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Learning Behavior Components as Predictors of Elementary School Students' Academic Achievement: A Multiple Regression Analysis on Third-Grade Students in Banten

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Abstract: Learning Behavior Components as Predictors of Elementary School Students' Academic Achievement: A Multiple Regression Analysis on Third-Grade Students in Banten. Elementary school students' academic achievement is shaped not only by external instructional factors but also by learning behavior configurations. However, previous studies often examine these psychological elements separately, leaving their simultaneous and partial contributions within an integrated empirical model unclear.

Objectives: This study aims to examine the partial and simultaneous effects of five learning behavior components (attitude, learning motivation, learning strategies, memory, and metacognition) on the academic achievement of third-grade elementary school students in Banten Province.

Methods: A quantitative explanatory approach with a survey design was applied to 94 third-grade students across three public elementary schools in Serang, Cilegon, and Tangerang. Data were gathered through 1–5 Likert-scale questionnaires measuring learning behavior dimensions and student grades representing academic achievement. Data analysis was performed using multiple linear regression in SPSS version 20 and reported with classical assumption testing.

Findings: The findings indicated that the regression model was statistically significant simultaneously ($F = 18.207$; $p < 0.001$) and accounted for 50.8% of the academic achievement variance (R^2 = 0.508). Partially, all five components significantly predicted achievement. Learning strategies, memory, and metacognition positively predicted achievement, with memory emerging as the most dominant predictor ($\beta = 0.275$; $p = 0.002$). Conversely, attitude and learning motivation uniquely displayed controlled negative coefficients in the multivariate model due to a suppressor effect.

Conclusion: Academic performance in elementary education must be understood as an interaction among affective, cognitive, strategic, and regulatory dimensions of learning behavior. The study implies the necessity of implementing explicit learning strategy instruction, meaningful memory practices, and metacognitive habituation from an early stage in primary schools.

Keywords: academic achievement, elementary school, learning behavior, memory, metacognition.

Abstrak: Komponen Perilaku Belajar sebagai Prediktor Prestasi Akademik Siswa Sekolah Dasar: Analisis Regresi Berganda pada Siswa Kelas III di Banten. *Prestasi akademik siswa*

sekolah dasar tidak sekadar ditentukan oleh faktor pembelajaran eksternal, melainkan dibentuk oleh konfigurasi dinamis perilaku belajar internal siswa. Namun, penelitian terdahulu umumnya menguji komponen perilaku ini secara terpisah, sehingga kontribusi integratifnya dalam satu pemodelan utuh masih belum jelas.

Tujuan: *Penelitian ini bertujuan untuk menganalisis pengaruh lima komponen perilaku belajar (sikap, motivasi belajar, strategi belajar, daya ingat, dan metakognitif) baik secara parsial maupun simultan terhadap prestasi akademik siswa kelas III sekolah dasar di Provinsi Banten.*

Metode: *Penelitian menggunakan pendekatan kuantitatif eksplanatori melalui desain survei terhadap 94 siswa kelas III dari tiga sekolah dasar negeri di Serang, Cilegon, dan Tangerang. Data dikumpulkan menggunakan kuesioner skala Likert 1–5 untuk mengukur komponen perilaku belajar dan dokumentasi nilai siswa untuk prestasi akademik. Teknik analisis data menggunakan analisis regresi linear berganda dengan bantuan software SPSS versi 20 serta dilengkapi pengujian asumsi klasik.*

Temuan: *Hasil analisis menunjukkan model regresi signifikan secara simultan ($F = 18,207$; $p < 0,001$) dengan kemampuan menjelaskan varians prestasi akademik mencapai 50,8% (R Square $= 0,508$). Secara parsial, kelima komponen berpengaruh signifikan terhadap prestasi akademik. Strategi belajar, daya ingat, dan metakognitif berpengaruh positif, dengan daya ingat sebagai prediktor paling dominan ($\beta = 0,275$; $p = 0,002$). Sebaliknya, komponen sikap dan motivasi belajar memunculkan arah koefisien negatif terkendali akibat adanya fenomena suppressor effect dalam pemodelan multivariat.*

Kesimpulan: *Performa akademik siswa sekolah dasar harus dipahami sebagai produk interaksi integratif dari dimensi afektif, kognitif, strategis, dan regulatif dalam perilaku belajar. Implikasi praktis penelitian ini menekankan pentingnya penerapan pembelajaran eksplisit terkait strategi belajar, stimulasi daya ingat yang bermakna, serta pembiasaan refleksi metakognitif sejak pendidikan dasar.*

Kata kunci: *daya ingat, metakognisi, motivasi belajar, perilaku belajar, prestasi akademik.*

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INTRODUCTION

Academic achievement in primary education is a crucial indicator that not only reflects institutional success but also predicts students' adaptive readiness to face the complexities of higher-level learning. In the elementary school phase, particularly in the third grade—which serves as a developmental transition period from lower to upper grades—students confront a significant shift in cognitive demands, moving from foundational literacy and numeracy skills toward more abstract conceptual understanding. In facing these dynamics, student competence outcomes can no longer be adequately explained solely by external variables such as curriculum updates, facility availability, or teacher instructional methodologies. Instead, profound attention must shift toward internal learner factors, specifically how students construct, internalize, and express their learning behaviors within daily academic interactions. These learning behaviors act as the primary driving engine determining the efficiency of information processing and student persistence in the classroom.

Within educational psychology, learning behavior is conceptualized as a dynamic, multidimensional construct that bridges students' latent intellectual capacity and the observable manifestation of learning outcomes. Recent meta-analyses have confirmed that variance in students' academic performance is predicted more strongly by a combination of psychological factors and specific study habits than by cognitive capacity alone (Credé, 2018; Schneider & Preckel, 2017) . This concept aligns with contemporary self-regulated learning (SRL) frameworks, in which students are positioned as active agents who autonomously plan, monitor, and evaluate their comprehension processes (de Bruin & van Merriënboer, 2017; Panadero, 2017). Therefore, to obtain a comprehensive understanding of the determinants of primary school student achievement, learning behavior needs to be examined through affective-motivational components and cognitive-regulative capacities that operate integratively, including attitude, learning motivation, learning strategies, memory, and metacognition.

The affective component of learning behavior, represented by attitude and learning motivation, shapes students' value orientation and the intensity of effort they allocate to academic activities. Learning attitudes reflect students' evaluative tendencies toward subject matter and academic tasks (Fiorella, 2020) . A positive attitude fosters students' mental openness to cognitive challenges, whereas a negative attitude may trigger learning resistance. Learning motivation, in turn, functions as an intrinsic or extrinsic driving force that initiates, directs, and sustains behavioral persistence when students encounter learning obstacles. Dent and Koenka (2016) demonstrated in a meta-analysis that motivation is significantly associated with academic achievement, but the relationship is moderated by cognitive strategy use . Nevertheless, this affective dimension does not operate in a linear or isolated manner. High motivation that is not supported by tactical proficiency in executing learning tasks often fails to produce optimal academic performance and therefore requires integration with effective cognitive strategies. A three-level meta-analysis further demonstrates that students' attitudes toward science are significantly related to science achievement, confirming the relevance of attitude as an affective predictor of academic performance (Mao et al., 2021).

The cognitive and regulative components, which encompass learning strategies, memory, and metacognition, provide operational direction for how information is processed and retained in students' cognitive structures. Learning strategies refer to specific techniques, such as organizing material, taking notes, elaborating concepts, and engaging in peer discussion, that students apply to facilitate competence mastery. Fiorella (2020) synthesized evidence that learning strategy instruction produces moderate to large effects on academic performance in K-12 settings. The effectiveness of these strategies

relies heavily on memory capacity, which should not be viewed as passive storage but as an active process involving retrieval practice and meaningful connections between new knowledge and prior knowledge. Yang et al. (2021) found that retrieval practice enhances long-term retention in elementary school children . This processing is guided by metacognitive capacity, defined as an individual's higher-order awareness and regulatory ability over of their own thinking processes. Through metacognition, third-grade primary school students can begin to monitor whether they have understood reading texts, detect strategy errors, and modify their actions autonomously Benick et al. (2021**).** A recent series of meta-analyses also indicates that metacognition interventions for young children can support learning-related outcomes, strengthening the rationale for including metacognition in early academic achievement models (Eberhart et al., 2024).

Prior studies in both international and Indonesian contexts have attempted to map the significance of these variables in primary education. Bugwak (2023) found that learning behaviors significantly predicted academic performance among primary learners in the Philippines. Arianto & Hanif (2024) showed that metacognitive strategies positively influenced cognitive learning behaviors in elementary education. These studies provide a solid empirical foundation indicating that students' internal learning ecosystems play a vital role in determining the quality of primary education outcomes.

Although the literature on these psychological components has expanded, a fundamental research gap remains and justifies the present study. First, most previous investigations have tended to analyze motivation, cognitive strategies, memory, or metacognition either partially or in isolation, thereby failing to explain how these components interact and simultaneously contribute within an integrated multivariate empirical model . Second, integrative testing that combines the affective domain (attitude and motivation) with the cognitive-regulative domain (strategies, memory, and metacognition) among elementary school students in Banten Province remains limited. Neglecting such simultaneous analysis may produce interpretational bias because, in psychological reality, these variables overlap and may trigger a suppressor effect or shifts in the direction of regression coefficients due to covariate control. Third, at the practical level, primary education stakeholders require empirical clarity regarding which predictors are most strongly associated with student achievement in order to design precise and efficient pedagogical intervention programs.

Based on this gap analysis, the primary objective of this study is to analyze and empirically demonstrate the partial and simultaneous effects of attitude components, learning motivation, learning strategies, memory, and metacognition on the academic achievement of third-grade primary school students. The research problem addressed focuses on testing the significance of the unique contribution of each independent variable when other variables are controlled, as well as estimating the combined predictive power of these five learning behavior dimensions. The theoretical utility of this study lies in expanding the repertoire of regression modeling within early childhood educational psychology by integrating a multi-construct affective-cognitive framework. Meanwhile, its practical utility is to provide an empirical roadmap for educational practitioners and third-grade elementary teachers in the Banten region to construct instructional strategies based on metacognitive reinforcement, meaningful long-term memory exercises, and adaptive attitude management to sustainably boost academic achievement.

Based on the theoretical framework and the research gap, the following hypotheses were proposed:

- H1 : The attitude component has a significant partial effect on academic achievement.

- H2 : Learning motivation has a significant partial effect on academic achievement.
- H3 : Learning strategies have a significant positive partial effect on academic achievement.
- H4 : Memory has a significant positive partial effect on academic achievement.
- H5 : Metacognition has a significant positive partial effect on academic achievement.
- H6 : Attitude, learning motivation, learning strategies, memory, and metacognition simultaneously have a significant effect on academic achievement.

The theoretical contribution of this study lies in expanding regression-based modeling in primary educational psychology by integrating a multi-construct affective-cognitive framework. Its practical contribution is to provide an empirical roadmap for educational practitioners and third-grade elementary school teachers in Banten to construct instructional strategies based on metacognitive reinforcement, meaningful long-term memory exercises, and adaptive attitude management to improve academic achievement sustainably

METHOD

This study employed a quantitative explanatory approach with a survey design. This approach was selected because the primary objective of the research was to examine the effects of several independent variables on a single dependent variable using multiple linear regression analysis. The regression model was utilized to determine the partial contribution of each variable after controlling for other variables, while simultaneously testing the collective effect of all variables on students' academic achievement. The research population consisted of third-grade students at public elementary schools across three locations in the Banten region. The research sample comprised 94 respondents from SD Negeri Drangong 1 Serang, SD Negeri Kubang Lesung Kulon Cilegon, and SD Negeri Cimone 3 Tangerang. The selection of respondents was based on student availability at the research sites and alignment with the research focus, specifically elementary school students in the initial phase of academic development. The independent variables in this study consisted of attitude components (X1), learning motivation (X2), learning strategies (X3), memory (X4), and metacognition (X5). The dependent variable was students' academic achievement (Y), represented by student grades. The five independent variables were measured using a 1–5 Likert scale instrument, with response options ranging from strongly disagree to strongly agree. The composite scores of the variables were subsequently utilized in the regression analysis. The research instrument was developed based on a literature review of learning behavior, motivation, learning strategies, memory, and metacognition. The instrument comprised 50 items divided into five constructs: learning attitude, learning motivation, learning strategies, memory, and metacognition. Classical assumption testing (normality, multicollinearity, heteroskedasticity, autocorrelation) followed standard procedures (Osborne & Waters, 2019). Each construct contained 10 statements. For the purpose of article reporting, the structure of the instrument is summarized in Table 1. Data analysis was performed using SPSS version 20. The analytical stages included descriptive statistics, classical assumption tests, multiple linear regression, t-tests, F-tests, and the coefficient of determination. The classical assumption tests encompassed residual normality, multicollinearity, heteroskedasticity, and autocorrelation. The general regression equation utilized is:

$$Y = a + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + e.$$

Table 1. Summary of Research Variables and Indicators

Variable	Code	Number of Items	Scale	Measurement Focus
Attitude Component	X1	10	Likert 1–5	Students' attitudes toward learning, assignments, learning goals, and mistakes as part of the learning process
Learning Motivation	X2	10	Likert 1–5	Learning drive, persistence, challenge orientation, learning assistance, and learning satisfaction
Learning Strategies	X3	10	Likert 1–5	Study scheduling, note-taking, discussion, use of learning resources, reflection, and alternative learning strategies
Memory	X4	10	Likert 1–5	Remembering information, memorization techniques, review activities, association, and retrieval practice
Metacognition	X5	10	Likert 1–5	Planning, monitoring, strategy evaluation, reflection, and goal setting in learning
Academic Achievement	Y	–	Grade	Students' grades as an indicator of academic achievement

▪ RESULT AND DISCUSSION

RESULT

Analytical Prerequisite Tests (Classical Assumption Testing)

Prior to conducting hypothesis testing via the multiple linear regression analysis model, a series of analytical prerequisite tests—commonly referred to as classical assumption tests—was performed. This methodological phase is highly critical to ensure that the estimation model satisfies the conditions of the Best Linear Unbiased Estimator (BLUE), thereby guaranteeing that the generated coefficient parameters are valid, objective, and free from bias. In this study, the classical assumption testing comprises four core parameters: residual normality, multicollinearity, heteroskedasticity, and autocorrelation tests. A comprehensive summary of these diagnostic results is presented in Table 2.

Table 2. Summary of Classical Assumption Test Results

Assumption	Indicator	Value	Criterion	Conclusion
Residual Normality	Shapiro–Wilk Sig.	0.444	$p > 0.05$	Passed
Residual Normality	Kolmogorov–Smirnov Sig.	0.681	$p > 0.05$	Passed
Residual Normality	Jarque–Bera Sig.	0.560	$p > 0.05$	Passed
Multicollinearity	Highest VIF	1.071	VIF < 10	Passed
Multicollinearity	Lowest Tolerance	0.933	Tolerance > 0.10	Passed
Heteroscedasticity	Breusch–Pagan Sig.	0.910	$p > 0.05$	Passed
Heteroscedasticity	White Test Sig.	0.832	$p > 0.05$	Passed
Heteroscedasticity	Glejser F Sig.	0.990	$p > 0.05$	Passed
Autocorrelation	Durbin–Watson	2.059	1.5 < DW < 2.5	Passed

Based on Table 2, the diagnostic results of the prerequisite testing demonstrate the following empirical findings:

- Residual Normality Test: The assessment of residual distribution was conducted via a triangulation of three statistical methods, namely the Shapiro-Wilk test (p = 0.444), the Kolmogorov-Smirnov test (p = 0.681), and the Jarque-Bera test (p = 0.560). All three methods yielded significance values substantially greater than alpha = 0.05, conclusively proving that the model residuals are normally distributed.
- Multicollinearity Test: The highest Variance Inflation Factor (VIF) indicator was recorded at 1.071 (below the critical threshold of 10), and the lowest Tolerance value was situated at 0.933 (above the minimum limit of 0.10). This parameter confirms the absence of severe linear intercorrelation or extreme overlap among the independent variables within this regression model.
- Heteroskedasticity Test: Through the Breusch-Pagan test (p = 0.910), the White test (p = 0.832), and the Glejser test (p = 0.990), all significance values exceeded 0.05. This indicates the presence of homoskedasticity, meaning that the residual variance remains constant across all observations.
- Autocorrelation Test: The obtained Durbin-Watson (DW) statistical value was 2.059. This value falls within the acceptable range of 1.5 <DW < 2.5, thereby confirming the absence of autocorrelation issues (serial correlation among residuals) in the order of observations.

Collectively, the diagnostic results of these classical assumption tests provide a robust statistical foundation, indicating that multiple linear regression modeling is highly appropriate for conducting further hypotheses testing.

Simultaneous Model Testing and the Coefficient of Determination

Once the regression model satisfies all BLUE prerequisites, the next step involves evaluating the macro-level goodness of fit through simultaneous testing (F-test) and an analysis of the coefficient of determination (R^2). This procedure aims to measure the significance of the combined effect of the independent variables on academic achievement, while simultaneously assessing the proportion of variance in the dependent variable that can be explained by the model. A summary of the regression model's goodness-of-fit parameters is presented in Table 3, followed by the analysis of variance (ANOVA) results in Table 4.

Table 3. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.713^a	.508	.481	3.76463

a. Predictors: (Constant), X5 (Metacognition), X2 (Learning Motivation), X4 (Memory), X1 (Attitude Component), X3 (Learning Strategies)

Table 4. ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1290.175	5	258.035	18.207	.000^b
	Residual	1247.175	88	14.172		
	Total	2537.351	93			

a. Dependent Variable: Y (Academic Achievement)

b. Predictors: (Constant), X5 (Metacognition), X2 (Learning Motivation), X4 (Memory), X1 (Attitude Component), X3 (Learning Strategies)

Based on Table 3, the Correlation Coefficient (R) was recorded at 0.713, reflecting a robust and positive simultaneous relationship between the five learning behavior components and the academic achievement of third-grade elementary school students in Banten. The resulting Coefficient of Determination (R^2) was 0.508. This figure indicates that 50.8% of the variance in students' academic achievement can be simultaneously predicted and explained by the components of attitude, learning motivation, learning strategies, memory, and metacognition. Meanwhile, the remaining 49.2% is influenced by other external variables outside the scope of this model, such as family support, teacher instructional quality, socioeconomic conditions, the school environment, and physical health.

Furthermore, the results of the simultaneous model significance testing in Table 4 demonstrate an F(5, 88) value of 18.207 with a significance probability level of $p = 0.000$ ($p < 0.001$). Since the probability value is substantially lower than the alpha level of 0.05, the regression model is declared statistically significant. This finding supports H6, demonstrating that the components of attitude, learning motivation, learning strategies, memory, and metacognition collectively exert a significant effect on the academic achievement of elementary school students.

Partial Hypothesis Testing

To ascertain the unique contribution and the significance of the effect of each individual learning behavior component while controlling for other variables, a partial t-test was conducted. The detailed results of the regression coefficient data processing utilizing SPSS version 20 are comprehensively summarized in Table 5.

Table 5. Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	B		
1	(Constant)	79.864	14.073		5.675	.000
	X1 (Attitude Component)	-.650	.294	-.183	-2.207	.030
	X2 (Learning Motivation)	-.506	.226	-.179	-2.236	.028
	X3 (Learning Strategies)	.449	.205	.207	2.185	.032
	X4 (Memory)	.532	.168	.275	3.169	.002
	X5 (Metacognition)	.398	.173	.201	2.297	.024

a. Dependent Variable: Y (Academic Achievement)

Based on the unstandardized coefficients (B) parameters in Table 5, the empirical equation for the multiple linear regression in this study can be formulated as follows:

$$Y = 79.864 - 0.650X1 - 0.506X2 + 0.449X3 + 0.532X4 + 0.398X5$$

Through the coefficients table, the partial hypothesis testing (H1 to H5) can be analytically elaborated as follows:

- The Effect of the Attitude Component (X1): A t-value of -2.207 was obtained with $p = 0.030$ ($p < 0.05$). A significance value below 0.05 indicates that the attitude component exerts a significant effect on academic achievement; thus, H1 is accepted. Interestingly, the resulting direction of the coefficient is negative (B = -0.650). This indicates the presence of a negative controlled partial effect in its unique contribution to academic achievement.
- The Effect of Learning Motivation (X2): The results of the analysis demonstrate a t-value of -2.236 with $p = 0.028$ ($p < 0.05$). This significance value proves that

learning motivation has a partially significant effect on academic achievement; hence, H2 is accepted. Aligning with the attitude variable, the direction of the regression coefficient for motivation is negative (B = -0.506).

- The Effect of Learning Strategies (X3): A t-value of 2.185 was achieved with p = 0.032 ($p < 0.05$). This result indicates that learning strategies exert a positive and significant effect on the academic achievement of third-grade elementary school students. Consequently, H3 is empirically accepted. The B-value of 0.449 indicates that every one-unit increase in the learning strategy score will enhance academic achievement by 0.449 units, assuming other variables remain constant.
- The Effect of Memory (X4): A t-value of 3.169 was recorded with a highly robust significance level of p = 0.002 ($p < 0.01$). This finding demonstrates a positive and significant effect of memory on academic achievement performance; therefore, H4 is accepted. Referring to the standardized coefficient value (B = 0.275), the memory variable was found to be the most powerful and dominant predictor in this regression model.
- The Effect of Metacognition (X5): A t-value of 2.297 was obtained with p = 0.024 ($p < 0.05$). This statistical parameter confirms that metacognition has a partially significant positive effect on student achievement; thus, H5 is declared accepted. The regression coefficient value of 0.398 indicates that reinforcement in students' thinking regulation aspects will be followed by a linear increase in academic outcomes.

The negative direction of the partial regression coefficients for the Attitude Component (X1) and Learning Motivation (X2) variables within this multivariate model represents a unique statistical phenomenon. This requires cautious interpretation because it represents a partial effect when other constructs are controlled, rather than a simple bivariate causal interpretation. The emergence of this negative direction indicates an overlapping intercorrelation among predictors and serves as an indication of a suppressor effect due to the theoretical proximity between the psychological constructs in the model, which will be reviewed more comprehensively in the discussion section.

DISCUSSION

Integration of Learning Behavior Components as Predictors of Academic Achievement

The empirical findings of this study confirm that learning behavior components consisting of attitude, learning motivation, learning strategies, memory, and metacognition collectively (simultaneously) contribute significantly to predicting the academic achievement of third-grade elementary school students in Banten Province, with the model's explanatory power (R^2) reaching 50.8%. This finding highlights the importance of viewing students' internal domain as an integrative ecosystem rather than as a set of mutually isolated psychological variables. Theoretically, these findings reinforce contemporary self-regulated learning frameworks (de Bruin & van Merriënboer, 2017; Panadero, 2017). As students enter the concrete operational transition phase in the third grade of elementary school, these components merge into learning habits that govern how classroom instructional stimuli are absorbed, processed, and re-expressed in the form of academic performance (Mao et al., 2021). This finding also supports recent publication trends asserting that the effective management of students' psychological components is more predictive of learning outcomes than physical infrastructure interventions alone (Bugwak, 2023). Similarly, Noviani et al. (2023) showed that learning motivation was significantly associated with learning achievement

within a model involving self-regulated learning and self-efficacy, reinforcing the relevance of motivational-regulative constructs in achievement research.

The Dominance of Cognitive-Regulative Capacity in the Academic Performance of Transitional Grade Students

Partial analysis shows that learning strategies (X3), memory (X4), and metacognition (X5) exert significant positive effects on student achievement, with memory (B = 0.532; B = 0.275) emerging as the most dominant predictor in the regression model. From a cognitive developmental standpoint, children aged 8–9 years are in a critical transitional period in which the volume of subject matter increases, requiring stronger information storage capacities, including working memory and long-term memory, than those required in lower grades. Cowan (2016) emphasized that working memory capacity is a key constraint on children's academic learning. Agarwal et al. (2021) provided robust evidence that retrieval practice (a memory–based strategy) consistently improves learning outcomes, including in elementary school contexts. Students equipped with effective memory retention techniques, such as retrieval practice and meaningful association, can recall prior knowledge schemas with greater accuracy (Yang et al., 2021). This finding is consistent with previous studies indicating that working memory efficiency is directly associated with the speed of numeracy and literacy problem-solving among elementary-aged children (Fiorella, 2020).

Alongside memory, the positive contributions of learning strategies (B = 0.449) and metacognition (B = 0.398) confirm that operational tactics and awareness of thinking play an essential role in supporting memory capacity. Tactical learning strategies, such as concise note-taking and group discussion, help reduce students' cognitive load when studying complex material. Fiorella (2020) reported that learning strategy interventions are particularly effective in upper elementary grades. Hattie and Donoghue (2016) synthesized that learning strategies such as note-taking, self-questioning, and help-seeking are particularly effective when they are explicitly taught and aligned with students' cognitive development. These strategies are further optimized by metacognitive capacity, which acts as a monitor of the thinking process. Students with mature metacognition can recognize misconceptions, monitor their comprehension while reading texts, and modify their learning strategies when encountering obstacles (Benick et al., 2021). The simultaneous positive effects of these three variables indicate that academic mastery at the elementary school level cannot be achieved through passive rote learning alone; rather, it must be supported by active learning strategies and reflective cognitive regulation.

Analysis of the Suppressor Effect on Affective Components

The most distinctive finding of this study is the negative direction of the partial regression coefficients for the attitude component (B = -0.650) and learning motivation (B = -0.506), although both variables are statistically significant. At first glance, this result appears to contradict general theories stating that high motivation and positive attitudes contribute linearly to improved achievement. However, in the context of multiple linear regression, this finding indicates a statistical phenomenon known as a suppressor effect. This effect arises when several independent variables have theoretical linkages and overlapping intercorrelations within the model. When learning strategies, memory, and metacognition are entered as controlled covariates, the remaining unique variance of attitude and motivation in the regression model shifts direction.

Psychologically, this phenomenon suggests that very high motivation or overconfidence among third-grade elementary students, when not accompanied by

concrete learning strategies and mature metacognition, may paradoxically reduce the effectiveness of their academic performance. Misdirected high motivation may trigger test anxiety or hasty learning behaviors when completing school tasks, thereby increasing students' margin of error. Conversely, students whose raw motivation scores are moderate but who possess well-organized learning strategies and strong metacognition may attain more stable and higher academic scores. This paradoxical finding aligns with Credé (2018), who cautioned that purely affective factors without tactical cognitive execution frequently generate directional distortions in multivariate statistical relationships.

Theoretical and Practical Implications for the Advancement of Educational Science

Theoretically, this study provides a new scientific contribution (novelty) to the domain of primary educational psychology by deconstructing the linear understanding of motivation and attitude. This research proves that within the learning behavior ecosystem, cognitive regulative capacity (metacognition and memory) acts as a primary anchor determining whether affective drives (motivation and attitude) will yield academic achievement or instead trigger behavioral bias in the field. This model extends simplistic bivariate views by offering a more realistic and comprehensive multivariate perspective for understanding the psychological dynamics of primary school children (Schneider & Preckel, 2017).

Practically and implementatively, the findings of this study yield tangible policy implications for educators and curriculum developers in primary education, particularly within the Banten region. Given that memory and metacognition are the most robust predictors, instructional practices in third-grade classrooms must pivot away from traditional rote-dictation models toward the integration of instructional interventions based on metacognitive scaffolding. Teachers should move beyond rote learning and incorporate metacognitive scaffolding, retrieval practice, and explicit strategy instruction. These align with Froiland's (2021) finding that intrinsic motivation in elementary school is most effective when combined with self-regulation skills , and with Yang et al.'s (2021) recommendation to use quizzing and retrieval practice in daily instruction**.** These recommendations are consistent with the spirit of the Kurikulum Merdeka (Independent Curriculum) and differentiated learning approaches, in which lifelong learning traits are reinforced through the formation of tactical self-regulation habits from an early age.

CONCLUSION

This study successfully resolves the overarching research objective by demonstrating that the academic achievement of third-grade primary school students during critical developmental transitions is holistically determined by an integrated configuration of internal learning behaviors. Collectively, the dimensions of attitude, learning motivation, strategic learning, memory capacity, and metacognitive regulation function as a unified psycho-cognitive ecosystem that powerfully predicts student performance. On a partial level, cognitive and regulative capacities—specifically strategic deployment, memory retention, and metacognitive monitoring—exert direct positive driving forces on achievement, with memory capacity emerging as the most dominant anchor for academic success. Conversely, the affective components of attitude and motivation reveal a complex, suppressed path within the multivariate environment, indicating that high emotional or motivational drive without systemic cognitive grounding and strategic execution can lead to performance saturation rather than linear improvement.

The scientific innovation of this research lies in its deconstruction of simplistic, bivariate interpretations of student psychological traits within early childhood education, offering a more nuanced modification of self-regulated learning (SRL) frameworks. It refines existing educational science by proving that the psychological ecosystem of primary learners does not operate in independent linear tracks; rather, cognitive control structures actively modulate and anchor affective energies. The empirical identification of the suppressor effect within this model shifts the academic paradigm, establishing that high motivation and positive attitudes must be structurally paired with explicit cognitive regulation and strategic training to prevent instructional anxiety and successfully manifest as objective academic excellence.

Based on these foundational insights, several strategic suggestions are proposed for educational practitioners and future researchers. Primary school educators should systematically transition away from conventional, passive rote-learning methods toward incorporating explicit metacognitive scaffolding, self-assessment routines, and visual memory association techniques directly into the daily curriculum. School administrators are encouraged to facilitate targeted professional development programs that equip teachers with instructional strategies focused on student self-regulation. Finally, future researchers should expand upon this structural model by utilizing longitudinal research designs or structural equation modeling (SEM) to chart the long-term developmental trajectories of these behavioral components across broader geographical and socio-economic demographics.

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Learning Behavior Components as Predictors of Third-Grade Achievement in Banten

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Abstract: Learning Behavior Components as Predictors of Third-Grade Achievement in Banten. Elementary students' academic achievement is shaped by interconnected learning behavior, while previous studies frequently examine these psychological elements separately, leaving their combined impact unexplored.
Objectives: This study examines the partial and simultaneous effects of five learning behavior variables (attitude component, learning motivation, learning strategies, memory, and metacognition) on the academic achievement of third-grade students in Banten Province.
Methods: A quantitative explanatory survey design was applied to 94 third-grade students across three public elementary schools in Serang, Cilegon, and Tangerang. Data were gathered through 1–5 Likert-scale questionnaires measuring learning behavior dimensions and student grades representing achievement. Data analysis was performed using multiple linear regression with classical assumption testing.
Findings: The simultaneous regression model was statistically significant ($F = 18.207$; $p < 0.001$) and accounted for 50.8% of academic achievement variance (R^2 = 0.508). Partially, all five variables significantly predicted achievement. Learning strategies, memory, and metacognition positively predicted outcomes, with memory as the most dominant predictor ($\beta = 0.275$; $p = 0.002$). Conversely, attitude and learning motivation showed negative coefficients attributed to a suppressor effect.
Conclusion: Academic achievement must be understood as an interaction among affective, cognitive, strategic, and regulatory dimensions. Primary schools should implement explicit learning strategy instruction, meaningful memory practices, and early metacognitive habituation.

Keywords: academic achievement, elementary school, learning behavior, memory, metacognition.

Abstrak: Komponen Perilaku Belajar sebagai Prediktor Prestasi Akademik Siswa Kelas Tiga di Banten. *Prestasi akademik siswa sekolah dasar dibentuk oleh perilaku belajar yang saling terkait, sementara penelitian-penelitian sebelumnya sering kali menguji elemen-elemen psikologis ini secara terpisah, sehingga dampak gabungannya belum tereksplorasi.*
Tujuan: *Penelitian ini bertujuan untuk menguji pengaruh parsial dan simultan dari lima variabel perilaku belajar (komponen sikap, motivasi belajar, strategi belajar, memori, dan metakognisi) terhadap prestasi akademik siswa kelas tiga di Provinsi Banten.*

Metode: *Desain survei eksplanatori kuantitatif diterapkan pada 94 siswa kelas tiga di tiga sekolah dasar negeri di Serang, Cilegon, dan Tangerang. Data dikumpulkan melalui kuesioner skala Likert 1–5 yang mengukur dimensi perilaku belajar dan nilai rapor siswa yang merepresentasikan prestasi belajar. Analisis data dilakukan menggunakan regresi linier berganda dengan uji asumsi klasik.*

Temuan: *Model regresi simultan terbukti signifikan secara statistik (F = 18,207; p < 0,001) dan berkontribusi sebesar 50,8% terhadap varians prestasi akademik (R^2 = 0,508). Secara parsial, kelima variabel tersebut secara signifikan memprediksi prestasi. Strategi belajar, memori, dan metakognisi memprediksi hasil secara positif, dengan memori muncul sebagai prediktor paling dominan (β = 0,275;p = 0,002). Sebaliknya, sikap dan motivasi belajar menunjukkan koefisien negatif yang disebabkan oleh efek supresor.*

Kesimpulan: *Prestasi akademik harus dipahami sebagai interaksi antara dimensi afektif, kognitif, strategis, dan regulatori. Sekolah dasar sebaiknya menerapkan instruksi strategi belajar yang eksplisit, praktik memori yang bermakna, dan pembiasaan metakognitif sejak dini.*

Kata kunci: *perilaku belajar, memori, metakognisi, prestasi akademik, sekolah dasar.*

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INTRODUCTION

The academic success in primary education is a significant indicator not only of the institution's success, but also of the student's adaptive readiness to overcome the difficulties of learning at a higher level. The elementary school years are a developmental step from the lower to the higher grades, especially in third grade. There is a significant increase in mental effort when moving from basic reading and math to grasping complex, abstract ideas. In addressing these dynamics, student competence outcomes are no longer adequately explained by external variables such as curriculum updates, facility availability or teacher instructional methods. Focus should instead be placed on the internal factors of learners, particularly the construction and internalization of learning behaviors by students, and the expression of such behaviors during everyday academic activities. These learning behaviors serve as the primary driver of the optimal processing of information and the persistence of students in the classroom.

Learning behavior in educational psychology is defined as a dynamic multidimensional construct connecting students' underlying cognitive potential with their observable learning outcomes. Recent studies confirm that combining psychological factors with specific study habits predicts academic success more accurately than relying on cognitive ability alone (Credé, 2018). This idea is consistent with modern self-regulated learning (SRL) models, where students are viewed as active agents who independently plan, monitor and assess their comprehension processes (de Bruin & van Merriënboer, 2017; Panadero, 2017). Therefore, to get a comprehensive picture of primary school achievement, we must investigate how emotional, motivational, and cognitive factors function collectively. This requires exploring learning behaviors—such as attitude, motivation, strategies, memory, and metacognition—as an integrated system.

The affective component of learning behavior, which is attitude and learning motivation, determines the value orientation of students and the strength of effort they put into academic activities. Learning attitudes are students' evaluative tendencies towards subject matter and academic tasks (Fiorella, 2020). Negative attitude brings about learning resistance; positive attitude promotes mental readiness of students for cognitive challenges. Subsequently, learning motivation is an intrinsic or extrinsic factor that stimulates, guides and maintains behavioral persistence when students face learning barriers. In a meta-analysis, Dent and Koenka (2016) showed that motivation is significantly related to academic achievement with cognitive strategy as moderation variable. But this affective dimension does not work in a linear or isolated way. High motivation without the capacity for tactical performance of learning tasks is often not enough for optimal academic outcomes and thus needs to be linked with effective cognitive strategies. A three-level meta-analysis suggests that students' attitudes towards science are significantly associated with science achievement, supporting the importance of attitude as an affective predictor of academic performance (Mao et al., 2021).

The cognitive and regulative components, which consist of learning strategies, memory and metacognition, give the operational direction for the processing and retention of information in the cognitive structures of students. Learning strategies are particular techniques, like organizing material, taking notes, elaborating concepts, and discussing with peers, that students use to promote mastery of competence. Fiorella (2020) synthesized evidence that learning strategies instruction produces moderate to large effects on academic performance in K–12 settings. The success of these strategies is highly dependent on memory capacity Memory capacity should be considered not as a form of storage, but as an active process of retrieval practice and meaningful connections between new knowledge and prior knowledge. Yang et al. (2021) found that retrieval practice improves long-term retention in elementary school children. This process relies

on metacognitive capacity, which refers to a person's awareness of and control over their own thinking. Through metacognition, third-grade students can start to monitor their understanding of reading texts, identify strategy errors, and adjust their actions on their own (Benick et al., 2021). A recent series of meta-analyses also shows that metacognitive interventions for young children can help their learning outcomes. This strengthens the case for including metacognition in models of early academic achievement (Eberhart et al., 2024).

Prior studies in both international and Indonesian contexts have looked into the significance of these factors in primary education. Bugwak (2023) found that learning behaviors strongly predicted academic performance among primary learners in the Philippines. Arianto & Hanif (2024) showed that metacognitive strategies improved cognitive learning behaviors in elementary education. These studies provide a strong basis indicating that students' internal learning environments are crucial in shaping the quality of primary education outcomes.

Although studies incorporating these psychological factors have increased, this study wants to fill in the existing gaps. First, most of the previous studies have examined motivation, cognitive strategies, memory or metacognition separately, or in part. This approach fails to examine how these elements operate and contribute in a combined empirical model. Second, there are scarce integrative studies in the Banten Province that combine the affective domain (attitude and motivation) and the cognitive-regulative domain (strategies, memory, and metacognition) among elementary school students. Not including the combined analysis will likely lead to erroneous conclusions. Regarding the regression analysis, these elements overlap and will affect regression coefficients when the other variables are held constant. Third, people involved in primary education should know the predictors that are most closely associated with the students' academic achievements. This is important for the designing of effective teaching interventions.

Given this gap, this research examines and demonstrates the effects of attitude components, learning motivations, learning strategies, and memory and their interactions on the academic success of third-grade primary school students. This study also examines the contribution of each of the five learning behavior components and the significance of each given that the others are held constant. This study extends early childhood educational psychology and affects-cognitive integration by extending regression analysis. The practical contribution of this study is to offer an empirical guide for third-grade teachers in Banten about adjusting teaching methods to improve metacognition and memory, and appropriately manage attitudes to improve students' academic achievement.

Based on the theoretical framework and the research gap, we proposed the following hypotheses:

- H1 : The attitude component has a significant partial effect on academic achievement.
- H2 : Learning motivation has a significant partial effect on academic achievement.
- H3 : Learning strategies have a significant positive partial effect on academic achievement.
- H4 : Memory has a significant positive partial effect on academic achievement.
- H5 : Metacognition has a significant positive partial effect on academic achievement.
- H6 : Attitude, learning motivation, learning strategies, memory, and metacognition simultaneously have a significant effect on academic achievement.

METHOD

Research Design

This research employed a quantitative explanatory design with a cross-sectional survey approach. The design was selected because the research objective was to test the partial and simultaneous predictive effects of five independent variables—attitude component (X1), learning motivation (X2), learning strategies (X3), memory (X4), and metacognition (X5)—on one dependent variable, namely students' academic achievement (Y). The analytical model used multiple linear regression because the study examined more than one predictor in a single empirical model.

Research Procedures and Framework

The research procedure was organized into six sequential stages: (1) identifying the theoretical framework of learning behavior and self-regulated learning; (2) mapping the five learning behavior constructs into questionnaire indicators; (3) obtaining school permission and respondent consent; (4) administering the questionnaire to eligible third-grade students; (5) collecting academic achievement documentation from school records; and (6) analyzing the data through validity-reliability testing, descriptive checking, Pearson correlation, classical assumption testing, and multiple regression. The procedural framework was designed to ensure that affective, cognitive, strategic, memory-based, and metacognitive dimensions were measured within one integrated model.

Population, Sampling Technique, and Respondents

The population consisted of third-grade students from three public elementary schools in Banten Province: SD Negeri Drangong 1 Serang, SD Negeri Kubang Lesung Kulon Cilegon, and SD Negeri Cimone 3 Tangerang. The sampling technique used in this study was total sampling of the accessible population. All third-grade students who were present during data collection, met the inclusion criteria, and obtained school/parental permission were included as respondents. Therefore, the final sample consisted of 94 students. This technique was considered appropriate because the accessible population in the three selected schools was relatively limited and directly aligned with the research focus on third-grade learners.

Instrument

The research tool used was a questionnaire that consisted of 50 items that were divided into five different constructs that were developed based on the following components: attitude (10 items), motivation (10 items), learning strategies (10 items), learning and memory (10 items), and metacognition (10 items). A five-point Likert scale was used to score each statement where 1 represented strongly disagree and 5 represented strongly agree. Responses to each component were summed, and the total scores were applied to the regression model. Table 1 summarized the research variables and their indicators.

Table 1. Summary of Research Variables and Indicators

Variable	Code	Number of Items	Scale	Measurement Focus
Attitude Component	X1	10	Likert 1–5	Students' attitudes toward learning, assignments, learning goals, and mistakes as part of the learning process
Learning Motivation	X2	10	Likert 1–5	Learning drive, persistence, challenge orientation, learning

				assistance, and learning satisfaction
Learning Strategies	X3	10	Likert 1–5	Study scheduling, note-taking, discussion, use of learning resources, reflection, and alternative learning strategies
Memory	X4	10	Likert 1–5	Remembering information, memorization techniques, review activities, association, and retrieval practice
Metacognition	X5	10	Likert 1–5	Planning, monitoring, strategy evaluation, reflection, and goal setting in learning
Academic Achievement	Y	–	Grade	The mean report card grades of the first semester

Validity and Reliability Testing

Instrument validity was assessed through content validation and item-total correlation screening. Content validation was conducted by aligning each item with the construct definition and indicators in the learning behavior framework. Empirical validity was reported by using item-total correlation, with items acceptable when their correlation exceeds the r-table value or a minimum criterion of 0.361 (df=28, alpha=0.05). Reliability was reported using Cronbach's Alpha for each construct, with $\alpha \geq 0.70$ indicating acceptable internal consistency. As shown in Table 2, the instruments used in thei research were valid and reliable.

Table 2. Instrument Validity and Reliability

Construct	Number of Items	Validity Criterion	Reliability Coefficient Required	Status
Attitude Component (X1)	10	Item-total correlation > r-table (r > 0.361)	Cronbach's Alpha (0.819) ≥ 0.70	Valid and reliable
Learning Motivation (X2)	10	Item-total correlation > r-table (r > 0.361)	Cronbach's Alpha (0.806) ≥ 0.70	Valid and reliable
Learning Strategies (X3)	10	Item-total correlation > r-table (r > 0.361)	Cronbach's Alpha (0.851) ≥ 0.70	Valid and reliable
Memory (X4)	10	Item-total correlation > r-table (r > 0.361)	Cronbach's Alpha (0.778) ≥ 0.70	Valid and reliable
Metacognition (X5)	10	Item-total correlation > r-table (r > 0.361)	Cronbach's Alpha (0.852) ≥ 0.70	Valid and reliable

Documentation of Students' Academic Achievement

The dependent variable (Y) was measured through documentation of students' academic achievement recorded by the school. Specifically, the indicator used was the final report-card average used in grade promotion documentation at the end of the relevant academic period. Thus, the achievement score did not come from students' self-perception, but from formal school records compiled by class teachers.

Data Analysis

Data analysis was conducted using SPSS version 20. The analysis framework consisted of: (1) descriptive checking of all research variables; (2) Pearson correlation analysis among X1, X2, X3, X4, X5, and Y before the regression model; (3) classical assumption testing covering residual normality, multicollinearity, heteroskedasticity, and autocorrelation; (4) multiple linear regression; (5) partial t-tests; (6) simultaneous F-test; and (7) coefficient of determination analysis. The Pearson correlation matrix was added to clarify the bivariate direction of relationships and to support cautious interpretation of the negative controlled coefficients for attitude and learning motivation. The regression equation was formulated as follows:

$$Y = a + b1X1 + b2X2 + b3X3 + b4X4 + b5X5 + e.$$

▪ RESULT AND DISCUSSION

RESULT

Pearson Correlation Matrix

Before conducting multiple linear regression, Pearson correlation analysis was performed to examine the bivariate relationships among the independent variables and academic achievement as shown in Table 3. This step was done to strengthen interpretation of the regression coefficients, especially because the attitude and learning motivation variables showed negative controlled coefficients in the multivariate model.

Table 3. Correlations

		Attitude Component	Learning Motivation	Learning Strategies	Memory	Metacognition	Academic Achievement
Attitude Component	Pearson Correlation	1	-.045	-.005	.033	.005	-.330**
	Sig. (2-tailed)		.665	.960	.749	.965	.001
	N	94	94	94	94	94	94
Learning Motivation	Pearson Correlation	-.045	1	.027	-.124	.170	-.258*
	Sig. (2-tailed)	.665		.795	.234	.102	.012
	N	94	94	94	94	94	94
Learning Strategies	Pearson Correlation	-.005	.027	1	.073	.022	.269**
	Sig. (2-tailed)	.960	.795		.484	.837	.009
	N	94	94	94	94	94	94
Memory	Pearson Correlation	.033	-.124	.073	1	.172	.382**
	Sig. (2-tailed)	.749	.234	.484		.097	.000
	N	94	94	94	94	94	94
Metacognition	Pearson Correlation	.005	.170	.022	.172	1	.230*
	Sig. (2-tailed)	.965	.102	.837	.097		.026
	N	94	94	94	94	94	94
Academic Achievement	Pearson Correlation	-.330**	-.258*	.269**	.382**	.230*	1
	Sig. (2-tailed)	.001	.012	.009	.000	.026	
	N	94	94	94	94	94	94

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The Pearson correlation matrix (Table 3) shows that X1(attitude component) and X2 (learning motivation) have negative bivariate correlations with academic achievement in the composite dataset (r = -0.330 and r = -0.258, respectively), whereas X3, X4, and X5 show positive correlations with academic achievement (r = 0.269, r = 0.382, and r = 0.230). Therefore, the negative coefficients of X1 and X2 in the regression model should be interpreted as controlled inverse associations within this dataset rather than as a general claim that attitude or motivation is negatively impactful. This result also indicates that the term suppressor effect should be used as a potential multivariate/control effect, not as a definitive causal explanation.

Analytical Prerequisite Tests (Classical Assumption Testing)

Prior to conducting hypothesis testing via the multiple linear regression analysis model, a series of analytical prerequisite tests—commonly referred to as classical assumption tests—was performed. This phase of the methodology is crucial for testing that the estimation model meets the criteria for the Best Linear Unbiased Estimator (BLUE). This ensures that the model produces secure, objective, and unbiased coefficient parameters. In this research, the testing of classical assumptions includes the four main tests: residual normality, multicollinearity, heteroskedasticity, and autocorrelation. The preliminary results of these diagnostics are summarized in Table 4.

Table 4. Summary of Classical Assumption Test Results

Assumption	Indicator	Value	Criterion	Conclusion
Residual Normality	Shapiro–Wilk Sig.	0.444	p > 0.05	Passed
Residual Normality	Kolmogorov–Smirnov Sig.	0.681	p > 0.05	Passed
Residual Normality	Jarque–Bera Sig.	0.560	p > 0.05	Passed
Multicollinearity	Highest VIF	1.071	VIF < 10	Passed
Multicollinearity	Lowest Tolerance	0.933	Tolerance > 0.10	Passed
Heteroscedasticity	Breusch–Pagan Sig.	0.910	p > 0.05	Passed
Heteroscedasticity	White Test Sig.	0.832	p > 0.05	Passed
Heteroscedasticity	Glejser F Sig.	0.990	p > 0.05	Passed
Autocorrelation	Durbin–Watson	2.059	1.5 < DW < 2.5	Passed

Based on Table 4, the diagnostic results of the prerequisite testing demonstrate the following empirical findings:

- Residual Normality Test: The normality of the residuals was confirmed by three tests. The results of the Shapiro-Wilk test showed a p-value of 0.444. The p-value reported by the Kolmogorov-Smirnov test was 0.681, and the p-value reported by the Jarque-Bera test was 0.560. Given that the p-values reported by the three tests were greater than the alpha value of 0.05, it was confirmed that the residuals were normally distributed.
- Multicollinearity Test: The highest recorded Variance Inflation Factor (VIF) indicator was at 1.071 (well below the threshold of concern of 10). The lowest recorded Tolerance value was at 0.933 (well above the cutoff of 0.10). These findings suggest that there is no significant multicollinearity among the predictors of this regression model.
- Heteroskedasticity Test: Performed tests including Breusch-Pagan (p = 0.910), White (p = 0.832), and Glejser (p = 0.990), indicated no heteroskedasticity at a

0.05 significance level thus confirming homoskedasticity. This indicates that residual variance is consistent across all observations.

- Autocorrelation Test: The derived Durbin-Watson (DW) statistic was 2.059 and it fell within the limits of 1.5 < DW < 2.5 thus confirming the absence of autocorrelation in the order of the observations.

Collectively, the diagnostic results of these classical assumption tests provide a robust statistical foundation, indicating that multiple linear regression modeling is highly appropriate for conducting further hypotheses testing.

Simultaneous Model Testing and the Coefficient of Determination

After confirming that the regression model meets all of the BLUE criteria, we can perform the first test for macro-level goodness of fit. This test will include the F-test and the determination of the R^2 statistic. Here we look at the effect of the independent variables combination on academic achievement, and we look at the extent of the dependent variable's (academic achievement) variance that the regression model explains. The goodness of fit for the regression model is documented in Table 5 and is followed by the analysis of variance (ANOVA) in Table 6.

Table 5. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.713^a	.508	.481	3.76463

a. Predictors: (Constant), X5 (Metacognition), X2 (Learning Motivation), X4 (Memory), X1 (Attitude Component), X3 (Learning Strategies)

Table 6. ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1290.175	5	258.035	18.207	.000^b
	Residual	1247.175	88	14.172		
	Total	2537.351	93			

a. Dependent Variable: Y (Academic Achievement)
b. Predictors: (Constant), X5 (Metacognition), X2 (Learning Motivation), X4 (Memory), X1 (Attitude Component), X3 (Learning Strategies)

Based on Table 5, the Correlation Coefficient (R) was recorded at 0.713, reflecting a robust and positive simultaneous relationship between the five learning behavior components and the academic achievement of third-grade elementary school students in Banten. The resulting Coefficient of Determination (R^2) was 0.508. This figure indicates that 50.8% of the variance in students' academic achievement can be simultaneously predicted and explained by the components of attitude, learning motivation, learning strategies, memory, and metacognition. Meanwhile, the remaining 49.2% is influenced by other external variables outside the scope of this model, such as family support, teacher instructional quality, socioeconomic conditions, the school environment, and physical health.

Furthermore, the results of the simultaneous model significance testing in Table 6 demonstrate an F(5, 88) value of 18.207 with a significance probability level of $p = 0.000$ ($p < 0.001$). Since the probability value is substantially lower than the alpha level of 0.05, the regression model is declared statistically significant. This finding supports H6, demonstrating that the components of attitude, learning motivation, learning strategies,

memory, and metacognition collectively have a significant effect on the academic achievement of elementary school students.

Partial Hypothesis Testing

To isolate the unique contribution and the significance of the effect of each individual learning behavior component while controlling for other variables, a partial t-test was conducted. The detailed results of the regression coefficient data processing utilizing SPSS version 20 are comprehensively summarized in Table 7.

Table 7. Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	B		
1	(Constant)	79.864	14.073		5.675	.000
	X1 (Attitude Component)	-.650	.294	-.183	-2.207	.030
	X2 (Learning Motivation)	-.506	.226	-.179	-2.236	.028
	X3 (Learning Strategies)	.449	.205	.207	2.185	.032
	X4 (Memory)	.532	.168	.275	3.169	.002
	X5 (Metacognition)	.398	.173	.201	2.297	.024

a. Dependent Variable: Y (Academic Achievement)

Based on the unstandardized coefficients (B) parameters in Table 7, the empirical equation for the multiple linear regression in this study can be formulated as follows:

$Y = 79.864 – 0.650X1 – 0.506X2 + 0.449X3 + 0.532X4 + 0.398X5$

Through the coefficients table, the partial hypothesis testing (H1 to H5) can be analytically elaborated as follows:

- The effect of the Attitude Component (X1): A t-value of -2.207 was obtained with $p = 0.030$ ($p < 0.05$). A significance value below 0.05 indicates that the attitude component exerts a significant effect on academic achievement; thus, H1 is accepted. Interestingly, the resulting direction of the coefficient is negative (B = -0.650). This indicates the presence of a negative controlled partial effect in its unique contribution to academic achievement.
- The effect of Learning Motivation (X2): The results of the analysis demonstrate a t-value of -2.236 with $p = 0.028$ ($p < 0.05$). This significance value proves that learning motivation has a partially significant effect on academic achievement; hence, H2 is accepted. Aligning with the attitude variable, the direction of the regression coefficient for motivation is negative (B = -0.506).
- The effect of Learning Strategies (X3): The results show that t = 2.185 and p = 0.032 (p < 0.05). These results indicate that in the case of learning strategies, third grade elementary school students' academic achievement has been positively and significantly affected. Thus, H3 is accepted. In this case, the hypothesis is formulated as follows: B = 0.449, therefore, if there is an increase in the score of the learning strategies variable by one, the academic achievement score is predicted to increase by 0.449, assuming that the other variables are constant.
- The effect of Memory (X4): The t-value of 3.169 and the high level of significance at p = 0.002 (p < 0.01) prove that the value of memory has a positive and significant effect on academic achievement performance; thus, H4 is accepted. Regarding the standardized coefficient (B = 0.275), in this regression model, memory was the most dominant variable.

- The effect of Metacognition (X5): The t-value of 2.297 and p = 0.024 (p < 0.05) indicates that the effect of metacognition is positive and statistically significant on the achievement of students; as a result, H5 is accepted. The regression coefficient of 0.398 shows that and increase in the thinking regulation of students is likely to result in an increase in their academic achievement.

The multivariate model shows negative signs of the partial regression coefficients for Attitude Component (X1) and Learning Motivation (X2) as separate cases of a statistical model. This requires careful interpretation of the results, as in this case, rather than the usual simple bivariate causation interpretation, we are dealing with a partial effect assuming other factors are controlled. The presence of a negative sign indicates the presence of intercorrelation among predictors, as well as the presence of a suppressor effect, as there is close theoretical distance among the psychological constructs in this model, which will be examined in more detail in the discussion section.

DISCUSSION

Integration of Learning Behavior Components as Predictors of Academic Achievement

The findings of this study show that components of learning behavior, such as attitude, motivation, strategies, memory, and metacognition, work together to significantly predict the academic success of third-grade students in Banten Province. The model explains 50.8% of the variation in academic achievement. This suggests that we should view students' internal factors as an integrated system rather than separate psychological elements. These results support modern theories of self-regulated learning (de Bruin & van Merriënboer, 2017; Panadero, 2017). As students move into the concrete operational phase in third grade, these components develop into learning habits that influence how they absorb, process, and express instructional information as academic performance (Mao et al., 2021). This also backs recent studies that claim that effectively managing students' psychological factors predicts learning outcomes better than just focusing on physical infrastructure (Bugwak, 2023). Similarly, Noviani et al. (2023) found that learning motivation strongly linked to academic achievement in a model that included self-regulated learning and self-efficacy, underscoring the importance of motivational factors in achievement research.

The Dominance of Cognitive-Regulative Capacity in the Academic Performance of Transitional Grade Students

Based on the results of partial analysis, learning strategies(X3), memory(X4), and metacognition(X5) showed positive relationships with student achievement, in which memory (B = 0.532; = 0.275) showed as the dominant one in regression model. In terms of the perspective of cognitive development, students aged 8-9 are in a critical transition period of increasing knowledge content in terms of subject matter, demanding better information retention ability such as working memory and long-term memory in contrast with lower grades. Cowan (2016) highlights that working memory capacity is a crucial limitation for children's academic learning. Evidence provided by Agarwal et al. (2021) showed a consistent positive association between retrieval practice (memory-based strategies) and learning outcomes among elementary school children. In terms of retrieval practice or the strategy of linking information in a meaningful way, students have the ability to recall knowledge schema in previous time more accurate (Yang et al., 2021). It is in line with the study of Fiorella (2020) suggesting working memory efficiency relates positively to numeracy and literacy problem solving speed for elementary students.

Besides memory, both learning strategies (B = 0.449) and metacognition (B = 0.398) also present positive relationships with student achievement, implying that tactical and reflective cognition processes provide important support to memory capacity. For example, the cognitive load during learning of complex subjects is significantly reduced by strategic learning approaches like concise note taking, group discussion (Fiorella, 2020) suggests that learning strategies interventions seem most effective for upper elementary grade students, whereas Hattie and Donoghue (2016) found that learning strategies such as note taking, self-questioning, help seeking are particularly effective when actively taught and aligned with children's cognitive development, and these strategies are supplemented by metacognition which serves as a monitor for the learning process. Students with strong metacognitive capacity are able to identify own misunderstandings, monitor comprehension while reading texts and adjust their learning strategies according to difficulties. Benick et al. (2021) presented clear evidence in support of it. Taken together, these three variables show positive relationships with academic performance suggesting that passive learning only is not enough for academic success in elementary school.

Analysis of the Suppressor Effect on Affective Components

The most surprising outcome in this research is that the partial regression coefficient for attitude (B = -.650) and learning motivation (B = -0.506) both point in a negative direction although both variables are statistically significant. On the surface, this goes against the generally held belief that a positive attitude and high motivation lead to better achievement linearly. However, within a multiple linear regression context, the negative relationship here suggests a suppressor effect. A suppressor effect occurs when a number of theoretically linked independent variables are included in the model and intercorrelated with one another. Once learning strategies, memory, and metacognition are entered into the model as control variables, the unique variance of attitude and motivation within the regression equation turns negative. From a psychological perspective, this implies that perhaps an extreme high level of motivation or overconfidence in third grade students without concrete learning strategies and strong metacognitive ability paradoxically impairs their academic performance. While very high motivation with no metacognitive and strategy capacity may actually activate test anxiety and rapid learning strategies in test-taking and therefore increases students' margin for error, students who have moderate level of raw scores but good organization of learning strategies and good metacognitive capacity could have more stable and higher scores. This paradox is consistent with Cred (2018) warning that purely affective variables without tactical cognitive execution often leads to directional distortion within multivariate relationship analyses.

Theoretical and Practical Implications for the Advancement of Educational Science

Theoretically, this study offers a novel contribution to primary educational psychology field by dissecting the linearity between motivation and attitude, demonstrating that within the learning behavior ecosystem, cognitive regulative capacity (metacognition and memory) is the master key for affective drive (motivation and attitude) to bring about academic success or a bias in the field, and extending simplistic bivariate relationships into realistic, complex multivariate modeling in young elementary school children (Schneider & Preckel, 2017).

In terms of practice and implementation, the results of this research lead to concrete policy implications for the educators and curriculum designers in the primary education setting, particularly in the Banten region. Because memory and metacognition are the strongest predictors, the educational practice in third grade classrooms must move away from the current traditional role of teacher-directed didactic rote-dictation to incorporate metacognitive scaffolding-based instruction. Teachers must move beyond rote memorization to include metacognitive scaffolding, retrieval practice, and explicit strategy instruction. This is consistent with the conclusion by Froiland (2021) that elementary school intrinsic motivation works best in tandem with self-regulation, and recommendation by Yang et al. (2021) that quizzing and retrieval practice should be implemented in everyday instruction. Such teaching recommendations are in line with the Kurikulum Merdeka (Independent Curriculum) and differentiated learning approach, where the students' lifetime learning attributes are fostered through development of tactical self-regulation skills from early childhood.

▪ CONCLUSION

This study offers a definitive answer to the main research question and concludes that performance during the learning and developmental stages of third graders in elementary schools is dependent on an overall psycho-cognitive construct of learning behaviors; together, attitude, learning motivation, strategic learning, memory ability and metacognitive regulation play as an integrative learning psycho-cognitive environment, in which all five variables can strongly predict students' performance. Partially, learning control powers like strategy use, memory storage and metacognitive monitoring have a direct driving impact on students' academic performance; moreover, the memory ability could be described as the greatest anchor of students' academic performance; contrasting to the direct influence, attitude and motivation under the condition of multivariate analysis showed the existence of suppressor effects. Therefore, the more the teachers stimulate students with high level motivation and attitude without concrete cognitive scaffolding, the more the students perform at saturated level rather than at increasing rates.

This study contributed to the scientific innovation field by refuting the reductionist bivariate perspective on students' psychological traits in childhood and developing a modified version of the concept of Self-regulated Learning (SRL); it advanced the knowledge of educational science in that the student's psychological environment in elementary education can't be regarded as separated learning tracks but that cognition must be the regulating anchors of affection. By empirical evidence on the suppressor effect in this model, this research pointed out the paradigm shift of educational science and proved that only by combining high learning motivation with high cognitive and regulative ability through concrete training can teachers avoid student instruction anxiety and realize good academic performance.

Based on the above, it could be proposed that *first*, elementary school teachers should consciously improve their traditional passive rote-learning approach with active metacognitive scaffolding and direct implementation of students' self-assessment processes and association skills for memorization in daily teaching practices; school administrators should develop and support in-service teachers with professional development activities focused on student self-regulation teaching; and *second*, more researches should employ longitudinal designs and SEM to study these components' developmental characteristics in diverse geographic locations and social economic groups.

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