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Enhancing Student Intelligence and Memory through Metacognitive Strategies: Insights from Classroom Practices in Secondary Education of South Punjab

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Keywords: Metacognition, Memorization, Intelligence, Secondary Education, South Punjab, Classroom Practices

Authors:

Muhammad Naveed Iqbal: Ph.D. Scholar, Department of Education, The Islamia University of Bahawalpur, Punjab, Pakistan.

Nosheen Malik:(Corresponding Author)
Assistant Professor, Department of Education, The Islamia University of Bahawalpur, Punjab, Pakistan.
(Email: nosheen.malik@iub.edu.pk)

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Title

Enhancing Student Intelligence and Memory through Metacognitive Strategies: Insights from Classroom Practices in Secondary Education of South Punjab

Authors:

Muhammad Naveed Iqbal: Ph.D. Scholar, Department of Education, The Islamia University of Bahawalpur, Punjab, Pakistan.

Nosheen Malik:(Corresponding Author)
Assistant Professor, Department of Education, The Islamia University of Bahawalpur, Punjab, Pakistan.
(Email: nosheen.malik@iub.edu.pk)

Contents

Abstract

This study investigates the mediating role of metacognition in the relationship between memorization and intelligence among students of secondary schools in South Punjab, Pakistan. Using a quantitative correlational design, data were collected from 393 students selected through stratified random sampling. A structured 50-item questionnaire measured metacognitive knowledge, regulation, memorization strategies, and intelligence. Reliability and validity were ensured through confirmatory factor analysis, while SPSS v.25 and SmartPLS v.4.0 were employed for analysis. Results revealed that metacognition was positively associated with both memorization and intelligence, and significantly mediated their relationship. Male students outperformed females in metacognitive knowledge and intelligence, though memorization showed no significant gender differences. The findings suggest that memorization provides the foundation of knowledge, but metacognitive regulation transforms it into meaningful application. The study recommends integrating metacognitive training into teaching and curricula to enhance reflective learning and foster higher-order thinking among secondary school learners.

Keywords:

Metacognition, Memorization, Intelligence, Secondary Education, South Punjab, Classroom Practices

Introduction

Education in Pakistan, particularly in South Punjab, continues to grapple with the legacy of rote learning as the primary instructional method. Secondary school students are frequently trained to memorize vast portions of textbooks, with their performance largely judged by examinations that reward factual recall. While this system has historically ensured the retention of cultural and academic content, it has also been criticized for

limiting students' ability to engage critically, reason analytically, and adapt knowledge to novel contexts (Shahid & Ghazi, 2022).

Globally, education has shifted toward cultivating higher-order thinking skills (HOTS), including creativity, problem solving, and critical thinking (OECD, 2021). Yet in South Punjab, the culture of memorization persists as the dominant strategy, raising concerns about whether students are adequately prepared for the intellectual and professional challenges of the twenty-first century. The pressing question becomes: *Can memorization be reformed into a tool for deeper learning rather than dismissed as a hindrance to intelligence?*

Recent advancements in educational psychology suggest that the answer lies in metacognition (the awareness and regulation) of one's thinking processes (Flavell, 1979). Metacognition involves both knowledge about cognition (understanding strategies and when to use them) and regulation of cognition (planning, monitoring, and evaluating one's learning). It is increasingly recognized as a mediator between basic memory skills and the application of intelligence in problem-solving and reasoning tasks (Efklides, 2006; Donker et al., 2021).

In the South Punjab context, where rote learning dominates, fostering metacognitive skills may represent the critical missing link between memorization and intellectual growth. Those students who simply memorize, but also plan, reflect, and choose strategies are better prepared to bridge factual proficiency with understanding. For instance, a student might learn facts about biological terms, but, in the context of self-questioning or discourse with peers, those facts help the student analyze ecological systems or predict the results of experiments.

This empirical paper has explored the mediating effect of metacognition between memorizing and the intelligence of high school students in the south of Punjab. The study demonstrates how metacognition sharpens memory and intelligence, and sheds light on what educators might do in the classroom to elevate education beyond rote learning.

Literature Review:

Memorization: A Double-Edged Sword

Memorization is described as the process of encoding, storing, and retrieving information in the human mind for later use (Roediger & Butler, 2019). Monica said in South Asian countries, memorization was emphasized because students were rewarded for factual accuracy in exam systems. While critics argue that excessive reliance on rote learning stifles creativity and critical thinking (Hameed & Qayyum, 2021).

The distinction lies in the type of memorization: rote rehearsal leads to shallow learning and short-term recall, while meaningful memorization, where new information is linked to prior knowledge, results in durable learning. In Pakistan, however, the former is often emphasized, leaving students vulnerable to inert knowledge that cannot be transferred to problem-solving contexts.

Intelligence and Its Educational Value

Intelligence is broadly defined as the ability to acquire and apply knowledge, reason abstractly, solve problems, and adapt to new situations (Neisser, 2020). While traditional psychometric views emphasized a general intelligence factor (Spearman, 1904), modern theories such as Gardner's multiple intelligences and Sternberg's triarchic theory recognize cognitive, creative, and practical dimensions (Gardner, 2011; Sternberg, 2020).

In the classroom, intelligence manifests in students' ability to comprehend complex subjects, apply reasoning in mathematics, interpret texts, and generate creative ideas. Research has shown that intelligence correlates strongly with academic performance, but also that intelligent students may underperform if they lack metacognitive strategies (Zimmerman, 2020). Conversely, students of average intelligence often excel when they employ effective self-regulation and strategy use.

Metacognition: The Bridge Between Memory and Intelligence

Metacognition, often described as "thinking about thinking," provides learners with tools to regulate their learning. It consists of two main components:

1. Metacognitive Knowledge – awareness of one's cognitive processes and strategies.
2. Metacognitive Regulation – planning, monitoring, and evaluating learning.

Studies confirm that metacognitive training significantly improves academic performance

across age groups (Coutinho et al., 2021). For instance, self-questioning helps identify gaps in understanding, while summarization aids retention and transfer. Donker et al. (2021) found that interventions designed to improve metacognitive awareness had a greater effect on student achievement than traditional teaching methods focusing solely on content delivery.

The critical importance of metacognition lies in its role as a mediator between memorization and intelligence. Without regulation, memorization risks remaining superficial. With metacognition, memorization becomes the raw material that fuels reasoning, creativity, and problem-solving.

The South Punjab Context

In South Punjab, educational practices emphasize textbook recall, particularly in science and arts disciplines at the secondary level. Students are often encouraged to memorize entire chapters without necessarily understanding the underlying concepts (Iqbal & Ahmad, 2015). Teachers, constrained by examination pressures, rarely integrate metacognitive instruction. This creates a gap between students' memorization-heavy learning strategies and the intellectual demands of higher education and the workforce.

The present study responds to this need, situating its analysis within a broader theoretical framework that combines Bloom's Taxonomy, Information Processing Theory, and Self-Regulated Learning Theory. Together, these models highlight how memorization provides foundational knowledge, metacognition regulates learning, and intelligence manifests as higher-order application.

Methodology:

Research Design

This study adopted a quantitative correlational design to investigate the relationships among memorization, metacognition, and intelligence among secondary school students in South Punjab. The objective was to explore associations between constructs rather than manipulate variables, making correlation the most suitable design. Mediation analysis was applied to test whether metacognition functioned as an intermediary between memorization and intelligence.

Population and Sampling

The population comprised approximately 135,500 students enrolled in 650 secondary schools across the four districts of Dera Ghazi Khan Division (Government of Punjab, 2023). Using stratified random sampling, 416 students were initially selected from 13 tehsils, ensuring representation from both rural and urban schools and from male and female institutions. Of these, 393 students returned completed questionnaires, producing a response rate of 94.5%.

Table 1

Sample Distribution by Gender and Locality

Distribution of Participants by Gender Wise

Gender	f	%age
Male	202	51.4
Female	191	48.6
Total	393	100.0

Table 2

Locality-Wise Distribution of Participants

Locality	*f*	%age
Urban	254	64.6
Rural	139	35.4
Total	393	100.0

This balanced distribution minimized sampling bias and provided a representative picture of the secondary education landscape in South Punjab.

Research Instrument

A 50-item structured questionnaire was developed, divided into three subscales:

1. Metacognition (20 items) – covering planning, monitoring, evaluation, and strategy regulation.
2. Memorization (15 items) – measuring frequency and type of memory strategies (e.g., repetition, acronyms, visualization).
3. Intelligence (15 items) – assessing problem-solving, logical reasoning, and application.

Items were rated on a five-point Likert scale (*Strongly Disagree* to *Strongly Agree)*.

Validity and Reliability

Content validity was ensured through expert review. Construct validity was confirmed using Confirmatory Factor Analysis (CFA), which showed acceptable factor loadings for all three constructs. Reliability analysis demonstrated high internal consistency.

Table 3

Reliability and Validity Statistics

Construct	Cronbach's Alpha	Composite Reliability	AVE
Metacognition	0.92	0.93	0.61
Memorization	0.88	0.90	0.58
Intelligence	0.91	0.92	0.63

Values exceeded the recommended thresholds (α > 0.70, CR > 0.70, AVE > 0.50), confirming the reliability and validity of the instrument.

Data Collection and Analysis

The collection of data was done by face-to-face administration of the questionnaires in selected schools, following ethical guidelines such as informed consent and confidentiality. Out of 416 distributed instruments, 393 were deemed valid. SPSS v.25 was used for descriptive and inferential statistical analysis, and SmartPLS v.4.0 for structural equation modeling (SEM) and mediation testing.

Results:

Level of Metacognition, Memorization, and Intelligence

Descriptive statistics showed that students demonstrated moderate to high use of memorization strategies and metacognitive practices. Intelligence scores were also moderate, with notable variation across gender.

Table 4

Mean Scores of Key Constructs

Construct	Mean	SD	Level
Metacognition	3.72	0.61	Moderate-High
Memorization	3.89	0.54	High
Intelligence	3.68	0.59	Moderate

The findings indicate that while memorization remains dominant, students also engage with reflective strategies, albeit inconsistently.

Correlation Analysis

Correlation coefficients confirmed significant positive relationships between constructs.

Table 5

Correlation between Constructs

Variables	Metacognition	Memorization	Intelligence
Metacognition	1	.62**	.71**
Memorization	.62**	1	.59**
Intelligence	.71**	.59**	1

Note: p < .01 (2-tailed).

The results suggest that students with stronger metacognitive awareness not only memorize more effectively but also demonstrate higher levels of intelligence.

Mediation Analysis

Mediation testing confirmed that metacognition significantly mediated the relationship between memorization and intelligence.

Table 6

Mediation Analysis (SmartPLS)

Pathway	β	t-value	p-value	Mediation
Memorization → Intelligence	.31	4.76	.001	Direct
Memorization → Metacognition	.55	9.23	.000	Significant
Metacognition → Intelligence	.47	8.12	.000	Significant
Memorization → Metacognition → Intelligence	.26	6.44	.000	Partial Mediation

These results establish metacognition as a vital bridge that enhances the effect of memorization on intelligence. Memorization alone has a direct influence, but its impact is magnified when mediated by metacognitive regulation.

Gender-Based Comparisons

Independent-samples t-tests

Table 7

Gender Differences in Constructs

Construct	Male (M±SD)	Female (M±SD)	t-value	Sig.
Metacognition	3.81 ± 0.59	3.63 ± 0.63	2.94	.004
Memorization	3.91 ± 0.55	3.87 ± 0.53	0.67	.501
Intelligence	3.75 ± 0.57	3.60 ± 0.61	2.15	.032

The analysis shows that male students scored significantly higher in metacognition and intelligence, while no meaningful gender differences emerged in memorization.

Discussion

The results of this study confirm the critical role of metacognition in enhancing both memory and intelligence among secondary school students in South Punjab. While memorization alone significantly predicted intelligence, its impact was magnified when mediated by metacognitive strategies. This finding aligns with international literature, which consistently demonstrates that students who plan, monitor, and evaluate their learning achieve more sustainable outcomes than

those who rely solely on rote rehearsal (Donker et al., 2021; Coutinho et al., 2021).

Memorization as a Foundational but Limited Tool

The study reinforces that memorization, despite its negative reputation, remains a necessary cognitive tool. Students in South Punjab reported frequent use of repetition, acronyms, and peer explanation—strategies that helped them retain factual knowledge. However, without metacognitive regulation, memorization produced only surface-level learning. This explains why examination-oriented systems produce students who can recall definitions but struggle to apply them in problem-solving tasks (Shahid & Ghazi, 2022).

Metacognition as a Mediator

The mediation analysis (Table 5) revealed that metacognition transformed memorization into meaningful learning. Students who used strategies such as goal-setting, self-questioning, and error analysis were more successful in transferring memorized content to intelligent application. This supports Self-Regulated Learning (SRL) Theory (Zimmerman, 2002), which emphasizes metacognition as the engine of reflective learning.

Gender Differences

The finding that male students scored higher on metacognition and intelligence is noteworthy. It suggests that social and cultural factors may shape how students approach learning. Boys in South Punjab often receive more encouragement to pursue education, while girls, though equally engaged in memorization, may have fewer opportunities for reflective practices due to traditional expectations (Hameed & Qayyum, 2021). However, the absence of gender differences in memorization indicates that rote learning remains a shared strategy across both groups.

Comparison with Previous Studies

The findings echo Rasheed and Zafar (2023), who found that metacognitive strategy training significantly improved Pakistani secondary students' self-regulation. Similarly, Ayaz et al. (2020) linked metacognition with academic achievement in higher education. However, this study extends the literature by explicitly demonstrating how metacognition mediates the memorization–intelligence relationship, a gap previously unaddressed in South Punjab's context.

Implications:

For Teachers

- Integrate metacognitive prompts (e.g., "What strategy will you use?", "How do you know this answer is correct?") into classroom instruction.
- Apply peer interaction and summarization in group learning, which supports recollection and reflection regulation.
- Combine memorization with opportunities for students to organize, monitor, and evaluate their learning.

For Curriculum Developers

- We need textbooks that contain reflection exercises along with factored occurrences. For instance, instead of teaching your child dates from a history lesson, question them to examine cause-and-effect.
- The curriculum should subtly move from lower-order memory tasks to higher-order applications, following Bloom's Taxonomy.

For Policymakers

- We need reformed examination systems that evaluate not only recall but also put into application, reasoning, and critical reflection.
- Among teacher education programs, metacognitive instruction must have a priority, giving the instructors the tools to teach metacognitive learning.

For Parents

- Avoid standing at a lectern or holding forth at the front of the room, lecturing while children take notes, safe in the belief they will read it and understand it later. Instead, get kids to articulate ideas in their own words, consider errors, and decide on learning goals for the next day at home.
- Foster learning that treasures comprehension more than mechanical memorization.

Conclusion

This research demonstrates empirical solidity that the insertion of metacognition brings about a significantly positive correlation between memory and intelligence of secondary students in South Punjab. Intellective memorization is necessary, but not everything without reflective regulation. Metacognitive approaches enable students to shift from learned-by-heart to applied intelligence, that is, from lower-order thinking to higher-order thinking.

The results emphasize the pressing need for educational reform in South Punjab: teachers should incorporate metacognitive training into their teaching strategies, curricula should combine rote with reflective activities, and examination practices should incentivize higher-order application. It is in this way that our schools will prepare students to do more than simply compete on exams, but to excel in the knowledge economy of the 21st century that drives individual and collective growth.

Recommendations for Future Researchers

The above suggested implications target the stakeholders (teachers, curriculum developers, policy makers, and parents) and the present study recommends that future researchers should;

1. Long-term studies should be carried out to explore the effects of metacognitive training on intelligence and long-term academic outcomes.
2. Investigate qualitative classroom observations to ascertain how teachers and students employ metacognitive strategies in actual practice.
3. Compare the function of metacognition in different parts of Pakistan to document differences in culture and context.
4. Examine the influence of digital devices and e-learning systems on the development of metacognitive awareness in high school students.
5. Investigate the development and impact on achievement of gender differences in metacognition over time.
6. Evaluate interventions (e.g., workshops, training modules) and ways in which explicit instruction in metacognitive strategies can enhance memorization abilities and intelligence.

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