfulness training.
- **Statistical Significance Confirmed by t-Test**: A paired sample t-test produced a t-value of -30.50 with a p-value of less than 0.01, confirming that the difference in scores was statistically significant and unlikely due to chance.
- **Strong Positive Correlation**: A Pearson correlation coefficient of r = 0.763 was found between pre- and post-test scores, indicating a strong positive relationship and consistent improvement among students.

9. EDUCATIONAL IMPLICATIONS

- The integration of mindfulness strategies into educational curricula may serve to enhance students' focus, attention regulation, and reasoning capabilities, all of which are crucial for higher-order thinking and performance on assessments.
- Mindfulness presents a cost-effective and non-invasive approach to assist students experiencing anxiety, concentration difficulties, or cognitive fatigue, thereby fostering academic potential.
- Students initially categorized with low and average reasoning abilities demonstrated significant improvement, underscoring mindfulness as an inclusive strategy conducive to cognitive equity.
- The findings advocate for the alignment of Social-Emotional Learning (SEL) frameworks with academic instruction via mindfulness practices to promote holistic student well-being and critical thinking.

10. RECOMMENDATIONS OF THE STUDY

- Educational institutions should contemplate the incorporation of brief daily mindfulness sessions (10–15 minutes) into classroom routines or as components of life skills education.
- It is imperative to provide teachers with professional development in mindfulness techniques to enhance the effective delivery and sustainability of these practices.
- Future investigations should assess the long-term effects of mindfulness on cognitive functions such as reasoning, problem-solving, and decision-making.
- Development of tailored mindfulness modules for students at varying performance levels is recommended to maximize the impact of interventions.
- Comparative studies across diverse states, educational boards, and urban-rural contexts should be conducted to evaluate the generalizability of the findings.

11. CONCLUSION

The study substantiates the effectiveness of mindfulness-based interventions in enhancing reasoning capabilities among higher secondary students. The statistically significant gains and strong positive correlations reinforce the premise that mindfulness serves as a potent cognitive tool for adolescent learners. Given that reasoning constitutes the foundation for critical thinking and academic success, it is paramount for educational institutions to consider the integration of MBIs to elevate students' mental and academic performance.

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