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Article

Social media use in second language teaching effectively enhances students' writing proficiency: A meta-analysis

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Abstract: This study employed a meta-analytic approach to examine the overall relationship between social media use and second language (L2) writing proficiency, with particular attention to the potential moderating roles of learners' age and the type of social media platform (symmetric vs. asymmetric). Guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, a comprehensive and systematic literature search was conducted across major academic databases. After rigorous screening and eligibility assessment, 32 empirical studies met the inclusion criteria and were synthesized quantitatively. The results revealed a significant and positive overall association between social media use and L2 writing proficiency, suggesting that engagement with social media environments may facilitate the development of writing skills in an additional language. Contrary to expectations, moderator analyses indicated that neither learners' age nor the type of social media platform significantly influenced the strength of this relationship. These findings demonstrate a relatively robust positive link across diverse learner populations and technological contexts. Overall, this study provides quantitative evidence supporting the pedagogical value of incorporating social media into L2 writing instruction. It also underscores the need for future research to explore additional moderating variables, such as task design, interactional patterns, and individual learner differences, to better understand the mechanisms underlying technology-enhanced L2 writing development.

Keywords: social media; second language writing; language proficiency; meta-analysis; moderation effect

1. Introduction

Language interaction and communication are fundamental to the process of language acquisition [1]. The diverse applications of social media are gradually reshaping the traditional paradigms of language learning [2]. Social media platforms have shown significant educational value, as they not only enhance students' critical thinking, problem-solving abilities, and communication competence but also promote constructive and lifelong learning skills [3]. Moreover, they provide learners with increased exposure to authentic materials and encourage interactive engagement, thereby deepening their understanding of the target language [4,5].

Previous studies on second language (L2) writing have primarily focused on evaluating the effectiveness of various instructional approaches, including CTsCALL [6], ICALA [7], CALL, and AIALL [8]. However, empirical findings on the impact of social

media use on L2 writing proficiency remain inconsistent and, at times, contradictory. These discrepancies can largely be attributed to variations in research design [9], contexts [10], methodologies [11], and educational levels [12], making it difficult to draw conclusions about the overall effectiveness of social media in this domain.

Although academic interest in this topic has been growing, few studies have attempted to systematically and quantitatively synthesize the existing body of research. Meta-analysis, as a rigorous statistical method for aggregating findings across empirical studies, provides a means to resolve these inconsistencies by offering precise estimates of overall effect sizes and identifying potential moderating variables [13]. To address these gaps, the present study employs a meta-analytic approach to investigate the impact of social media use on L2 writing proficiency, with particular focus on the moderating effects of learners' age and the type of social media platform. Overall, this study presents the first meta-analysis of social media use and L2 writing, highlights the moderating roles of age and media type, and offers interdisciplinary insights to inform technology-enhanced language learning.

2. Literature review

2.1. The effect of social media use on L2 writing proficiency

The rapid development of social media has drawn increasing attention from linguists and educators seeking to enhance L2 writing proficiency [14]. Social media refers to internet-based applications that support functions such as image sharing (e.g., Instagram), information organization (e.g., Pinterest), video calling (e.g., Skype), and instant messaging (e.g., WhatsApp), or combine these features (e.g., Facebook) [15]. This study focuses on platforms that facilitate written interaction and collaboration among L2 learners, particularly instant messaging tools and social networking sites with text-based communication features, such as WhatsApp and Facebook.

L2 writing is a complex and productive skill involving cognitive, metacognitive, and motivational self-regulation processes [16–18]. As a dynamic activity shaped by behavioral, cognitive, personal, and environmental factors, L2 writing instruction increasingly incorporates web-based social media to support language learning [19].

However, the impact of social media on L2 writing proficiency remains underexplored and inconclusive. Barrot [20] argued that social media-assisted learning outperformed traditional L2 acquisition methods. Some studies reported that social media-assisted instruction significantly ,enhanced learners' writing skills [21–23], overall proficiency [24], and features such as accuracy, clarity, and fluency [25]. Others, however, found no notable differences compared to traditional instruction in areas like lexical richness [26] or grammatical accuracy [27]. Additionally, Rahimi and Fathi [28] found no significant correlation between social media use and L2 writing proficiency. Still, some researchers raise concerns about social media's potential drawbacks, including privacy risks [29], limited academic suitability [30], distraction [31], and psychological impacts [32].

To date, few studies have systematically synthesized the evidence, leaving the overall impact of social media use on L2 writing proficiency unclear and highlighting

the need for further meta-analysis.

2.2. Moderators of social media use on L2 writing proficiency

A growing body of research has examined potential moderators of the relationship between social media use and L2 writing proficiency, such as learners' gender [33], educational level [34], and learning environment [10]. These variables have shown relatively consistent effects. In contrast, the moderating roles of learners' age [35,36] and type of social media [37–39] remain debated and inconclusive.

2.2.1. Age

Existing research on the relationship between social media use and L2 writing proficiency has primarily involved adolescent or adult learners, with few directly comparing the two groups. This limits our understanding of age as a potential moderator. For example, Verheijen and Spooren [36] found that among adolescents, pre-writing social media use significantly reduced spelling errors, while the effect among adults was positive but non-significant. Such mixed findings underscore the need for moderating analysis to clarify how age influences the relationship between social media use and L2 writing proficiency.

2.2.2. Types of social media

Different types of social media may affect L2 writing outcomes in distinct ways. Two classification systems are frequently used including synchronous vs. asynchronous discussions [40] and symmetric vs. asymmetric platforms [38]. The latter is considered more theoretically grounded, reflecting variations in social closeness and interaction reciprocity [41, 42]. Symmetric platforms (e.g., Facebook, Skype) foster real-time interaction and reciprocal feedback, whereas asymmetric platforms (e.g., wikis, blogs) involve more individual content production with limited immediate peer interaction. Empirical evidence on platform type is mixed. Shukor and Noordin [39] found that symmetric platforms improved both the quantity and quality of writing, whereas Paul and Friginal [38] reported no significant effects for asymmetric tools. Conversely, other research indicated that asymmetric social media could also enhance writing proficiency [37] and learner motivation [43]. These inconsistencies highlight the need for a meta-analytic approach to assess whether and how social media type moderates L2 writing outcomes.

To address these gaps, this study used meta-analysis to evaluate the impact of social media use on L2 writing proficiency, focusing on age and platform type as moderators. Specifically, it addressed the following research questions:

RQ1: Does social media use significantly affect L2 writing proficiency?

RQ2: Is this effect moderated by learners' age?

RQ3: Is this effect moderated by the type of social media platform?

3. Research methodology

3.1. Literature search

A comprehensive search of English-language literature was conducted with a cutoff date of 31 December 2023. Following the PRISMA guidelines proposed by Moher et

al. [44], the selection process involved four stages: identification, screening, eligibility assessment, and final inclusion. Searches were carried out across multiple databases, including PubMed, Web of Science Core Collection, Google Scholar, EBSCO, and ProQuest. The search strategy combined terms such as "social media" & ("second language writing" OR "language learning" OR "second language learning" OR "L2" OR "bilingual learning"). To minimize the risk of missing relevant studies, reference lists of eligible reviews and empirical articles were also manually screened. After initial screening of titles and abstracts, full texts were assessed against predefined inclusion criteria. Ultimately, 71 studies were retained for further analysis. (See **Figure 1**).

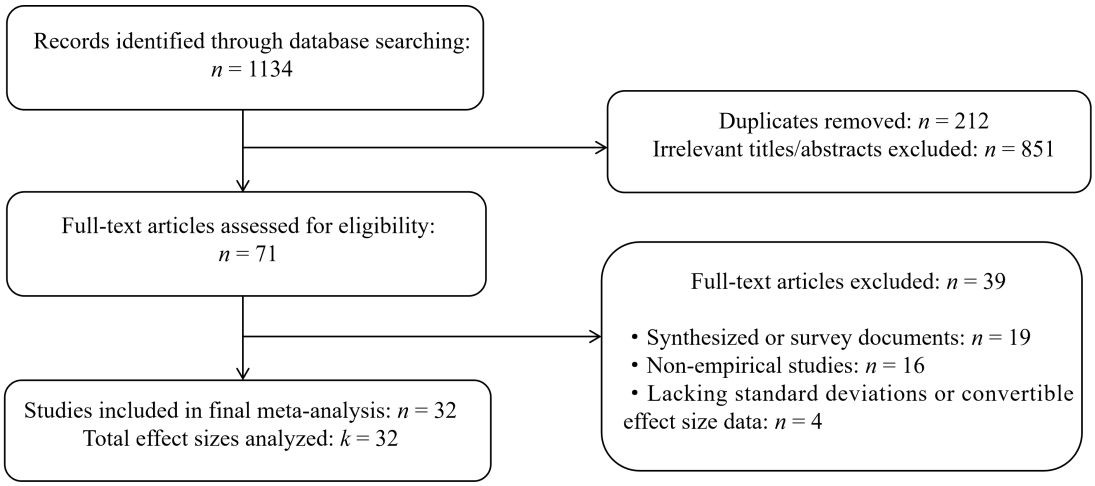

Figure 1. Document search and screening process.

3.2. Literature screening criteria

To ensure transparency and rigor, the literature screening process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [44]. Studies were included based on the following criteria: (1) The study must examine the relationship between social media use and L2 writing proficiency; (2) The study must report key moderators such as learner age and social media type; (3) Only quantitative, empirical studies were included; theoretical papers, literature reviews, and purely qualitative research were excluded; (4) The study must report sufficient statistical information, such as Cohen's *d* or other statistical values (e.g., *F*-values, *t*-values, or χ^2-values), with a clearly specified sample size, allowing for the calculation of effect sizes; (5) The sample population must consist of general L2 learners, excluding specialized subgroups; (6) Duplicated datasets were excluded. If a study reported multiple independent samples, each sample was treated as a separate data set and coded individually to ensure statistical independence.

As shown in **Figure 1**, the search initially yielded 1134 records. After removing 212 duplicates, 851 studies were excluded based on titles and abstracts. Seventy-one full-text articles were assessed for eligibility, and 39 were excluded due to lack of empirical data ($n = 16$), use of synthesized or survey data ($n = 19$), or insufficient statistical information for effect size calculation ($n = 4$). Ultimately, 32 eligible studies were included in the final meta-analysis, contributing 32 independent samples and a combined total of 1893 participants.

3.3. Literature coding

Following standard meta-analytic procedures, the 32 eligible studies were systematically coded based on the following variables: (1) bibliographic details (author's name, year of publication); (2) sample size; (3) age group (adolescents: 13–17 years; adults: 18 years and above, following the definition proposed by Blakemore [45]; (4) type of social media (symmetric vs. asymmetric); (5) effect size (Cohen's *d*); (6) *p*-value. Effect sizes were calculated using reported descriptive statistics (means, standard deviations, and sample sizes) related to writing outcomes before and after social media use. **Table 1** presents a summary of the key characteristics of the included studies.

Table 1. Table of information on studies included in the meta-analysis.

Author (date of publication)	Sample size	Age	Social media types	Effect *d*-value	*p*-value
Yen et al., 2015 [40]	42	T	SY	0.652	0.004
Dizon, 2016 [26]	30	A	SY	0.154	0.674
Shih, 2011[a] [23]	23	A	SY	1.488	0.008
Shih, 2011[b] [23]	23	A	SY	1.279	0.029
Shih, 2011[c] [23]	23	A	SY	2.070	0.001
Barrot, 2021 [21]	89	T	SY	0.698	0.001
Sirivedin et al., 2018 [25]	403	A	SY	0.828	0.000
Rahimi and Fathi, 2021 [28]	67	A	ASY	3.235	0.000
Khan et al., 2016 [46]	20	A	SY	1.828	0.000
Arslan and Sahin-Kizil, 2010 [37]	50	A	ASY	1.477	0.000
Bin-Tahir and Suriaman, 2014 [9]	47	A	SY	1.396	0.000
Wichadee, 2013[a] [27]	30	A	SY	1.089	0.000
Wichadee, 2013[b] [27]	30	A	SY	1.097	0.000
Chang and Lu, 2018[a] [47]	80	T	SY	1.339	0.000
Chang and Lu, 2018[b] [47]	80	T	SY	1.796	0.000
Paul and Friginal, 2019[a] [38]	27	A	SY	0.164	0.059
Paul and Friginal, 2019[b] [38]	27	A	ASY	0.299	0.000
Alghamdy, 2019 [24]	48	T	SY	1.861	0.000
Wichadee, 2013 [27]	35	A	ASY	1.543	0.000
Alkhoudary, 2018 [48]	60	A	SY	0.776	0.004
Yen, 2015 [40]	45	T	SY	0.467	0.029
Ebadi and Rahimi, 2018 [49]	10	A	ASY	1.486	0.003
Awada et al., 2019[a] [33]	78	A	ASY	0.009	0.985
Awada et al., 2019[b] [33]	78	A	ASY	0.642	0.073
Awada et al., 2019[c] [33]	78	A	ASY	1.804	0.009
Shukor and Noordin, 2014 [39]	33	A	SY	0.081	0.816
Hosseini et al., 2020 [50]	50	A	ASY	5.112	0.000
Sun, 2010 [43]	23	A	ASY	0.195	0.510
Wang, 2014 [51]	48	A	ASY	1.093	0.000
Hosseini et al., 2020[a] [50]	72	T	ASY	0.598	0.000
Hosseini et al., 2020[b] [50]	72	T	ASY	0.763	0.000
Hosseini et al., 2020[c] [50]	72	T	ASY	1.423	0.000

Note: (1) The superscript letters a, b, and c following the author's name and year indicate different samples from the same study. (2) In the "Age Group" column: T = Teenagers; A = Adults. (3) In the "Social Media Type" column: SY = Symmetric media; ASY = Asymmetric media. (4) To save space, only the first author of each coded study is reported.

The coding procedure was adapted from López-Nicolás et al. [52] and implemented in multiple phases. A pilot coding round was conducted on five randomly selected studies, during which two coders independently applied the initial coding form. Discrepancies were discussed and resolved through iterative consensus meetings. One key disagreement involved the classification of YouTube. While one coder viewed it as a symmetric platform due to its interactive features, the other considered it asymmetric given its predominantly one-way content delivery. The coders ultimately agreed to classify YouTube as asymmetric, reflecting its typical unidirectional user engagement structure. The coding manual was revised accordingly.

After finalizing the coding scheme, both coders independently coded all 32 studies. Inter-coder reliability was assessed using Cohen's Kappa, with all variables achieving values above 0.98, indicating excellent agreement. Any remaining discrepancies were resolved through discussion to ensure data accuracy and consistency.

3.4. Data processing and analysis

All data were processed using Comprehensive Meta-Analysis (CMA) software, version 3.3. The standardized mean difference (Cohen's *d*) was used as the unified effect size across studies to assess the impact of social media use on L2 writing proficiency. For studies reporting sample size, mean, and standard deviation, Cohen's *d* was calculated directly using its standard formula. For studies that did not report Cohen's *d* directly but instead provided statistics *r*-values, *F*-values, *t*-values, or χ^2-values, these values were converted into Cohen's *d* using standard transformation formulas. To assess moderation effects, subgroup analyses were conducted based on learner age (adolescents vs. adults) and type of social media (symmetric vs. asymmetric).

Both fixed-effects models (FEM) and random-effects models (REM) are commonly used in meta-analysis. FEM assumes a single true effect size, while REM accounts for heterogeneity across studies [53]. Given the diversity of the included studies, involving different age groups, social media types, and educational settings, the random-effects model was deemed more appropriate and was employed to estimate the overall effect size [54]. The REM considers both within-study variance and between-study heterogeneity, making it suitable for this analysis.

4. Analysis of research findings

This study investigated the impact of social media use (independent variable: symmetric vs. asymmetric platforms) on L2 writing proficiency (dependent variable: continuous outcome). The standardized mean difference (Cohen's *d*) was used as the effect size, interpreted as small (0.2), medium (0.5), or large (0.8).

4.1. Heterogeneity test

To assess variability across studies and determine the appropriate analytical model, heterogeneity was evaluated using Q, I^2, and τ^2 statistics. As shown in **Table 2**, the Q-value was 225.932 ($p < 0.001$), indicating significant heterogeneity among effect sizes. This result confirmed the appropriateness of using a random-effects model (REM). The I^2 value was 86.28%, well above the 75% threshold, suggesting that a substantial

proportion of the observed variance (86.28%) was attributable to true differences in effect sizes rather than sampling error. The τ^2 value was 0.27, indicating moderate between-study variance that influenced the weighting of studies in the analysis.

Table 2. Results of the heterogeneity test for the effect sizes.

Social media type	Sample size (*k*)	Heterogeneity			Tau-squared and Tau	
		Q	*df* (*Q*)	I^2	τ^2	τ
Social media	32	225.932***	31	86.28	0.27	0.52

Note: *** $p < 0.001$.

Taken together, these findings provided strong empirical support for employing a REM to estimate the overall impact of social media use on L2 writing proficiency while also highlighting the likely influence of moderator variables such as learner age and social media type.

4.2. Publication bias test

Publication bias occurs when studies with statistically significant findings are more likely to be published and included in meta-analyses, leading to a potentially skewed estimate of the true effect size [55, 56]. This study assessed publication bias using multiple methods (see **Table 3**), including funnel plot inspection, Classic Fail-safe N, Begg's rank correlation test, and the Trim and Fill method, following recommendations by Borenstein et al. [53].

Table 3. Results of publication bias test.

Variant	Classic fail-safe *N*		Begg's rank correlation test		
	Z	*N*	Tau	*Z*	*p*
Social media	21.72***	3898	0.13	1.05	0.29

Note: *** $p < 0.001$.

Initial visual inspection of the funnel plot showed a symmetrical distribution of effect sizes around the mean, suggesting minimal publication bias. To supplement this subjective method, quantitative tests were conducted. The Classic Fail-safe *N* was calculated to be 3898, greatly exceeding the critical threshold ($5k + 10$, with k being the number of independent samples for the effect value), indicating that over 3800 null-result studies would be needed to nullify the observed effect size. This result was statistically significant ($p < 0.001$), suggesting a low risk of publication bias. Furthermore, Begg's rank correlation test yielded a non-significant result ($p = 0.29$), providing additional support for the absence of systematic bias.

To further validate the robustness of the findings, the Trim and Fill method [57] was employed. The adjusted effect size remained statistically significant ($d = 0.87$, 95% $CI = [0.66, 1.08]$), reinforcing the stability of the meta-analytic results even after accounting for potential missing studies.

In sum, both visual and statistical diagnostics indicated that publication bias was minimal, lending greater credibility to the overall conclusions drawn from the meta-analysis.

4.3. Main effects test

This section evaluated the overall impact of social media use on L2 writing proficiency. The meta-analysis included 32 independent effect sizes derived from a cumulative sample of 1893 participants. As summarized in **Table 4**, the analysis revealed a significant overall effect size (Cohen's $d = 1.03$, $Z = 9.62$, $p < 0.001$), indicating a strong positive association between social media use and L2 writing proficiency. According to Cohen's [58] conventional benchmarks, effect sizes of 0.2, 0.5, and 0.8 are interpreted as small, medium, and large, respectively. The observed effect size of 1.03 therefore falls within the large-effect range, suggesting that social media use has a substantial and beneficial impact on learners' L2 writing skills.

Table 4. Results of main effects test.

Variant	*k*	*N*	*d*	*SE*	$CI_{95\%}$	*Z*
Social media	32	1893	1.03	0.11	[0.82; 1.24]	9.62^{***}

Note: *** $p < 0.001$.

4.4. Moderating effect test

This section explored whether the relationship between social media use and L2 writing proficiency was moderated by learners' age group (adolescents vs. adults) and type of social media platform (symmetric vs. asymmetric). Due to the significant heterogeneity observed in effect sizes, a random-effects model was applied to examine these potential moderators. As shown in **Table 5**, the moderation analysis revealed that neither learners' age group ($Q_b = 0.001$, $p = 0.975$) nor social media type ($Q_b = 0.141$, $p = 0.707$) had a statistically significant moderating effect on the relationship between social media use and L2 writing proficiency. These findings suggest that the positive impact of social media on L2 writing proficiency is robust and consistent across different age groups and types of social media platforms.

Table 5. Moderating effects test (random effects model).

Reconcile variant	Group	*k*	*N*	*d*	*SE*	$CI_{95\%}$	Q_w	I^2	$Q_b(df)$
Age	adolescent	9	600	1.03	0.16	[0.71; 1.35]	39.66^{***}	79.83	0.001(1)
	adult	23	1293	1.02	0.14	[0.76; 1.29]	173.18^{***}	87.30	
Social Media Type	asymmetrical	18	1133	0.99	0.14	[0.02; 0.73]	112.67^{***}	84.91	0.141(1)
	asymmetric	14	760	1.08	0.19	[0.04; 0.70]	113.25^{***}	88.52	

Note: *** $p < 0.001$; Q_w denotes within-group heterogeneity; Q_b denotes between-group heterogeneity.

5. Discussion

5.1. The relationship between social media use and L2 writing proficiency

The present meta-analysis revealed a significant and robust positive effect of social media use on L2 writing proficiency ($d = 1.03$, $Z = 9.62$, $p < 0.001$), corroborating previous empirical findings that highlight social media as a beneficial tool for enhancing L2 writing skills [23,46,59]. This positive impact can be attributed to the affordances of social media platforms, which provide learners with opportunities for authentic communication, immediate feedback, and collaborative learning environments [15,19].

However, this overall positive effect should be interpreted with caution due to mixed results reported in the literature. Some studies have documented null or even negative effects, pointing to challenges such as privacy concerns that inhibit learner participation [29], the use of platforms ill-suited for academic purposes [30], and learner distraction or off-task behavior [31]. These conflicting findings underscore the complexity of the relationship between social media use and L2 writing proficiency.

Moreover, the influence of social media appears to be highly context-dependent, varying significantly across cultural, educational, and pedagogical settings [25,60,61]. Such variability highlights that the impact of social media on L2 writing development is not uniform but shaped by a dynamic interplay of sociocultural, technological, and instructional factors.

Therefore, while social media generally serves as a valuable resource for facilitating L2 writing development, its effects should be understood within a nuanced framework that considers specific learner contexts and the nature of platform use. Future research would benefit from exploring these contextual moderators to provide more targeted recommendations for integrating social media into L2 writing instruction.

5.2. Moderating effects of the relationship between social media use and L2 writing proficiency

5.2.1. Moderating effect of age

Contrary to prior studies that suggest age-related differences in the benefits derived from social media use in L2 writing [35,36,48], the present meta-analysis did not identify a significant moderating effect of age ($Q_b = 0.001$, $p > 0.05$). For example, Alkhoudary [48] reported that adult learners gained more from social media-based writing tasks than their adolescent counterparts. However, this discrepancy may stem from the demographic characteristics of the included samples. In many of the studies analyzed, adult participants were predominantly university students whose digital behaviors, familiarity with social media, and cognitive engagement likely resembled those of adolescent learners. This convergence in user profiles may have attenuated observable age-related differences.

Furthermore, Verheijen and Spooren [36] emphasized that age-related moderation often emerges in relation to specific subcomponents of writing performance, such as spelling accuracy or syntactic complexity, rather than in holistic measures of writing proficiency. This distinction may partially explain the lack of significant moderation in the current study, which synthesized studies using varied and often global measures of L2 writing ability. Additionally, inconsistencies in the operational definitions of writing outcomes and substantial variation in assessment tools across the primary studies likely contributed to the difficulty in detecting age as a consistent moderator. These findings suggest that while age may influence discrete aspects of L2 writing development, it may not play a decisive role in moderating the overall effectiveness of social media use.

5.2.2. Moderating effect of social media type

Similarly, no significant moderating effect was found for the type of social media platform (symmetric vs. asymmetric) on L2 writing proficiency ($Q_b = 0.141$, $p > 0.05$).

This finding contrasts with earlier claims that different platform types exert differential effects on language outcomes [35,38]. For instance, Paul and Friginal [38] reported that symmetric platforms, which support reciprocal interactions (e.g., discussion forums, group chats), were more conducive to improving writing proficiency than asymmetric platforms, where communication tends to be unidirectional (e.g., YouTube comment sections, blog reading).

One potential explanation for this discrepancy lies in the functional overlap and hybrid usage of social media in educational contexts. Although platforms can be conceptually divided into symmetric and asymmetric types, in practice, learners often engage with both types simultaneously or use platforms in ways that blur these distinctions. For example, learners might use an asymmetric platform like YouTube in a dialogic manner by posting comments and engaging in peer feedback. As a result, the binary classification of platforms may not adequately capture the nuanced and multifaceted ways in which social media supports L2 writing development.

Additionally, variations in usage intensity, learner autonomy, and the degree of pedagogical integration across studies may obscure platform-specific effects. While Sun [43] found that asymmetric platforms enhanced motivation and writing fluency, other studies, such as Paul and Friginal [38] reported negligible outcomes, highlighting the role of contextual factors. Taken together, these findings suggest that the pedagogical effectiveness of social media may depend less on platform type per se and more on how the platforms are embedded within instructional design, learner goals, and interactional patterns. Consequently, future research should move beyond dichotomous classifications and adopt more granular frameworks that consider affordances, interactional modes, and instructional context.

5.3. Significance of the study

The findings of this meta-analysis confirm that social media use exerts a significant positive effect on L2 writing proficiency. This result contributes to the growing body of evidence supporting the integration of digital technologies, particularly social media platforms, into second language writing instruction. The study offers important implications for both educational research and pedagogical practice. Specifically, it underscores the potential of leveraging computers and mobile devices not merely as communication tools but as meaningful components of instructional design aimed at fostering L2 writing development. From a pedagogical perspective, the results encourage language educators to incorporate social media technologies into the curriculum as a means of enhancing learner engagement, promoting authentic communication, and fostering collaborative learning environments. These platforms offer unique affordances, such as real-time feedback, audience awareness, and multimodal expression, that align well with contemporary communicative and process-based approaches to writing instruction.

Importantly, the moderator analyses revealed that neither learner age nor the type of social media platform significantly influenced the relationship between social media use and writing proficiency. This suggests a generalizable benefit across demographic groups, implying that both adolescent and adult learners can derive comparable writing

gains from social media-based instruction. Similarly, the absence of significant differences across platform types indicates that educators can flexibly select social media tools based on contextual and logistical considerations, such as accessibility, user preferences, institutional policies, and instructional goals, rather than assumptions about their inherent pedagogical value.

6. Conclusion

6.1. Research findings

This meta-analysis yielded two key findings: 1) Social media use has a significant and positive influence on L2 writing proficiency; 2) This positive relationship is not significantly moderated by learners' age or the type of social media employed. These results indicate a broadly consistent benefit of social media integration in L2 writing instruction across varied learner demographics and technological contexts.

6.2. Research limitations

Despite its contributions, this study has several limitations that require careful consideration: 1) Lack of subcomponent analysis: The analysis did not examine the effects of social media use on specific subcomponents of L2 writing (e.g., grammar, coherence, content development) due to an insufficient number of primary studies in each domain ($k < 5$). 2) Ambiguities in age classification: Variability in how age groups were reported, particularly the reliance on institutional labels such as "university students" rather than explicit age data, posed challenges for clear subgroup delineation. Such categorizations, while necessary for synthesis, may obscure finer-grained age effects. 3) Limited moderator scope: The relatively small number of studies included in this meta-analysis ($k = 32$) restricted the power and breadth of moderator analyses. As a result, potentially influential factors, such as L1 background, length of social media exposure, learning context, or instructional design, could not be systematically examined.

6.3. Future research directions

In light of these findings and limitations, several avenues for future research are recommended: 1) Skill-specific analysis: Future studies should investigate how social media affects discrete dimensions of L2 writing proficiency (e.g., lexical diversity, syntactic complexity, discourse coherence). In addition, expanding the scope to include other language modalities (e.g., listening, speaking, reading) would offer a more comprehensive understanding of social media's impact on L2 acquisition. 2) Underrepresented learner populations: Existing research disproportionately focuses on adolescents and young adults. Future studies should examine how children and older adults engage with social media for L2 writing development, addressing potential differences in cognitive, motivational, and technological factors across the lifespan. 3) Expanded and diversified evidence base: To support more robust and comprehensive moderator analyses, future meta-analyses should include a larger and more diverse pool of primary studies. This would enable the investigation of additional contextual

variables (e.g., formal vs. informal learning) that may shape the observed relationship between social media use and L2 writing proficiency.

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