Concordia Journal of Administration and Education /https://concordia.org
Volume 6, No. 14 / nov-feb / ISSN: 3006-9912 / e-ISSN: 3006-9912
https://doi.org/10.62319/concordia.v6i14.60
Research article

Handwriting and Academic Writing among Students of English as a Foreign Language

Escritura a mano y escritura académica en estudiantes de inglés como lengua extranjera

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Received: August 10, 2026 **Peer-reviewed:** August 25, 2026 **Accepted:** September 24, 2026 **Published:** November 04, 2026

Keywords:
Academic writing; Handwriting; Cognitive load; Foreign language; Note-taking.

Palabras clave:
Escritura académica; Escritura a mano; Carga cognitiva; Lengua extranjera; Toma de notas.

Cómo citar:
Cabezas Arévalo, L. E., & Fuertes López, B. N. (2026). Handwriting and Academic Writing among Students of English as a Foreign Language. *Concordia Journal of Administration and Education, 6*(14), 1-14. https://doi.org/10.62319/concordia.v.6i14.60

Abstract

Introduction: Academic writing in English as a foreign language constitutes a demanding competence for university students. **Objective:** To evaluate the effect of a 16-week handwriting intervention on the quality of academic writing among 27 Business Administration students. **Methodology:** A mixed-methods design was adopted, in which pretest and posttest essays were scored using the ESL Composition Profile, while reflective journals (n = 24) were examined through thematic analysis. **Results:** The findings revealed an increase in the mean score from 68.2 to 93.4, with improvements across all assessed dimensions and greater relative gains in organization and language use, whereas mechanics showed the most modest change. Qualitative analysis linked these improvements to the Cornell note-taking system, transcriptions, mind maps, and autobiographical writing. **Conclusion:** Handwriting practice improves the quality of academic texts; however, the pilot design without a control group limits the generalizability of the findings.

Resumen

Introducción: La escritura académica en inglés como lengua extranjera es una competencia exigente para el estudiantado universitario. **Objetivo:** Evaluar el efecto de una intervención de escritura a mano de 16 semanas sobre la calidad de la escritura académica en 27 estudiantes de Administración de Empresas.

Metodología: Se adoptó un diseño de métodos mixtos, en el cual los ensayos de pretest y posttest se califican con el Perfil de Composición ESL, y los diarios reflexivos (n = 24) se examinan mediante análisis temático. **Resultados:** Los hallazgos muestran un incremento del promedio de 68.2 a 93.4, con avances en las dimensiones evaluadas y mayores cambios relativos en organización y uso del lenguaje, mientras que la mecánica ortográfica presenta el cambio más modesto. El análisis cualitativo vincula estos cambios con el sistema Cornell, las transcripciones, los mapas mentales y la escritura autobiográfica. **Conclusión:** La práctica de escritura a mano mejora la calidad del texto académico, aunque el diseño piloto sin grupo de control limita la generalización.

Introduction

Academic writing is among the most demanding competencies in university education and its instruction in English as a foreign language places an additional cognitive burden on Ibero-American students. Reviews of writing instruction concur that programs with clear objectives, explicit scaffolding, and distributed practice produce higher-quality texts than courses based on sporadic correction (Graham & Perin, 2007). Likewise, comparative studies of typing and pen-based writing indicate that the mode of production influences written text, although the effect varies according to age and task type (Feng et al., 2019). The discussion has shifted toward how to leverage handwriting in Spanish-speaking university classrooms in which English serves as the language of instruction.

Cognitive models of composition describe writing as a system of interdependent operations, namely planning, text generation, and revision (Hayes & Flower, 1980). A central assumption is that transcription skills, including graphomotor skills and spelling, become automated and free resources for higher-order processes (Hayes, 2012). Recent evidence supports this relationship, as handwriting fluency among university students is associated with longer bursts and higher-scoring texts (Carnota et al., 2024). In early schooling, handwriting fluency predicts writing quality (Alves & Limpo, 2015), and training this fluency improves performance (Limpo & Graham, 2020). Thus, the automation of transcription functions as a prerequisite for academic writing production.

When writing occurs in a second language, working memory absorbs linguistic demands that are almost transparent in the native language. The working memory model of writing distinguishes phonological, visuospatial, and executive resources that compete during composition (Kellogg, 1996). This competition becomes more pronounced in a foreign language because less fluent writers produce short bursts and frequent pauses, which are associated with lower-quality texts (Chenoweth & Hayes, 2001). Subsequent

studies confirm that working memory and linguistic competence condition performance in L2 composition (Vasylets & Marin, 2021). Likewise, Li, (2023) reports consistent relationships between cognitive capacity and text quality; thus, automating handwriting emerges as a means of alleviating this burden in the classroom.

The biological basis of handwriting is supported by direct experimental evidence. Using high-density electroencephalography, Van der Weel and Van der Meer (2024) observed that handwriting activates more extensive patterns of brain connectivity than keyboard writing, which are associated with learning and memory. The precise manipulation of the writing instrument and tactile feedback may explain this advantage, which is absent in typing. Neuroimaging studies involving children link handwriting acquisition to reading networks (Loh et al., 2024), and paper-based notes outperform laptop notes in comprehension and memory (Mueller & Oppenheimer, 2014). In the foreign-language university classroom, these findings raise the hypothesis that deliberate practice strengthens attention to form and lexical retention.

The available evidence presents nuances that should be specified. A recent meta-analysis of typed and handwritten note-taking highlights moderate advantages of the handwritten format, with results depending on age and task duration (Flanigan et al., 2024). In a second language, note-taking modes affect listening comprehension tests, in which handwritten notes outperform digital notes (Kim, 2026). The same pattern is observed between handwriting fluency and text quality in primary education (Skar et al., 2021). However, gaps remain, as most studies have been conducted with native speakers or school-age populations, and few have explored structured interventions among university students learning English as a foreign language, where typing and graphomotor difficulties coexist (Rosenberg-Adler & Weintraub, 2020; Stuart & Barnett, 2025).

The pedagogical design of the study is grounded in two well-established traditions. On the one hand, the process-genre approach combines the stages of the writing process with explicit instruction in academic genres (Badger & White, 2000), a framework represented in the literature compiled by MacArthur et al. (2006). On the other hand, the Cornell method organizes the page into keywords, cues, notes, and a summary, a structure developed for university study (Pauk & Owens, 2013) that aligns with the implications of neuroscience for writing instruction (Berninger & Winn, 2006). Both converge on the principle that when text production is supported by visible structures and deliberate practice, students have more resources available to attend to content and form.

This study is justified by the scarcity of local evidence on low-cost manual resources in Ibero-American universities, where pressure for digitalization coexists with highly heterogeneous initial English proficiency levels and discomfort with second-language writing (Guvendir & Uzun, 2023). The general objective was to evaluate the effect of a

structured 16-week handwriting intervention on the academic writing quality of fourth-level Business Administration students at the Escuela Superior Politécnica de Chimborazo. Three research questions guided the study: to what extent does the intervention improve overall text quality? How does each dimension of the ESL Composition Profile change? And what perceptions do students hold regarding its four components?

Methodology

The study adopted a concurrent embedded mixed-methods design (QUAN + qual), following the terminology of Creswell and Plano (2018). The quantitative strand served as the primary axis, while the qualitative strand was integrated simultaneously at several points throughout the 16-week intervention. This simultaneity was useful because it enabled the students' experiences to be recorded in real time, sustained a feedback loop between the initial reflective journals and instructional decisions, and provided an interpretive framework for explaining score changes. Unlike the explanatory sequential design, in which qualitative data are collected after the numerical phase has concluded, both types of evidence coexisted throughout the intervention. Following the intervention, both datasets were integrated at the end.

The population consisted of 27 fourth-level students enrolled in the Business Administration program at the Escuela Superior Politécnica de Chimborazo, selected through convenience sampling from the existing classroom cohort. The placement test classified participants at A1 (15%, n = 4), A2 (41%, n = 11), B1 (26%, n = 7), B2 (4%, n = 1), and C1 (15%, n = 4) levels of the Common European Framework. A power analysis conducted using G Power 3.1 for a paired t-test ($d = 0.5$, $\alpha = 0.05$) indicated that 34 cases were required to achieve a power of 0.80. With the 27 available participants, the achieved power was 0.70; this figure is reported transparently and frames the study as a pilot investigation.

The quantitative instruments included the placement test, 2,000-word autobiographical pretest and posttest essays, weekly essay transcriptions, and timed handwriting fluency tests. Written products were scored using the ESL Composition Profile (Jacobs et al., 1981), which assesses five dimensions: content (30), organization (20), vocabulary (20), language use (25), and mechanics (5). The qualitative component drew on handwritten reflective journals in weeks 4 and 16, field notes, a mini focus group, observations of oral presentations, and a final perceptions survey. The 10- to 15-minute oral presentations were prepared using Cornell notes and handwritten glossaries, thereby linking the intervention to spoken academic discourse.

The intervention was implemented over 16 weeks and integrated four components, including weekly handwritten transcriptions of audio recordings and readings, the

Cornell note-taking system, mind maps, and autobiographical writing. The transcriptions were based on short audio recordings and readings; the Cornell system accompanied theoretical classes; mind maps initiated the planning of each essay; and autobiographical writing provided the initial material for the drafts. The data collection schedule is described in Table 1. Participants signed informed consent forms, journals were anonymized using ST-XX codes, and data were handled confidentially in accordance with institutional regulations. Each session combined a source text with handwritten copying and concluded with Cornell notebook work, and attendance was recorded weekly.

Table 1. *Intervention and data collection schedule.*

Phase and period	Data collection activities	Data type
Pre-intervention (weeks 1–2)	Placement test; autobiographical essay (pretest)	Quantitative
Block 1 (weeks 3–6)	Weekly transcripts; reflective journal 1 (week 4)	QUAN + qual
Block 2 (weeks 7–10)	Transcripts; field notes and video observation (week 8)	QUAN + qual
Block 3 (weeks 11–14)	Transcripts; mini focus group (week 12)	QUAN + qual
Block 4 (weeks 15–16)	Transcripts; reflective journal 2 (week 16); posttest and survey	QUAN + qual

Note. QUAN = quantitative strand; qual = qualitative strand. Data were collected concurrently throughout the 16-week intervention, with an analytic closure at the end of each block. Activities were distributed evenly.

Three safeguards were established to control researcher-teacher bias. The first consisted of a reflective log documenting classroom decisions and points at which the teaching role could bias the assessment. The second involved blind grading of the final essays by an external English instructor who was not involved in the intervention design. The third provided for the calculation of inter-rater reliability using Cohen's kappa and the intraclass correlation coefficient, with a minimum acceptance threshold established a priori. Blinding was verified before each scoring session, and discrepancies exceeding two points per dimension triggered a third review. The external instructor received the essays in random order. Scores were compared by dimension prior to analysis.

Quantitative analysis consisted of paired-samples t-tests with Cohen's d and 95% confidence intervals for the pretest-posttest comparison. Qualitative data from the journals were examined through thematic analysis in six sequential phases, involving initial open coding, pattern identification, and review of themes against the full dataset. Credibility was supported through triangulation of sources and time points, participant checking, and a reflective log, criteria aligned with the discipline's classical standards. Differences with $p < .001$ were reported using the available value, and intervals were calculated at the 95% confidence level. Qualitative material was coded twice to ensure thematic stability. Discordant cases were compared against the original text.

Results

Mean scores on the ESL Composition Profile increased from 68.2 (SD = 7.1) at pretest to 93.4 (SD = 4.3) at posttest. The 25.2-point difference was statistically significant, t (26) = 11.45, p < .001, 95% CI [20.68, 29.72], with a Cohen's d of 2.21. The gain was equivalent to 36.9% and placed the cohort in the instrument's high range. Score dispersion decreased at posttest, with the standard deviation declining from 7.1 to 4.3, indicating greater group homogeneity after the 16 weeks. However, the effect size should be interpreted within the context of a design without a control group, as detailed in the discussion.

Scoring reliability was examined through double scoring of a set of essays by the researcher and the external instructor, both blinded to the time point of administration. Cohen's kappa ranged from 0.82 to 0.86 across the five dimensions, and the intraclass correlation coefficient for the total score was 0.88. According to the classical thresholds proposed by Landis and Koch (1977), these values indicate almost perfect agreement and exceeded the a priori minimum criterion of 0.80. Such a margin is relevant because the five dimensions were scored using different ranges. Inter-rater consistency supports the comparability of pretest and posttest scores and validates the use of score differences as an indicator of changes in written-text quality.

Examination by dimension revealed a differentiated pattern (Table 2). Organization showed the greatest relative gain (+46.1%), followed by language use (+39.8%), vocabulary (+38.9%), content (+29.5%), and mechanics (+28.1%). Content increased from 22.0 (SD = 2.4) to 28.5 (SD = 1.1) out of 30, whereas organization rose from 12.8 (SD = 1.8) to 18.7 (SD = 0.9) out of 20. Language use increased from 17.1 (SD = 2.1) to 23.9 (SD = 1.2) out of 25, and vocabulary from 13.1 (SD = 1.9) to 18.2 (SD = 1.0) out of 20. Mechanics, by contrast, increased from 3.2 (SD = 0.6) to 4.1 (SD = 0.5) out of 5, representing the most modest improvement.

Table 2. *Mean scores by dimension of the ESL Composition Profile before and after the intervention.*

ESL Profile Dimension	Max.	Pretest M (SD)	Posttest M (SD)	Relative Change from Pretest (%)	t(26)	p	95% CI
Content	30	22.0 (2.4)	28.5 (1.1)	+29.5	16.75	< .001	[5.70, 7.30]
Organization	20	12.8 (1.8)	18.7 (0.9)	+46.1	20.36	< .001	[5.30, 6.50]
Vocabulary	20	13.1 (1.9)	18.2 (1.0)	+38.9	16.69	< .001	[4.47, 5.73]
Language Use (Grammar)	25	17.1 (2.1)	23.9 (1.2)	+39.8	20.12	< .001	[6.10, 7.50]

Mechanics (Spelling and Punctuation)	5	3.2 (0.6)	4.1 (0.5)	+28.1	8.84	< .001	[0.69, 1.11]

Note. SD = standard deviation; CI = confidence interval. Relative change was calculated as [(posttest − pretest) / pretest] × 100 and depends on the baseline value of each dimension; therefore, it should not be interpreted as a direct comparison across dimensions with different maximum scores. The p values were derived from paired-samples t-tests (n = 27). The five dimensions comprise the instrument's overall score.

The final survey was consistent with this pattern: 100% of the cohort reported greater English handwriting fluency, with 31% rating it as greatly increased and 69% as slightly increased. In the ranking of five skills, 45% placed grammatical accuracy first. On the qualitative strand, the reflective journals of 24 students were analyzed using Braun and Clarke's (2006) method, which organizes the material into phases of familiarization, coding, theme searching, reviewing, defining, and writing. The analysis yielded themes that explained score changes, including the metacognitive synthesis promoted by the Cornell system, orthographic attention fostered by transcriptions, the visual representation of mind maps, and the affective resonance of autobiographical writing.

The first theme described the Cornell system as a synthesis framework. The complete page layout, with columns for keywords, cues, notes, and summary, required students to process, filter, and prioritize information rather than copy it. Student ST-2 expressed this clearly: "the summary at the bottom forces me to put everything in my own words, and that makes a difference when I study." Other participants reported time savings and improved organization, such as ST-8, for whom the method made it possible to divide the page into useful sections and focus on relevant concepts. This reorganization work aligns with the increases in organization (+46.1%) and content (+29.5%) and shows that the physical template functioned as an external framework for academic writing.

The second theme addressed handwritten transcriptions. Copying audio recordings and readings word for word required students to pause and attend to graphemes, morphemes, and linking devices that often go unnoticed during rapid listening. ST-2 acknowledged that writing by hand forces one to slow down and attend to every word, whereas ST-4 linked the practice to improved listening comprehension. One particular case merits special mention: student ST-16, who transcribed economic literature, among many other texts (Adam Smith's The Wealth of Nations), and reported an expanded technical vocabulary and improved contextual understanding. Nevertheless, spelling mechanics remained the group's most vulnerable area, consistent with the lowest recorded gain (+28.1%). These accounts are consistent with the vocabulary score (+38.9%).

Mind maps constituted the third theme because, by connecting a central idea with branches, colors, and keywords, students organized projects and business plans more clearly, as reported by ST-24. ST-11 added that the same branches served as an outline

for their oral presentations. The fourth theme showed that autobiographical writing brought language closer to students' own experiences. ST-19 associated the activity with practice in past tenses and personal vocabulary, and ST-21 highlighted its encouragement of self-reflection. To integrate both strands, a joint display was constructed (Table 3), a format recommended by Guetterman et al. (2015), and the triangulation of journals, field notes, and Cornell tools followed the criteria of Lincoln and Guba (1985). Each quantitative dimension received thematic support.

Table 3. *Mixed-methods integration: quantitative gains, qualitative themes, and interpretive mechanisms.*

Dimension	Qualitative Theme	Illustrative Quote	Interpretive Mechanism
Organization	Theme 1: metacognitive synthesis (Cornell)	"the bottom summary forces me to put everything into my own words" — ST-2	The spatial template externalizes text organization and shifts copying toward active synthesis.
Vocabulary	Theme 2: letter-by-letter orthographic attention	"writing by hand forces you to slow down and attend to every word" — ST-2	Motor slowing concentrates attention on form and facilitates lexical encoding.
Language Use	Theme 4: affective resonance and grammar	"practicing personal vocabulary and past tenses" — ST-19	Anchoring structures in personal narratives reduces discomfort and promotes the production of complex syntax.
Mechanics	Theme 2: persistent orthographic bottleneck	"spelling can be tricky; writing word by word helps avoid mistakes" — ST-11	Automating opaque orthography requires sustained practice and extends beyond the timeframe of a single course.

Note. Quantitative effect sizes are reported in Table 2; this table integrates only the correspondence among dimensions, themes, quotations, and mechanisms. Quotations were drawn from reflective journals (n = 24) and are presented in the authors' translation.

Mind maps also functioned as outlines during the oral presentations in Week 16. ST-11 explained that the branches enabled them to organize their thoughts and speak without reading a lengthy text: "I only looked at the keywords and explained them." ST-24 described how the visual map structured the identity of their brands and consumer needs in a business plan.

The transition from paper to spoken language shows that handwritten outlines are not confined to writing; rather, they also support the oral retrieval of content, reduce dependence on prepared slides, and provide confidence to learners who still hesitate when producing spoken English. The four presentations in the final unit provided evidence of transfer between handwritten preparation and oral performance.

Discussion

The overall increase of 25.2 points and a d of 2.21 place the intervention among those reporting the largest effects in foreign-language writing. This magnitude exceeds what is typically observed in brief interventions. According to Carnota et al. (2024), handwriting fluency is associated in university samples with longer bursts and higher text quality, a relationship activated here through explicit training rather than merely through correlational measurement. Meta-analyses of production modality concur regarding the direction of the effect, although the magnitude is more modest (Feng et al., 2019; Flanigan et al., 2024). This difference suggests that distributed practice over 16 weeks produces greater gains than those observed in single-session cross-sectional comparisons.

The cognitive explanation rests on two distinct levels. The first is biological: handwriting integrates fine motor movements and tactile feedback that activate extensive brain connectivity, a pattern absent during keyboard use according to the high-density electroencephalography study by Van der Weel and Van der Meer (2024). The second is functional, as composition requires coordinated phonological and visuospatial processing and therefore consumes working-memory resources (Kellogg, 1996); in a second language, this capacity is already constrained by lexical and grammatical demands (Vasylets & Marin, 2021; Li, 2023). When transcription becomes automated, students have greater cognitive capacity available for planning and revision. This interpretation is consistent with the gains in organization and language use observed in the study.

The Cornell system functions as an external organizer that guides retrieval and synthesis, a role its authors describe in the context of university teaching (Pauk & Owens, 2013). When used as an essay prewriting organizer, the method aligns with the process-genre approach, in which planning, drafting, and revision are supported by explicit tools (Badger & White, 2000). The results are consistent with the literature on note-taking modality, in which handwritten notes promote comprehension relative to digital transcription (Mueller & Oppenheimer, 2014), a pattern replicated in foreign-language contexts, where handwritten notes outperform digital notes in listening-comprehension tests (Kim, 2026). In the classroom, the cue column and summary transform note-taking into a productive task rather than a copying exercise.

Autobiographical writing introduces an affective component that recent literature associates with performance: L2 writing anxiety, which is linked to lower-quality texts and limited use of working memory (Guvendir & Uzun, 2023). By writing about their own experiences, students reduce the distance between the language to be practiced and their interests, a pattern consistent with the notion that writing bursts increase when content is accessible (Chenoweth & Hayes, 2001; Alves & Limpo, 2015). The improvement in language use (+39.8 %) is consistent with this process. Sustaining

handwritten practice beyond the course is reasonable, given that fluency is consolidated through deliberate practice rather than occasional exposure (Limpo & Graham, 2020).

The Ecuadorian context warrants separate consideration. The modernization of university classrooms has prioritized digital tools and, consequently, typing as the primary means of text production (Mueller & Oppenheimer, 2014), whereas handwriting is generally reserved for basic levels of schooling. This separation overlooks the fact that business education requires the precise drafting of reports, memoranda, and analyses, and that the workload involved in a foreign language multiplies the cognitive demands of each draft. The results presented here indicate that reintroducing deliberate handwritten practice in university courses entails no technological costs and can coexist with the regular use of spreadsheets and presentations. The proposal does not replace digital tools; rather, it complements them.

This study provides an integrated interpretation of traditions that are often addressed separately, including writing-process models, working memory in second-language learning, and neurocognitive evidence on graphomotor skills. By linking transcription automatization to the available cognitive capacity, the findings complement the classic framework of writing processes (Hayes, 2012) and the description of writing bursts as a predictor of text quality (Chenoweth & Hayes, 2001). This integration is useful for the design of university English courses, in which content planning often receives greater attention than the mechanical production of text, despite the fact that both operate jointly during composition and mutually support one another when transcription no longer requires conscious effort.

Despite the results, the study has limitations associated with the absence of a randomized control group, which makes it impossible to disentangle the effect of the intervention from maturation, test familiarity, and English instruction; thus, the d of 2.21 represents an upper bound, and comparative designs constitute the next step (Creswell & Plano, 2018). The statistical power of 0.70, convenience sampling, and self-reported journals limit generalizability, as does the tension between typing and graphomotor skills in higher education. In particular, the proposed affective mechanism is supported solely by self-reports from the journals; no independent measures of writing anxiety or cognitive load were administered. Therefore, the affective interpretation should be regarded as a plausible hypothesis rather than a confirmed mechanism. Replicating the study with larger cohorts, longitudinal follow-up, and neurocognitive evidence, as suggested by Loh et al. (2024) and Skar et al. (2021), would make it possible to confirm the stability of the effects.

From a pedagogical perspective, the findings support the integration of handwriting for academic purposes into course planning rather than treating it as an isolated activity. Programs with explicit objectives and distributed practice yield more stable transfer effects than sporadic activities (Graham & Perin, 2007), and the use of the Cornell

system as an essay pre-organizer links note-taking to the planning, drafting, and revision cycle of the genre-process approach (Badger & White, 2000; Pauk & Owens, 2013). Sustaining handwriting fluency training throughout the degree program, through short and progressively structured tasks, frequent feedback, and no additional software costs, appears to be a realistic and cost-effective strategy for strengthening academic writing in a foreign language (Limpo & Graham, 2020).

Conclusions

The findings of this pilot study show that participation in a structured 16-week handwriting intervention is associated with improved academic writing quality in the assessed cohort, as the overall mean increased from 68.2 to 93.4 points, with a large effect size. However, because the design lacked a randomized control group, these changes cannot be attributed exclusively to the intervention; rather, they should be interpreted as covariation also compatible with maturation, test familiarity, and concurrent English instruction. The gains were not evenly distributed; organization and language use showed the greatest relative improvements, whereas spelling mechanics remained the aspect most resistant to change, a pattern consistent with the literature on transcription automatization.

The qualitative component suggests possible explanatory mechanisms for this association rather than demonstrated causal relationships. The Cornell system functions as an active synthesis framework, handwritten transcriptions as a means of focusing attention on form, mind maps as prior organizers of thought, and autobiographical narratives as an affective bridge to grammar. The journals of 24 students make it possible to trace this process in their own words; however, as self-reports based on a single perceptual source, their value is interpretive and complementary rather than confirmatory. The combination of the four resources jointly addresses planning, form, and motivation, although their relative usefulness compared with other approaches remains to be examined.

Overall, the study is consistent with the hypothesis that training handwritten production for academic purposes accompanies measurable improvements in foreign-language texts, even among groups with heterogeneous initial proficiency levels. However, the limited statistical power (0.70), convenience sampling, and absence of comparison preclude generalizing the findings and establishing causal relationships. Future replications incorporating a control group, larger cohorts, and independent measures of cognitive load or writing anxiety would make it possible to determine whether the observed association is sustained and explained by the mechanisms proposed here.

About

Author Contributions: The authors contributed to the conceptualization of the study, methodological development, data analysis and interpretation, manuscript drafting, and critical review of its intellectual content. Both authors approved the final version for publication.

Funding: The authors declare that they received no funding for this research.

Conflict of Interest: The authors declare that they have no conflicts of interest for the publication of this scientific article.

Ethical Certification: The protocol for this study was submitted for review and approved by the University Research Ethics Committee, in compliance with applicable ethical principles and institutional regulations.

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