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WORKING MEMORY AS A PREDICTOR OF SCIENTIFIC REASONING ABILITY AMONG NEET ASPIRANTS

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ABSTRACT
The development of higher-order cognitive abilities is essential for students aspiring to enter the medical profession, where complex problem-solving and evidence-based reasoning are indispensable. Among these cognitive abilities, working memory plays a pivotal role in temporarily storing and manipulating information required for reasoning, comprehension, and learning. According to Alan Baddeley (2003), working memory functions as a limited-capacity system that supports complex cognitive activities such as learning and reasoning. In the context of the National Eligibility cum Entrance Test (NEET), which serves as a gateway to medical education in India, aspirants are expected to process large volumes of scientific information and apply conceptual understanding to solve problems efficiently. However, while NEET predominantly evaluates content knowledge and application skills, it often overlooks underlying cognitive mechanisms such as working memory that significantly influence reasoning performance.

INTRODUCTION

Scientific reasoning ability, which involves hypothesis formation, control of variables, logical inference, and data interpretation, is fundamentally dependent on cognitive processes governed by working memory. Empirical evidence suggests that individuals with higher working memory capacity demonstrate superior reasoning performance due to their ability to manage cognitive load and integrate multiple sources of information (Kyllonen & Christal, 1990; Cowan, 2014). For NEET aspirants, who operate under intense academic pressure and time constraints, working memory becomes a critical determinant of their ability to engage in scientific thinking and problem-solving. Furthermore, John Sweller (1988) emphasized that excessive cognitive load can hinder reasoning performance, making working memory capacity crucial for success in high-stakes examinations.
Despite its importance, limited empirical research has explored the predictive role of working memory in shaping scientific reasoning ability among competitive exam aspirants, particularly in the Indian context. While studies such as Alloway and Alloway (2010) have established working memory as a strong predictor of academic achievement, and Oberauer et al. (2005) have linked it to fluid intelligence, there remains a gap in understanding its specific role in scientific reasoning among NEET aspirants. Therefore, the present study seeks to examine working memory as a predictor of scientific reasoning ability among NEET aspirants, thereby contributing to a deeper understanding of cognitive factors influencing scientific thinking in high-stakes examination settings.

LITERATURE REVIEW

Research in cognitive science has consistently highlighted the central role of working memory in complex cognitive tasks, particularly reasoning and problem-solving. Working memory, as conceptualized in Baddeley's multicomponent model, comprises the central executive, phonological loop, and visuospatial sketchpad, all of which contribute to the processing and integration of information necessary for reasoning tasks. Vallat-Azouvi, Pradat-Diehl, and Azouvi (2012) developed a working memory questionnaire that provides a reliable measure of everyday working memory functioning, emphasizing its relevance in academic and cognitive performance contexts. A substantial body of research supports the relationship between working memory and reasoning ability. Kyllonen and Christal (1990) demonstrated that working memory capacity is highly correlated with reasoning ability, suggesting that reasoning performance depends heavily on working memory resources. Similarly, Oberauer et al. (2005) confirmed through meta-analytic evidence that working memory is a strong predictor of fluid intelligence. Engle (2002) further argued that working memory capacity reflects executive attention, which is essential for maintaining task-relevant information during reasoning tasks.
Empirical studies have also established the importance of working memory in educational achievement. Alloway and Alloway (2010) found that working memory is a better predictor of academic success than traditional measures such as IQ, particularly in tasks requiring comprehension and problem-solving. Cowan (2014) emphasized that working memory plays a central role in learning by enabling individuals to integrate new information with existing knowledge, thereby supporting reasoning and understanding. Scientific reasoning,

which involves hypothesis testing, control of variables, and data interpretation, is inherently dependent on cognitive processes supported by working memory. Lawson (2004) found that students with higher working memory capacity perform better in scientific reasoning tasks, particularly those involving logical inference and experimental thinking. Zimmerman (2007) also highlighted that the development of scientific reasoning skills is closely linked to cognitive capacities such as working memory and executive functioning. Han (2013) further emphasized that scientific reasoning involves multiple cognitive processes, including argumentation and evidence evaluation, all of which rely on working memory resources.

Recent research has also explored additional factors influencing scientific reasoning ability. Fang-Ying Yang et al. (2024) demonstrated that epistemic beliefs significantly predict reasoning performance, indicating that cognitive and metacognitive factors interact in shaping scientific reasoning. Kuhn (2010) argued that scientific reasoning develops through active engagement and inquiry-based learning rather than rote memorization, highlighting potential limitations of exam-oriented systems such as NEET. Research on gender differences in cognitive abilities has largely supported the Gender Similarities Hypothesis proposed by Hyde (2005), which suggests that males and females are similar in most psychological traits, including reasoning ability. Halpern et al. (2007) further confirmed that observed differences in cognitive performance are often influenced by sociocultural and educational factors rather than inherent ability differences. This suggests that variations in scientific reasoning among NEET aspirants may be better explained by environmental and instructional variables rather than gender. Despite extensive research on working memory and reasoning, there remains a lack of studies focusing specifically on competitive examination contexts such as NEET. This highlights a critical research gap and underscores the need for studies that examine working memory as a predictor of scientific reasoning ability among NEET aspirants.

Significance of the Study

The present study holds substantial significance in the context of medical education, cognitive psychology, and competitive examination systems in India. Scientific reasoning ability, which includes skills such as hypothesis testing, evaluation of evidence, and logical inference, is a fundamental competency required for effective clinical decision-making and evidence-based medical practice. Research indicates that deficiencies in reasoning skills among medical students can lead to diagnostic errors and cognitive biases, thereby affecting the quality of healthcare delivery (Huang et al., 2014; Barz & Achimas-Cadariu, 2016). Therefore, understanding the cognitive factors that contribute to scientific reasoning ability is essential for preparing competent future medical professionals.

Among these cognitive factors, working memory has been identified as a critical determinant of reasoning and problem-solving. According to Alan Baddeley (2003), working memory supports the temporary storage and manipulation of information necessary for complex cognitive tasks. Empirical studies have consistently demonstrated that working memory capacity is strongly associated with reasoning ability and academic performance (Kyllonen & Christal, 1990; Alloway & Alloway, 2010; Cowan, 2014). Furthermore, John Sweller (1988) emphasized that limitations in working memory can hinder learning and reasoning when cognitive load exceeds processing capacity. In the context of NEET preparation, where students are required to process vast amounts of scientific information under time pressure, working memory becomes a crucial factor influencing reasoning performance.

The significance of this study is further underscored by the nature of the NEET examination system, which predominantly emphasizes content knowledge and application skills, often neglecting underlying cognitive processes such as working memory and reasoning ability. While high scores in NEET are typically associated with mastery of subject content, they may not necessarily reflect the candidate's ability to engage in scientific reasoning or clinical thinking. This disconnect raises concerns about whether current selection processes adequately identify students with the cognitive competencies required for medical education and practice. By examining working memory as a predictor of scientific reasoning ability, the present study addresses a critical gap in existing research, particularly within the Indian educational context. The findings of this study will provide valuable insights for educators, curriculum designers, and policymakers by highlighting the importance of integrating cognitive skill development into teaching and assessment practices. Interventions aimed at enhancing working memory capacity, such as cognitive training and instructional strategies that reduce cognitive load, can potentially improve students' reasoning abilities and overall academic performance (Paas, Renkl, & Sweller, 2003).

Operational Definition of the Key Terms

Working Memory

Working memory is defined as the measurable cognitive capacity of an individual to temporarily store, process, and manipulate information required for complex cognitive tasks such as reasoning, comprehension, and problem-solving. It is assessed using the *Working Memory Questionnaire* developed by Claire Vallat-Azouvi, Pascale Pradat-Diehl, and Philippe Azouvi (2012), which evaluates everyday working memory functioning across domains such as attention control, executive functioning, and information processing. Scores obtained from the questionnaire indicate the level of working memory functioning among NEET aspirants.

Scientific Reasoning Ability

Scientific reasoning ability refers to the cognitive capacity to apply logical, analytical, and evidence-based thinking in understanding and solving scientific problems. It includes skills such as hypothesis formation, control of variables, data interpretation, and logical inference.

It can be assessed through standardized test developed by Anuradha Joshi and Bhuban Chandra Mahapatra (2000) that evaluate the aspirant's proficiency in deductive and inductive reasoning, causal reasoning, control of variables, and data interpretation within the context of biology, chemistry, and physics relevant to the NEET syllabus. Scores obtained from such tools are used to classify the aspirants' scientific reasoning ability as high, moderate, or low.

NEET Aspirants

NEET aspirants are individuals who are actively preparing to appear for the National Eligibility cum Entrance Test (NEET), an all-India entrance examination for admission to undergraduate medical and dental courses.

Objectives of the Study

The present study aims at the following objectives:

- To examine the differences in working memory among NEET aspirants based on demographic variables such as gender, stream of study, type of management, medium of instruction, type of family, and socio-economic status.
- To explore the differences in scientific reasoning ability among NEET aspirants based on demographic variables such as gender, stream of study, type of management, medium of instruction, type of family, and socio-economic status.
- To investigate the relationship between the working memory and scientific reasoning ability among NEET aspirants.

Hypotheses

The following hypotheses have been formulated:

- There is no significant difference between male and female NEET aspirants in their working memory and scientific reasoning ability.
- There is no significant difference among NEET aspirants who opted for bio-maths and pure science in their working memory and scientific reasoning ability.
- There is no significant difference among NEET aspirants studying in government, government aided, matriculation and CBSE schools in their working memory and scientific reasoning ability.
- There is no significant difference among NEET aspirants studying in Tamil and English medium in their working memory and scientific reasoning ability.
- There is no significant difference between NEET aspirants from nuclear and joint family with respect to their working memory and scientific reasoning ability.
- There is no significant difference among NEET aspirants who are hailing from low, average and high socio-economic status with respect to their working memory and scientific reasoning ability.
- There is no significant relationship between working memory and scientific reasoning ability among NEET aspirants.

METHODS AND PROCEDURES

The present study adopts the survey method of research. A sample of 800 NEET aspirants (both male and female) were selected using a simple random sampling technique from various schools and coaching centres in Chennai district.

Data were collected using the following tools:

1. **Working Memory Questionnaire** developed by Claire Vallat-Azouvi, Pascale Pradat-Diehl, and Philippe Azouvi (2012).
2. **Scientific Reasoning Ability Test** constructed and standardized by Anuradha Joshi and Bhuban Chandra Mahapatra (2000).

The collected data were scored according to the respective scoring procedures of the tools. Statistical techniques such as mean, standard deviation, 't'-test, one-way ANOVA, and regression analysis will be employed to analyse the data using SPSS software. The results will be interpreted to test the formulated hypotheses and to determine the predictive relationship between working memory and scientific reasoning ability.

Hypothesis Testing

H$_0$1: There is no significant difference between male and female NEET aspirants in their working memory and scientific reasoning ability.

Table - 1 showing the significant difference between male and female NEET aspirants in their working memory and scientific reasoning ability

Variables	Gender	N	Mean	SD	't' - Value	Level of Significance
Working Memory	Male	403	109.53	25.684	0.022	NS
	Female	397	109.49	26.220		
Scientific Reasoning Ability	Male	403	65.21	13.740	2.756	0.01
	Female	397	62.70	11.980		

NS - Not Significant, 0.01 – 1% Level of Significance

Table 1 presents the comparison between male and female NEET aspirants with respect to their working memory and scientific reasoning ability. With regard to working memory, the mean scores of male (M = 109.53, SD = 25.684) and female (M = 109.49, SD = 26.220) NEET aspirants are almost identical. The obtained *t*-value (0.022) is not statistically significant. This indicates that there is no significant difference between male and female aspirants in their working memory. Hence, the null hypothesis stating that there is no significant difference in working memory based on gender is accepted. This suggests that working memory capacity is similar across genders and is not influenced by gender differences.

In contrast, with respect to scientific reasoning ability, male aspirants (M = 65.21, SD = 13.740) scored higher than female aspirants (M = 62.70, SD = 11.980). The obtained *t*-value (2.756) is significant at the 0.01 level, indicating a statistically significant difference between male and female NEET aspirants. Therefore, the null hypothesis is rejected for scientific reasoning ability. This implies that male aspirants demonstrate relatively higher scientific reasoning ability compared to female aspirants in the present sample.

Overall, the findings reveal that while working memory does not vary significantly with gender, scientific reasoning ability shows a significant gender difference, favoring male aspirants. However, this difference may be influenced by external factors such as learning environment, exposure to problem-solving tasks, and educational practices rather than inherent cognitive differences.

H$_0$2: There is no significant difference among NEET aspirants who opted for bio-maths and pure science in their working memory and scientific reasoning ability.

Table - 2 showing the significant difference among NEET aspirants who opted for bio-maths and pure science in their working memory and scientific reasoning ability.

Variables	Stream of Study	N	Mean	SD	't' - Value	Level of Significance
Working Memory	Bio-Maths	333	114.85	28.447	3.537	0.01
	Pure Science	467	108.04	25.589		
Scientific Reasoning Ability	Bio-Maths	333	66.66	16.672	5.995	0.01
	Pure Science	467	60.62	12.298		

0.01 – 1% Level of Significance

Table 2 presents the comparison among NEET aspirants who opted for Bio-Maths and Pure Science streams with respect to their working memory and scientific reasoning ability. With regard to working memory, the mean score of Bio-Maths students (M = 114.85, SD = 28.447) is higher than that of Pure Science students (M = 108.04, SD = 25.589). The obtained *t*-value (3.537) is significant at the 0.01 level, indicating a statistically significant difference between the two groups. Hence, the null hypothesis stating that there is no significant difference in working memory based on stream of study is rejected. This suggests that NEET aspirants who opted for Bio-Maths possess relatively higher working memory compared to those in the Pure Science stream.
Similarly, in the case of scientific reasoning ability, Bio-Maths students (M = 66.66, SD = 16.672) scored higher than Pure Science students (M = 60.62, SD = 12.298). The calculated *t*-value (5.995) is also significant at the 0.01 level, indicating a significant difference between the two groups. Therefore, the null hypothesis is rejected for scientific reasoning ability as well. This implies that students from the Bio-Maths stream demonstrate better scientific reasoning ability compared to their counterparts in the Pure Science stream.
Overall, the findings indicate that the stream of study has a significant influence on both working memory and scientific reasoning ability among NEET aspirants, with Bio-Maths students outperforming Pure Science students. This may be attributed to greater exposure to analytical and problem-solving tasks in the Bio-Maths curriculum, which potentially enhances both cognitive processing and reasoning skills.
$H_0$3: There is no significant difference among NEET aspirants studying in government, government aided, matriculation and CBSE schools in their working memory and scientific reasoning ability.

Table - 3 showing the significant difference among NEET aspirants studying in government, government aided, matriculation and CBSE schools in their working memory and scientific reasoning ability

Variables	Type of Management	N	Mean	SD	'F' - Value	Level of Significance
Working Memory	Government	172	104.57	26.288	9.269	0.01
	Government-Aided	154	108.25	25.394		
	Matriculation	156	119.22	33.464		
	CBSE	318	116.98	34.434		
Scientific Reasoning Ability	Government	172	61.95	11.741	4.340	0.01
	Government-Aided	154	59.64	12.176		
	Matriculation	156	59.41	10.927		
	CBSE	318	67.21	17.711		

0.01 – 1% Level of Significance

Table 3 presents the comparison among NEET aspirants studying in government, government-aided, matriculation, and CBSE schools with respect to their working memory and scientific reasoning ability. With regard to working memory, the mean scores indicate that students from matriculation schools (M = 119.22, SD = 33.464) have the highest working memory, followed by CBSE students (M = 116.98, SD = 34.434), government-aided students (M = 108.25, SD = 25.394), and government school students (M = 104.57, SD = 26.288). The obtained *F*-value (9.269) is significant at the 0.01 level, indicating a statistically significant difference among the four groups. Hence, the null hypothesis stating that there is no significant difference in working memory based on type of school management is rejected. This suggests that the type of school management has a significant influence on the working memory of NEET aspirants.
In the case of scientific reasoning ability, CBSE students (M = 67.21, SD = 17.711) scored the highest, followed by government school students (M = 61.95, SD = 11.741), government-aided students (M = 59.64, SD = 12.176),

and matriculation students (M = 59.41, SD = 10.927). The calculated *F*-value (4.340) is significant at the 0.01 level, indicating a statistically significant difference among the groups. Therefore, the null hypothesis is rejected for scientific reasoning ability as well. This implies that the type of school management significantly influences the scientific reasoning ability of NEET aspirants.

Overall, the findings reveal that both working memory and scientific reasoning ability vary significantly across different types of school management. Students from matriculation and CBSE schools tend to perform better in working memory, while CBSE students show comparatively higher scientific reasoning ability. These differences may be attributed to variations in curriculum design, teaching methodologies, exposure to problem-solving activities, and academic resources across different school systems.

$H_0$4: There is no significant difference among NEET aspirants studying in Tamil and English medium in their working memory and scientific reasoning ability.

Table -4 showing the significant difference among NEET aspirants studying in Tamil and English medium in their working memory and scientific reasoning ability

Variables	Medium	N	Mean	SD	't' - Value	Level of Significance
Working Memory	Tamil	240	113.94	32.420	0.510	NS
	English	560	112.70	31.126		
Scientific Reasoning Ability	Tamil	240	60.03	10.993	4.104	0.01
	English	560	64.68	16.020		

NS - Not Significant, 0.01 - 1% Level of Significance

Table 4 presents the comparison among NEET aspirants studying in Tamil and English medium with respect to their working memory and scientific reasoning ability. With regard to working memory, the mean scores of Tamil medium students (M = 113.94, SD = 32.420) and English medium students (M = 112.70, SD = 31.126) are very close. The obtained *t*-value (0.510) is not statistically significant. Hence, the null hypothesis stating that there is no significant difference in working memory based on medium of instruction is accepted. This indicates that the medium of instruction does not significantly influence the working memory capacity of NEET aspirants.

In contrast, for scientific reasoning ability, English medium students (M = 64.68, SD = 16.020) scored higher than Tamil medium students (M = 60.03, SD = 10.993). The calculated *t*-value (4.104) is significant at the 0.01 level, indicating a statistically significant difference between the two groups. Therefore, the null hypothesis is rejected for scientific reasoning ability. This suggests that English medium students demonstrate relatively higher scientific reasoning ability compared to Tamil medium students.

Overall, the findings reveal that while working memory is not influenced by the medium of instruction, scientific reasoning ability shows a significant difference, favoring English medium students. This difference may be attributed to factors such as greater exposure to scientific resources, instructional methods, and language accessibility in English medium education, which may enhance reasoning skills.

$H_0$5: There is no significant difference between NEET aspirants from nuclear and joint family with respect to their working memory and scientific reasoning ability.

Table - 5 showing the significant difference between NEET aspirants from nuclear and joint family with respect to their working memory and scientific reasoning ability.

Variables	Stream of Study	N	Mean	SD	't' - Value	Level of Significance
Working Memory	Nuclear Family	627	105.82	25.565	4.213	0.01
	Joint Family	173	115.92	35.250		

Scientific Reasoning Ability	Nuclear Family	627	63.68	14.782	3.787	0.01
	Joint Family	173	59.05	12.083		

0.01 - 1% Level of Significance

Table 5 presents the comparison between NEET aspirants from nuclear and joint families with respect to their working memory and scientific reasoning ability. With regard to working memory, the mean score of students from joint families (M = 115.92, SD = 35.250) is higher than that of students from nuclear families (M = 105.82, SD = 25.565). The obtained *t*-value (4.213) is significant at the 0.01 level, indicating a statistically significant difference between the two groups. Hence, the null hypothesis stating that there is no significant difference in working memory based on type of family is rejected. This suggests that NEET aspirants from joint families possess relatively higher working memory compared to those from nuclear families.

In the case of scientific reasoning ability, students from nuclear families (M = 63.68, SD = 14.782) scored higher than those from joint families (M = 59.05, SD = 12.083). The calculated *t*-value (3.787) is also significant at the 0.01 level, indicating a statistically significant difference between the two groups. Therefore, the null hypothesis is rejected for scientific reasoning ability. This implies that NEET aspirants from nuclear families demonstrate better scientific reasoning ability compared to their counterparts from joint families.

Overall, the findings indicate that family type significantly influences both working memory and scientific reasoning ability among NEET aspirants. While students from joint families exhibit higher working memory, those from nuclear families show better scientific reasoning ability. These differences may be attributed to variations in family environment, availability of individual attention, academic support, and learning conditions.

$H_0$6: There is no significant difference among NEET aspirants who are hailing from low, average and high socio-economic status with respect to their working memory and scientific reasoning ability.

Table 6 - showing the significant difference among NEET aspirants who are hailing from low, average and high SES with respect to their working memory and scientific reasoning ability

Variables	Socio-Economic Status	N	Mean	SD	'F' - Value	Level of Significance
Working Memory	Low SES	152	113.47	33.598	5.516	0.01
	Average SES	253	106.82	24.821		
	High SES	395	104.87	25.881		
Scientific Reasoning Ability	Low SES	395	61.93	14.916	13.276	0.01
	Average SES	253	69.17	17.868		
	High SES	152	63.52	14.829		

0.01 -1% Level of Significance

Table 6 presents the comparison among NEET aspirants belonging to low, average, and high socio-economic status (SES) with respect to their working memory and scientific reasoning ability**.** With regard to working memory, NEET aspirants from low SES (M = 113.47, SD = 33.598) scored higher than those from average SES (M = 106.82, SD = 24.821) and high SES (M = 104.87, SD = 25.881). The obtained *F*-value (5.516) is significant at the 0.01 level, indicating a statistically significant difference among the three groups. Hence, the null hypothesis stating that there is no significant difference in working memory based on socio-economic status is rejected**.** This suggests that socio-economic status has a significant influence on the working memory of NEET aspirants.

In the case of scientific reasoning ability, students from average SES (M = 69.17, SD = 17.868) scored the highest, followed by high SES students (M = 63.52, SD = 14.829) and low SES students (M = 61.93, SD = 14.916). The calculated F-value (13.276) is also significant at the 0.01 level, indicating a statistically significant difference among the groups. Therefore, the null hypothesis is rejected for scientific reasoning ability. This implies that socio-economic status significantly influences the scientific reasoning ability of NEET aspirants.

Overall, the findings reveal that socio-economic status plays a significant role in both working memory and scientific reasoning ability among NEET aspirants. While students from low SES demonstrate relatively higher working memory, those from average SES exhibit better scientific reasoning ability. These variations may be attributed to differences in educational opportunities, access to learning resources, academic support systems, and environmental influences associated with socio-economic background.

$H_0$7: There is no significant relationship between working memory and scientific reasoning ability among NEET aspirants.

Table 7 - showing the significant relationship between working memory and scientific reasoning ability among NEET aspirants

Variables	N	'Y'
Working Memory and Scientific Reasoning Ability	800	0.281**

** - 1% Level of Significance

Table 7 presents the relationship between working memory and scientific reasoning ability among NEET aspirants. The obtained correlation coefficient (r = 0.281) is positive and statistically significant at the 0.01 level. This indicates that there is a significant positive relationship between working memory and scientific reasoning ability. Hence, the null hypothesis stating that there is no significant relationship between working memory and scientific reasoning ability among NEET aspirants is rejected.

FINDINGS AND DISCUSSION

The findings of the present study provide important insights into the cognitive and contextual factors influencing scientific reasoning ability among NEET aspirants. The absence of a significant gender difference in working memory aligns with the Gender Similarities Hypothesis proposed by Hyde (2005), which suggests that males and females are similar in most cognitive abilities. However, the finding that male students performed better in scientific reasoning ability contrasts with several studies (Halpern et al., 2007), which argue that gender differences in reasoning are minimal and often influenced by socio-cultural and educational factors rather than inherent ability. The observed difference in the present study may be attributed to differential exposure to problem-solving tasks, confidence levels, or exam-oriented training rather than biological differences.

The significantly higher performance of Bio-Maths students in both working memory and scientific reasoning ability supports the view that engagement in mathematically intensive and analytical tasks enhances cognitive processing and reasoning skills. This finding is consistent with the work of Kyllonen and Christal (1990), who established a strong relationship between working memory and reasoning ability, suggesting that cognitively demanding subjects strengthen both constructs. The differences observed across school types, particularly the superior performance of CBSE and matriculation students, can be linked to differences in curriculum design and pedagogical practices. CBSE curricula often emphasize conceptual understanding and application-based learning, which may enhance both working memory utilization and reasoning skills. This finding is supported by Kuhn (2010), who emphasized that scientific reasoning develops through active engagement and inquiry-based learning rather than rote memorization.

The lack of significant difference in working memory across medium of instruction suggests that working memory is a core cognitive function independent of language context, supporting the views of Cowan (2014). However, the higher scientific reasoning ability among English medium students may be due to greater access to learning resources, exposure to scientific terminology, and instructional advantages, particularly in a competitive exam context like NEET. The findings related to family type reveal an interesting contrast: while joint family students exhibit higher working memory, nuclear family students demonstrate better scientific reasoning ability. This may be explained by differences in environmental stimulation, academic support, and opportunities for focused learning. These findings indicate that cognitive ability and its application (reasoning) may be influenced differently by environmental contexts. Similarly, socio-economic status shows a significant influence on both working memory and scientific reasoning ability. While low SES students displayed higher working memory, average SES students performed better in reasoning ability. This partially contrasts with traditional assumptions that higher SES is always associated with better cognitive outcomes. However, it aligns with research suggesting

that cognitive development is influenced by a complex interaction of environmental, motivational, and educational factors rather than SES alone (Alloway & Alloway, 2010).
The most significant finding of the study is the positive correlation between working memory and scientific reasoning ability, which confirms that working memory is a key cognitive predictor of reasoning ability. This finding strongly supports previous research by Oberauer et al. (2005), who established that working memory is closely linked to fluid intelligence, and by Engle (2002), who emphasized the role of working memory in executive attention and reasoning processes. Furthermore, John Sweller (1988) highlighted that efficient working memory utilization is essential for managing cognitive load, which directly impacts reasoning performance. However, the moderate strength of the correlation ($r = 0.281$) suggests that while working memory is an important factor, it is not the sole determinant of scientific reasoning ability. Other variables such as epistemic beliefs, cognitive style, academic engagement, and instructional practices also contribute significantly, as highlighted by recent research (Yang et al., 2024).

Educational Implications

The findings of the present study offer important implications for educational practice, curriculum design, and NEET preparation strategies. The significant positive relationship between working memory and scientific reasoning ability highlights the need to focus on cognitive skill development alongside content mastery. Teachers and coaching institutes should incorporate activities that enhance working memory, such as problem-solving exercises, mental manipulation tasks, and memory-based learning strategies. Strengthening working memory can improve students' ability to process, retain, and apply scientific information effectively.
The observed differences across streams of study and school types indicate that instructional practices play a crucial role in shaping cognitive abilities. Curricula that emphasize analytical thinking, conceptual understanding, and application-based learning, particularly those followed in CBSE and Bio-Maths streams, may contribute to higher levels of working memory and reasoning ability. Adopting inquiry-based and problem-oriented teaching methods can foster deeper scientific understanding and reasoning skills. The finding that medium of instruction does not significantly influence working memory but affects scientific reasoning ability underscores the importance of language accessibility in science education. Providing bilingual instructional support and ensuring conceptual clarity can help students from regional language backgrounds overcome barriers in understanding scientific content and reasoning processes.
The variations observed based on family type and socio-economic status highlight the influence of environmental factors on cognitive development. Educational institutions should ensure equitable learning opportunities by offering academic support programmes, mentoring, and access to quality learning resources, especially for students from disadvantaged backgrounds. The moderate relationship between working memory and scientific reasoning ability suggests that reasoning is influenced by multiple factors. This calls for the integration of critical thinking, metacognitive strategies, and active learning approaches such as discussions, experimentation, and reflective activities to enhance overall reasoning ability. The findings also indicate the need for reforms in competitive examinations like NEET, which predominantly emphasize content knowledge. Incorporating components that assess reasoning and cognitive abilities can lead to a more comprehensive evaluation of students, ensuring that selected candidates possess the skills required for medical education and practice.

CONCLUSION

The present study examined working memory as a predictor of scientific reasoning ability among NEET aspirants, providing valuable insights into the cognitive foundations of scientific thinking in a competitive examination context. The findings reveal that while working memory does not differ significantly across certain demographic variables such as gender and medium of instruction, it varies significantly with respect to factors such as stream of study, type of school, family background, and socio-economic status. Scientific reasoning ability, on the other hand, shows greater sensitivity to these contextual variables, indicating that it is influenced not only by cognitive capacity but also by environmental and educational factors. A key outcome of the study is the identification of a significant positive relationship between working memory and scientific reasoning ability, confirming that working memory plays an important role in supporting reasoning processes; however, the moderate strength of this relationship indicates that scientific reasoning is a multidimensional construct influenced by a combination of cognitive, instructional, and socio-environmental factors. Overall, the study underscores the importance of moving beyond rote learning and focusing on the development of cognitive and reasoning skills among NEET aspirants. Enhancing working memory and promoting scientific reasoning through effective teaching strategies and curriculum reforms can contribute to the preparation of students who are not only academically competent but also capable of critical thinking and evidence-based decision-making. In conclusion, the study contributes to the field of educational psychology by highlighting the interplay between cognitive processes and academic performance and provides a foundation for future research aimed at improving science education and medical entrance preparation in India.

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