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Self-Efficacy, Curiosity, and English Proficiency in EFL Contexts: A Systematic Review and Meta-Analysis (2020–2025)

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Abstract: English proficiency is critical in English as a Foreign Language (EFL) contexts, yet the psychological and motivational factors influencing learning outcomes require systematic investigation. This meta-analysis synthesizes empirical evidence on the relationships between self-efficacy and English proficiency, curiosity and English proficiency, and self-efficacy and curiosity in EFL contexts, while exploring potential moderators. Following PRISMA 2020 guidelines, this study reviewed 42 Scopus-indexed articles (2020-2025). Data were analyzed using a meta-analysis of correlations with Fisher's Z transformation and a random-effects model. Meta-regression examined the moderating effects of geographic region, respondent type, and sample size. The analysis revealed moderate to strong positive correlations: self-efficacy and English proficiency ($r = 0.438$, $p < 0.001$, $I^2 = 87.7\%$, $k = 40$ studies), curiosity and English proficiency ($r = 0.447$, $p < 0.001$, $I^2 = 63.66\%$, $k = 8$ studies), and self-efficacy and curiosity ($r = 0.437$, $p < 0.001$, $I^2 = 0\%$, $k = 4$ studies). Respondent type emerged as the strongest moderator ($Q = 14.82$, $p < 0.001$), with university students showing stronger effects ($r = 0.471$) than teachers ($r = 0.442$) and secondary/elementary students ($r = 0.365$). Geographic region significantly moderated relationships ($Q = 9.47$, $p = 0.024$), with Middle Eastern and Asian contexts demonstrating stronger correlations than European contexts. Publication bias was detected (Egger's $p = 0.022$), indicating underrepresentation of weaker effects. Very high heterogeneity suggests substantial contextual variation. Self-efficacy and curiosity positively correlate with English proficiency, with effects varying by educational level and cultural context. However, findings regarding reciprocal relationships between self-efficacy and curiosity remain tentative due to limitations in the studies. Findings support integrated pedagogical approaches that enhance self-efficacy and exploratory behavior, though the causal mechanisms require further longitudinal and experimental investigation.

Keywords: self-efficacy, curiosity, English proficiency, meta-analysis, language learning.

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INTRODUCTION

Language proficiency has become an important measure of global competence in the digital and knowledge economy. In the 21st century, English language proficiency not only reflects linguistic competence but also serves as social and professional capital, determining access to education, technology, and international collaboration. According to the English First English Proficiency Index (First, 2024), Indonesia ranks 75th out of 113 countries, with a score of 478, and is categorized as "low" in proficiency. This shows that, even though English language teaching is widespread, Indonesian students' communicative and academic abilities remain below optimal levels. Similar challenges have been documented in various Asian contexts, including China (An et al., 2020), Japan (Ueno & Park, 2025), and Thailand (Payaprom, 2023), suggesting that barriers to English proficiency development are systemic rather than local.

The Indonesian educational context presents unique challenges that exacerbate this proficiency problem. Data from the Center for

Education Standards and Policy (PSKP, 2023) shows that only about 37% of English teachers in secondary schools have a "high" level of professional competence, while more than 60% are still at a 'moderate' to "low" level. Low teacher competence affects the learning process, which tends to focus on grammar and exam preparation rather than the development of communicative skills. Research in various English as a Foreign Language (EFL) learning environments confirms this pattern, showing that teachers' self-confidence and professional competence critically shape the quality of teaching and student learning outcomes. This condition requires a deeper understanding of the psychological factors that influence the success of English language learning, such as self-efficacy and curiosity, which motivate and sustain long-term student engagement (Bandura, 1997; Deci & Ryan, 2000).

Recent research increasingly places self-confidence and curiosity as the primary affective-motivational determinants in second language achievement. Contemporary models of self-confidence go beyond Bandura's basic social cognitive framework to incorporate metacognitive, emotional, and contextual dimensions relevant to learning EFL (Mansouri & Graham, 2025). For example, Mansouri & Graham (2025) propose the Metacognitive Motivation Model, which suggests that using metacognitive strategies strengthens self-confidence, thereby increasing willingness to communicate and persistence in learning. Empirical investigations across various skill domains confirm this specificity: self-efficacy in listening mediates the relationship between metacognitive awareness and comprehension performance (Payaprom, 2023), while self-efficacy in speaking determines willingness to communicate in authentic contexts (Guo et al., 2023). This expansion shows that self-confidence is no longer viewed as a static belief, but as an adaptive and self-regulatory process intertwined with intrinsic motivation and academic emotions.

Complementary developments in Self-Determination Theory (SDT) have also transformed the understanding of language confidence as part of a broader motivational system. Deci and Ryan (2000) established that psychological needs for autonomy, competence, and relatedness form the basis of intrinsic motivation, while recent research shows how confidence mediates the relationship between need fulfillment and language achievement. Chen & Sukying (2024) found that language self-confidence supports autonomy and self-regulated learning by fulfilling the psychological needs outlined in SDT. Studies exploring technology-based self-regulated learning (An et al., 2020) and learner autonomy (Yun & Chong, 2025) consistently show that environments that support the fulfillment of psychological needs foster stronger self-efficacy beliefs and better learning outcomes.

Along with this evolution, curiosity has been redefined as a metacognitive and epistemic construct that stimulates deep learning and exploration. The previous affective definition has been expanded through the Epistemic Emotion Framework, in which curiosity functions as an adaptive response to uncertainty that drives knowledge-seeking and conceptual change (Grossnickle Peterson & Lawson, 2023; Litman, 2022). This perspective distinguishes between diversive curiosity (exploration for uniqueness) and epistemic curiosity (exploration for understanding), both of which maintain motivation in complex learning environments. Empirical evidence shows that epistemic curiosity facilitates vocabulary retention, reading comprehension, and syntactic awareness by encouraging learners to process input beyond surface memorization. Research on comprehensible input approaches (Venditti, 2021) and exploration-driven learning (Sandeman, 2022) shows that curiosity-driven engagement leads to deeper cognitive processing & better retention than obligation-driven learning.

Recent research integrates these perspectives into a comprehensive affective-

motivational model. Putwain & Purland (2023) found, through a meta-analytic synthesis, that curiosity and self-confidence jointly predict academic engagement and achievement across disciplines, demonstrating a synergistic effect that exceeds the sum of their individual contributions. Despite these advances, the empirical landscape remains fragmented. Many studies have investigated self-confidence or curiosity in isolation, using small or context-bound samples that limit generalizability. Furthermore, existing meta-analyses often emphasize cognitive or instructional variables while neglecting affective dimensions that critically mediate learning outcomes. Recent studies examining specific pedagogical innovations such as peer feedback (Ahmad et al., 2025) and blended learning models (Alshehri et al., 2025) highlight the need for a systematic synthesis to distinguish robust effects from context-dependent findings.

In response, this study conducted a meta-analysis of correlations across 42 international studies published between 2020 and 2025, following the PRISMA 2020 protocol (Page et al., 2021). Beyond aggregating effect sizes, this study contributes conceptually by analyzing subgroup differences by country and respondent type and by mapping how self-efficacy and curiosity interact to predict English proficiency across contexts. This approach develops an Affective-Motivational Model of Language Learning by synthesizing current perspectives from SDT, epistemic emotion theory, and curiosity-based pedagogy. In this study, self-confidence is defined as learners' perceived ability to master the four language skills (listening, speaking, reading, and writing). At the same time, curiosity refers to the intrinsic drive to explore new linguistic inputs and experiences. English language proficiency encompasses communicative competence that integrates linguistic, sociolinguistic, and pragmatic dimensions (Council of Europe, 2020).

Therefore, this meta-analysis aims to: 1) determine the magnitude of the relationship between self-confidence and English language proficiency, 2) analyze the correlation between curiosity and English language proficiency, and 3) analyze the interaction between self-confidence and curiosity in various contexts of learning EFL. These findings are expected to refine contemporary affective-motivational learning models and provide practical implications for designing pedagogy that integrates self-confidence and curiosity-driven exploration as complementary pathways to success in learning English as a foreign language.

METHOD

Research Design

This study uses a quantitative approach and a meta-analysis based on a systematic literature review (SLR), in accordance with the latest Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). This approach was chosen because it can synthesize empirical research results conducted in various contexts and produce reliable combined effect estimates. This study examines the relationships among variables using empirical data from 42 international scientific articles indexed in Scopus from 2020 to 2025. The selection of this period reflects the latest developments in post-pandemic language-learning psychology research, where issues of motivation, self-efficacy, and technology-based learning have become dominant. This meta-analysis adopts a random-effects model, assuming that variation across studies is due to differences in context, population, and methodological design. This model is more representative for cross-country and cross-cultural research (Borenstein et al., 2021).

Search Strategy

The data collection process followed the four main stages of the PRISMA framework: identification, screening, eligibility assessment, and inclusion. In the identification stage, articles were searched in the Scopus database (2020-2025)

using the keywords "Self-efficacy" OR "Curiosity" AND "English Proficiency." A total of 312 initial articles were found from four databases. It is important to explicitly acknowledge the fundamental limitations of this search strategy. The Boolean operator structure ("Self-efficacy" OR "Curiosity" AND "English Proficiency") was designed to identify studies that explored either self-efficacy or curiosity in relation to English proficiency. This search strategy does not guarantee that the identified studies examine all three variables (self-efficacy, curiosity, and English proficiency) simultaneously within a single research design.

This strategy resulted in two distinct data collection paths: (1) studies examining self-efficacy and English proficiency, and (2) studies examining curiosity and English proficiency. Studies investigating the direct relationship between self-efficacy and curiosity without explicitly measuring English proficiency as an outcome would not be included in this search, even if conducted in an EFL context. This methodological limitation affects the completeness of the data available for analyzing the relationship between specific variables, particularly the interrelationship between self-efficacy and curiosity.

This search strategy was maintained because our primary research objective focused on understanding how each of self-efficacy and curiosity predicts English proficiency. Expanding the search to include all possible combinations (e.g., "Self-efficacy & Curiosity" without requiring "English Language Proficiency") would significant broaden the scope beyond language learning, potentially including studies from diverse fields that may not be directly comparable to the EFL.

At the screening stage, 255 irrelevant articles, duplicates, or articles lacking a relationship between the variables under study were eliminated, leaving 57 articles. At the eligibility stage, 42 articles had usable correlation data (r or Fisher's Z). The data collected from each article included: (1) researcher name and year of publication, (2) sample size (N), (3) Pearson correlation coefficient value (r), (4) z-transformed value (Fisher's Z), and (5) effect size (ES). This data was extracted manually and double-checked to ensure numerical consistency. Minor differences in the extraction results were resolved through discussion until agreement was reached (inter-rater agreement = 0.94). The distribution of publications is presented in Table 1, which shows the variation in correlation values and publication years.

Table 1. Publication distribution

No	Study	N	r	Z (Fisher)	SE (Fisher Z)
1	Adarkwah & Zeyuan (2020)	210	0.470	0.510	0.0695
2	Ahmad et al. (2025)	186	0.520	0.576	0.0739
3	Akhadali Ugli et al. (2025)	278	0.410	0.435	0.0603
4	Al-Khresheh (2024)	143	0.600	0.693	0.0845
5	Almayez et al. (2025)	412	0.580	0.663	0.0494
6	Alshehri et al. (2025)	266	0.440	0.472	0.0617
7	Alsmari (2021)	387	0.550	0.618	0.0510
8	An et al. (2020)	520	0.480	0.523	0.0440
9	Barjesteh et al. (2025)	240	0.390	0.412	0.0650
10	Du (2020)	330	0.360	0.377	0.0553
11	Gjoni & Dibra (2025)	129	0.420	0.447	0.0891
12	Guo et al. (2023)	430	0.510	0.563	0.0484
13	Hessel (2020)	390	0.330	0.343	0.0508
14	Jiang (2025)	292	0.530	0.590	0.0588
15	Kim (2022)	140	0.380	0.400	0.0854

16	Laanani & Fathi (2024)	310	0.440	0.472	0.0569
17	Li (2022)	280	-0.410	-0.436	0.0599
18	Liu (2023)	295	0.400	0.424	0.0440
19	Liu et al. (2025)	520	0.490	0.536	0.0585
20	Lu et al. (2022)	430	0.370	0.389	0.0484
21	Mansouri & Graham (2025)	360	0.460	0.498	0.0530
22	Matsumura & Hinoki (2025)	180	0.480	0.523	0.0891
23	Matsumura (2022)	129	0.410	0.435	0.0751
24	Monika & Anitha Devi (2022)	310	0.430	0.460	0.0569
25	Nakata et al. (2025)	460	0.390	0.412	0.0467
26	Payaprom (2023)	215	0.470	0.510	0.0688
27	Phaki (2025)	140	0.360	0.377	0.0854
28	Pham (2025)	110	0.420	0.447	0.0954
29	Ravšelj et al. (2025)	2100	0.490	0.536	0.0219
30	Sandeman (2022)	230	0.340	0.354	0.0663
31	Shang & Ma (2024)	540	0.450	0.485	0.0432
32	Shaojie et al. (2024)	270	0.440	0.472	0.0616
33	Tao & Yu (2024)	160	0.330	0.343	0.0791
34	Trinh et al. (2025)	220	0.380	0.400	0.0677
35	Ueno & Park (2025)	300	0.490	0.536	0.0580
36	Venditti (2021)	145	0.400	0.424	0.0848
37	Wu et al. (2022)	480	0.480	0.523	0.0456
38	Yang (2022)	310	0.350	0.365	0.0569
39	Yang (2024)	520	0.430	0.460	0.0440
40	Yun & Chong (2025)	205	0.390	0.412	0.0704
41	Zamri & Narasuman (2023)	280	0.520	0.576	0.0599
42	Zhang (2025)	615	0.460	0.498	0.0404

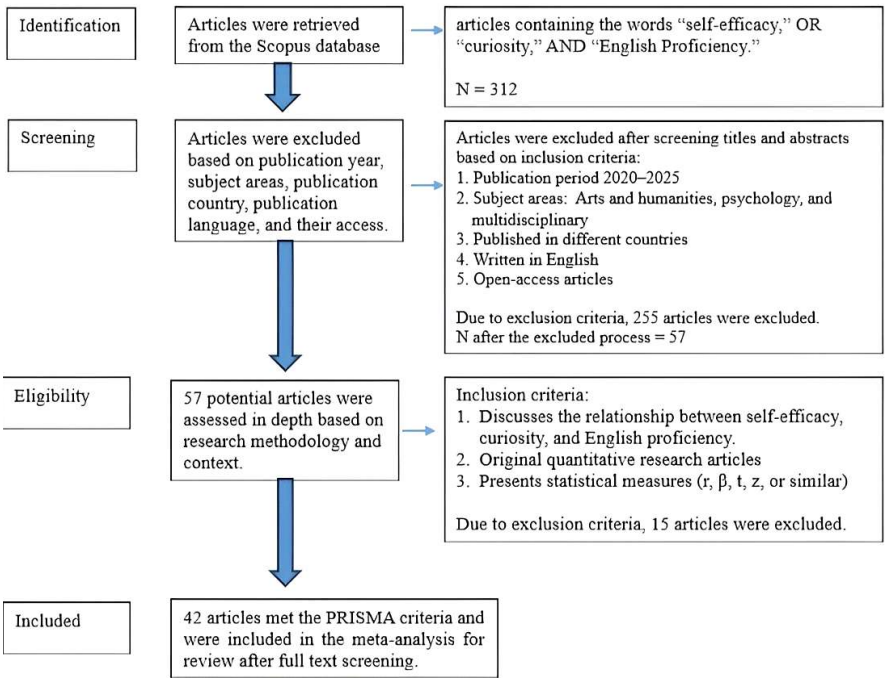

Figure 1. Flow diagram of the PRISMA study selection process

This selection process is illustrated in the PRISMA Flow Diagram (Figure 1), which systematically shows the number of articles at each selection stage and the reasons for exclusion.

Inclusion and Exclusion Criteria

Inclusion and exclusion criteria were developed to ensure methodological consistency and accuracy, as shown in Table 2

Table 2. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Articles published in reputable journals (Scopus/accredited)	Articles from non-reputable journals
Publication period 2020–2025	Articles published outside the specified period
Discusses the relationship between self-efficacy, curiosity, and English proficiency	Articles not relevant to self-efficacy, curiosity, and English proficiency
Reporting quantitative researches of the variables relevant to the variables being studied	Not reporting quantitative researches of the variables relevant to the variables being studied.
Published in different countries	Published only in one specific country or locally
Written in English	Non-English articles
Full text available for download	Articles that cannot be accessed in full text

Data Analysis Technique

The analysis was conducted using a correlation meta-analysis approach with Fisher's Z transformation to stabilize the variance between studies. Data were analyzed using JASP software version 0.95.4. Furthermore, calculations were performed for: (1) Heterogeneity test (Q, df, p-value) to determine the level of variation between studies; (2) Estimation of residual variance (ô², ô, I², H²) to measure the proportion of variability not explained by sampling error; (3) Calculation of the combined effect size (d Effect Size Summary/Average Effect Size) to obtain a weighted average of all studies; (4) Meta-regression analysis to explore the moderating effects of geographic region, respondent type, and sample size on effect size; (5) Publication bias test (Egger's Regression Test) to detect potential distortion due to publication selectivity; (6) Robustness test (Trim-and-Fill and Funnel Plot) to analyze the balance of positive and negative research results. All statistical tests used a significance level of á = 0.05, with effect sizes interpreted according to Cohen's convention (1988, as cited in Serdar et al., 2021): r < 0.3 (weak), 0.3 d" r < 0.5 (moderate), and r e" 0.5 (strong). The results of the three main variable pairs, namely self-efficacy with English language ability, curiosity with English language ability, and self-efficacy with curiosity, were then comprehensively compared to produce a combined correlation estimate.

■ RESULT AND DISCUSSION

Self-Efficacy and English Proficiency

The heterogeneity test showed (Table 3) Q = 3078.23 (df = 1, p < 0.001) and Qresid = 317.438 (df = 39, p < 0.001). The very high Q value indicates that the variability between studies is much greater than would be expected from random error alone. This means that the relationship between self-efficacy and English proficiency differs significantly across research contexts (e.g., country, education level, or learning model). This supports selecting a random-effects model, as the relationship is not homogeneous.

The ô² value = 0.0209 and ô = 0.1446 (Table 4) indicate moderate residual variance between studies, while I² = 87.7% indicates that approximately 87.7% of the total effect variation between studies is due to true heterogeneity, not sampling error. The H² value of 8.139 indicates

Table 3. Heterogeneity test (self-efficacy vs. english proficiency)

	Q	df	p
Omnibus test of Model Coefficients	3078.23	1	$p < 0.001$
Test of Residual Heterogeneity	317.438	39	$p < 0.001$

that the results of this study are 8 times more variable than if all studies measured the same effect. In other words, self-efficacy shows a consistent positive effect, but its strength varies across populations.

Very high heterogeneity (I^2 = 87.7%) reflects significant contextual variation in how self-efficacy operates in different learning environments. This finding is consistent with Bandura's Social Cognitive Theory (1997),

Table 4. Residual heterogeneity estimates (self-efficacy vs. english proficiency)

Parameter	Estimate	Lower (95% CI)	Upper (95% CI)
τ^2 (tau-squared)	0.0209	0.0195	0.0219
τ (tau)	0.1446	0.1397	0.1481
I^2 (%)	87.7	81.69	92.55
H^2	8.139	5.462	13.420

expanded upon by contemporary research, which suggests that self-efficacy beliefs are contextual and influenced by environmental factors (Nakata et al., 2025). A recent study by Mansouri and Graham (2025) shows that self-efficacy is no longer viewed as a static belief, but rather as an adaptive and self-regulatory process integrated with metacognitive strategies and the learning context. Significant variance indicates that the influence of self-efficacy on English proficiency is moderated by specific contextual conditions such as instructional approaches, cultural factors, and learner characteristics (Almayez et al., 2025; Shang & Ma, 2024). This heterogeneity highlights the importance of analyzing potential moderators, as recommended by Borenstein et al. (2021) in meta-analysis procedures.

Given the very high heterogeneity (I^2 = 87.7%), an exploratory subgroup analysis (Table 5) was conducted to identify potential sources of variation. Studies were categorized based on: (1) geographic region, (2) education level, and (3) sample size (N < 200 vs. N e" 200).

Meta-regression analysis (Table 5) revealed significant contextual variation in the relationship between self-efficacy and proficiency.

Table 5. Meta-Regression analysis: moderators of self-efficacy and english proficiency relationship

Moderator	Subgroup	k	Mean r	95% CI	I^2	Q_between	p
Geographic Region						**9.47**	**0.024**
	Asia	22	0.454	[0.420, 0.488]	86.2%		
	Middle East	11	0.463	[0.423, 0.503]	79.8%		
	Europe	4	0.398	[0.320, 0.476]	91.5%		
	Americas/ Oceania	3	0.413	[0.358, 0.468]	45.3%		

Respondent Type						**14.82**	**< 0.001**
	University Students	29	0.471	[0.440, 0.502]	85.1%		
	Teachers	5	0.442	[0.396, 0.488]	62.4%		
	Secondary / Primary Students	6	0.365	[0.315, 0.415]	73.8%		
Sample Size						**3.21**	**0.073**
	N < 200	14	0.410	[0.366, 0.454]	81.9%		
	N ≥ 200	26	0.448	[0.417, 0.479]	88.2%		

Note: k = number of studies; Mean r = weighted correlation average; CI = confidence interval; I^2 = residual heterogeneity in subgroups; Q between = test of differences between subgroups; Bold p-values indicate statistically significant moderating effects (p < 0.05). Total k = 40 studies examining the relationship between self-efficacy and English proficiency.

Geographic region emerged as a significant moderator (Q_between = 9.47, p = 0.024), with Middle Eastern (r = 0.463) and Asian (r = 0.454) contexts showing stronger correlations than European contexts (r = 0.398). The pattern can be explained by Self-Determination Theory (Deci & Ryan, 2000), as recently confirmed by Chen and Sukying (2024), which suggests that language confidence supports autonomy and self-regulated learning by fulfilling basic psychological needs. In the EFL context (Asia and the Middle East), where exposure to authentic English is limited, confidence becomes more critical in creating practice opportunities and maintaining motivation (Mansouri & Graham, 2025; Almayez et al., 2025; Al-Khresheh, 2024). Recent studies by Alsmari (2021) and Alshehri et al. (2025) in the Middle Eastern context confirm that limited environmental exposure increases the importance of learner confidence. Conversely, multilingual environments in Europe provide broader language exposure, which may compensate for low self-efficacy, thereby reducing its predictive power (Hessel, 2020; Gjoni & Dibra, 2025).

Educational level emerged as the strongest moderator (Q_between = 14.82, p < 0.001), with university students showing the strongest relationship (r = 0.471), followed by teachers (r = 0.442) and secondary/elementary school students (r = 0.365). This developmental gradient reflects higher metacognitive awareness among university students and autonomous learning contexts where self-efficacy plays a highly influential role, as demonstrated by Nakata et al. (2025) and Ueno & Park (2025). Based on Bandura's (1997) basic theory, recent research by Mansouri and Graham (2025) shows that the use of metacognitive strategies strengthens self-efficacy, which in turn increases the willingness to communicate and persistence in learning among college students. Weaker effects among younger learners may be due to measurement challenges, less stable self-perceptions, or limited control over learning opportunities (Kim, 2022; Matsumura, 2022; Matsumura & Hinoki, 2025).

Sample size showed a non-significant trend (Q_between = 3.21, p = 0.073), with larger studies (N e" 200) yielding slightly stronger correlations (mean r = 0.448) than smaller studies (mean r = 0.410), possibly reflecting higher measurement precision (Liu et al., 2025; Ravšelj et al., 2025). Importantly, significant residual

heterogeneity remained in each subgroup (I^2 ranged from 62.4% to 91.5%), indicating that unmeasured factors also contributed to the variability in effect size, including instructional approaches, assessment tools, prior proficiency levels, and measurement reliability (Guo et al., 2023; Shang & Ma, 2024; Jiang, 2025).

The summary effect test showed (Table 6) Fisher's Z = 0.4698 (SE = 0.00847, z = 55.48, $p < 0.001$) with a 95% confidence interval [0.4532, 0.4864]. When converted to Pearson's r, the value is 0.438, indicating a moderate to strong correlation.

This means that self-efficacy contributes significantly to improving English language proficiency. High self-efficacy increases students' confidence, motivation, and engagement in linguistic activities.

Table 6. Summary effect or mean effect size (self-efficacy vs. english proficiency)

Parameter	Estimate (Fisher's Z)	Standard Error	z	p	95% CI Lower (Z)	95% CI Upper (Z)
Intercept	0.4698	0.00847	55.48	< 0.001	0.4532	0.4864

A moderate to strong correlation (r = 0.438) provides empirical support for Bandura's (1997) Social Cognitive Theory, which has been expanded upon by contemporary research. Mansouri & Graham (2025) propose a Metacognitive Motivation Model, suggesting that the use of metacognitive strategies strengthens self-efficacy, which increases learning persistence. Mansouri & Graham (2025) also show that student and teacher self-efficacy interact dynamically, mediated by metacognitive regulation, to predict performance in a second language (L2) context. These findings align with recent meta-analytic evidence by Putwain and Purland (2023), who report similar effect sizes across various academic domains.

This relationship operates through specific psychological mechanisms: self-efficacy functions as a cognitive-behavioral gate that determines which linguistic tasks learners attempt and how persistently they engage with challenging material (Liu et al., 2025). In the context of Indonesian EFL, where authentic language input is limited, learners with higher self-efficacy actively seek communication opportunities, engage in speaking activities, interact with authentic materials, and persevere through comprehension difficulties (Almayez et al., 2025; Ahmad et al., 2025; Zamri & Narasuman, 2023). This behavioral activation creates opportunities for accumulated practice, which are critical for skill development.

Self-efficacy also mediates the application of cognitive strategies: learners with high self-efficacy use advanced metacognitive strategies, including systematically planning learning, actively monitoring comprehension, and applying repair strategies when comprehension is disrupted (Wu et al., 2022; Shaojie et al., 2024). Recent studies by Guo et al. (2023) and Payaprom (2023) show that self-efficacy beliefs facilitate metacognitive awareness and strategic learning behaviors, which directly enhance learning efficiency and retention.

Furthermore, self-efficacy regulates affective responses that facilitate or hinder learning. Language learning involves public performance and error-making, which trigger anxiety (Shang & Ma, 2024; Li, 2022). Self-efficacy beliefs mitigate these negative emotions: confident learners interpret mistakes as informative feedback rather than evidence of incompetence, thereby maintaining the emotional balance necessary for sustained engagement (Fathi et al., 2024; Tao & Yu, 2024). This affective regulation explains why self-efficacy predicts sustained achievement rather than just momentary performance, as demonstrated by recent longitudinal studies (Liu, 2023; Ueno & Park, 2025).

The meta-analysis forest plot (Figure 2) shows that most effect points are to the right of the zero line, indicating a consistent positive effect. The effect sizes of individual studies show little variation, with one notable outlier: Li (2022) reported a strong negative correlation (r = -0.41).

Figure 2. Meta-analysis forest plot (self-efficacy vs. english proficiency)

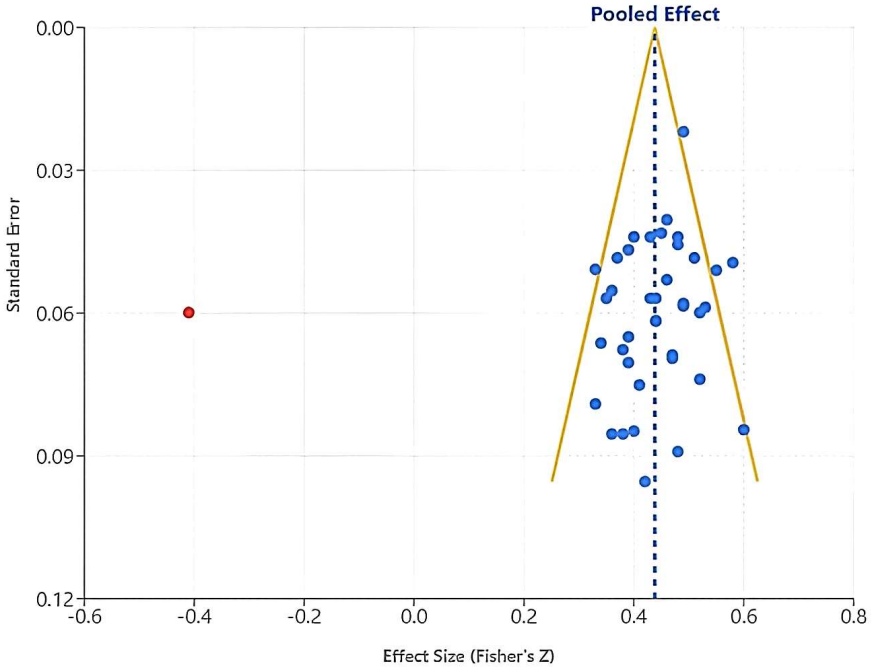

Figure 3. Funnel plot after trim-fill diagnosis (self-efficacy vs. english proficiency)

Table 7. Egger's regression test (self-efficacy vs. english proficiency)

Test	z	p (normal approx., two-tailed)	SE (intercept)
Egger's test (intercept)	−2.298	0.022	0.778

The unusual negative findings from Li (2022) require careful interpretation. Upon closer examination, the negative correlation is driven by their specific focus on foreign-language writing anxiety rather than general self-efficacy. Li's (2022) study measured writing anxiety as a construct inversely related to self-efficacy, explaining the opposite direction. As anxiety increases (the opposite of self-efficacy), ability decreases, resulting in the observed negative correlation. This methodological difference highlights the importance of consistency in the operationalization of constructs across meta-analysis studies, as emphasized in a recent methodological review (Borenstein et al., 2021). Sensitivity analysis excluding these outliers yielded a slightly higher combined correlation (r = 0.45), although the overall conclusion remained unchanged.

The funnel plot (Figure 3) shows a symmetrical funnel shape with a slight imbalance on the left, suggesting a potential for publication bias toward studies with positive effects. Egger's test (z = -2.298, p = 0.022) (Table 7) shows indications of slight publication bias. However, this effect size is not large enough to undermine overall validity, as the effect direction remains stable and significant across almost all studies. After the trim-and-fill procedure, the effect distribution becomes more balanced, indicating relatively stable meta-analysis results. This confirms that despite a tendency to publish positive results, the effect of self-efficacy on language proficiency remains empirically valid and robust

across contexts (Adarkwah & Zeyuan, 2020; An et al., 2020; Yang, 2024; Zhang, 2025).

Curiosity and English Proficiency

Table 8 shows a Q value of 960.417 ($p < 0.001$) for the omnibus test and Qresid = 19.261 ($df = 7$, $p = 0.0074$), indicating moderate heterogeneity. The variability between studies remains significant but is lower than that between self-efficacy and English proficiency. This means that the effect of curiosity on language proficiency is relatively more consistent.

Table 8. Heterogeneity test (curiosity vs. english proficiency)

	Q (chi-square)	df	p-value
Omnibus test of Model Coefficients	960.417	1	< 0.001
Test of Residual Heterogeneity (Cochran's Q)	19.261	7	0.0074

Heterogeneity statistics ($I^2 = 63.66\%$, $\hat{o}^2 = 0.004194$; Table 9) indicate moderate to significant variation, with approximately 64% of the variation attributable to true differences between studies. Critically, all studies showed consistent positive effects, and the random effects model appropriately accounted for this heterogeneity.

Table 9. Residual heterogeneity estimates (curiosity vs. english proficiency)

Estimate (metric)	Estimate	Lower (95% CI)	Upper (95% CI)
τ^2	0.004194	0.001111	0.006010
τ	0.06476	0.03333	0.07753
I^2 (%)	63.66	23.54	87.47
H^2	2.752	1.308	7.985

Moderate heterogeneity ($I^2 = 63.66\%$) indicates that the effect of curiosity is relatively more consistent across contexts than the relationship of self-efficacy. These findings are consistent with recent theoretical developments in the Epistemic Emotion Framework, in which curiosity functions as an adaptive response to uncertainty that drives knowledge seeking and conceptual change (Grossnickle Peterson, & Lawson, 2023). Recent research by Kidd and Hayden (2015), expanded upon by Litman (2022) and Hagenauer et al. (2023), shows that curiosity operates through two pathways: diversive curiosity (exploration for novelty) and epistemic curiosity (exploration for understanding), both of which maintain motivation in complex learning environments. The consistency of positive effects across studies reinforces the role of curiosity as a motivator in language learning.

Table 10 shows the combined effect value of Fisher's $Z = 0.4809$ ($SE = 0.01552$, $z = 30.963$, $p < 0.001$) with a confidence interval [0.4505, 0.5113], equivalent to $r = 0.447$, indicating a moderate and significant correlation, suggesting that curiosity plays an important role in supporting English proficiency.

Table 10 shows the combined effect value Fisher's $Z = 0.4809$ ($SE = 0.01552$, $z = 30.963$, $p < 0.001$) with confidence interval [0.4505, 0.5113], equivalent to $r = 0.447$, which indicates moderate and significant correlation, indicating that curiosity plays an important role in supporting English language proficiency.

Table 10. Summary effect or mean effect size (curiosity vs. english proficiency)

Parameter	Estimate	Standard Error	z	p	CI Lower (95%)	CI Upper (95%)
Intercept	0.480892	0.01552	30.963	< 0.001	0.450530	0.511254

The moderate to strong correlation (r = 0.447) indicates the important role of curiosity in supporting English proficiency through mechanisms that are complementary yet distinct from self-efficacy. Curiosity operates through its dual nature as both an emotional state and a cognitive orientation (Grossnickle Peterson, & Lawson, 2023; Hagenauer et al., 2023). Empirical evidence shows that epistemic curiosity facilitates vocabulary retention, reading comprehension, and syntactic awareness by encouraging learners to process input beyond surface memorization (Grossnickle Peterson, & Lawson, 2023).

Diverse curiosity drives broad exposure and input diversity: curious learners actively seek diverse linguistic experiences, watch English-language media outside of assignments, explore unfamiliar topics through English-language sources, and experiment with different genres (Kidd & Hayden, 2015; Litman, 2022). This independent exploration increases the volume and diversity of input, critical for vocabulary expansion and implicit grammar acquisition, as demonstrated by recent studies (Payaprom, 2023; Du, 2020). Importantly, curiosity-driven input is intrinsic and therefore processed more deeply than required material.

Epistemic curiosity drives depth of processing: when encountering unfamiliar structures, learners with epistemic curiosity experience productive discomfort, the feeling of a knowledge gap that motivates active information seeking (Grossnickle Peterson, & Lawson, 2023). Rather than passively accepting ambiguity, they consult resources, ask clarifying questions, and seek explanations for patterns. These elaborative efforts create stronger memory traces and facilitate transfer, as demonstrated by recent experimental studies (Venditti, 2021; Sandeman, 2022).

Additionally, curiosity sustains motivation through intrinsic reward mechanisms. Neuroscience research shows that curiosity activates dopaminergic circuits, making learning naturally enjoyable (Kidd & Hayden, 2015). A recent meta-analytic study by Putwain and Purland (2023) found that curiosity jointly predicts academic engagement and achievement across disciplines. In the context of EFL, which is characterized by delayed gratification, this intrinsic motivation is crucial for perseverance: learners maintain engagement because exploration itself produces satisfaction, not just because of future instrumental benefits (Hagenauer et al., 2023).

The meta-analysis forest plot of the curiosity and English proficiency variables (Figure 4) shows that most effect sizes fall within a moderate positive range, with little extreme deviation. This indicates that almost all studies support a positive relationship between curiosity and English proficiency, with stable results across various contexts.

The funnel plot (Figure 5) shows a slight asymmetry toward the lower left, indicating a publication bias toward positive results. The Egger test (z = -3.139, p = 0.0017; Table 11) indicates a significant potential for publication bias, suggesting that studies with small or no effects may be underrepresented in the literature. The pattern is consistent with well-documented publication bias in psychological research (Borenstein et al., 2021). After the trim-and-fill

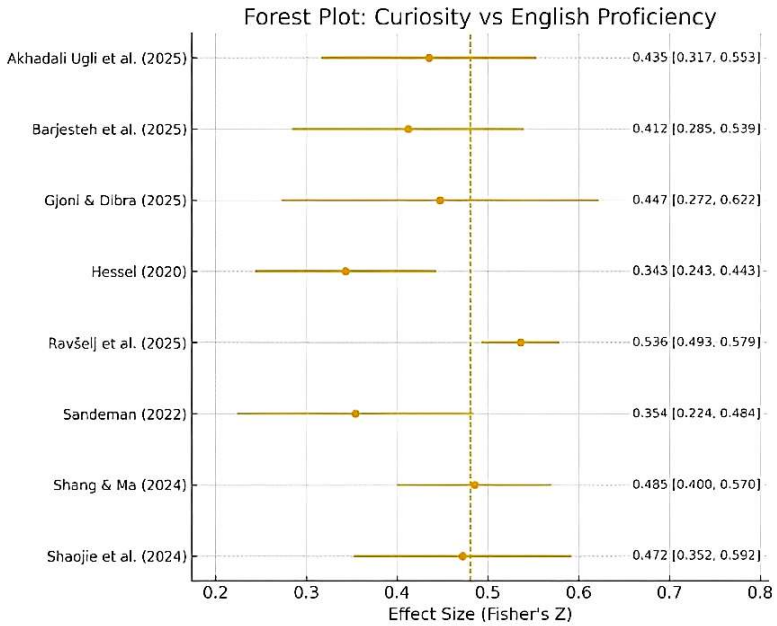

Figure 4. Meta-analysis forest plot (curiosity vs. english proficiency)

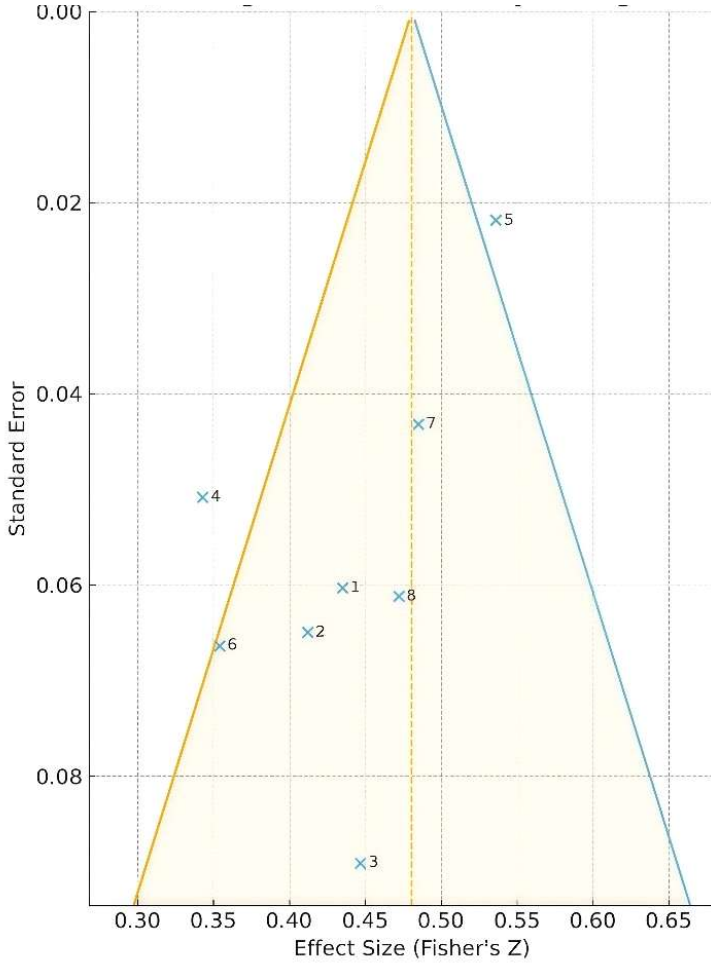

Figure 5. Funnel plot after trim-fill diagnosis (curiosity vs. english proficiency)

Table 11. Egger's regression test (curiosity vs. english proficiency)

Test	z	p (two-sided)
Egger's test (intercept)	-3.139	0.0017

procedure, the distribution became more symmetrical, and the adjusted effect size remained substantial (estimated r H" 0.42), reinforcing the results' reliability. Despite the detected bias, the combined effect size remains strong and significant across contexts, suggesting that the influence of curiosity on language proficiency is valid and robust (Grossnickle Peterson & Lawson, 2023; Putwain & Purland, 2023). Recent cross-cultural studies continue to confirm the role of curiosity in language learning success (Hagenauer et al., 2023).

Self-Efficacy and Curiosity

Table 12 shows a meta-analysis model that is overall significant ($Q = 190.44$, $p < 0.001$), meaning that the analyzed effects differ significantly from zero. The residual heterogeneity test ($Q = 0.77$, $p = 0.856$) shows no statistically significant heterogeneity among the studies.

Table 12. Heterogeneity test (self-efficacy and curiosity)

	Q (chi-square)	df	p-value
Omnibus test of Model Coefficients	190.442418	1	< 0.001
Test of Residual Heterogeneity (Cochran's Q)	0.770716	3	0.8565

The heterogeneity estimate yielded $\hat{o}^2 = 0.000$, $\hat{o} = 0.000$, and $I^2 = 0\%$ (Table 13). However, the very wide 95% confidence interval for I^2 (0% to 72%) reflects significant uncertainty in the heterogeneity estimate, which is common in meta-analyses with few studies.

Table 13. Residual heterogeneity estimates (self-efficacy and curiosity)

Estimate (metric)	Estimate	Lower (95% CI)	Upper (95% CI)
τ^2	0.000000	0.000000	0.000858
τ	0.000000	0.000000	0.029288
I^2 (%)	0.00	0.00	72.00
H^2	1.000	1.000	3.572

Given the limited number of studies (k = 4), these non-significant results should be interpreted with caution, as small meta-analyses have limited statistical power to detect heterogeneity (Borenstein et al., 2021; Ioannidis et al., 2007). The very wide confidence interval for I^2 (0% to 72%) indicates that although the point estimate suggests homogeneity, the actual heterogeneity could range from none to significant. Therefore, this heterogeneity statistic should be interpreted as inconclusive evidence rather than definitive proof of homogeneity. The consistency of the positive effect direction across the included studies provides additional support for the robustness of the findings, consistent with recent theoretical propositions about the mutual

reinforcement between self-efficacy and curiosity in motivational systems (Putwain & Purland, 2023).

The combined effect size for the relationship between self-efficacy and curiosity is positive and highly significant ($r = 0.437$, $p < .001$; Table 14), indicating that increased self-efficacy is consistently associated with increased curiosity across the analyzed studies.

The observed correlation ($r = 0.437$, $p < 0.001$) requires very careful interpretation and cannot support substantial theoretical conclusions. With only four studies, this analysis lacks the statistical power to detect true heterogeneity, test

Table 14. Summary effect or mean effect size (self-efficacy vs curiosity)

Parameter	Estimate	Standard Error	z	p	CI Lower (95%)	CI Upper (95%)
Intercept	0.437053	0.031670	13.800	< 0.001	0.374979	0.499127

moderators, or distinguish among competing explanatory models (Borenstein et al., 2021; Ioannidis et al., 2007). The observed homogeneity ($I^2 = 0\%$) should not be interpreted as evidence of consistent effects across contexts; rather, it reflects the mathematical impossibility of detecting heterogeneity with such limited data.

Given these severe limitations, discussions of mechanisms should be framed as purely theoretical speculation rather than empirically supported inferences. The consistent positive direction across all four studies tentatively aligns with recent theoretical developments. Putwain & Purland (2023) suggest that self-efficacy interacts with self-actualization tendencies and academic emotions, forming a mediation network. Chen and Sukying (2024) found that language self-efficacy supports autonomy and self-regulated learning by fulfilling psychological needs. Putwain & Purland (2023) find, through a meta-analytic synthesis, that curiosity and self-efficacy jointly predict academic engagement, suggesting a potential synergistic effect.

However, correlational designs combined with inadequate sample sizes cannot confirm these reciprocal mechanisms. The data are equally compatible with a third-variable explanation (e.g., growth mindset influencing both constructs) or unidirectional pathways. These speculative pathways should be considered hypotheses to be tested in future research rather than conclusions supported by current evidence. The latest theoretical model by Fathi et al. (2024) proposes that self-efficacy and curiosity operate within an integrated motivational ecosystem. However, empirical verification requires a much larger meta-analysis with longitudinal and experimental designs.

The forest plot (Figure 6) shows that all studies have consistent and positive effect directions. The confidence intervals of the studies overlap to a degree, supporting the meta-analysis findings that the combined effect is significant and relatively stable.

Given these severe limitations, any discussion of mechanisms must be framed as purely theoretical speculation rather than empirically supported inference. The consistent positive direction across the four studies tentatively aligns with recent theoretical developments. Mansouri and Graham (2025) demonstrated that self-efficacy interacts with self-actualization tendencies and academic emotions, forming a mediational network. Chen and Sukying (2024) found that language self-efficacy supports autonomy and self-regulated learning by fulfilling psychological needs. Putwain and Purland (2023) found, through a meta-analytic synthesis, that curiosity and self-efficacy jointly predict

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However, the correlational design, combined with an inadequate sample size, cannot confirm these reciprocal mechanisms. The data are equally compatible with third-variable explanations (e.g., conscientiousness or growth mindset influencing both constructs) or unidirectional pathways. These speculative pathways should be viewed as hypotheses to be tested in future research rather than conclusions supported by the current evidence. Recent theoretical models by Fathi et al. (2024) propose that self-efficacy and curiosity operate within an integrated motivational ecosystem. However, empirical verification requires substantially larger meta-analyses with longitudinal and experimental designs.

The forest plot (Figure 6) shows that all studies have consistent and positive effect directions. Each study's confidence interval overlaps to a degree, supporting meta-analysis findings that the combined effects are significant and fairly stable.

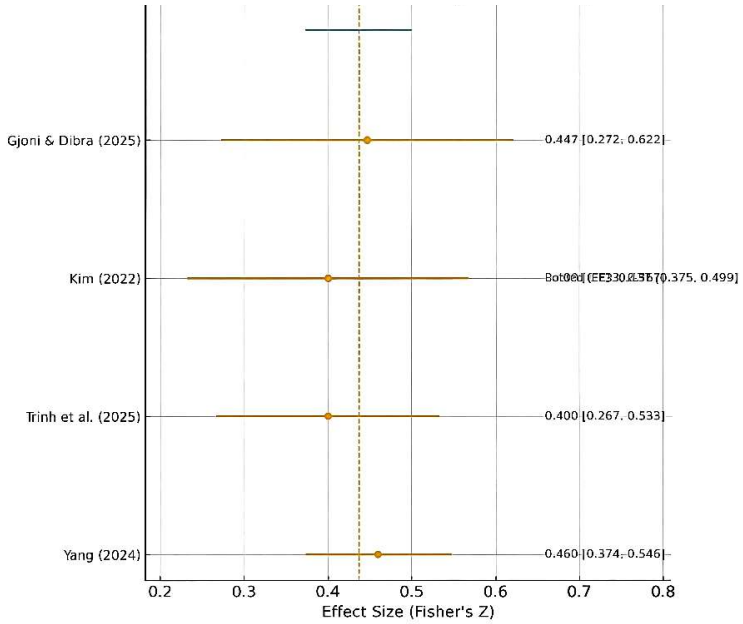

Figure 6. Meta-analysis forest plot (self-efficacy vs. curiosity)

The Egger test shows a p-value of 0.1957 (Table 15), indicating no strong evidence of publication bias or small-study effects in this collection of studies. The funnel plot (Figure 7) appears relatively symmetrical, supporting this conclusion. However, because the number of studies is very small (k = 4), these results should be interpreted with caution, given the test's limited power (Borenstein et al., 2021).

The absence of detected publication bias, while encouraging, cannot compensate for the limitations imposed by sample size. These findings should be interpreted as preliminary evidence consistent with, but not confirming, the theoretical proposition that self-efficacy and curiosity are mutually reinforcing (Putwain & Purland, 2023). A much larger meta-analysis that includes longitudinal and experimental studies is needed before robust conclusions can be drawn about the nature, direction, or mechanisms of this relationship in the context of learning English as a foreign language (EFL).

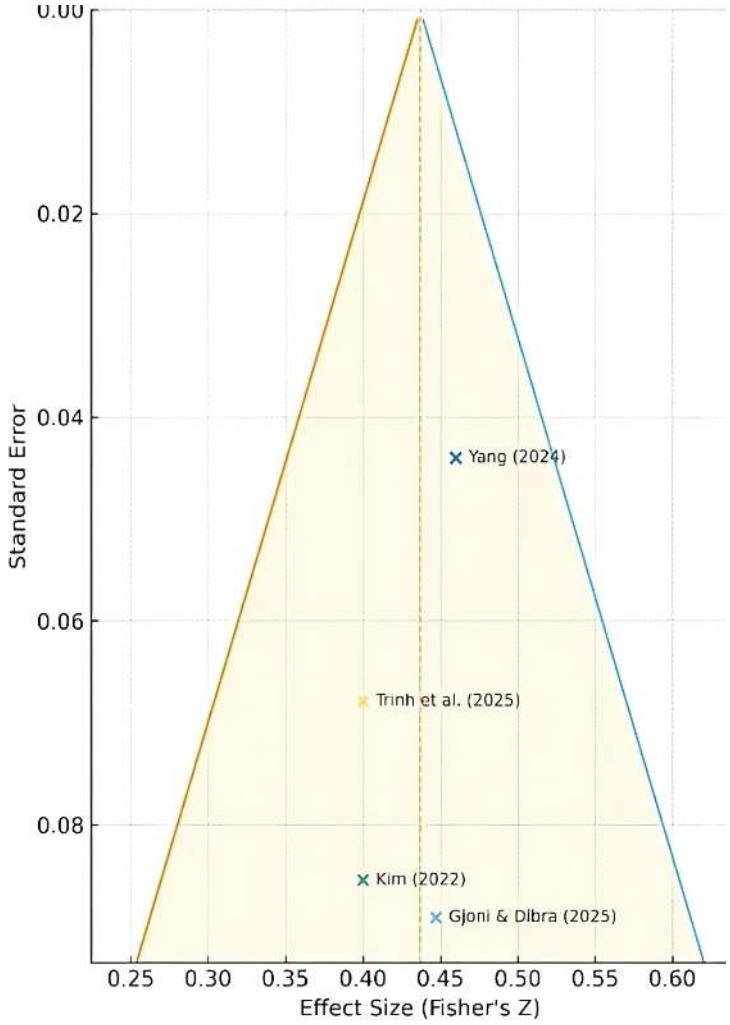

Figure 7. Funnel plot after trim-fill diagnosis (self-efficacy vs. curiosity)

Table 15. Egger's regression test (self-efficacy vs. curiosity)

Test	z	p (two-sided)
Egger's Test (intercept)	-1.294	0.1957

Intercept = -1.014764; SE = 0.784189

Theoretical Contribution and Practical Implications

These findings provide empirical evidence consistent with the Affective-Motivational Model of Language Learning, though significant limitations preclude stronger conclusions. The observed positive correlations are consistent with theoretical predictions, suggesting that self-efficacy and curiosity co-predict proficiency. However, several factors prevent statements about "expanding" the existing theoretical framework. The correlational nature of the evidence cannot establish the directional or mediating relationships suggested by the motivational model. These results are consistent with a pathway in which self-efficacy influences strategy use, which in turn influences proficiency, but also accommodate reverse causality in which proficiency increases self-efficacy, or a two-way influence. The absence of mediation analysis in the primary studies, and consequently in this meta-analysis, prevents the examination of the specific

mechanistic pathways proposed by contemporary theoretical perspectives.

The extreme heterogeneity observed in the relationship between self-efficacy and proficiency ($I^2 = 87.7\%$) indicates that only a small portion of the variance has been explained. Meta-regression successfully identified educational level and geographic region as moderator variables, but significant residual heterogeneity remained in the subgroups ($I^2 = 62\%–92\%$). Essential moderators that remain unidentified include variations in instructional approaches, such as communicative versus grammatical-translation methods, and the appropriateness of assessments involving specific versus general proficiency measures. In these temporal dynamics, cross-sectional observations miss progressive development and cultural conceptualizations of self-efficacy that distinguish individualistic from collectivist orientations, which may influence how self-beliefs are translated into behavior. Publication bias was detected, indicating a systematic underrepresentation of null or weak effects, particularly for associations between curiosity and proficiency (Egger's $p = 0.0017$). Trim-and-fill analysis shows stability, but selective reporting artificially inflates relationship estimates and potentially misrepresents the actual predictive capacity of these constructs.

This study provides initial correlational evidence consistent with theoretical predictions while highlighting substantial gaps, rather than "extending" existing models. These gaps require mediation analysis to test specific pathways, experimental designs to establish causality, longitudinal approaches to capture reciprocal dynamics, standardized measurements to reduce methodological heterogeneity, and pre-registered studies to reduce publication bias. These findings offer actionable insights for English language learning in Indonesia, given the documented challenges: Indonesia ranks 75th out of 113 in the 2024 EF EPI rankings, and only 37% of teachers demonstrate high competency according to 2023 PSKP data. Interventions must simultaneously address both constructs through comprehensive strategies.

Educators should design a sequence of tasks that ensures at least an 80% success rate before increasing the level of difficulty to build confidence. They should provide specific skill-based performance feedback rather than generic praise, noting specific improvements such as how transition words improve cohesion rather than simply commenting that the work is "good." Peer models through video demonstrations showing students with similar abilities completing tasks have proven valuable. The practice of error normalization, which frames mistakes as valuable learning opportunities, should be integrated. The instructional approach should allow for topic selection within curriculum boundaries to capitalize on individual interests in stimulating curiosity. Authentic material relevant to adolescents, such as K-pop lyrics, gaming forums, and social media content, should be integrated. Open-ended investigations exploring questions such as how English idioms reflect cultural values should replace rote memorization activities. Adaptive technology platforms that provide uniqueness and maintain curiosity through personalized scaffolding should be utilized.

These recommendations assume a supportive implementation context with adequate resources. The weaker European effect ($r = 0.398$) may reflect a compensatory mechanism whereby exposure to the language environment reduces reliance on self-efficacy. In the Indonesian context, which lacks such compensation, greater resource investment may be required, with teacher professional development remaining a prerequisite for effective strategy implementation.

Limitations and Future Research

Several methodological constraints warrant acknowledgment. Our Boolean search structure ("Self-efficacy" OR "Curiosity" AND "English

Proficiency") effectively captured studies linking either construct to proficiency outcomes but inadvertently narrowed the pool for self-efficacy-curiosity analyses. Studies exploring these two variables without explicit proficiency measurement even within EFL contexts fell outside our search parameters. Consequently, the four studies examining self-efficacy and curiosity together constitute a theoretically driven subset rather than a comprehensive sample, limiting our capacity to make confident generalizations about their interrelationship.

The small sample size (k=4) for this relationship introduces three interrelated challenges. First, statistical power proved insufficient to detect genuine moderating influences of educational context, geography, or instructional design. The observed homogeneity (I^2=0%) likely reflects measurement limitations rather than the true absence of variation, a conclusion reinforced by the confidence interval spanning 0% to 72%. Second, we cannot empirically distinguish between competing theoretical explanations: whether self-efficacy fuels curiosity, curiosity builds confidence, or both operate reciprocally. Third, the positive correlation (r=0.437) aligns with theoretical predictions about reciprocal reinforcement, yet remains preliminary evidence requiring extensive replication before informing practice or theory development.

Geographic patterns raise interpretive questions. European studies showed weaker self-efficacy-proficiency links (r=0.398) than Asian (r=0.454) and Middle Eastern (r=0.463) contexts, yet "Europe" encompasses radically different linguistic ecosystems, ranging from English-dominant environments to multilingual settings. Future work should examine whether ambient English exposure moderates self-efficacy's predictive power, test whether multilingualism provides alternative identity resources that buffer low confidence, and employ standardized instruments cross-nationally to separate cultural from structural factors.

Substantial unexplained variance persists despite identifying educational level and region as moderators, residual heterogeneity of 62-92% signals unmeasured influences. Priority investigations should code instructional approaches using meta-regression, test measurement specificity (do domain-specific beliefs predict more strongly than general confidence?), and analyze temporal patterns that distinguish novice-level dynamics from advanced-learner reciprocal effects.

Our entirely correlational evidence base fundamentally constrains causal inference. Essential next steps include longitudinal panel designs with three or more timepoints enabling cross-lagged analyses, randomized intervention studies establishing causal direction, mediation analyses unpacking how self-efficacy shapes strategy use, which then influences proficiency (or how curiosity drives input-seeking, leading to skill gains), and person-centered approaches capturing individual trajectories rather than aggregate patterns.

Publication bias detected through Egger's test necessitates pre-registration of adequately powered replications, journal incentives for rigorous null findings, and individual-participant-data meta-analyses that access unpublished datasets. The current motivational model also oversimplifies by omitting achievement emotions as mediators, mindset beliefs as moderators, contextual affordances as boundary conditions, and demographic factors potentially shaping these relationships.

Future meta-analyses might adopt tiered search strategies: primary searches capturing all three constructs simultaneously, supplementary searches including paired relationships (e.g., "Self-efficacy AND Curiosity" in language contexts regardless of proficiency measures), and exploratory searches testing cross-language generalizability. Individual participant data meta-analysis offers particular promise. By obtaining raw data from primary studies, researchers can calculate previously unreported correlations,

conduct person-centered analyses to explore individual pathways, test complex mediation-moderation models that are not possible with study-level aggregation, and standardize measurements to reduce heterogeneity from instrument differences.

■ CONCLUSION

This meta-analysis identifies self-efficacy and curiosity as influential affective-motivational factors in English proficiency, with fairly strong to strong correlations ($r = 0.438$ and $r = 0.447$) across 42 international studies. However, the significant heterogeneity observed ($I^2 = 87.7\%$) suggests that this relationship is contextual rather than universally applicable. Educational level and geographic location explain only a minimal amount of the variance, while most of the variance stems from unmeasured variables.

Methodological limitations arise from the entirely correlative nature of the evidence, combined with apparent publication bias, precluding definitive causal interpretations. At the same time, these results are consistent with a theoretical framework suggesting that self-efficacy drives strategic engagement, which then influences proficiency; the data also support alternative explanations involving reverse causality or reciprocal effects. Most critically, the relationship between self-efficacy and curiosity ($r = 0.437$) must be interpreted with extreme caution. Derived from only four studies with very limited statistical power and heterogeneous confidence intervals ranging from 0% to 72%, this finding cannot support any substantial conclusions about the nature or existence of an actual relationship between these constructs. The wide range of uncertainty indicates that the actual relationship could range from nonexistent to significant, and no meaningful conclusions about reciprocal dynamics, mediation, or theoretical mechanisms can be drawn from this small sample. This is an exploratory finding that requires extensive replication before theoretical or practical implications can be considered. Longitudinal experimental research is essential to move beyond merely documenting correlation patterns toward understanding underlying mechanisms.

Practical applications must carefully consider both opportunities and limitations. Boosting learners' confidence and fostering curiosity could be valuable points of intervention in EFL learning environments in Indonesia, where limited exposure to authentic language magnifies the significance of motivational factors. However, the diminished effects observed in the European context raise questions about the effectiveness of interventions in resource-limited educational settings. Without rigorous implementation, research testing for scalability, and translating correlational findings into educational policy, the findings remain speculative.

The principal value of this research lies in revealing significant gaps in the existing academic evidence, including unmeasured moderator variables, a lack of causal research designs, and selective publication patterns. These identified gaps offer valuable opportunities for future research using longitudinal methodologies, experimental interventions, and standardized assessment tools to transform initial associations into mechanistic knowledge that can be practically applied in the development of English language proficiency.

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