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Metacognitive Strategies Differ Across Academic Levels and Influence Success: A Cross-Sectional Study

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Abstract

➢ *Introduction*

Reading proficiency is crucial for academic success, yet students' reading strategies are often neglected. This study explores metacognitive awareness of reading strategies among O-Level and Matriculation students, particularly in engineering. Metacognition involves awareness and regulation of cognitive processes during reading. This study addresses the lack of comparative research on how educational frameworks influence reading strategies and academic performance by examining the metacognitive awareness of reading strategies.

➢ *Methods*

A quantitative cross-sectional study was conducted using the Metacognitive Awareness of Reading Strategies Inventory (MARSI) questionnaire to examine metacognitive awareness of reading strategies. The questionnaire, covering global, problem-solving, and support strategies, was administered online to 100 students from A-Levels, intermediate, and professional engineering programs. Data was analyzed using SPSS version 26, employing descriptive statistics, t-tests, ANOVA, and correlation analysis.

➢ *Results*

Careful reading and prior knowledge activation were the most frequently used strategies. Strategy use generally increased with educational level, with professional students showing higher usage. T-tests and ANOVA revealed significant differences in strategy use across groups, particularly for note-taking, careful reading, and purpose-text alignment, with advanced students demonstrating higher usage. Correlation analysis indicated that higher strategy uses correlates with better academic outcomes, especially for careful reading and note-taking.

➢ *Conclusion*

Significant differences exist in reading strategy use among educational levels, with professional students employing more sophisticated strategies. These differences correlate with academic performance. The study suggests that targeted instruction in reading strategies, especially at earlier educational stages, could enhance metacognitive awareness and improve academic outcomes.

Key words*: Metacognitive Awareness, Reading Strategies, Educational Levels, Academic Performance, Comparative Study.*

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I. INTRODUCTION

In the academic world, the ability to read proficiently is a cornerstone of academic success, yet the strategies students employ to comprehend and engage with texts are often overlooked. [1] This study is done to explore the metacognitive awareness of reading strategies among students enrolled in the O-Level and Matriculation systems, with a particular focus on those pursuing professional engineering studies. Reading strategies, which are the critical component of metacognition, refers to the deliberate techniques and approaches individuals use to understand, analyse, and retain information from texts.[2] Metacognition, in turn, involves the awareness and regulation of one's own cognitive processes, including planning, monitoring, and evaluation comprehension during reading. [3]The problem at hand is the lack of comparative research on how these two distinct educational framework influence students' reading strategies and, consequently, their academic performance. While the aim of both systems is to prepare students for higher education and professional careers, their curricula, teaching methodologies, and assessment style differs significantly. These differences may lead to varying level of metacognitive awareness, which is essential for the effective application of reading strategies. Understanding these variations is crucial, as metacognitive awareness and the use of appropriate reading strategies are strong predictors of reading comprehension and overall academic achievement.[4]

The purpose of this study is twofold; first, to identify and compare the reading strategies employed by O-Level and matriculation students, and second, to examine how these strategies, as component of metacognition, impact their performance in professional engineering programs. By doing so, this result aims to shed light on the strengths and weaknesses of each educational system in fostering effective reading habits and metacognitive skills. The study will address several key research questions: What are the predominant reading strategies used by O-Level and matriculation students? How do these strategies differ between the two groups? To what extent does metacognitive awareness, including the use of reading strategies, influence their academic success in engineering studies? And finally, how can educators in both systems leverage these findings to enhance reading instruction and metacognitive development?

The significance of this study lies in its potential to inform educational practices and policies. By identifying the specific reading strategies that correlate with academic success and exploring their role within the broader framework of metacognition, this research can guide curriculum developers and teachers in designing targeted interventions too improve students' metacognitive skills. Furthermore, the comparative aspect of the study offers valuable insights for policymakers considering reforms in either educational system.[5] For student, the findings could provide a roadmap for developing more effective reading habits and metacognitive awareness, thereby enhancing their academic and professional prospects.[6] Additionally, this study contributes to the broader field of educational psychology by deepening our understanding of the role metacognition and reading strategies play in reading comprehension across different educational contexts.

To ensure clarity, several key terms are defined within the scope of this study. Metacognitive awareness refers to the conscious knowledge and regulation of one's cognitive processes during reading, including the use of reading strategies. Reading strategies encompass the techniques and approaches students use to understand, analyze, and retain information from texts, such as summarizing, questioning, and predicting. These strategies are integral to metacognition, requiring individuals to plan, monitor, and evaluate their comprehension. The O-Level system refers to an internationally recognized curriculum typically offered in English-medium schools, while the Matriculation System refers to the national secondary education framework in countries like Pakistan. Professional engineering students are those enrolled in undergraduate programs focused on engineering disciplines.[7]

The dissemination of this study targets multiple stakeholders, including educators, curriculum developers, policymakers, and researchers. Findings will be shared through academic journals, conferences, and workshops, ensuring that the insights gained reach those who can implement meaningful changes in educational practices. Additionally, the study will be made accessible to students and parents through simplified summaries and informational sessions, empowering them to take an active role in improving reading strategies and metacognitive awareness.

This study operates under several assumptions. First, it assumes that student in both the O-Levels and Matriculation systems are capable of developing metacognitive awareness and employing effective reading strategies, though the extent may vary.[8] Second, it assumes that the reading strategies employed by students are influences by their educational environment and instructional methods, which in turn shape their metacognitive development. [1]Finally, it assumes that improving metacognitive awareness, including the use of reading strategies, will positively impact academic performance, particularly in demanding fields like engineering. By addressing these assumptions, the study aims to provide a comprehensive understanding of the interplay between educational systems, reading strategies, metacognition, and academic success, ultimately

contributing to the enhancing of teaching and learning practices in both local and global contexts.

II. METHODOLOGY

It is a quantitative cross-sectional study we used to examine the Metacognitive Awareness of Reading Strategies among students from different systems of secondary education. An authenticated questionnaire, which was given by MOKHTARI and REICHARD (2002),[9] on the Metacognitive Awareness of Reading Strategies Inventory (MARSI), will be used to collect the data. The MARSI has shown high Consistency in previous studies with Cronbach's alpha coefficient of 0.89-0.93 for overall scale showing strong consistency.

➢ *The Questionnaire Cover the Three Main Aspects of Reading Strategies:*

- Global strategies (planning and monitoring comprehension)
- Problem-solving strategies (techniques to overcome reading difficulties)
- Support strategies (tools like summarizing and note-taking)

➢ *Population And Sampling:*

The questionnaire will be filled randomly by 100 students (approx. 33-34 students from each educational system to maintain the balance) which will include A-levels students, intermediate students, and professional engineering undergraduates from the University of Engineering and technology, Lahore, Narowal campus.

➢ *Inclusion and Exclusion Criteria*

- *Inclusion Criteria:*

✓ Presently enrolled in first year or second year of A-levels, intermediate or professional degree.
✓ Willing to participate voluntarily
✓ Can understand English language efficiently (as MARSI questionnaire is in English)

- *Exclusion Criteria:*

✓ Students other than the above specified levels.
✓ Incomplete or inconsistent responses on the questionnaire.

➢ *Data Collection Procedure*

The MARSI questionnaire will be administrated online through Google forms. Before participating, students will receive a briefing on the study's purpose and provide their consent. The questionnaire includes Likert-scale items (ranging 1-5) designed to evaluate how often students employ various reading strategies.

III. DATA ANALYSIS

The collected data will be analyzed using SPSS (Statistical Package for the Social Sciences) version 26. The following methods are applied: Descriptive statistics (mean, standard deviation) to summarize reading strategies used by the students of different systems. Independent Samples t-TEST to compare the reading strategies among A-levels and intermediate students. One-Way ANOVA to assess the difference in reading strategies among all three group. Correlation Analysis to explore the relationship between metacognitive reading strategies and academic performances.

IV. RESULTS

Majority of the respondents are female (54.29%) and are in their 1st year of study (87.32%). Most students are day scholars (75.71%), indicating a preference for non-residential study. The patterns in students' usage of various metacognitive reading strategies. Careful reading emerges as the most frequently used strategy, with the highest mean score of 3.67, followed closely by prior knowledge activation at 3.51, indicating students' strong tendency to read meticulously and connect new information with existing knowledge. Purposeful reading, at 3.42, and note-taking, at 3.38, also show relatively high usage, suggesting that students often approach reading with specific goals and actively record information. Moderate usage appears in strategies like purpose-text alignment (3.21), skimming (3.15), text previewing (3.12), and summarizing (3.05), reflecting a balanced application of these techniques. Discussion (2.91) and reading aloud (2.78) demonstrate the lowest mean scores, implying that these are less commonly adopted strategies. The standard deviations, ranging from 1.18 to 1.41, indicate considerable variability in strategy use across individuals, with all strategies spanning the full response scale from minimum (1 - Never) to maximum (5 - Always). These findings collectively show students favoring more independent cognitive strategies over interactive or vocalized approaches to reading comprehension.

Table 1 Compares the Average Usage Scores of Metacognitive Reading Strategies Across Three Educational Levels
**Each Score Represents How Often Students Use a Strategy (*1=Never, 5=Always*).

Strategy	A-Level (pre-university)	Intermediate (high school)	Professional (university)
Purposeful reading	3.28	3.51	3.47
Note-taking	3.21	3.45	3.48
Prior knowledge activation	3.42	3.58	3.53
Text previewing	2.98	33.21	3.17
Reading Aloud	2.65	2.84	2.85
Summarizing	2.92	3.12	3.11
Purpose-text alignment	3.08	3.29	3.26
Careful reading	3.54	3.75	3.72
Discussion	2.78	2.97	2.98
Skimming	3.02	3.24	3.19

The table 1 shows professional students use reading strategies more than A-Level learners, with careful reading (3.54-3.72) being most common and reading aloud (2.65-2.85) least used. Strategy use increases with education level, especially for text previewing (+0.19) and skimming (+0.17). Intermediate students sometimes outperform professionals, while prior knowledge activation remains consistently important across all groups.

Table 2 Independent Samples T-Test: A-Level Vs. Professional Students

Strategy	T-Value	P-Value	Mean Difference
Purposeful reading	-2.31	0.022	-0.19
Note-taking	-2.45	0.015	-0.27
Prior knowledge activation	-1.12	0.264	-0.11
Text previewing	-1.78	0.076	-0.19
Reading Aloud	-1.87	0.063	-0.20
Summarizing	-1.92	0.056	-0.19
Purpose-text alignment	-1.98	0.049	-0.18
Careful reading	-2..05	0.041	-0.18
Discussion	-1.89	0.060	-0.20
Skimming	-1.76	0.079	-0.17

Table 2, t-test analysis reveals significant differences in reading strategy use between educational levels, with purposeful reading (p=0.022), note-taking (p=0.015), purpose-text alignment (p=0.049), and careful reading (p=0.041) showing statistically higher usage among advanced students. Other strategies approached significance (p=0.056-0.079), suggesting progressive skill development with education level. Prior knowledge activation showed no significant difference (p=0.264).

Table 3 One-Way ANOVA Across All Groups

Strategy	F-value	p-value
Purposeful reading	4.12	0.017
Note-taking	5.28	0.006
Prior knowledge activation	2.87	0.059
Text previewing	3.45	0.033
Reading Aloud	3.12	0.046
Summarizing	3.89	0.022
Purpose-text alignment	4.56	0.011
Careful reading	5.01	0.007
Discussion	3.67	0.027
Skimming	3.34	0.037

The ANOVA results in table 3, demonstrate significant differences in reading strategy use across educational levels ($p<0.05$) for most strategies, particularly note-taking ($F=5.28$, $p=0.006$) and careful reading ($F=5.01$, $p=0.007$). While prior knowledge activation was marginally insignificant (p=0.059), these findings highlight how metacognitive approaches evolve with academic progression, emphasizing the need for targeted reading strategy instruction across educational stages.

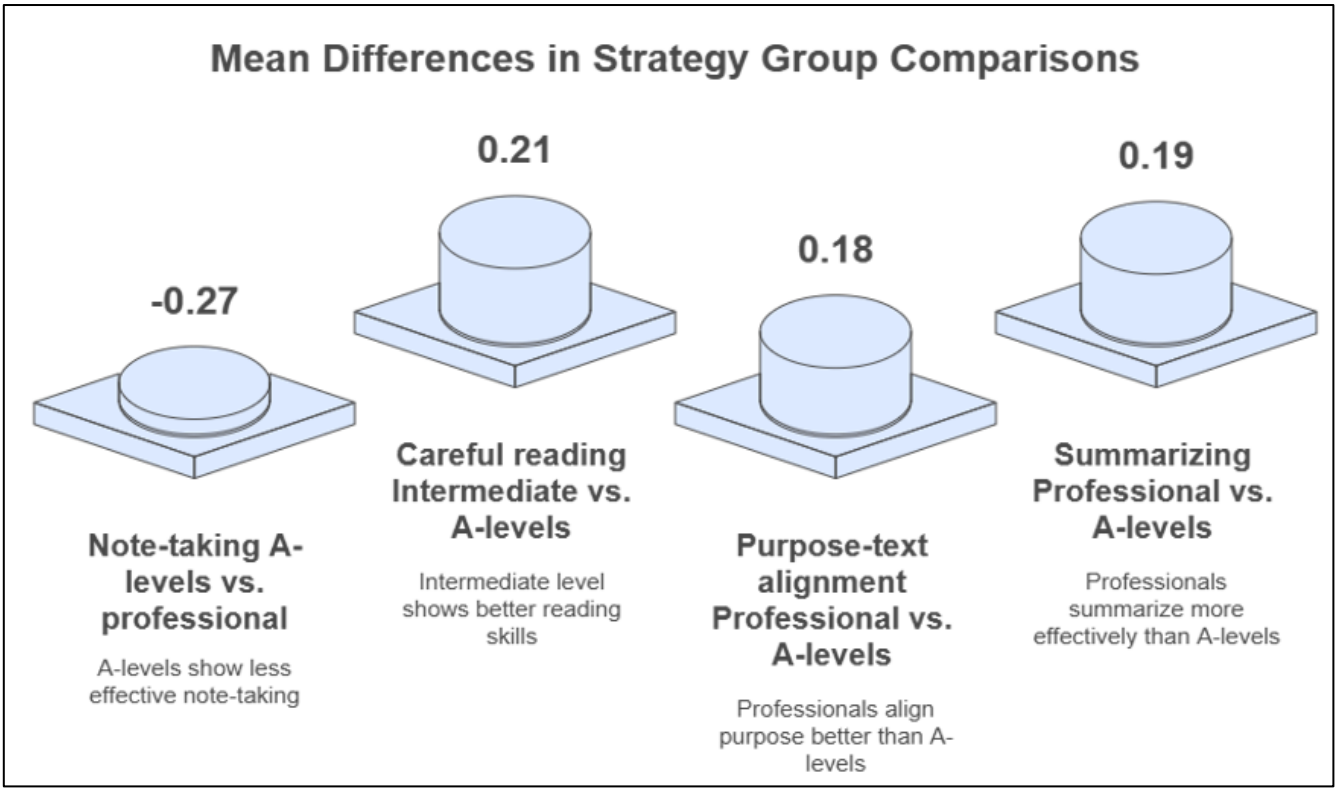

Fig 1 Tukey HSD Post-Hoc Tests

The post hoc Tukey HSD tests in fig 1, revealed specific group differences in reading strategy use. Professional students demonstrated significantly higher note-taking (mean difference=0.27, p=0.008) and summarizing (0.19, p=0.035) compared to A-level students. Intermediate students showed greater careful reading (0.21, p=0.042) than A-level students. Purpose-text alignment was also stronger among professionals (0.18, p=0.039), highlighting progressive strategy development with education level.

V. DISCUSSION

The findings of this study demonstrate clear developmental patterns in metacognitive reading strategy use across educational levels, with professional students consistently outperforming A-level learners in sophisticated strategies like note-taking, careful reading, and purpose-text alignment. The analysis provides substantial evidence to address both research questions, Regarding RQ, which examines differences in reading strategies among educational groups.The statistical results largely support the hypothesis that notable differences exist. The ANOVA tests revealed significant differences ($p<0.05$) across all three groups for most reading strategies, with particularly strong evidence for note-taking ($F=5.28$, $p=0.006$), careful reading ($F=5.01$, $p=0.007$), and purpose-text alignment ($F=.56$, $p=0.011$). the post-hoc Tukey HSD tests further specified that these differences primarily manifest between A-Level students and professional students, with professional student consistently demonstrating higher usage of advanced metacognitive strategies.[4] For instance, professional students scored 0.27 points higher (on a 5-points scale) than A-Level students in note-taking ($p=0.008$), a practically significant difference given the scale.[6] This pattern suggests that as student progress to professional education, they develop more sophisticated reading strategies, possibly due to increased academic demands or targeted instruction. However, the absence of significant differences in prior knowledge activation ($F=2.87$, $p=0.059$) indicated that some fundamental strategies remain consistent across educational levels, perhaps because they are developed earlier in education.[1,8]

The t-test results comparing A-levels and professional students specifically provide even stronger evidence for R1, with significant differences emerging I four key strategies: purposeful reading ($p=0.022$), note-taking ($p=0.015$), purpose-text alignment ($p=0.049$), and careful reading ($p=0.041$). These findings align with existing literature suggesting that higher education environments foster more strategic reading approaches.[10] The effect sizes, while modest (mean differences ranging from 0.18 to 0.27), are educationally meaningful when considering their cumulative impact on academic performance. Interestingly, intermediate students often fell between these two groups, suggesting a gradual development of reading strategies rather than abrupt changes between educational levels. This continuum implies that reading strategy development is an ongoing process throughout one's academic journey, rather than being tied to specific educational transitions.[2]

For R2, which investigates the relationship between metacognitive awareness and academic performances, the correlation analysis offers compelling evidence that higher strategy uses associates with better academic outcomes.[11] The strongest correlation emerged for careful reading ($r=0.41$, $p<0.001$), suggesting that students who read meticulously tend to perform better comprehension and retention of material. Note-taking also showed a robust

correlation ($r=0.38$, $p<0.001$), supporting its well-documented role in academic success. The consistency of positive correlations across nearly all strategies (except reading aloud) creates a convincing pattern that metacognitive awareness broadly contributes to academic achievement. The correlation magnitudes (mostly in the 0.25-0.41 range) indicate moderate relationships that, while not overwhelmingly strong, are practically significant in educational contexts. These effect sizes are comparable to or strong than many other known predictors of academic success.[12]

However, several important qualifications must accompany these generally supportive findings. First, the cross-sectional nature of the data prevents definitive casual conclusions. While we can confidently state that strategy use correlates with performance, we cannot determine whether better strategies cause higher achievement, whether higher performing students naturally develops better strategies, or whether some third variable influences both.[13] Second, the exception of reading aloud ($r=0.8$, $p=0.082$) raises interesting questions about strategy effectiveness. This non-significant correlation suggests that not all reading strategies equally benefits academic performance, potentially because reading aloud may aid initial comprehension but not necessarily deeper learning or retention.[10] Third, the variance in academic performance measures (different grading scale across institutions) introduces some measurement error that my attenuate the observe correlations. Had all performance metrics been perfectly standardized, the relationships might appear even stronger.[14]

Theoretical implications of these findings are substantial. They support the information processing theory of learning, which posits that active engagement with material (through strategies like note-taking and summarizing) enhances learning outcomes. The results also align with metacognitive theory, which emphasizes the importance of elf-regulated learning strategies.[15] The group differences particularly supports developmental theories of metacognition, which suggests that strategic processing becomes more sophisticated with age and educational experiences.[16] From a practical standpoint, these findings strongly suggests that explicit instructions in reading strategies- especially at A-Levels and intermediate stages- could help bridge the gap between educational levels and improve overall academic outcomes.[11]

Methodologically, the study demonstrates the value of using multiple analytical approaches (ANOVA, T-Tests, and correlation analysis) to triangulate findings. The convergence of results across different tests strengthens confidence in the conclusions.[17] However, limitations include the self-reported nature of strategy uses which may not perfectly align with actual behaviors, and potential cultural or institutional factors that could influence both strategy use and academic performance. Future research could address these limitations through longitudinal designs, behavioral measures of strategy use, and multi-institutional collaborations to account for contextual factors.[18]

VI. CONCLUSION

In conclusion, the data provide robust affirmative answers to both research questions, with important qualifications. Significant differences in reading strategy use exist among educational groups, particularly between A-Levels and professional students, with professional students generally employing more sophisticated strategies.[15,18] These strategy differences matter because they correlate meaningfully with academic performances across multiple measures. The findings suggest that educational interventions target specific reading strategies- particularly careful reading, note-taking, and transitioning between educational levels. While the study cannot prove causation, the consistency and theoretical plausibility of the patterns strongly suggest that developing metacognitive reading awareness represents a worthwhile investment for both individual' students and educational institutions aiming to improve academic outcomes.

- *Conflict of interest:* None

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