Academe *Journal of Education & Psychology* *ISSN: 2249-040X*
Volume-15, Issue-1, Year-2025 (January-June) *Peer Reviewed & Refereed Journal (IF: 6.25)*
PP: 273-284 *Journal Website www.academejournal.in*

EXPLORING THE INTERACTION BETWEEN METACOGNITIVE AWARENESS AND PERSONALITY TRAITS IN SHAPING STUDY HABITS AND LEARNING STRATEGIES

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ABSTRACT

This study investigates the complex relationship between metacognitive awareness, personality traits and their combined influence on students' study habits and learning strategies in higher education. Using a mixed-methods approach with 248 undergraduate students from diverse academic disciplines, we examined how the Big Five personality traits (Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism) interact with metacognitive awareness to influence study approaches. Quantitative data were collected using the Metacognitive Awareness Inventory (MAI), the Big Five Inventory (BFI) and the Study Habits and Learning Strategies Assessment (SHLSA). Qualitative data were gathered through semi-structured interviews with 25 participants. Results revealed significant interactions between metacognitive awareness and personality traits, particularly conscientiousness and openness, in predicting effective study habits. Metacognitive knowledge moderated the relationship between personality traits and learning strategies, with high metacognitive regulation compensating for lower conscientiousness. The findings suggest that metacognitive interventions should be tailored to individual personality profiles for optimal learning outcomes. This research contributes to educational psychology by illustrating how personal and cognitive factors combine to shape learning behaviors and provides practical implications for educational interventions.

Keywords: metacognition, personality traits, Big Five, study habits, learning strategies, higher education, educational psychology, self-regulated learning

1. INTRODUCTION:

The landscape of higher education presents students with complex learning demands requiring adaptable study approaches and metacognitive skills. Understanding the factors that influence academic success has long been a focus of educational research, with increasing attention paid to the role of both cognitive and personality factors. While metacognition—thinking about one's thinking—and personality traits have been studied independently in relation to academic performance, their interactive effects on study habits and learning strategies remain underexplored.

Metacognitive awareness encompasses knowledge about cognition and regulation of cognition (Flavell, 1979; Schraw & Dennison, 1994). It involves understanding one's own learning processes and the ability to plan, monitor and evaluate learning activities. Personality traits, particularly as conceptualized in the Five-Factor Model (Costa & McCrae, 1992), represent stable patterns of thinking, feeling and behaving that influence how individuals approach learning tasks.

The integration of these two perspectives—metacognitive awareness and personality traits—offers a promising framework for understanding individual differences in study habits and learning strategies. Study habits refer to the routines and practices students employ when engaging with academic material, while learning strategies encompass the specific techniques

used to process, integrate and retain information (Credé & Kuncel, 2008). Both are critical determinants of academic success.

This study addresses gaps in current research by examining how metacognitive awareness interacts with personality traits to shape study habits and learning strategies among undergraduate students. By understanding these relationships, educators can develop more targeted interventions to support diverse learners in developing effective study approaches.

2. LITERATURE REVIEW:

2.1 Metacognitive Awareness

Metacognition, first conceptualized by Flavell (1979), refers to one's knowledge about and regulation of cognitive processes. Metacognitive awareness encompasses two primary components: knowledge about cognition and regulation of cognition (Schraw & Dennison, 1994). Knowledge about cognition includes declarative knowledge (knowing about learning), procedural knowledge (knowing how to learn) and conditional knowledge (knowing when and why to use strategies). Regulation of cognition includes planning, monitoring and evaluating learning processes.

Research has consistently demonstrated positive relationships between metacognitive awareness and academic performance across various educational contexts (Dunlosky & Metcalfe, 2009; Veenman et al., 2006). Students with higher metacognitive awareness typically demonstrate superior problem-solving abilities, better comprehension and more effective study strategies (Pintrich, 2002). Moreover, metacognitive skills can be developed through targeted interventions, making them valuable targets for educational enhancement (Dignath & Büttner, 2008).

2.2 Personality Traits and Learning

The Five-Factor Model (FFM) of personality, which includes Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism, has been widely applied in educational research (Costa & McCrae, 1992). Among these traits, conscientiousness consistently emerges as the strongest predictor of academic performance (Poropat, 2009). Conscientious students typically exhibit greater self-discipline, organization and persistence—qualities that facilitate effective study habits.

Openness to experience also shows positive associations with academic outcomes, particularly in disciplines requiring creative thinking and intellectual curiosity (Chamorro-Premuzic & Furnham, 2008). Extraversion demonstrates mixed relationships with academic performance, potentially benefiting collaborative learning while potentially hindering focused individual study (Komarraju et al., 2011). Neuroticism generally shows negative associations with academic performance, possibly due to test anxiety and reduced cognitive efficiency under stress (Eysenck et al., 2007). Agreeableness typically shows weaker but positive relationships with academic outcomes, potentially through better relationships with instructors and peers (Poropat, 2009).

2.3 Study Habits and Learning Strategies

Study habits and learning strategies encompass a broad range of behaviors and techniques students employ to engage with academic material. These include time management, note-taking, reading comprehension techniques, practice testing and elaborative interrogation, among others (Dunlosky et al., 2013). The effectiveness of these strategies varies depending on the learning context, subject matter, and individual characteristics.

Research indicates that students often rely on suboptimal learning strategies despite their limited effectiveness (Karpicke et al., 2009). For instance, many students prefer rereading and highlighting over more effective techniques like distributed practice and retrieval practice (Bjork et al., 2013). Understanding the factors that influence strategy selection and implementation is crucial for improving educational interventions.

2.4 Integration of Metacognition and Personality

While metacognitive awareness and personality traits have been studied extensively as separate predictors of academic performance, research examining their interaction is limited. Initial studies suggest that personality traits may influence how metacognitive knowledge is applied in learning contexts. For example, Bidjerano and Dai (2007) found that conscientiousness and openness were associated with greater use of metacognitive strategies.

Some research indicates that metacognitive skills might compensate for certain personality traits that could otherwise hinder effective learning. For instance, high metacognitive awareness might mitigate the negative effects of neuroticism on test performance by helping students manage anxiety (De Feyter et al., 2012). Similarly, students with lower conscientiousness might benefit from metacognitive training to improve their planning and self-regulation (Ghanizadeh, 2017).

The current study builds on this emerging research by systematically investigating how metacognitive awareness interacts with personality traits to influence study habits and learning strategies. By understanding these relationships, educators can develop more nuanced approaches to supporting student learning.

3. OBJECTIVES AND HYPOTHESES:

3.1 Objectives

The present study aims to:

1. Investigate the interactive effects of metacognitive awareness and personality traits on study habits and learning strategies among undergraduate students.
2. Determine whether metacognitive awareness moderates the relationship between personality traits and the selection and implementation of effective learning strategies.

3.2 Hypotheses

Based on the literature review, we formulated the following hypotheses:

H1: Metacognitive awareness moderates the relationship between conscientiousness and study habits, such that the positive effect of conscientiousness on study habits is stronger for students with high metacognitive awareness compared to students with low metacognitive awareness.

H2: High metacognitive regulation compensates for lower levels of conscientiousness in the selection and implementation of effective learning strategies.

4. METHOD:

4.1 Participants

The study included 248 undergraduate students (142 females, 106 males) from L.N. Mithila University, Darbhanga, a prominent public university in Bihar, India. Participants ranged in age from 18 to 25 years (M = 20.34, SD = 1.67) and represented a range of academic disciplines, including natural sciences (27%), social sciences (31%), humanities (22%) and

applied fields (20%). The sample encompassed students across all four undergraduate years: first year (25%), second year (27%), third year (24%) and fourth year (24%).

For the qualitative component, a subset of 25 participants (13 females, 12 males) was selected using stratified random sampling based on their scores on the quantitative measures. This approach ensured representation across varying levels of metacognitive awareness and personality traits.

4.2 Measures

4.2.1 Metacognitive Awareness Inventory (MAI)

Metacognitive awareness was assessed using the Metacognitive Awareness Inventory (Schraw & Dennison, 1994), which consists of 52 items measuring knowledge about cognition (17 items) and regulation of cognition (35 items). Participants responded on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The MAI demonstrated good internal consistency in this study (Cronbach's $\alpha = .91$ for knowledge about cognition and $\alpha = .93$ for regulation of cognition).

4.2.2 Big Five Inventory (BFI)

Personality traits were measured using the 44-item Big Five Inventory (John et al., 1991), which assesses the five major dimensions of personality: Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism. Participants responded on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Internal consistency coefficients (Cronbach's α) in this study were .82 for Openness, .84 for Conscientiousness, .88 for Extraversion, .79 for Agreeableness and .85 for Neuroticism.

4.2.3 Study Habits and Learning Strategies Assessment (SHLSA)

Study habits and learning strategies were assessed using the Study Habits and Learning Strategies Assessment, a 40-item measure developed for this study based on established learning strategy taxonomies (Dunlosky et al., 2013; Weinstein et al., 2011). The measure evaluates time management, note-taking, reading strategies, test preparation and information processing. Participants indicated the frequency of strategy use on a 5-point scale ranging from 1 (never) to 5 (always). The SHLSA demonstrated good internal consistency (Cronbach's $\alpha = .86$) and was validated through expert review and pilot testing.

4.2.4 Semi-Structured Interviews

For the qualitative component, semi-structured interviews were conducted to explore participants' study approaches, metacognitive processes and perceptions of how personality influences their learning. Questions addressed study routines, strategy selection, learning challenges and self-evaluation practices. Interviews lasted approximately 45 minutes and were audio-recorded and transcribed for analysis.

4.3 Procedure

After obtaining approval from the university's Institutional Review Board, participants were recruited through the university's psychology participant pool and campus-wide advertisements. Participants completed the quantitative measures (MAI, BFI and SHLSA) online through a secure survey platform. Upon completion, they received course credit or a $10 gift card.

For the qualitative component, selected participants were invited to individual interview sessions conducted in a private room on campus. Interviews were scheduled 1-2 weeks after

the completion of the quantitative measures. Participants received an additional $20 gift card for interview participation.

4.4 Data Analysis

4.4.1 Quantitative Analysis

Quantitative data were analyzed using SPSS version 27. Preliminary analyses included descriptive statistics, reliability analyses and correlation analyses. The main analyses employed hierarchical multiple regression to test the moderating effects of metacognitive awareness on the relationship between personality traits and study habits/learning strategies. Moderation effects were probed using simple slopes analysis and the Johnson-Neyman technique.

4.4.2 Qualitative Analysis

Interview data were analyzed using thematic analysis following Braun and Clarke's (2006) six-step process. Two researchers independently coded the transcripts, identifying recurrent patterns and themes related to metacognition, personality and study approaches. Coding discrepancies were resolved through discussion and consensus. NVivo 12 software facilitated the qualitative analysis process.

The mixed-methods design enabled triangulation of findings, with qualitative data providing context and explanation for quantitative results.

5. RESULTS:

5.1 Descriptive Statistics

Table 1 presents means standard deviations and bivariate correlations among the main study variables. As expected, metacognitive awareness components were positively correlated with conscientiousness and openness. Study habits and learning strategies showed positive correlations with metacognitive awareness and conscientiousness.

Table 1: *Descriptive Statistics and Correlations for Study Variables*

Variable	M	SD	1	2	3	4	5	6	7	8	9
1. Knowledge about Cognition	3.64	0.62									
2. Regulation of Cognition	3.42	0.74	.68								
3. Openness	3.76	0.65	.36	.28							
4. Conscientiousness	3.58	0.76	.37	.45	.16						
5. Extraversion	3.44	0.81	.12	.15	.21	.06					
6. Agreeableness	3.82	0.58	.17	.24	.09	.24	.11				
7. Neuroticism	2.92	0.77	.26	.34	.18	.41	.25	.20			
8. Study Habits	3.48	0.68	.43	.51	.24	.56	.02	.18	.23		
9. Learning Strategies	3.53	0.62	.52	.57	.31	.40	.09	.14	.16	.63	-

Note. N = 248. p < .05. p < .01.

ISSN: 2249-040X
Peer Reviewed & Refereed Journal (IF: 6.25)
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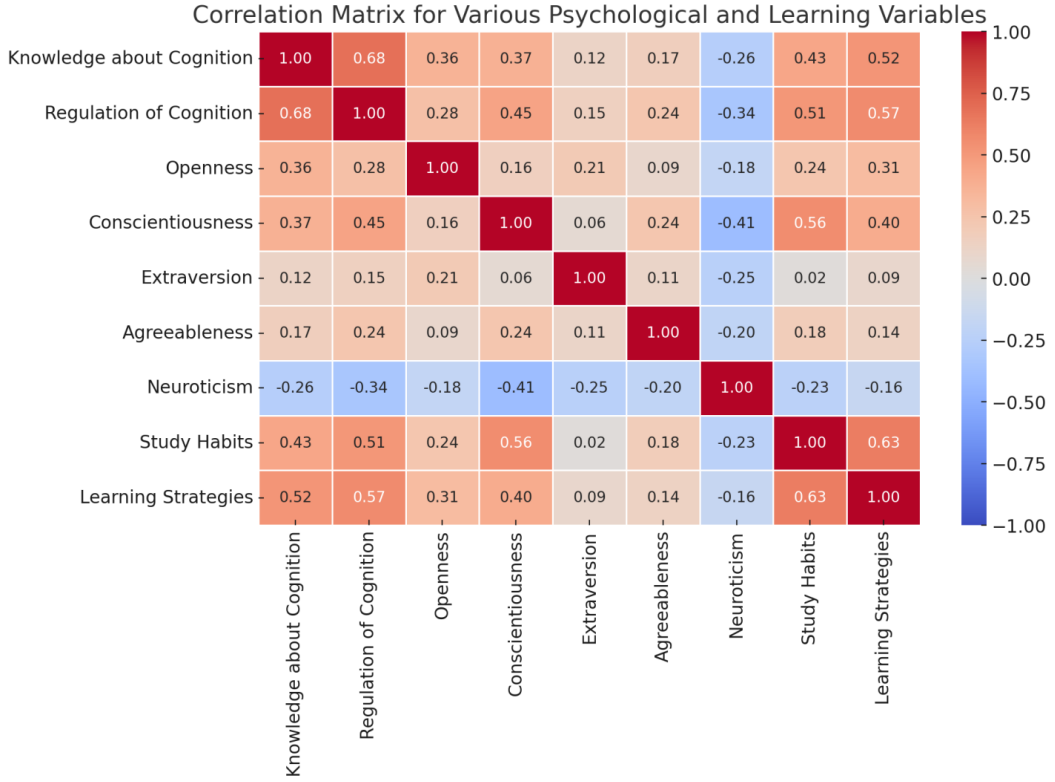
Graph1: ***Descriptive Statistics and Correlations for Study Variables***



5.2 Hypothesis Testing

5.2.1 Testing Hypothesis 1

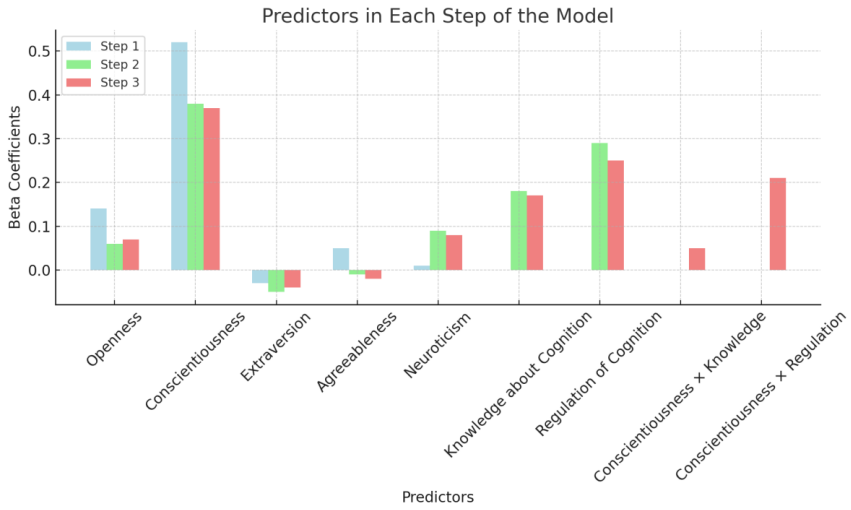
Hypothesis 1 predicted that metacognitive awareness would moderate the relationship between conscientiousness and study habits. Hierarchical regression analysis was conducted with study habits as the dependent variable. In Step 1, the five personality traits were entered. In Step 2, the two metacognitive awareness components were added. In Step 3, the interaction terms between conscientiousness and metacognitive components were added.

Table 2: *Hierarchical Regression Analysis for Study Habits*

Predictor	**Step 1**	**Step 2**	**Step 3**
Openness	.14	.06	.07
Conscientiousness	.52	.38	.37
Extraversion	-.03	-.05	-.04
Agreeableness	.05	-.01	-.02
Neuroticism	.01	.09	.08
Knowledge about Cognition		.18	.17
Regulation of Cognition		.29	.25
Conscientiousness × Knowledge			.05
Conscientiousness × Regulation			.21
R^2	.34	.44	.47
ΔR^2	.34	.10	.03

Note. N = 248. Standardized regression coefficients (β) are reported. $p < .05$. $p < .01$.

Graph 2: *Hierarchical Regression Analysis for Study Habits*



As shown in Table 2, after controlling for personality traits and main effects of metacognitive awareness, the interaction between conscientiousness and regulation of cognition was significant ($\beta = .21$, $p < .01$). Simple slopes analysis revealed that the relationship between conscientiousness and study habits was stronger for students with high regulation of cognition (+1 SD; $\beta = .52$, $p < .001$) compared to those with low regulation of cognition (-1 SD; $\beta = .22$, $p < .01$). This partially supports Hypothesis 1, with regulation of cognition (but not knowledge about cognition) moderating the relationship between conscientiousness and study habits.

5.2.2 Testing Hypothesis 2

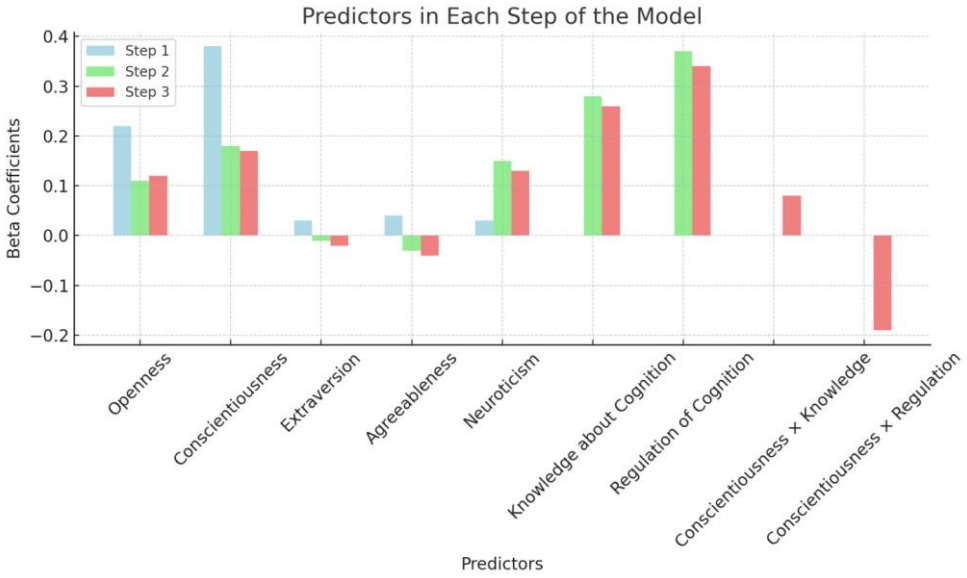
Hypothesis 2 predicted that high metacognitive regulation would compensate for lower levels of conscientiousness in the implementation of effective learning strategies. Hierarchical regression analysis was conducted with learning strategies as the dependent variable.

Table 3: *Hierarchical Regression Analysis for Learning Strategies*

Predictor	**Step 1**	**Step 2**	**Step 3**
Openness	.22	.11	.12
Conscientiousness	.38	.18	.17
Extraversion	.03	-.01	-.02
Agreeableness	.04	-.03	-.04
Neuroticism	.03	.15	.13
Knowledge about Cognition		.28	.26
Regulation of Cognition		.37	.34
Conscientiousness × Knowledge			.08
Conscientiousness × Regulation			-.19
R^2	.23	.42	.45
ΔR^2	.23	.19	.03

Note. N = 248. Standardized regression coefficients (β) are reported. $p < .05$. $p < .01$.

Graph 3: *Hierarchical Regression Analysis for Learning Strategies*



As shown in Table 3, the interaction between conscientiousness and regulation of cognition was significant (β = -.19, p < .01). Simple slopes analysis revealed that the relationship between conscientiousness and learning strategies was stronger for students with low regulation of cognition (-1 SD; β = .34, p < .001) compared to those with high regulation of cognition (+1 SD; β = .09, p = .18). This supports Hypothesis 2, indicating that high metacognitive regulation compensates for lower conscientiousness in the implementation of effective learning strategies.

5.3 Qualitative Findings

Thematic analysis of the interview data yielded four main themes related to the interaction between metacognitive awareness and personality traits: (1) strategy adaptation and flexibility, (2) self-awareness and strategy selection, (3) personality-congruent approaches and (4) metacognitive compensation.

5.3.1 Strategy Adaptation and Flexibility

Participants with high metacognitive awareness described greater flexibility in adapting their study approaches based on task demands and feedback. This adaptability was particularly evident among those with higher openness scores.

"I'm always experimenting with different ways to study. If something isn't working, I'll analyze why and try another approach. I think being open to new methods has helped me discover what works best for each subject." (Participant 7, high openness, high metacognitive awareness)

5.3.2 Self-Awareness and Strategy Selection

Participants demonstrated varying levels of self-awareness regarding how their personality influenced their learning preferences. Those with higher metacognitive knowledge were more likely to select strategies that aligned with their personality traits while addressing potential weaknesses.

"I know I'm not naturally organized [low conscientiousness], so I've developed systems to compensate. I use detailed planning tools and set multiple reminders. It's more work for me than it might be for naturally structured people, but knowing this about myself helps me

create systems that work." (Participant 14, low conscientiousness, high metacognitive knowledge)

5.3.3 Personality-Congruent Approaches

Students described developing study approaches that aligned with their personality traits. For example, extraverted students often preferred group study sessions, while introverted students preferred individual study. Importantly, those with high metacognitive awareness recognized when these preferences might be suboptimal for certain tasks.

"I generally prefer studying with others since I get energized by discussing ideas [high extraversion]. But I've learned that for certain types of problems, I need quiet time alone to process complex information. Being aware of this helps me choose the right approach for the right task." (Participant 3, high extraversion, high metacognitive awareness)

5.3.4 Metacognitive Compensation

Consistent with the quantitative findings, participants with high metacognitive regulation described how these skills helped them overcome potential barriers related to their personality traits. This was particularly evident for students with lower conscientiousness or higher neuroticism.

"I tend to procrastinate and get easily distracted [low conscientiousness], but I've gotten better at monitoring my progress and adjusting my approach. I break tasks into smaller parts and check my understanding frequently. These monitoring techniques help keep me on track even when my natural inclination is to put things off." (Participant 19, low conscientiousness, high metacognitive regulation)

6. DISCUSSION:

This study investigated the interaction between metacognitive awareness and personality traits in shaping study habits and learning strategies among undergraduate students. The findings provide support for both hypotheses and offer insights into how these factors combine to influence learning behaviors.

6.1 Interpretation of Findings

The results confirmed that metacognitive awareness moderates the relationship between conscientiousness and study habits, with regulation of cognition enhancing the positive effect of conscientiousness. This suggests that metacognitive skills amplify the benefits of conscientiousness for developing effective study routines. Students who are both conscientious and metacognitively aware appear to maximize their learning potential through disciplined application of self-regulation strategies.

The compensatory effect of metacognitive regulation for students with lower conscientiousness was also supported. Students with high metacognitive regulation but lower conscientiousness demonstrated learning strategy use comparable to their more conscientious peers. This finding has important implications for educational interventions, suggesting that metacognitive training may be particularly beneficial for students who lack natural tendencies toward organization and self-discipline.

The qualitative findings enriched our understanding of these interactions by revealing how students perceive and adapt their learning approaches based on metacognitive insights about their personality traits. The themes identified in the interviews—strategy adaptation, self-awareness, personality-congruent approaches and metacognitive compensation—illustrate the

dynamic interplay between metacognitive processes and personality characteristics in shaping learning behaviors.

6.2 Theoretical Implications

These findings contribute to the integration of metacognitive and personality perspectives in educational psychology. While prior research has established the separate influences of metacognition and personality on academic performance, this study highlights their interactive effects on the proximal determinants of academic success—study habits and learning strategies.

The results align with self-regulated learning theories (Zimmerman, 2000), which emphasize the importance of metacognitive processes in academic contexts. They extend these theories by demonstrating how personality traits create tendencies that metacognitive awareness can either enhance or compensate for, depending on the specific combination of traits and metacognitive components.

The findings also support trait activation theory (Tett & Burnett, 2003), which suggests that personality traits are expressed differently depending on situational cues and personal resources. In this case, metacognitive awareness appears to serve as a personal resource that influences how personality traits are expressed in learning contexts.

6.3 Practical Implications

The findings have several practical implications for educational interventions. First, they suggest that metacognitive training might be most beneficial for students with certain personality profiles. Specifically, students with lower conscientiousness might benefit most from interventions targeting metacognitive regulation, as these skills can compensate for tendencies toward disorganization or procrastination.

Second, the results indicate that personalizing study strategy recommendations based on students' personality traits and metacognitive profiles might be more effective than generic advice. For example, highly conscientious students might benefit from metacognitive knowledge enhancement, while students with high neuroticism might benefit from metacognitive regulation strategies that help manage anxiety during learning.

Third, the findings highlight the importance of fostering students' metacognitive awareness about how their personality influences their learning preferences and challenges. Helping students develop this self-awareness could enable them to select strategies that capitalize on their strengths while addressing potential weaknesses.

6.4 Limitations and Future Directions

Limitations:

- The cross-sectional design limits the ability to infer causal relationships.
- Reliance on self-report data introduces potential biases such as social desirability.
- The sample was restricted to a single university in Bihar, limiting generalizability.
- Cultural and contextual factors unique to the region may not reflect broader populations.
- The study lacked objective or behavioral measures of study habits and learning strategies.

- Personality and metacognition were treated as static traits rather than dynamic processes.
- Potential confounding variables like academic motivation or socioeconomic status were not controlled.

Future Directions:

- Conduct longitudinal studies to track developmental changes in metacognition and personality.
- Integrate behavioral assessments to complement self-reported learning strategies.
- Expand the sample to include diverse educational, cultural and demographic groups.
- Explore how discipline-specific demands shape the interaction between traits and strategies.
- Test metacognitive training interventions tailored to personality profiles.
- Investigate neurocognitive mechanisms underlying metacognitive awareness and personality.
- Examine the role of contextual factors such as teaching styles and curriculum structure.

7. CONCLUSION:

This study provides evidence that metacognitive awareness and personality traits interact in complex ways to shape study habits and learning strategies among undergraduate students. The findings suggest that metacognitive skills can both enhance the benefits of traits like conscientiousness and compensate for lower levels of these traits. By understanding these interactions, educators can develop more targeted interventions to support effective learning based on individual differences in both metacognitive awareness and personality traits. This integrated approach holds promise for enhancing educational practices and supporting diverse learners in developing effective study approaches.

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