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Exploring the Role of Inferential Skills in Reading Comprehension and Metacognitive Development

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Abstract

This quantitative study examines the relationship between Karachi University students' self-reported metacognition components and their reading comprehension performance. The study involved 100 undergraduate students, 50 from public universities and 50 from private ones. The study concentrated on how students' self-reported using planning and evaluation-related metacognitive strategies affected their performance on reading comprehension tasks with inferential questions. The findings showed that the metacognitive elements of planning and assessment could explain a sizable amount of the variation in students' inferential comprehension performance. These results highlight how important metacognitive awareness is for deciphering implicit meanings and making deductions while reading. The study emphasises the need for focused teaching methods that promote metacognitive growth to improve ESL students' inferential reading abilities in higher education.

Keywords: Inferential Skills, Reading Comprehension, Metacognitive Development

Introduction

In educational research, metacognition is a complex and theoretically rich concept. According to Flavell's initial definition, metacognition is the process of reflecting on one's own thought processes (Flavell, 2020). The idea has been developed and broadened in the decades that have followed. Recent reviews continue to highlight the two primary functions of metacognition, which were defined by Nelson and Narens (2020): monitoring (assessing progress) and control (modifying behavior) (Azevedo, 2025).

According to modern frameworks, metacognition can be divided into two main categories: knowledge of cognition and regulation of cognition (Schraw & Dennison, 2020; Turn20). Declarative knowledge (knowing what strategies are available), procedural knowledge (knowing how to implement them), and conditional knowledge (knowing when and why to apply certain strategies) are all included in the concept of cognition. On the other hand, cognitive regulation encompasses the abilities required to supervise and guide one's cognitive processes, including organising, handling information, resolving misconceptions, assessing results, and keeping track of comprehension (Schraw & Dennison, 2020).

In particular, comprehension monitoring a regulatory sub-process crucial to successful learning is the focus of this study. The process of accurately and quickly evaluating one's comprehension while reading and taking remedial action when necessary is known as comprehension monitoring

(Turn0search14). Monitoring and control are reciprocal and interactive aspects of metacognitive regulation, which is consistent with Nelson and Narens' cyclical model (Nelson & Narens, 2020).

Numerous metacognitive monitoring indicators have been used in empirical research in recent years. We operationalize metacognitive monitoring accuracy in this paper as a "feeling-of-knowing" (FOK) judgment that captures learners' prospective judgments (predictions about their future performance) and, if relevant, retrospective confidence following tasks. Additionally, researchers differentiate between local judgments (item-level confidence) and global judgments (overall confidence in one's comprehension), both of which produce different insights.

The congruence between expected and actual performance is known as monitoring accuracy, or metacomprehension accuracy, while the discrepancy is known as metacomprehension bias or error. To evaluate metacomprehension accuracy, studies frequently use judgments of learning, ease of learning, and absolute judgments (overall confidence) versus relative judgments. Effective learning is based on metacognitive awareness and regulation. In addition to knowing what they already know, effective learners are able to identify knowledge gaps and use strategies to fill them .The ability to track comprehension helps students identify when they fall short of their own expectations and use self-control techniques like summarizing or rereading to improve comprehension (Keys to Literacy, 2024).

While low accuracy frequently results in either unnecessary effort or an early end to learning, both of which are linked to worse academic outcomes, readers with high metacomprehension accuracy demonstrate greater study efficiency and academic effectiveness (Turn0search14; Turn0search12). In fact, poorer performance and less productive study habits have been associated with lower metacomprehension accuracy.

Sadly, despite its significance, metacognitive monitoring is a problem for many students; their self-evaluations usually don't match their comprehension. As a result, studies are still investigating interventions that use focused training to improve metacomprehension.

Two new aspects of reading metacomprehension are examined in this study: which metacognitive knowledge components best predict performance on text-based versus inferential comprehension questions.

There are still unanswered questions despite mounting evidence that metacognition improves reading comprehension. According to some research, there are ambiguous relationships between reading performance and the application of metacognitive strategies (e.g., Peronard, 2021). Others discover weak relationships between comprehension outcomes and awareness measures (Puente Jiménez & Alvarado, 2022), indicating that reading success may not be accurately predicted by explicit metacognitive knowledge. Researchers partially blame these contradictory results on differences in the formats used for comprehension tests.

It is important to clarify how we conceptualize comprehension monitoring before delving into these conflicting findings. According to some researchers, monitoring includes both identifying and fixing comprehension problems (Hacker et al., 2021).

Others, in line with Schraw and Dennison (2020), make a more stark distinction, viewing regulatory actions and monitoring as distinct but connected processes. Our study views monitoring as evaluative judgment that is separate from subsequent control actions, in accordance with this latter definition.

Literature Review

Students' metacomprehension accuracy—defined as their capacity to predict their own comprehension performance—remains consistently low across many learning environments, despite growing attention in educational research. Studies have found that when students are asked to read a text and estimate their performance on a comprehension test, their self-assessed performance often

does not match actual performance outcomes (Bol & Hacker, 2001; Dunlosky & Lipko, 2007; Hacker et al., 2008.). Accuracy remains poor even in cases of specific detail predictions—such as the recall of definitions or key points (Dunlosky, Rawson, & McDonald, 2002). Considered markers of poor metacognitive monitoring are these mismatches between performance and judgment.

Thiede et al. (2009) conducted a meta-analysis comprising more than 40 studies and found an average correlation of just.27 between students' comprehension predictions and their actual scores, so indicating a modest link between monitoring judgments and reading comprehension. Many elements lead to this low accuracy. The dubious validity of comprehension tests used in past studies raises serious issues; assessments that are too limited and fail to adequately reflect the whole spectrum of text content will not provide a reliable basis for evaluating metacognitive accuracy (Weaver, 1990; Dunlosky et al., 2005). Particularly likely to produce false predictions from students are comprehension tests that ignore whole segments or neglect to evaluate interrelations among ideas.

Also seems to affect accuracy is text length. Longer passages often show lower prediction accuracy among students, as Dunlosky and Lipko (2007) observe when cognitive demands rise and memory traces fade. Longer books challenge readers to retain more knowledge and manage more complexity, which may skew their perceptions of comprehension.

The type of cues students use to guide their judgments also has a major impact on metacomprehension accuracy. Dunlosky et al. (2002) propose that students deduce comprehension quality from subjective experiences during reading—such as encountering unknown words, ambiguous pronouns, or confusing sentence structures. Whether these interruptions of reading fluency really reflect comprehension performance, readers see them as signals of poor understanding.

Strong evidence points to inferential ability as being a major determinant of reading comprehension quality. Generating inferences especially bridging inferences linking far-off sections of the text or tie information to past knowledge—especially challenges poor comprehenders (Cain et al., 2001; Cain & Oakhill, 1999). On the other hand, good readers show better comprehension since they make more frequent and accurate inferments during reading.

Promising are instructional interventions meant to raise inferencing skills. For example, McNamara's Self-Explanation Reading Training (SERT) specifically instructs students to make inferences while reading. Results show that lower prior knowledge students gain much from such approaches (McNamara, 2004, 2017), suggesting that inferential education can help close knowledge gaps.

This suggests that students' degree of inferential skill probably affects their metacomprehension judgments, or predictions of their comprehension. Higher inferencing ability readers often show disturbances at the level of the situation model and hence base their metacognitive judgments on more thorough understanding processes. Readers with limited inferential ability, on the other hand, concentrate more on surface-level problems and are thus more prone to mistakes in metacognitive evaluation. Empirically confirmed is this theoretical link between mental representation and metacomprehension accuracy. Encouragement of students to summarize or identify keywords after reading—a strategy that generates retrieval from the situation model—helps to greatly increase metacomprehension accuracy, according to Thiede et al. (2009). Anderson and Thiede (2003) for instance found that students who produced delayed summaries following a text showed notably better metacomprehension accuracy (r =.60) than those in a control group (r =.26). These techniques enable students to reach more coherent and richer mental models, so improving their understanding and resulting in more accurate assessments of their knowledge.

All things considered, inferential ability improve comprehension results and provide a basis for exact metacognitive monitoring. Students become more skilled in spotting what they do and do not understand as they grow better able to combine text and prior knowledge, so enhancing the learning efficiency and academic performance.

Problem Statement

Many university students, especially ESL learners, continue to struggle with reading comprehension, even English is a required language of instruction in Pakistani higher education. When students must respond to inferential questions, which call for more than a cursory knowledge of text this difficulty is particularly evident. According to international studies, reading success is much influenced by metacognitive awareness—more especially, metacomprehension accuracy that helps one to evaluate their own degree of understanding. Students often show poor metacomprehension accuracy, which results in either over- or underestimating of their comprehension ability, ineffective study strategies, and less-than-ideal academic results.

Limited empirical research has been conducted in Pakistan specifically on the interaction between metacognitive strategies, inferential reading skills, and actual university-level comprehension performance. Moreover, little is known about whether students from different institutional backgrounds public versus private universities—differ in their metacomprehension accuracy or inferential comprehension. Teachers and legislators without such insights lack the evidence base required to create successful reading interventions catered to students' Metacognitive and inferential capacity.

Students answered a self-report form evaluating their metacognitive awareness within the framework of reading. Three main components of metacognition planning (involving strategies used to prepare for a reading task), monitoring (the ability to detect comprehension difficulties and make adjustments while reading), and evaluation the process of judging one's understanding by identifying what was successfully comprehended and what was not during reading were measured on the survey.

By looking at how metacognitive strategy use (planning and evaluation) affects inferential reading comprehension, and how precisely students predict their reading performance, this study hopes to close this gap. This study aims to find important differences by concentrating on students from public and private sector universities in Karachi, so as to guide evidence-based teaching strategies that promote deeper reading comprehension by better metacognitive awareness.

Objectives

- To examine the relationship between students' self-reported use of planning, monitoring, and evaluation strategies and their performance on text-based and inferential reading comprehension questions.
- To determine the extent to which planning, monitoring, and evaluation predict students' performance on text-based and inferential comprehension tasks.

Research Questions

1. What is the relationship between students' self-reported metacognitive strategies (planning, monitoring, and evaluation) and their performance on text-based and inferential reading comprehension tasks?
2. To what extent do planning, monitoring, and evaluation predict students' reading comprehension performance on inferential and text-based questions?

Significance of the Study

For Pakistani higher education system teachers, curriculum designers, and language policy makers in particular, this study has great relevance. In an academic environment where English is both the language of instruction and a gateway to academic success, student success depends on a capacity to understand difficult texts especially at inferential levels. Many university students, particularly those in ESL environments, show poor comprehension performance, which is usually related not only in language constraints but also in weak metacognitive awareness.

This study intends to offer empirical data on how students control their understanding during reading by looking at the relationship between their actual performance on reading comprehension activities and their self-reported use of metacognitive strategies (planning, monitoring, and evaluation). Particularly in differentiating between surface-level (text-based) and deeper (inferential) understanding, the results will help determine whether students' opinions of their reading match their actual comprehension ability.

Moreover, by including participants from both public and private sector universities in Karachi, this study paints a more complete picture of the differences in reading strategy use and comprehension results among institutional forms. This analogy can guide context-specific interventions, teacher preparation courses, and reading comprehension support projects more sensitive to students' academic and language background.

In the end, the study adds to the increasing corpus of studies on metacognition in ESL environments and has pragmatic ramifications for improving reading instruction, assessment strategy, and learner autonomy in Pakistani colleges.

Research Methodology

Examining the relationship between students' self-reported metacognitive strategies planning, monitoring, and evaluation—and reading comprehension performance using a quantitative, correlational research design specifically on text-based and inferential comprehension questions.

Target Population

The target population was undergraduates registered in public and private sector universities in Karachi, Pakistan. These students were selected based on their regular English-language book reading experience and the importance of reading comprehension for their courses.

Sampling Technique

Stratified random sampling guaranteed representation for both public and private universities. Keeping demographic balance, this method allowed the researchers to assess performance among several institutional configurations.

Sample Size

The total sample comprised 100 undergraduate students, with: 50 students from public sector universities, and 50 students from private sector universities

Study Procedure

To examine students' metacognitive awareness in relation to reading comprehension, the study utilized a structured self-report instrument adapted from the Escala de Conciencia Lectora (ESCOLA)—a validated Reading Awareness Scale originally developed for Spanish-speaking students. While the original ESCOLA is designed for learners aged 18 to 22, the core structure and metacognitive components of the instrument were adapted and translated into English for appropriateness with Pakistani university students enrolled in undergraduate programs.

Table 1.

Sample Questions from the Three ESCOLA Dimensions

Dimension	Sample Question	Response Options	Points
PLANNING	Before you start reading, what do you do to help in the reading process?	a) I do not make any plans, I just start reading.	0
		b) I consider why I'm going to read.	2

Dimension	Sample Question	Response Options	Points
		c) I choose a comfortable place to read.	1
MONITORING	If you are reading a book and find a paragraph difficult to understand, what do you do?	a) I stop to think about the problem and how to fix it.	2
		b) I do not keep reading because I cannot solve the problem.	0
		c) I continue to read to see if the meaning is clarified later.	1
EVALUATION	In carrying out the activity of reading:	a) I think it is useful to assess whether I understood what was written.	2
		b) I think that evaluating understanding is good but that it should be done by an adult.	1
		c) I do not think that evaluating understanding is helpful after finishing reading.	0

Reading Comprehension Test

To assess students' reading comprehension, a custom-designed test was developed for this study, focusing on a neutral academic topic to avoid bias from prior exposure. The reading passage used for the test was an informational text on the human digestive system, consisting of approximately 430 words. The content and structure of the passage were carefully reviewed and validated by subject matter experts and aligned with the Construction-Integration Model of comprehension (Kintsch, 1998), which highlights multiple levels of mental representation—linguistic, text-based, and situation model.

The comprehension test included a total of 20 open-ended questions, evenly divided between: 10 text-based questions, which required students to locate explicitly stated information from the passage. 10 inferential questions, which required students to generate meaning by connecting ideas and applying prior knowledge beyond the literal text.

The test was administered following the completion of the metacognitive self-report scale. No images or visual aids were included in the reading passage, ensuring that students relied solely on text-based and cognitive strategies during the comprehension process. This assessment approach enabled a clear distinction between students' literal comprehension and their ability to make inferences, key to understanding their metacognitive regulation during reading.

Data Analysis

Before conducting statistical analyses, the dataset was carefully screened to ensure accuracy and adherence to assumptions required for parametric testing. Data were evaluated for potential outliers across the three ESCOLA subscales (planning, monitoring, and evaluation) as well as the reading comprehension scores (text-based and inferential).

Using the casewise diagnostic procedure in SPSS, outliers were identified by specifying standardized residuals exceeding ±3 standard deviations. This process revealed a total of 11 outliers

across the dataset 4 in the planning subscale and 7 in the evaluation subscale of the ESCOLA instrument. In accordance with the guidelines proposed by Tabachnick and Fidell (2013), these outliers were removed to prevent any undue influence on the results and to enhance the reliability of statistical interpretation. Consequently, the final dataset included 89 complete and valid cases for further analysis.

All assumptions for parametric testing including normality, linearity, multicollinearity, and homoscedasticity were tested and met. Skewness and kurtosis values for all major variables fell within acceptable ranges, and plots of residuals confirmed a linear relationship between the predictors (metacognitive subscales) and the outcome variables (reading comprehension scores).

Descriptive and Correlational Analyses

First, **descriptive statistics** (mean, standard deviation, and minimum, maximum) were calculated for the three metacognitive components (planning, monitoring, and evaluation) and for the two types of reading comprehension (text-based and inferential). These descriptive findings provided an overview of students' self-reported strategy use and their overall comprehension performance.

To address the **first research question** examining the relationship between metacognitive strategy use and comprehension performance **Pearson's zero-order correlation coefficients** were computed. This helped determine the strength and direction of association between each metacognitive component and students' performance on both text-based and inferential comprehension questions.

Regression Analysis

To address the second research question, which focused on the predictive power of planning, monitoring, and evaluation strategies in explaining reading comprehension performance, multiple linear regression analyses were conducted. Two separate standard (simultaneous) regression models were run: One for predicting text-based comprehension scores. Another for predicting inferential comprehension scores. In each model, the three ESCOLA subscales served as the independent variables. Given that multiple tests were run on related outcomes, the **Bonferroni correction** was applied to adjust the level of significance and reduce the risk of Type I error. As a result, the adjusted significance level (α) was set accordingly.

The results from both the correlational and regression analyses helped identify which metacognitive strategies were most influential in students' ability to comprehend texts—particularly those requiring inferential reasoning. These findings have direct implications for improving reading instruction and metacognitive awareness among university students in Pakistan's diverse educational landscape.

Results

The correlation coefficients, as presented in Table 3, indicate that all relationships between metacognitive components (planning, monitoring, and evaluation) and reading comprehension scores were positive and in alignment with theoretical expectations. Notably, the components of planning and evaluation showed stronger correlations with inferential comprehension than with text-based comprehension. In contrast, monitoring was more strongly associated with text-based comprehension performance.

To further examine the predictive power of metacognitive strategies, two simultaneous multiple regression analyses were conducted—one for text-based and one for inferential comprehension scores. In the first regression model, where text-based comprehension scores served as the dependent variable, the combination of planning, monitoring, and evaluation did not significantly predict performance, $F(3, 170) = 2.45$, $p = .06$. Among the predictors, monitoring came

closest to reaching statistical significance ($p = .07$), suggesting a trend-level association but not a definitive predictive effect.

In contrast, the second regression model, which used inferential comprehension scores as the dependent variable, was statistically significant, $F(3, 170) = 7.38$, $p = .001$, $R^2 = .12$. This indicates that approximately 12% of the variance in students' inferential comprehension performance could be explained by their reported use of metacognitive strategies. Within this model, planning and evaluation emerged as significant predictors, with evaluation being the strongest contributor to inferential comprehension. These results suggest that students who rated themselves higher in their ability to assess their own reading performance and strategically prepare for reading tasks were more likely to perform better on questions requiring inference and deep-level understanding. These findings highlight the importance of self-evaluative awareness and strategic planning in facilitating inferential comprehension key skills for university-level academic reading.

Table 2

Descriptive Statistics for Metacognitive Strategies and Reading Comprehension Performance among University Students in Karachi (N = 100)

Variable	Mean (M)	SD	Sum	Minimum	Maximum	Skewness	Kurtosis
Metacognitive Strategies (ESCOLA)							
Planning	37.31	4.82		25.00	48.00	–0.19	–0.36
Monitoring	22.99	3.31		15.00	30.00	–0.35	–0.42
Evaluation	19.69	2.67		13.00	26.00	–0.23	–0.26
Reading Comprehension Scores							
Text-Based Questions	7.82	3.10		1.00	12.00	–0.34	–1.06
Inferential Questions	10.88	4.29		0.00	19.00	–0.36	–0.45

These statistics represent the performance of undergraduate students from public and private universities in Karachi, Pakistan. Scores were based on responses to the ESCOLA self-report scale and a researcher-developed reading comprehension test.

Table 3

Zero-Order Correlation Matrix between ESCOLA Subscales and Reading Comprehension Scores (Study 1, N = 100)

Variable	1	2	3	4	5
1. Text-Based	—	.62**	.13*	.17*	.15*
2. Inferential		—	.22*	.10	.31**
3. Planning			—	.42**	.33**
4. Monitoring				—	.24*
5. Evaluation					—
Skewness	–0.38	–0.35	–0.47	–0.77	–0.49
Kurtosis	–1.07	–0.44	–0.04	0.32	0.46

$p < .05$, **p** < .01 (one-tailed). Correlations reflect relationships among ESCOLA metacognitive subscales (planning, monitoring, and evaluation) and reading comprehension outcomes (text-based and inferential). All values are based on responses from university students (N = 100) in Karachi, Pakistan.

Table 4

Standard Regression Results for Predicting Text-Based and Inferential Reading Comprehension from Metacognitive Strategies (N = 100)

Outcome	Predictor	B (95% CI)	β	t	p
Text-Based Performance					
	Planning	0.03 (–0.08, 0.14)	.05	0.73	.46 ns
	Monitoring	0.12 (–0.04, 0.27)	.12	1.48	.14 ns
	Evaluation	0.12 (–0.06, 0.30)	.10	1.26	.21 ns
Inferential Performance					
	Planning	0.13 (0.02, 0.27)	.15	2.02	.039*
	Monitoring	–0.04 (–0.24, 0.17)	–.03	–0.34	.73 ns
	Evaluation	0.44 (0.19, 0.68)	.27	3.53	.001**

$p < .05$, **p** < .01, ns = not significant. B = Unstandardized regression coefficients; CI = 95% Confidence Interval; β = Standardized regression coefficients.

Discussion

The primary goal of this study was to examine the relationship between metacognitive strategies—specifically planning, monitoring, and evaluation—and students' reading comprehension performance, with a distinction made between text-based and inferential understanding. The results revealed several meaningful insights and patterns that both align with and contrast previous research.

Key Findings and Interpretation

A major finding of this study was that planning and evaluation strategies significantly predicted students' performance on inferential comprehension questions, but not on text-based comprehension. This suggests that students who actively prepare for reading and reflect on their understanding tend to perform better when deep-level processing, such as drawing inferences and connecting background knowledge, is required.

In contrast, monitoring was not a significant predictor for either comprehension type, although it showed a weak positive correlation with text-based comprehension. This finding indicates that while students may recognize difficulties during reading, their ability to adjust strategies in real time does not strongly influence their comprehension outcomes—at least not at the university level in this context.

Comparison with Similar Studies

The current findings are consistent with those reported by Thiede et al. (2009), who argued that readers with strong evaluation and planning skills build more coherent mental representations and, consequently, show improved comprehension. In particular, the predictive strength of evaluation aligns with Thiede's assertion that readers who can assess their own understanding are more likely to perform better on inferential tasks.

Similarly, McNamara (2004, 2017) demonstrated that teaching students self-explanation and inference-building strategies—both aligned with metacognitive planning and evaluation—enhances inferential comprehension. Our study supports this by showing that students who score higher on these subscales of metacognition are better at processing beyond the literal meaning of texts. Moreover, Dunlosky et al. (2002) emphasized the importance of inference skills for accurate metacomprehension judgments. Our results also suggest that students with stronger planning and evaluative abilities may generate more effective inferences, leading to better performance.

Contrast with Other Studies

However, not all research aligns with our findings. For example, Puente Jiménez and Alvarado (2022) found only weak or inconsistent correlations between self-reported metacognitive strategies and comprehension outcomes. One possible explanation for this discrepancy lies in the differences in instructional context and language background. While their study focused on L1 readers in more developed educational environments, our participants are ESL learners in a multilingual Pakistani setting, where comprehension strategies may function differently.

Furthermore, while Bol and Hacker (2001) found monitoring to be a strong predictor of reading performance in younger learners, our study did not replicate this pattern. It is possible that university-level students, although more experienced readers, may not consistently engage in active real-time monitoring while reading academic texts—perhaps due to lack of strategy instruction or reading fatigue.

Theoretical Implications

These findings reinforce the Construction-Integration Model (Kintsch, 1998), which posits that deeper comprehension, especially the development of a situation model, depends on inferencing and integration with prior knowledge. Our study suggests that students who use metacognitive strategies

related to planning (before reading) and evaluation (after reading) are more likely to successfully build such models and perform better on inferential questions.

Additionally, the results support Flavell's theory of metacognition (2020) and the Simple View of Reading (Gough & Tunmer, 1986), highlighting the crucial role of self-regulation in comprehension, particularly among ESL learners.

Limitations and Future Research

One limitation of this study is the reliance on self-reported metacognitive data, which may not always accurately reflect actual cognitive behavior. Also, the use of a single reading passage may limit generalizability. Future research should include think-aloud protocols, eye-tracking, or longitudinal classroom interventions to provide a more comprehensive understanding of how metacognitive processes operate during reading in real-time.

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