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NEGOTIATING LANGUAGE THROUGH ALGORITHMS: A QUANTITATIVE INVESTIGATION OF TRANSLANGUAGING IN AI-ASSISTED EFL WRITING

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Abstract:
The rapid integration of artificial intelligence (AI) writing tools into English as a Foreign Language (EFL) education is transforming multilingual writing practices. Yet, limited empirical research has examined how AI-mediated environments interact with learners' deployment of their full linguistic repertoires through translanguaging. This quantitative study addresses this gap by investigating patterns of language alternation, the functions of translanguaging in AI-assisted writing, learners' satisfaction, and the relationship between translanguaging functions and satisfaction across institutional contexts. Data were collected from 100 Moroccan university students engaged in AI-supported writing tasks. Analyses included descriptive statistics, the Kruskal–Wallis H test, and Spearman's rank-order correlation. Results showed relatively high satisfaction with translanguaging practices ($M = 4.04$, $SD = 0.94$). Learners employed diverse language alternation patterns, primarily to support idea generation, lexical retrieval, and comprehension. No significant differences in satisfaction emerged across language patterns or institutions, and the relationship between translanguaging functions and satisfaction was weak and non-significant ($\rho = -.167$, $p = .097$). These findings suggest that translanguaging in AI-mediated writing operates as a flexible, agentive practice rather than a determinant of user satisfaction. Pedagogically, the results support integrating AI tools in ways that legitimize multilingual meaning-making.

Keywords: translanguaging, Artificial Intelligence (AI), EFL writing, language alternation, AI-mediated learning, student satisfaction

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1. Introduction

The rapid proliferation of artificial intelligence (AI) tools in language education is transforming how learners engage with writing in English as a Foreign Language (EFL) contexts. AI-powered platforms, including chatbots and large language models, offer real-time feedback, lexical support, and syntactic scaffolding, thereby reshaping the conditions under which learners produce and negotiate written texts (Chen *et al.*, 2023; Huang & Zou, 2024). While such tools are often designed to optimize target-language accuracy, their implications for multilingual meaning-making remain insufficiently explored, particularly in relation to how learners draw on their full linguistic repertoires. From a translanguaging perspective, bilingual and multilingual speakers are understood not as operating within separate, bounded language systems, but as dynamically mobilizing an integrated linguistic repertoire to construct meaning, negotiate understanding, and mediate cognitive activity (García & Li Wei, 2014; Canagarajah, 2011). In educational settings, translanguaging has been shown to support vocabulary development, reading comprehension, and writing processes by legitimizing the strategic deployment of diverse linguistic resources (Creese & Blackledge, 2010). This perspective challenges monolingual ideologies that privilege target-language exclusivity and instead foregrounds the agentive and flexible practices of multilingual learners.

The emergence of AI-mediated writing environments introduces a further layer of complexity, positioning learners in interaction with non-human agents that generate, model, and evaluate language. Such environments may reconfigure translanguaging practices by either enabling the flexible orchestration of multilingual resources or reinforcing implicit English-dominant norms embedded in AI systems. Although existing research highlights the potential of AI to enhance learner engagement, motivation, and writing performance (Yuan & Liu, 2025; Jeon, 2024), there remains a lack of empirical insight into how these technologies intersect with translanguaging as a meaning-making practice.

Addressing this gap, the present study examines how Moroccan university students engage in translanguaging while interacting with AI writing tools, with particular attention to patterns of language use, the functions of translanguaging, and learners' satisfaction with these practices across institutional contexts.

2. Research Questions

RQ1: What patterns characterize participants' deployment of their linguistic repertoires during interaction with AI writing tools?
RQ2: What functions does translanguaging serve in participants' engagement with AI-mediated writing tasks?
RQ3: To what extent are participants satisfied with their translanguaging practices in AI-assisted writing contexts?

RQ4: How are translanguaging functions related to students' satisfaction with AI-mediated writing tasks?
RQ5: To what extent do patterns of translanguaging and levels of satisfaction vary across institutional contexts?

3. Literature Review

3.1 Translanguaging in Multilingual Education

The concept of translanguaging has gained increasing attention in applied linguistics and language education as a framework for understanding how multilingual speakers draw on their full linguistic repertoires to construct meaning. Rather than viewing languages as separate systems, translanguaging recognizes the fluid and dynamic use of multiple linguistic resources in communication and learning (García & Li, 2014). In educational contexts, translanguaging enables learners to strategically mobilize their first language (L1) and additional languages to facilitate comprehension, expression, and knowledge construction.

Early discussions of translanguaging emphasized its pedagogical value in bilingual and multilingual classrooms. Wei (2011) describes translanguaging as a process through which multilingual individuals integrate linguistic resources to maximize communicative effectiveness. Similarly, Canagarajah (2011) argues that translanguaging practices challenge traditional monolingual assumptions in language education and highlight the importance of flexible language use in academic environments. From this perspective, learners' L1 is not viewed as an obstacle to second language acquisition but rather as a cognitive and communicative resource that supports learning.

In English language teaching (ELT), translanguaging has been increasingly recognized as a pedagogical approach that supports student engagement and identity formation. Anderson (2023) describes translanguaging as a paradigm shift in ELT theory and practice, advocating for teaching approaches that acknowledge the multilingual realities of learners. Empirical studies in diverse educational contexts have demonstrated how translanguaging practices facilitate comprehension, collaborative learning, and linguistic confidence. For example, Lee (2022) documents how translanguaging strategies in a Korean heritage language classroom enabled students to connect linguistic knowledge across languages while developing academic literacy. Similarly, Caruso (2018) highlights the benefits of using multiple languages in higher education settings to support the analysis of complex academic content.

Research across different educational contexts further demonstrates the pedagogical value of translanguaging. Triastuti *et al.* (2023) examined translanguaging practices in an English for Specific Purposes (ESP) course in Indonesia and found that allowing students to alternate between languages enhanced comprehension and disciplinary understanding. Likewise, Pawapootanon *et al.* (2025) report that both teachers and students in Thai secondary schools perceive pedagogical translanguaging as an effective strategy for supporting English learning. These findings are echoed in

studies exploring students' perspectives on translanguaging interventions. Leonet and Saragueta (2023), for instance, show that learners in a trilingual primary school valued translanguaging activities because they enabled deeper understanding and encouraged participation. Similarly, Yolandana *et al.* (2024) found that translanguaging practices in Indonesian EFL classrooms supported students' linguistic identity development and promoted inclusive learning environments.

Therefore, existing research suggests that translanguaging plays a critical role in multilingual education by enabling learners to draw on their full linguistic repertoires to support comprehension, communication, and identity construction. As language learning environments become increasingly diverse and technologically mediated, understanding how translanguaging operates within digital contexts has become an important area of inquiry.

3.2 Artificial Intelligence in Language Learning

Recent advances in artificial intelligence (AI) have significantly transformed language learning environments, and sparked new lines of inquiry in higher education. Studies examining the educational impact of AI tools suggest that they can positively influence learners' motivation and learning experiences. Yuan and Liu (2025), for example, investigated the effects of AI-based tools on EFL learners' engagement, enjoyment, and motivation, finding that AI-supported activities enhanced learners' participation and emotional engagement with language learning tasks. Similarly, Jeon (2024) explored the affordances of AI chatbots in the EFL classroom and reported that students perceived these tools as useful for practicing language skills and receiving immediate feedback.

Generative AI technologies such as ChatGPT have further expanded the possibilities for AI-assisted language learning. Yu *et al.* (2025) argue that AI-powered systems can play a transformative role in multilingual education by providing learners with flexible linguistic support and facilitating cross-linguistic interactions. These tools allow learners to experiment with language use, access explanations, and engage in interactive dialogue, thereby creating new forms of digitally mediated learning environments.

Despite these opportunities, researchers also emphasize the need to critically examine how AI influences language practices and learning processes. The integration of AI into language education raises questions about authorship, learner autonomy, and the nature of linguistic interaction. Consequently, scholars increasingly call for research that explores how learners use AI tools in multilingual contexts and how these technologies shape language practices.

3.3 Translanguaging in AI-Mediated Learning Environments

As AI technologies become embedded in language learning environments, the intersection between translanguaging and AI-mediated communication has emerged as an important area of research. Generative AI systems often allow users to switch between languages, request translations, and clarify meaning across linguistic boundaries. This

flexibility aligns closely with the principles of translanguaging, which emphasize the dynamic use of multilingual resources.

Recent scholarship has begun to explore how translanguaging practices manifest in AI-supported learning contexts. Jeon *et al.* (2025) examine generative AI from a translanguaging perspective and argue that AI tools may simultaneously support and complicate multilingual language practices. On the one hand, AI systems can facilitate translanguaging by enabling learners to access explanations and linguistic resources in multiple languages. On the other hand, these technologies may introduce new dilemmas related to language dominance and digital mediation.

Similarly, Tzirides (2026) highlights the role of generative AI in shaping multilingual literacy practices in higher education. From a multiliteracies perspective, AI technologies create new possibilities for multimodal and multilingual meaning-making, allowing learners to combine linguistic, digital, and cognitive resources in innovative ways. She further argues that AI-mediated environments encourage learners to engage in translingual and multimodal communication practices that transcend traditional language boundaries. She suggests that the generative AI era is characterized by new forms of transposition in which linguistic and multimodal resources interact dynamically during the learning process. These developments highlight the importance of examining how learners navigate multilingual communication in technologically mediated environments.

4. Material and Methods

To investigate these relationships, quantitative research designs provide valuable tools for examining patterns of learner behavior and perceptions. Quantitative methods enable researchers to analyze relationships between variables and identify statistically significant trends within large samples (Creswell & Creswell, 2018). Although qualitative approaches are often used in translanguaging research, combining quantitative measures with appropriate statistical analyses can provide additional insights into learners' experiences and attitudes toward AI-mediated writing practices.

4.1 Participants

A total of 100 undergraduate students from two Moroccan universities participated in this study, including 48 students from FLLA and 52 students from ESEF. The participants completed AI-assisted English as a Foreign Language (EFL) writing tasks within their regular classroom settings. During these activities, the researcher documented the types of language alternation used by the students as well as the translanguaging functions that emerged throughout the writing process. In addition, participants' satisfaction with the experience was measured through a self-report questionnaire based on a five-point Likert scale.

5. Results and Discussion

5.1 Frequency Table

The analysis of the data revealed that Participants exhibited a relatively balanced distribution across the three language alternation types, as shown in Table 1 below.

Table 1: Language alternation Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Arabicenglish	31	31,0	31,0	31,0
	Frenchenglish	33	33,0	33,0	64,0
	Mixedmultilingual	36	36,0	36,0	100,0
	Total	**100**	**100,0**	**100,0**	

Language alternation was relatively balanced: Arabic–English (31%), French–English (33%), and Mixed Multilingual (36%). These results suggest that no single group dominates the sample, allowing for meaningful comparisons in satisfaction and translanguaging functions.

A frequency analysis, as shown in Table 2, was performed to identify the main purposes for which participants used the tool. The results show that vocabulary search was the most common purpose, representing 44% of the responses (n = 44). The second most frequently reported purpose was clarification, accounting for 33% (n = 33). In comparison, translation was the least reported use, comprising 23% of responses (n = 23). These findings indicate that participants primarily used the tool to locate or verify vocabulary items, suggesting that lexical support was the most prominent need. A considerable proportion of participants also used the tool to clarify meanings or better understand linguistic content. By contrast, the relatively lower percentage for translation implies that participants relied less on the tool for direct translation tasks.

Table 2: Functions of translanguaging

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Translation	23	23,0	23,0	23,0
	Clarification	33	33,0	33,0	56,0
	Vocabulary search	44	44,0	44,0	100,0
	Total	**100**	**100,0**	**100,0**	

The sample is balanced across institutions, with slightly more students from ESEF (52%) than FLLA (48%).

This balance supports valid comparisons of satisfaction or other variables by institution. The near-equal distribution of participants between FLLA and ESEF ensures that institutional effects on satisfaction or translanguaging can be reliably assessed.

Table 3: Distribution of Participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Flla	48	48,0	48,0	48,0
	Esef	52	52,0	52,0	100,0
	Total	**100**	**100,0**	**100,0**	

Descriptive analyses were conducted to examine students' satisfaction with language alternation when interacting with AI tools and to explore the distribution of language alternation types and translanguaging functions.

The results indicated that the mean satisfaction score was 4.04, suggesting generally high levels of satisfaction with language alternation in AI-mediated writing. The standard deviation (SD = 0.94) reflects moderate variability, indicating that while most students' responses clustered around the mean, some variation existed across participants. In addition, the minimum and maximum scores ranged from 1 to 5, demonstrating that the full Likert scale was utilized, thereby capturing both low and high levels of satisfaction.

These descriptive findings suggest that students largely perceived traslanguaging positively, although the moderate variability in responses indicates differences in individual experiences, engagement levels, or interaction with the AI tool.Min/Max = full 1–5 scale → full range of responses, capturing both low and high satisfaction.

Table 4: Levels of Satisfaction Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Satisfaction	100	1,00	5,00	4,0400	,94195
Valid N (listwise)	100				

Table 5 reports the results of normality statistical tests used to determine whether the satisfaction variable follows a normal distribution across three language alternation groups: Arabic–English, French–English, and Mixed Multilingual. The researcher applied the Kolmogorov–Smirnov test with Lilliefors correction and the Shapiro–Wilk test to assess the assumption of normality prior to conducting statistical analyses.

Table 5: Tests of Normality

	Langalteration	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Satisfaction	Arabicenglish	,253	31	,000	,815	31	,000
	Frenchenglish	,245	33	,000	,826	33	,000
	Mixedmultilingual	,200	36	,001	,852	36	,000
a. Lilliefors Significance Correction							

The results indicated significant departures from normality for the Arabic–English group (K–S = .253, $p < .001$; S–W = .815, $p < .001$), the French–English group (K–S = .245, $p < .001$; S–W = .826, $p < .001$), and the Mixed Multilingual group (K–S = .200, $p = .001$; S–W = .852,

$p < .001$). These findings suggest that the satisfaction scores were not normally distributed across the three language alteration conditions.

These distributions demonstrate sufficient variability to explore associations between satisfaction, language alternation, and translanguaging function.

A Kruskal–Wallis H test was conducted to examine whether there were statistically significant differences in satisfaction levels across the three language alteration groups: Arabic–English, French–English, and Mixed Multilingual. This non-parametric test was used because the normality assumption was violated in the earlier normality tests.

5.2 Kruskal-Wallis Test

Table 6: Ranks

	Langalteration	**N**	**Mean Rank**
Satisfaction	Frenchenglish	31	54,52
	Arabicenglish	33	50,62
	Mixedmultilingual	36	46,93
	Total	**100**	

The ranks table from the Kruskal–Wallis analysis indicated differences in satisfaction levels across the language alternation groups. The French–English group obtained the highest mean rank (54.52), followed by the Arabic–English group (50.62), while the Mixed Multilingual group showed the lowest mean rank (46.93). This pattern suggests that satisfaction was relatively higher among participants exposed to French–English language alteration compared to the other groups.

Table 7: Test Statistics a,b

H	**Satisfaction**
Chi-Square	1,281
df	2
Asymp. Sig.	,527
a. Kruskal-Wallis Test	
b. Grouping Variable: language alternation	

A Kruskal–Wallis H test was conducted to examine differences in satisfaction across the three language alternation groups (Arabic–English, French–English, and Mixed Multilingual). The results indicated that the differences in satisfaction scores were not statistically significant, $\chi^2(2) = 1.28$, $p = .527$. Although the French–English group showed the highest mean rank (54.52), followed by the Arabic–English group (50.62) and the Mixed Multilingual group (46.93), these differences were not statistically significant. This suggests that language alteration did not significantly affect participants' satisfaction levels.

5.3 Nonparametric Correlations

Table 8 : Spearman's rank-order correlations

			Satisfaction	Functranlang
Spearman's rho	Satisfaction	Correlation Coefficient	1,000	-,167
		Sig. (2-tailed)	.	,097
		N	100	100
	Functranlang	Correlation Coefficient	-,167	1,000
		Sig. (2-tailed)	,097	.
		N	100	100

A Spearman's rank-order correlation, as shown in Table 8, was conducted to examine the relationship between the function of translanguaging and students' satisfaction with AI-mediated writing. Results indicated a weak, negative correlation, $\rho = -0.167$, which was not statistically significant ($p = 0.097$, $N = 100$). The analysis revealed a weak, negative correlation between translanguaging function and satisfaction, which was not statistically significant. Thus, the type of translanguaging strategy employed by students does not meaningfully affect their satisfaction with AI-mediated writing.

6. Discussion

The present study set out to examine how multilingual learners deploy their linguistic repertoires in AI-mediated EFL writing, with particular attention to patterns of language use, the functions of translanguaging, and learners' satisfaction. Overall, the findings suggest that participants actively mobilized diverse linguistic resources while interacting with AI tools and reported relatively high levels of satisfaction. More importantly, the results provide empirical insight into how translanguaging operates within AI-mediated environments, contributing to ongoing debates about the role of digital technologies in shaping multilingual meaning-making.

With respect to patterns of language use, the relatively balanced distribution of Arabic–English, French–English, and mixed multilingual practices reflects the fluid and dynamic nature of learners' linguistic repertoires. Rather than indicating discrete instances of "language alternation," these patterns are more productively understood, from a translanguaging perspective, as the flexible orchestration of semiotic resources in response to task demands (García & Li Wei, 2014; Li Wei, 2018). The findings thus align with research emphasizing that multilingual learners do not operate within bounded language systems but draw on an integrated repertoire to mediate meaning-making processes (Canagarajah, 2011). In this sense, the observed variability across language practices should not be interpreted as categorical differences, but rather as context-sensitive realizations of translanguaging in action.

In relation to function, the predominance of vocabulary search and meaning clarification suggests that translanguaging in AI-mediated writing is primarily oriented toward lexical and cognitive scaffolding. Participants appeared to engage with AI tools

not as mechanisms for direct translation, but as dialogic resources that support lexical retrieval, semantic precision, and comprehension. This finding is theoretically significant in that it positions translanguaging as an epistemic practice, one through which learners actively construct knowledge by leveraging their full linguistic repertoires (García & Li Wei, 2014). At the same time, the relatively limited reliance on direct translation challenges assumptions that AI tools necessarily promote reductive or substitutional uses of language, instead pointing to more nuanced forms of multilingual engagement.

These patterns resonate with emerging scholarship on AI in language education, which conceptualizes AI systems as mediational tools that can extend learners' interactional and cognitive capacities (Jeon, 2024; Yuan & Liu, 2025). However, the present findings refine this perspective by demonstrating that such mediation does not occur in a linguistically neutral space; rather, it is shaped by learners' pre-existing multilingual repertoires and their strategic deployment in situated contexts. In this regard, AI-mediated writing can be understood as a site where human and technological resources intersect, enabling new configurations of multilingual meaning-making while remaining grounded in learners' agentive practices.

A further important finding concerns learners' satisfaction with translanguaging in AI-assisted writing. The relatively high satisfaction scores suggest that participants perceived these environments as supportive of their writing processes. This aligns with recent research highlighting the potential of AI tools to enhance engagement and foster more interactive learning experiences (Yu *et al.*, 2025). From a translanguaging perspective, such positive evaluations may reflect the extent to which AI-mediated environments implicitly legitimize the use of diverse linguistic resources, even if not explicitly designed to do so.

At the same time, the absence of statistically significant differences in satisfaction across language practices and translanguaging functions warrants closer consideration. Neither the type of linguistic repertoire deployed nor the specific function of translanguaging was associated with variations in satisfaction. This suggests that learners' positive orientations toward AI-mediated writing are not contingent on particular configurations of language use, but rather relate to broader perceptions of the tool's usefulness and accessibility. Importantly, this finding challenges any assumption that certain forms of translanguaging are inherently more effective or desirable than others. Instead, it reinforces a core tenet of translanguaging theory: that multilingual practices are inherently fluid, adaptive, and resistant to hierarchical evaluation (García & Li Wei, 2014; Vogel & García, 2017).

From a theoretical standpoint, the findings contribute to a growing body of work that seeks to extend translanguaging into digitally mediated and posthuman contexts. The interaction between learners and AI systems can be understood as a form of distributed meaning-making, in which agency is co-constructed across human and non-human actors. However, the lack of significant relationships between translanguaging practices and satisfaction suggests that AI tools, in their current form, may not substantially reshape how learners organize or prioritize their linguistic resources. Rather

than reconfiguring translanguaging practices, AI appears to provide an additional layer of support within which these practices unfold.

Accordingly, the findings suggest that AI-mediated writing environments can function as enabling spaces for multilingual learners, affording flexible engagement with linguistic resources without imposing rigid norms of language separation. Pedagogically, this underscores the value of integrating AI tools in ways that recognize and support learners' full linguistic repertoires, rather than constraining them within monolingual frameworks. At the same time, the results point to the need for more critical engagement with the ideological and design assumptions embedded in AI systems, particularly regarding their implicit orientation toward standardized target-language norms.

7. Conclusion

This study examined how Moroccan university students engage with AI-mediated EFL writing through the lens of translanguaging, focusing on the deployment of linguistic repertoires, the functions of multilingual meaning-making, and learners' satisfaction. The findings indicate that participants actively mobilized Arabic, French, and English in fluid and context-sensitive ways, reflecting the dynamic and integrated nature of their linguistic repertoires. Rather than relying predominantly on direct translation, learners engaged with AI tools primarily for lexical retrieval and meaning clarification, suggesting that these technologies function as mediational resources supporting cognitive and linguistic processes during writing.

While participants reported relatively high levels of satisfaction with AI-assisted writing, this satisfaction was not significantly associated with specific patterns or functions of translanguaging. This finding is theoretically significant in that it reinforces a central tenet of translanguaging scholarship: multilingual practices are flexible, adaptive, and not inherently hierarchical. Learners' positive orientations toward AI-mediated writing appear to be shaped less by how they deploy their linguistic resources and more by the perceived affordances of the technological environment itself.

From a pedagogical perspective, the results underscore the importance of designing AI-integrated EFL instruction in ways that recognize and legitimize learners' full linguistic repertoires, rather than privileging monolingual norms. AI tools, when positioned as mediational and dialogic resources, can create conditions that support multilingual meaning-making, lexical development, and learner engagement. At the same time, these findings invite a more critical consideration of the implicit linguistic ideologies embedded in AI systems, particularly their orientation toward standardized target-language norms.

Theoretically, this study contributes to emerging discussions on translanguaging in digitally mediated and posthuman learning environments by suggesting that AI does not fundamentally reconfigure how learners orchestrate their linguistic resources, but rather provides an additional layer of support within which these practices unfold. In

this sense, translanguaging remains a learner-driven, agentive process, even within technologically augmented contexts.

Future research should extend this line of inquiry by examining how different types of AI interaction (e.g., prompt design, feedback modes) may shape multilingual practices over time, and by exploring the longitudinal impact of AI-mediated translanguaging on writing development. Further work is also needed to investigate how pedagogical interventions can more explicitly leverage AI to foster critical multilingual awareness and more sophisticated forms of meaning-making. Such efforts will be essential for advancing our understanding of how human multilingual competence and artificial intelligence intersect in shaping the future of language education.

Conflict of Interest Statement
The author declares no conflicts of interest.

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