

Teaching English for Specific Purposes through Content-Based Instruction in Food Security Terminology: Effects on Indonesian EFL Students' Writing

Nurhaedah Gailea¹, Syafrizal^{1,*}, John Pahamzah¹, & Andri Kurniawan²

¹Department of English Education, Universitas Sultan Ageng Tirtayasa, Indonesia

²Department of English Education, Universitas Islam Syekh Yusuf, Indonesia

*Corresponding email: andri.kurniawan@unis.ac.id

Received: 20 July 2026

Accepted: 24 August 2026

Published: 14 September 2026

Abstract: This study examined the effects of content-based instruction (CBI) using food-security terminology and of learner creativity on university EFL writing achievement. A quasi-experimental 2×2 factorial design involved 80 students selected by cluster random sampling (20 per cell). One class received CBI and the other problem-based learning (PBL); creativity was measured with a 30-item questionnaire and dichotomized at the class median. Data were analyzed using descriptive statistics, assumption tests, two-way ANOVA, and Tukey HSD comparisons. Two-way ANOVA revealed a significant main effect of teaching method, $F(1, 76) = 5.82, p = .018$, partial $\eta^2 = .071$; a significant main effect of creativity, $F(1, 76) = 4.88, p = .030$, partial $\eta^2 = .060$; and a large, significant interaction, $F(1, 76) = 37.80, p < .001$, partial $\eta^2 = .332$. CBI produced a higher overall mean than PBL (70.95 vs. 67.40), and highly creative students outperformed less creative students (70.80 vs. 67.55). Still, the interaction was crossover: Tukey comparisons showed that CBI-high creativity ($M = 77.10$) exceeded every other cell, whereas low-creativity learners scored higher under PBL ($M = 70.30$) than under CBI ($M = 64.80$). Authentic food-security content can strengthen ESP writing, but differentiated scaffolding is required because the relative effectiveness of CBI and PBL is conditional on learner creativity.

Keywords: content-based instruction, english for specific purposes, food security, EFL writing, learner creativity.

Article's DOI: <https://doi.org/10.23960/jpp.v16i3.pp1768-1783>

■ INTRODUCTION

English for Specific Purposes (ESP) is designed around learners' need to use English within a particular academic, occupational, or professional domain, so that course content is derived from an analysis of the target situation rather than from a general syllabus (Basturkmen, 2014; Flowerdew, 2015). In university EFL settings, ESP instruction is therefore expected to develop language competence while simultaneously enabling students to engage with disciplinary knowledge (Tzoannopoulou, 2015). Food security is a relevant content domain for this purpose because it connects language learning with current concerns involving climate variability,

population growth, and economic disruption (Godfray & Garnett, 2014; Mbow et al., 2019; Müller & Lotze-Campen, 2012). Global monitoring reports indicate that access to adequate and nutritious food remains uneven across regions (FAO et al., 2023; Webb et al., 2018), and machine-learning work on predicting food-security transitions has further expanded the field's technical vocabulary (Westerveld et al., 2021). Studies of university populations show that food insecurity is not only a social and nutritional issue but also an educational concern that can affect students' participation and academic experience (Eche & Hernández-Herrera, 2018; Henry, 2020). Integrating content and language

is thus a core principle of contemporary ESP (Stoller, 2015).

Content-based instruction (CBI) uses subject matter as the vehicle for second language teaching, providing authentic input and a clear thematic structure that can support vocabulary acquisition and written production (Richards & Rodgers, 2014; Stoller, 2015). Because learners encounter linguistic forms within coherent disciplinary discourse rather than in isolated exercises, they are expected to connect prior knowledge, new content, and the language needed to communicate that content (Dalton-Puffer, 2016; Nurjannah et al., 2020). Meta-analytic evidence indicates a positive overall effect of content-based and content-and-language-integrated instruction on EFL writing and on English proficiency more generally (Cen, 2021; Lo & Jeong, 2019), and classroom studies report gains in reading comprehension (Apsari, 2018), in secondary-school writing (Suzuki, 2021), and in technical report writing when an adjunct CBI model supplies the necessary knowledge base (Chekol et al., 2023). Technology-enhanced and thematically organized CBI has likewise been found to strengthen engagement in EFL writing because students work with information that is purposeful and relevant (Sariani et al., 2022), and recent ESP work has extended the approach to twenty-first-century skills and to flipped, genre-based academic writing instruction (Ahmad & Tuomainen, 2026; Kang et al., 2026).

Problem-based learning (PBL) offers a related but distinct orientation. It begins with an authentic problem that learners investigate collaboratively while the teacher acts as a facilitator, and it is valued for fostering autonomy, transfer, and professional learning (Ali, 2019; Hung, 2015; Yew & Goh, 2016). In EFL writing specifically, PBL has been associated with improved argumentative writing and critical thinking (Fitriani & Gani, 2021; González-Geraldo & González-Herrero, 2017; Jumariati

& Sulistyo, 2017), and project-based variants have been used successfully in Indonesian and Omani teacher-education contexts (Al-Busaidi, 2021). Its effectiveness, however, may depend on learners' readiness, prior knowledge, and capacity to generate and organize ideas without extensive external structure.

Learner creativity is consequently important in writing instruction, because writing requires learners to select, develop, and structure ideas rather than merely reproduce linguistic forms (Hyland, 2016). Creativity is commonly conceptualized as a set of divergent-thinking dispositions (fluency, flexibility, originality, and elaboration) that can be measured through self-report and performance instruments (Said-Metwaly et al., 2017) and is increasingly treated as a learnable classroom capacity rather than a fixed trait (Karwowski & Beghetto, 2019). Interventions that stimulate idea generation, such as brainstorming and creative-writing activities, have been shown to improve EFL writing outcomes (Al-Dhamit & Al-Subh, 2019; Harizaj & Çeliku, 2020; Szabó-Szettele & Kárpáti, 2023), and creative-thinking approaches embedded in project work have produced comparable benefits (Hsia & Hwang, 2016). Task design that grants learners agency has also been linked to flow experiences in L2 writing (Wu & Albert, 2024). It is therefore plausible that highly creative learners and less creative learners respond differently to highly structured content support on the one hand and open-ended problem solving on the other.

Despite an extensive literature on CBI and PBL considered separately, three gaps remain. First, food-security terminology has rarely been used as the content base of an ESP writing course, even though it is a socially urgent and lexically rich domain. Second, CBI and PBL have seldom been compared directly within a single factorial design in an Indonesian university EFL setting. Third, and most importantly, learner

creativity has usually been treated as an outcome or a covariate rather than as a moderator that may reverse the relative advantage of one method over another; the one Indonesian study that did examine CBI in relation to learner creativity treated creativity as a single grouping variable without a competing method (Jaelani, 2017). The present study addresses these gaps by comparing CBI and PBL within a 2×2 factorial design in which learner creativity is modeled as a second factor. Accordingly, three research questions were formulated: (1) Is there a significant difference in writing achievement between students taught through CBI and students taught through PBL? (2) Is there a significant difference in writing achievement between students with high and low creativity? (3) Is there a significant interaction between teaching method and learner creativity on writing achievement?

METHOD

Research Design

The study employed a quasi-experimental factorial design with two instructional methods and two creativity levels. Teaching method consisted of content-based instruction (A_1) and problem-based learning (A_2), while learner creativity consisted of high creativity (B_1) and low creativity (B_2). The dependent variable was EFL writing achievement. The design enabled the study to test the main effect of teaching method, the main effect of creativity, and the interaction between the two independent variables. Intact classes were used because random assignment of individual students was not administratively possible; the design is therefore quasi-experimental rather than fully randomized. Figure 1 summarises the factorial structure.

The Design of 2×2 ANOVA

Teaching Methods	Content-Based Instruction A_1	Problem-Based Learning A_2
High Creativity (B_1)	First group EFL Learners ($A_1 B_1$)	Second group EFL Learners ($A_2 B_1$)
Low Creativity (B_2)	Third group EFL Learners ($A_1 B_2$)	Fourth group EFL Learners ($A_2 B_2$)

Figure 1. The 2×2 factorial design used in the study

Participants and Sampling

The population comprised 120 university EFL students distributed across three intact classes (A, B, and C), with 40 students in each class. Cluster random sampling was used to select two classes, resulting in a sample of 80 students. The two selected classes were then randomly assigned to the instructional conditions: one class received content-based instruction and the other received problem-based learning. Within each class, students were subsequently classified as having high or low creativity, producing four

factorial cells of 20 students each. Before data collection, all students were informed about the purpose and procedures of the study and provided written informed consent; participation carried no consequence for course grades.

Because intact classes were compared, the baseline equivalence of the two groups was examined before the intervention. Table 1 reports the demographic profile of the participants together with their scores on the institutional English placement test administered at the

beginning of the semester. The two groups did not differ significantly on any background characteristic, which supports the assumption that

post-treatment differences are attributable to the instructional conditions rather than to pre-existing disparities.

Table 1. Participant allocation by instructional group and creativity level

Characteristic	A ₁ (CBI) n = 40	A ₂ (PBL) n = 40	Total N = 80
High creativity (B ₁), n (%)	20 (50.0)	20 (50.0)	40 (50.0)
Low creativity (B ₂), n (%)	20 (50.0)	20 (50.0)	40 (50.0)
Total, n (%)	40 (100)	40 (100)	80 (100)

Note. A₁ = content-based instruction (CBI); A₂ = problem-based learning (PBL); B₁ = high creativity; B₂ = low creativity. Percentages are calculated within instructional group and for the total sample

Instructional Treatments and Procedure

The CBI treatment introduced food-security terminology through authentic or adapted texts drawn from FAO reports, news features, and popular-science articles. Each of the eight weekly meetings followed the same sequence: activation of background knowledge, explicit attention to key vocabulary, analysis of how food-security concepts are expressed in connected text, oral discussion, guided writing, and independent writing. The sequence therefore moved from exposure and comprehension to language practice and written production, so that students used the terminology in meaningful contexts rather than in isolated exercises.

The comparison class was taught through PBL over the same eight meetings and with the same total instructional time. Students worked in small groups with food-security-related problem scenarios, identified the information needed to understand each problem, discussed possible explanations, consulted sources, and developed written responses. The teacher facilitated the inquiry process and supported language use on demand. Both groups addressed comparable content and completed an equivalent number of writing tasks. Still, the organization of learning differed: CBI foregrounded systematic content and language scaffolding, whereas PBL foregrounded collaborative problem-solving.

Both classes were taught by the same lecturer to control for teacher effects, and a fidelity checklist was completed after each session.

Instruments and Data Collection

Writing achievement test

Writing achievement was measured through an argumentative writing task administered after the instructional treatments. Students responded to a food-security prompt and were given 90 minutes to plan, draft, and revise a text of approximately 300 words. The scripts were scored using an analytic rubric adapted from the ESL Composition Profile (Jacobs et al., 1981), covering five weighted criteria: content and topical relevance (30 points), organization (20 points), vocabulary and terminological accuracy (20 points), language use (25 points), and mechanics (5 points), for a maximum score of 100. Comprehensibility was defined as the extent to which a reader could recover the intended message and follow the organization of the text (Derwing, 2018). Task directions and scoring criteria were reviewed before administration to ensure that the expected response was clear and consistent for both instructional groups.

Raters and inter-rater procedure

Two lecturers in the English Education Department, each holding a master's degree in English language teaching and having at least five

years of experience assessing academic writing, scored all scripts independently. Neither rater taught the participating classes. Scripts were anonymized and contained no indication of instructional condition. Before formal scoring, the raters completed a two-hour calibration session using five benchmark scripts and discussed scoring differences to establish a common interpretation of the rubric. Inter-rater agreement was evaluated using a two-way mixed-effects, absolute-agreement, average-measures intraclass correlation coefficient for the total writing score and Cohen's kappa for the ordinal criterion bands, following the reporting principles described by Koo and Li (2016). Any discrepancy greater than five points was resolved through discussion, and the mean of the two raters' scores was used as the final writing-achievement score for analysis.

Creativity questionnaire

Learner creativity was measured using a printed 30-item questionnaire covering six indicators: fluency, flexibility, originality, elaboration, curiosity, and risk-taking. Each item used five response options, producing a possible total score from 30 to 150. The instrument was piloted with 40 students from a class that was not included in the research sample. Item validity was examined through corrected item-total

correlations using the critical value $r = .312$ for $n = 40$ at $\alpha = .05$; all 30 items were retained after the pilot screening. Internal consistency was evaluated using Cronbach's alpha as the reliability index for the questionnaire. The same instrument, instructions, response format, and time allocation were used for the two research classes; only the administration schedule differed because of class timetabling.

Categorization and data-collection sequence

The continuous creativity scores were dichotomized separately within each intact class using the class median as the cut-off point because the 2×2 factorial design required a categorical learner factor. In each class, the 20 students at or above the median were assigned to the high-creativity level (B_1), while the 20 students below the median were assigned to the low-creativity level (B_2). The within-class median split retained all 80 participants and produced four equal cells of 20 students, avoiding unequal cell sizes in the interaction analysis. The creativity questionnaire provided the grouping variable for the factorial design, whereas the writing achievement task provided the post-treatment dependent measure after the eight weekly instructional meetings. Table 2 presents the operational categorization used in the analysis.

Table 2. Operational categorization and distribution of learner creativity

Category	Operational criterion	A ₁ (CBI) f (%)	A ₂ (PBL) f (%)	Total f (%)
High creativity (B ₁)	$X \geq$ class median	20 (50.0)	20 (50.0)	40 (50.0)
Low creativity (B ₂)	$X <$ class median	20 (50.0)	20 (50.0)	40 (50.0)
Total	Possible score: 30–150	40 (100)	40 (100)	80 (100)

Note. X = total creativity score. The high/low cut-off was the median calculated separately within each intact class; therefore, the raw numerical cut-off could differ between classes. This procedure retained all participants and produced equal factorial cell sizes ($n = 20$).

Data Analysis

Data were summarised using score ranges, means, and standard deviations. Before hypothesis testing, the distribution of the writing scores within each of the four factorial cells was examined with the Lilliefors test; the obtained L values were smaller than the critical value of $L = .190$ for $n = 20$ at $\alpha = .05$, so the normality assumption was retained. Homogeneity of variance across the four cells was examined with Bartlett's test, which yielded $\chi^2 = 4.00$, smaller than the critical value $\chi^2(3) = 7.81$ at $\alpha = .05$; the variances were therefore treated as homogeneous. The hypotheses were then tested with a two-way analysis of variance (ANOVA) with teaching method and creativity as between-subjects factors, followed by Tukey's honestly significant difference (HSD) test for pairwise comparisons among the four cells. Effect sizes are reported as partial eta squared and interpreted using Cohen's (1988) conventions (.01 = small,

.06 = medium, .14 = large). All analyses were conducted in IBM SPSS Statistics; the alpha level was set at .05 for all tests.

RESULT AND DISCUSSION

Descriptive Statistics

Table 3 summarises the writing scores for each main-effect group and each factorial cell. The CBI group achieved a higher overall mean than the PBL group (70.95 compared with 67.40), and students classified as highly creative achieved a higher mean than students classified as having lower creativity (70.80 compared with 67.55). The cell means, however, do not follow the additive pattern implied by these marginal figures: high-creativity students taught through CBI had the highest mean (77.10) and low-creativity students taught through PBL had the lowest (64.50). In contrast, among low-creativity students, the two methods were reversed.

Table 3. Descriptive statistics of EFL writing achievement

Group	n	Score range	M	SD
A ₁ (CBI)	40	53–83	70.95	8.71
A ₂ (PBL)	40	55–80	67.40	7.49
B ₁ (High creativity)	40	55–83	70.80	8.75
B ₂ (Low creativity)	40	53–80	67.55	7.51
A ₁ B ₁ (CBI – high)	20	65–83	77.10	5.24
A ₂ B ₁ (PBL – high)	20	55–78	64.50	6.79
A ₁ B ₂ (CBI – low)	20	53–75	64.80	6.97
A ₂ B ₂ (PBL – low)	20	58–80	70.30	7.16

Note: Marginal means and standard deviations for A₁, A₂, B₁, and B₂ are computed from the four cells ($n = 20$ each) and are therefore internally consistent with them.

Figure 2 displays the distribution of scores in the four cells. The dispersion of scores is visibly narrower in the CBI–high-creativity cell ($SD = 5.24$) than in the remaining three cells ($SD = 6.79$ – 7.16), indicating that the combination of authentic content and high creativity produced not only the highest but also the most consistent performance. No group showed a score outside the range spanned by the other cells, and the

observed minima and maxima overlap substantially, consistent with the homogeneity result reported above.

Main Effect of Teaching Method

Table 4 reports the two-way ANOVA. The main effect of teaching method was significant, $F(1, 76) = 5.82$, $p = .018$, partial $\eta^2 = .071$, indicating that, averaged across creativity levels,

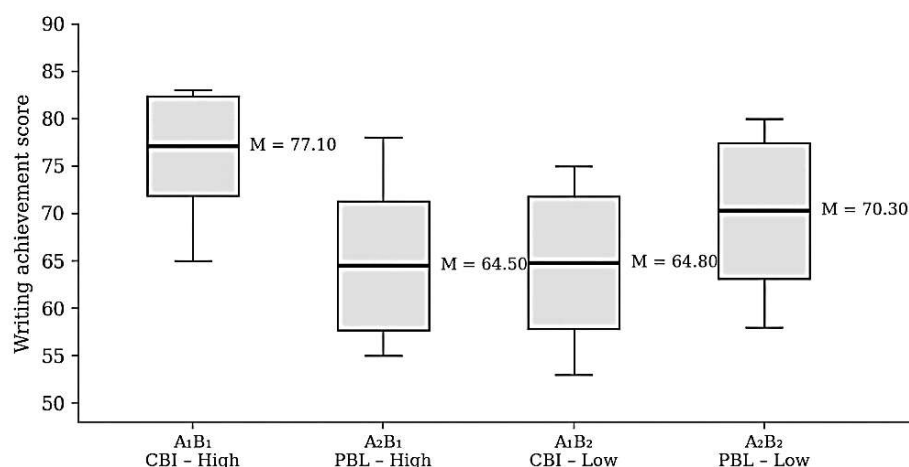


Figure 2. Distributional summary of writing achievement scores across the four factorial cells. Note: The horizontal line marks the group means, the box spans one standard deviation above and below the mean, and the whiskers indicate the observed minimum and maximum. $n = 20$ per cell.

students taught through CBI outperformed students taught through PBL by 3.55 points. By Cohen's (1988) benchmarks, this is a medium effect, and it accounts for approximately 7% of the variance in writing achievement that is not

explained by the other terms in the model. Research question 1 is therefore answered affirmatively, although the interaction reported below qualifies this conclusion.

Table 4. Summary of the two-way analysis of variance for EFL writing achievement

Source	SS	df	MS	F	p	Partial η^2
Teaching method (A)	252.05	1	252.05	5.82	.018	.071
Creativity (B)	211.25	1	211.25	4.88	.030	.060
A $\times$ B	1,638.05	1	1,638.05	37.80	< .001	.332
Error (within cells)	3,293.45	76	43.33			
Corrected total	5,394.80	79				

Note. $N = 80$ ($n = 20$ per cell). Partial $\eta^2 = SS(\text{effect}) / [SS(\text{effect}) + SS(\text{error})]$. Alpha = .05.

Main Effect of Learner Creativity

The main effect of learner creativity was also significant, $F(1, 76) = 4.88, p = .030$, partial $\eta^2 = .060$, with high-creativity students scoring 3.25 points higher on average than low-creativity students. The magnitude of this effect is comparable to that of teaching method and is likewise conventionally medium. Research question 2 is therefore answered affirmatively.

Interaction Effect between Teaching Method and Creativity

The interaction between teaching method and creativity was significant and considerably

larger than either main effect, $F(1, 76) = 37.80, p < .001$, partial $\eta^2 = .332$, corresponding to a large effect that accounts for roughly a third of the residual variance. Because the interaction term explains about five times as much variance as the two main effects combined, the main effects should not be interpreted in isolation. Research question 3 is answered affirmatively.

Figure 3 plots the estimated marginal means with standard-error bars and shows a crossover (disordinal) interaction: the two lines intersect rather than diverge. Highly creative students performed best under CBI ($M = 77.10, SE = 1.17$) and worst under PBL ($M = 64.50, SE =$

1.52), a difference of 12.60 points. Among students with lower creativity, the ordering was reversed: PBL produced a higher mean ($M = 70.30$, $SE = 1.60$) than CBI ($M = 64.80$, $SE = 1.56$), a difference of 5.50 points. The simple

effect of teaching method is thus positive at the high-creativity level and negative at the low-creativity level, which is why the modest overall advantage of CBI in the marginal means conceals two opposing patterns.

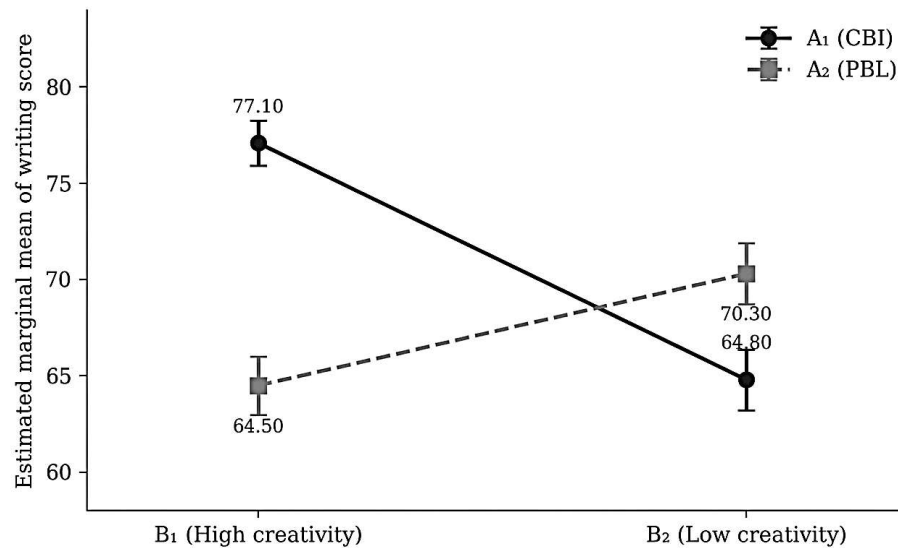


Figure 3. Two-way interaction between teaching method and learner creativity. Note: Error bars represent ± 1 standard error of the mean. $n = 20$ per cell

Tukey's HSD test was used to locate the significant differences among the four cells; the critical mean difference at $\alpha = .05$ was 5.47. Table 5 reports the six pairwise comparisons. The CBI–high-creativity cell differed significantly from all three other cells, including the PBL–low-creativity cell ($MD = 6.80$, $p = .009$), the second-highest-performing group. Within the low-creativity level, PBL significantly outperformed CBI ($MD = 5.50$, $p = .048$), and within the PBL condition, low-

creativity students significantly outperformed high-creativity students ($MD = 5.80$, $p = .033$). The only non-significant comparison was between high-creativity students taught through PBL and low-creativity students taught through CBI ($MD = -0.30$, $p = .999$), whose means were virtually identical. Together, these comparisons confirm that CBI's advantage is confined to the high-creativity group and is reversed in the low-creativity group.

Table 5. Tukey HSD post-hoc comparisons among the four factorial cells

Comparison	Mean difference	SE	p	95% CI
A1B1 vs. A2B1	12.60*	2.08	< .001	[7.13, 18.07]
A1B1 vs. A1B2	12.30*	2.08	< .001	[6.83, 17.77]
A1B1 vs. A2B2	6.80*	2.08	.009	[1.33, 12.27]
A2B1 vs. A1B2	−0.30	2.08	.999	[−5.77, 5.17]
A2B1 vs. A2B2	−5.80*	2.08	.033	[−11.27, −0.33]
A1B2 vs. A2B2	−5.50*	2.08	.048	[−10.97, −0.03]

Note. A = CBI; A₂ = PBL; B₁ = high creativity; B₂ = low creativity. MSE = 43.33, df = 76. Critical mean difference (HSD) at $\alpha = .05 = 5.47$. * $p < .05$.

Teaching Method and ESP Writing Achievement

The significant main effect of teaching method indicates that, on average, systematic engagement with authentic food-security content was associated with stronger writing performance than open-ended problem solving. This is consistent with meta-analytic findings that content-based and integrated approaches yield positive effects on EFL writing and proficiency (Cen, 2021; Lo & Jeong, 2019) and with classroom evidence from technical report writing, where an adjunct CBI model supplied the knowledge base that students needed before they could write (Chekol et al., 2023). The present findings extend that line of work to an ESP topic (food security) that has not previously served as the content base of a writing course.

One plausible mechanism concerns the management of cognitive resources. Cognitive load theory distinguishes the load imposed by the material's intrinsic complexity from the load imposed by how instruction is organized. It predicts that novices benefit from strong guidance because searching for information consumes working-memory capacity that could otherwise be devoted to schema construction (Sweller et al., 2019). In the CBI condition, terminology and propositional content were pre-taught and modeled before writing began, so learners could allocate more capacity to language production and text organization. In the PBL condition, by contrast, students had to identify the problem, locate information, negotiate group positions, and compose all within the same instructional time. This account also explains why the smallest dispersion of scores occurred in the CBI-high-creativity cell: guidance reduced the variability introduced by differences in search strategy. Food security therefore functioned not merely as a list of technical terms but as a conceptual framework that gave learners a reason to read and write about a recognizable social problem (Tzoannopoulou, 2015).

Learner Creativity as a Moderating Characteristic

Students with high creativity achieved a higher overall mean than students with low creativity, which is consistent with the view that writing quality depends on the generation, selection, connection, and elaboration of ideas as much as on linguistic accuracy (Hyland, 2016; Said-Metwaly et al., 2017). Learners who are more willing to explore alternatives and to persist with challenging tasks appear better positioned to transform content knowledge into an organized text. Creativity may also support flexible vocabulary use and the ability to view a problem from several perspectives. This ability is particularly valuable when students explain the causes, consequences, and possible responses to food-security issues (Szabó-Szettele & Kárpáti, 2023). Comparable score gradients by learner characteristic have been documented in other quantitative analyses of English performance (Mtambo & Tshuma, 2023).

It is important, however, not to interpret this main effect as evidence of a fixed personal advantage. Creativity is increasingly understood as a classroom capacity that instruction can cultivate rather than an immutable trait (Karwowski & Beghetto, 2019), and interventions such as brainstorming, staged drafting, and creative-writing activities have improved the performance of initially less creative EFL writers (Al-Dhamit & Al-Subh, 2019; Harizaj & Çeliku, 2020). Model-based feedback and carefully calibrated task complexity have produced similar benefits for lower-proficiency and less confident writers (Mujtaba et al., 2025, 2026; Shi & Wang, 2026). The moderate size of the creativity effect in the present data (partial $\eta^2 = .060$) is consistent with this more malleable interpretation.

The Crossover Interaction

The most substantial finding of the study is the crossover interaction, which was five times

larger than either main effect. This pattern is a textbook instance of an aptitude–treatment interaction: the optimal instructional method depends on a measured learner characteristic, and the regression lines for the two treatments cross within the observed range of the aptitude (Cronbach & Snow, 1977). Under such conditions, reporting only the main effect of method is misleading, because the average conceals two opposing simple effects.

For highly creative learners, CBI appears to supply rich disciplinary input that can be expanded, reorganized, and expressed in original ways without constraining the direction of their ideas. The availability of authentic information may stimulate curiosity while leaving the compositional decisions open, which corresponds to the conditions under which learner agency has been linked to flow in L2 writing (Wu & Albert, 2024). Conversely, the open-ended PBL condition may have under-served these learners: with abundant internal capacity for idea generation, the additional cost of coordinating group inquiry consumed time that could have been spent on drafting, and the group product may have constrained individual originality.

For learners with lower creativity, the pattern reverses. The problem structure and collaborative inquiry of PBL provide a clear external purpose for writing and immediate peer support, and a concrete problem narrows the range of admissible responses, making it easier to identify relevant information and to organize a solution. Collaborative prewriting has been shown to benefit precisely such learners by distributing the idea-generation burden across the group (McDonough & De Vleeschauwer, 2019); structured peer feedback (Memari Hanjani, 2024) and writing-group arrangements (Patria & Laili, 2021) work in the same direction, and problem-based writing instruction has produced comparable gains in argumentative writing (Jumariati & Sulisty, 2017). In the CBI

condition, by contrast, these students received abundant content but comparatively little support in deciding what to do with it, and the resulting cell mean (64.80) was statistically indistinguishable from that of highly creative students in PBL.

The interaction therefore clarifies why instructional comparisons should routinely include learner characteristics. A method may produce a favorable overall mean while functioning differently across subgroups, and an evaluation that stops at the main effect would recommend CBI for a population in which half the students are demonstrably disadvantaged by it.

Pedagogical Implications

For ESP courses, food-security content can be organized into progressive units that move from terminology and reading comprehension to discussion, problem analysis, and written communication. Teachers should select authentic materials that are accurate but linguistically accessible, pre-teach essential concepts, model disciplinary text organization, and provide formative feedback during drafting (Hyland, 2018; Ramazani, 2024; Tang & Liu, 2018). Assessment should evaluate both language quality and accurate content communication, aligning the course with the outcome-based logic now widely adopted in competency-based curriculum reform (Muraraneza et al., 2018).

Because the results indicate an interaction with creativity, the practical recommendation is not to choose between CBI and PBL but to sequence and differentiate them. A hybrid design in which a well-scaffolded body of food-security content is introduced first and then applied through carefully designed problems may preserve the conceptual depth of CBI while supplying the task structure and social support associated with PBL. Within such a sequence, teachers can vary the degree of task openness, offer optional planning supports such as

vocabulary banks, clustering and outlining techniques (Wati, 2018), and model texts to learners who need them, and use collaborative work strategically rather than uniformly (Barkaoui, 2024; Chien, 2026; L. J. Wang, 2026; Zhao & Wang, 2026). Corpus tools can help teachers identify the terminology that most warrants explicit treatment (Anthony, 2018; Juknevičienė & Grabowski, 2018), and data-driven learning offers one structured route into that vocabulary (Ammari, 2025).

Limitations and Directions for Future Research

Several limitations should be borne in mind. First, the design was quasi-experimental: intact classes were assigned to conditions, so unmeasured class-level differences cannot be excluded. However, the baseline comparison in Table 1 found no significant disparities. Second, creativity was dichotomized at the class median, which discards information and reduces statistical power relative to treating creativity as a continuous moderator; a moderated regression on the continuous scores would be a valuable robustness check. Third, the study measured post-instruction writing achievement only, without a delayed post-test, so nothing can be said about retention or about transfer to other ESP topics. Fourth, the sample was drawn from a single institution, which limits generalisability, and the eight-week treatment period was relatively short. Finally, although the raters were blind to condition, the same lecturer delivered both treatments, so differential enthusiasm cannot be entirely ruled out.

Future research should replicate the design with larger, more diverse samples; model creativity continuously; include delayed post-tests; and examine whether the hybrid CBI–PBL sequence proposed above produces more consistent benefits across creativity levels. Extending the design to other ESP content domains and to technology-mediated delivery

would also help establish the boundary conditions of the interaction reported here (Arshad et al., 2026; Shadiev et al., 2025; L. Wang, 2026).

CONCLUSION

This study examined how teaching method and learner creativity jointly shape EFL writing achievement in an ESP context built on food-security terminology. Content-based instruction produced a higher overall mean than problem-based learning, $F(1, 76) = 5.82, p = .018$, and highly creative students outperformed less creative students, $F(1, 76) = 4.88, p = .030$. These main effects, however, were qualified by a large crossover interaction, $F(1, 76) = 37.80, p < .001$, partial $\eta^2 = .332$: CBI was markedly advantageous for highly creative students ($M = 77.10$), whereas PBL was more supportive for students with lower creativity ($M = 70.30$). The study's principal contribution is not identifying a superior method, but showing that authentic disciplinary content must be combined with differentiated scaffolding. ESP teachers can use food-security materials to develop both language competence and social awareness, provided task structure, collaboration, and support are adjusted to learners' creativity profiles.

ACKNOWLEDGEMENT

The authors express their appreciation to the institution, the lecturers, and the students who supported the implementation of the study and contributed to completing the research process. The authors also thank the editor and the anonymous reviewers of *Jurnal Pendidikan Progresif* for their constructive comments on earlier versions of this manuscript.

DECLARATION OF GENERATIVE AI USAGE IN THE WRITING PROCESS

During the drafting of this manuscript, the author(s) utilized a generative AI language assistant

for the purpose of refining sentence structure, improving the readability of the English text, and formatting the reference list in APA style. The tool was not used to generate research data, conduct or interpret statistical analyses, or produce the substantive scientific content of the article. Following the use of this tool, the author(s) reviewed and revised the content as necessary and accept full responsibility for the final content of the article.

■ REFERENCES

- Ahmad, S., & Tuomainen, S. (2026). Enhancing ESP learning with content-based instruction and 21st-century skills. *Baltic Journal of English Language, Literature and Culture*, 16, 4–22. <https://doi.org/10.22364/bjellc.16.2026.01>
- Al-Busaidi, S. (2021). Project-based learning as a tool for student-teachers' professional development: A study in an Omani EFL teacher education program. *International Journal of Learning, Teaching and Educational Research*, 20(4), 116–136. <https://doi.org/10.26803/ijlter.20.4.7>
- Al-Dhamit, Y., & Al-Subh, S. (2019). The impact of brainstorming strategy on developing creative writing skills among EFL learners. *International Journal of English Language and Literature Studies*, 8(1), 1–11.
- Ali, S. S. (2019). Problem based learning: A student-centered approach. *English Language Teaching*, 12(5), 73–78. <https://doi.org/10.5539/elt.v12n5p73>
- Ammari, M. (2025). Advancing ESP instruction through DDL: A structured training framework. *Glottodidactica*, 52(1), 123–150. <https://doi.org/10.14746/gl.2025.52.1.7>
- Anthony, L. (2018). A critical look at software tools in corpus linguistics. *Linguistic Research*, 35(Special Issue), 141–161. <https://doi.org/10.17250/khisli.35.201804.007>
- Apsari, Y. (2018). The use of content-based instruction (CBI) to improve students' reading comprehension. *ELTIN Journal*, 6(1), 39–46. <https://doi.org/10.22219/eltin.v6i1.5439>
- Arshad, S., Irshad, S., & Batool, H. (2026). Balancing agency and automation to overcome digital divide in ESP writing instruction. *Journal of International Students*, 16(12), 1–24. <https://doi.org/10.32674/z8n0h321>
- Barkaoui, K. (2024). Exploring the effects of task difficulty and learner variables on performance on picture description writing tasks. *Assessing Writing*, 60, 100827. <https://doi.org/10.1016/j.asw.2024.100827>
- Basturkmen, H. (2014). *Developing courses in English for specific purposes*. Palgrave Macmillan.
- Cen, Y. (2021). Effects of content-based instruction on English writing skills of EFL learners: A meta-analysis. *SAGE Open*, 11(3). <https://doi.org/10.1177/21582440211038459>
- Chekol, A., Shiferie, K., & Teshome, S. (2023). Effects of using adjunct model of content-based instruction on students' technical report writing performance. *Cogent Education*, 10(1). <https://doi.org/10.1080/2331186X.2023.2214427>
- Chien, C. W. (2026). Evidence-based writing instruction and its impact on Taiwanese novice researchers' flow and writing skills. *Journal of Second Language Writing*, 72, 101306. <https://doi.org/10.1016/j.jslw.2026.101306>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum.
- Cronbach, L. J., & Snow, R. E. (1977).

- Aptitudes and instructional methods: A handbook for research on interactions*. Irvington.
- Dalton-Puffer, C. (2016). Cognitive discourse functions: A bridge between content, literacy and language in CLIL. In T. Nikula, E. Dafouz, P. Moore, & U. Smit (Eds.), *Conceptualising integration in CLIL and multilingual education* (pp. 89–106). Multilingual Matters.
- Derwing, T. M. (2018). Comprehensibility. In J. I. Lontas (Ed.), *The TESOL encyclopedia of English language teaching* (pp. 1–6). Wiley.
- Eche, D., & Hernández-Herrera, M. (2018). Studying food security among students: A comparative case study between public and private universities in Quito-Ecuador. *Nutrición Hospitalaria*, 35(6), 1372–1378. <https://doi.org/10.20960/nh.1972>
- FAO, IFAD, UNICEF, WFP, & WHO. (2023). *The state of food security and nutrition in the world 2023*. FAO. <https://doi.org/10.4060/cc3017en>
- Fitriani, H., & Gani, S. A. (2021). The effectiveness of problem-based learning on students' critical thinking and writing skills in an EFL context. *Studies in English Language and Education*, 8(1), 249–266. <https://doi.org/10.24815/siele.v8i1.18318>
- Flowerdew, L. (2015). Needs analysis and curriculum development in ESP. In B. Paltridge & S. Starfield (Eds.), *The handbook of English for specific purposes* (pp. 325–346). Wiley-Blackwell.
- Godfray, H. C. J., & Garnett, T. (2014). Food security and sustainable intensification. *Philosophical Transactions of the Royal Society B*, 369(1639), 20120273. <https://doi.org/10.1098/rstb.2012.0273>
- González-Geraldo, J. L., & González-Herrero, M. E. (2017). The effect of problem-based learning on the development of writing skills in English as a foreign language. *Porta Linguarum*, 28, 87–102.
- Harizaj, M., & Çeliku, T. (2020). The impact of creative writing activities on EFL learners' writing skills. *European Journal of English Language Teaching*, 6(1). <https://doi.org/10.46827/ejel.v6i1.3369>
- Henry, C. J. (2020). The role of nutrition in the achievement of the UN's sustainable development goals. *Nutrition Bulletin*, 45(1), 5–19. <https://doi.org/10.1111/nbu.12415>
- Hsia, T. L., & Hwang, G. J. (2016). A creative-thinking approach to improving the project-based learning of elementary school students. *Journal of Computer Assisted Learning*, 32(5), 427–443. <https://doi.org/10.1111/jcal.12148>
- Hung, W. (2015). Problem-based learning: A learning environment for enhancing learning transfer. *New Directions for Adult and Continuing Education*, 2015(145), 27–38. <https://doi.org/10.1002/ace.20122>
- Hyland, K. (2016). Teaching and researching writing: A personal account. *Journal of Second Language Writing*, 33, 55–61. <https://doi.org/10.1016/j.jslw.2016.04.009>
- Hyland, K. (2018). *Metadiscourse: Exploring interaction in writing*. Bloomsbury Academic.
- Jacobs, H. L., Zinkgraf, S. A., Wormuth, D. R., Hartfiel, V. F., & Hughey, J. B. (1981). *Testing ESL composition: A practical approach*. Newbury House.
- Jaelani, S. R. (2017). Treating of content-based instruction to teach writing viewed from EFL learners' creativity. *English Language Teaching*, 10(11), 156–161. <https://doi.org/10.5539/elt.v10n11p156>
- Juknevičienė, R., & Grabowski, Ū. (2018).

- Comparing formulaicity of learner writing through phrase-frames: A corpus-driven study of Lithuanian and Polish EFL student writing. *Research in Language*, 16(3), 303–323. <https://doi.org/10.2478/rela-2018-0016>
- Jumariati, J., & Sulisty, G. (2017). Problem-based writing instruction: Its effect on students' skills in argumentative writing. *Arab World English Journal*, 8(2), 87–100. <https://doi.org/10.24093/awej/vol8no2.6>
- Kang, M., Peng, F., Chen, Y., & Jin, T. (2026). Flipping the classroom in ESP genre-based academic writing instruction: An exploratory study. *International Journal of Applied Linguistics*. <https://doi.org/10.1111/ijal.70169>
- Karwowski, M., & Beghetto, R. A. (2019). Creative learning in education. In J. C. Kaufman & R. J. Sternberg (Eds.), *The Cambridge handbook of creativity* (2nd ed., pp. 589–608). Cambridge University Press.
- Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine*, 15(2), 155–163. <https://doi.org/10.1016/j.jcm.2016.02.012>
- Lo, Y. Y., & Jeong, D. W. (2019). Effects of content and language integrated learning on students' English proficiency and content knowledge: A meta-analysis. *System*, 86, 102133. <https://doi.org/10.1016/j.system.2019.102133>
- Mbow, C., Rosenzweig, C., Barioni, L. G., Benton, T. G., Herrero, M., Krishnapillai, M., & Wollenberg, E. (2019). Food security. In *Climate change and land: An IPCC special report* (pp. 437–550). IPCC.
- McDonough, K., & De Vleeschauwer, J. (2019). Comparing the effect of collaborative and individual prewriting on EFL learners' writing development. *Journal of Second Language Writing*, 44, 123–130. <https://doi.org/10.1016/j.jslw.2019.04.003>
- Memari Hanjani, A. (2024). Comparing trained EFL peer reviewers' feedback: From claim to reality. *Assessing Writing*, 60, 100836. <https://doi.org/10.1016/j.asw.2024.100836>
- Mtambo, B., & Tshuma, L. (2023). Intermediate phase learner performance in English: A quantitative analysis. *Reading & Writing*, 14(1). <https://doi.org/10.4102/rw.v14i1.430>
- Mujtaba, S. M., Sippel, L., Barrot, J., & Parkash, R. (2025). The effects of model-based feedback on students' writing performance: The role of writing anxiety and learner beliefs. *Language Awareness*, 35(1), 201–221. <https://doi.org/10.1080/09658416.2025.2467113>
- Mujtaba, S. M., Zhang, T., & Sletova, N. (2026). Task complexity, collaborative writing, and learner engagement: Examining second language learners' writing performance. *Assessing Writing*, 68, 101042. <https://doi.org/10.1016/j.asw.2026.101042>
- Muraraneza, C., Mtshali, N. G., & Mukamana, D. (2018). Issues and challenges of curriculum reform to competency-based curricula in Africa: A meta-synthesis. *Nursing & Health Sciences*, 19(1), 5–12. <https://doi.org/10.1111/nhs.12316>
- Müller, C., & Lotze-Campen, H. (2012). Integrating the complexity of global change pressures on land and water. *Global Food Security*, 1(2), 88–93. <https://doi.org/10.1016/j.gfs.2012.11.001>
- Nurjannah, S., Erniati, E., & Jusmaniar, N. (2020). The use of content-based instruction in English language teaching. *DIKDAS MATAPPA*, 3(2), 359–363.

- <https://doi.org/10.31100/dikdas.v3i2.809>
- Patria, B., & Laili, L. (2021). Writing group program reduces academic procrastination: A quasi-experimental study. *BMC Psychology*, 9(1). <https://doi.org/10.1186/s40359-021-00665-9>
- Ramazani, M. (2024). Written corrective feedback in English for specific purposes nursing students' writing courses: A quasi-experimental study. *Journal of Medical Education Development*, 17(53), 82–90. <https://doi.org/10.61186/edcj.17.53.82>
- Richards, J. C., & Rodgers, T. S. (2014). *Approaches and methods in language teaching* (3rd ed.). Cambridge University Press.
- Said-Metwaly, S., Van den Noortgate, W., & Kyndt, E. (2017). Approaches to measuring creativity: A systematic literature review. *Creativity. Theories – Research – Applications*, 4(2), 238–275. <https://doi.org/10.1515/ctra-2017-0013>
- Sariani, S., Yaningsih, Y., & Rozi, F. (2022). Implementing content-based instruction (CBI) on EFL students' writing through technology-enhanced language teaching. *Education Quarterly Reviews*, 5(1), 174–184. <https://doi.org/10.31014/aior.1993.05.01.429>
- Shadiev, R., Liu, T., Reynolds, B. L., & Hwang, W. Y. (2025). Exploring the effects of (un)familiar environments on MALL task writing performance, EFL writing proficiency, and learner perceptions. *ReCALL*, 38(2), 187–205. <https://doi.org/10.1017/s0958344025100402>
- Shi, S., & Wang, Y. (2026). The effects of AI-powered genre-based writing instruction on low-proficiency EFL writers' ideal L2 writing self, writing enjoyment and L2 writing performance: A quasi-experimental mixed-methods study. *European Journal of Education*, 61(3). <https://doi.org/10.1111/ejed.70791>
- Stoller, F. L. (2015). Content-based instruction. In M. Celce-Murcia, D. M. Brinton, & M. A. Snow (Eds.), *Teaching English as a second or foreign language* (4th ed., pp. 165–180). National Geographic Learning.
- Suzuki, N. (2021). Effects of content-based instruction (CBI) on EFL secondary school learners' writing. *Journal of Immersion and Content-Based Language Education*, 10(1), 5–32. <https://doi.org/10.1075/jicb.20006.suz>
- Sweller, J., van Merriënboer, J. J. G., & Paas, F. (2019). Cognitive architecture and instructional design: 20 years later. *Educational Psychology Review*, 31(2), 261–292. <https://doi.org/10.1007/s10648-019-09465-5>
- Szabó-Szettele, K., & Kárpáti, A. (2023). Quasi-experimental study on fostering creativity through creative writing in German as a Foreign Language (GFL) in COVID-19. *F1000Research*, 12, 1307. <https://doi.org/10.12688/f1000research.133982.1>
- Tang, C., & Liu, Y. T. (2018). Effects of indirect coded corrective feedback with and without short affective teacher comments on L2 writing performance, learner uptake and motivation. *Assessing Writing*, 35, 26–40. <https://doi.org/10.1016/j.asw.2017.12.002>
- Tzoannopoulou, M. (2015). Rethinking ESP: Integrating content and language in the university classroom. *Procedia – Social and Behavioral Sciences*, 173, 149–153. <https://doi.org/10.1016/j.sbspro.2015.02.045>
- Wang, L. (2026). Learner engagement and writing performance in assessment as learning L2 writing. *Languages*, 11(4), 62. <https://doi.org/10.3390/languages11>

- 040062
- Wang, L. J. (2026). Question-only AI Socratic dialogue as dialogic feedback in L2 argumentative writing: A quasi-experimental study. *Journal of Second Language Writing*, 73, 101331. <https://doi.org/10.1016/j.jslw.2026.101331>
- Wati, D. R. (2018). Improving the students' descriptive text writing ability through the implementation of clustering technique at the tenth grade of MAN 1 Metro. *English Education: Jurnal Tadris Bahasa Inggris*, 11(1), 129–146. <https://doi.org/10.24042/jet.v11i1.2293>
- Webb, P., Stordalen, G. A., Singh, S., Wijesinha-Bettoni, R., Gahukar, R. T., & Ghosh-Jerath, S. (2018). Hunger and malnutrition in the 21st century. *BMJ*, 361, k2238. <https://doi.org/10.1136/bmj.k2238>
- Westerveld, J. J. L., van den Homberg, M. J. C., Nobre, G. G., van den Berg, D. L. J., Teklesadik, A. D., & Stuit, S. M. (2021). Forecasting transitions in the state of food security with machine learning using transferable features. *Science of the Total Environment*, 786, 147366. <https://doi.org/10.1016/j.scitotenv.2021.147366>
- Wu, Q., & Albert, Á. (2024). Learner agency and potential for creativity in writing task design and Chinese EFL students' flow experiences in writing: A contextual perspective. *Language Teaching Research*. <https://doi.org/10.1177/13621688241258661>
- Yew, E. H. J., & Goh, K. (2016). Problem-based learning: An overview of its process and impact on learning. *Health Professions Education*, 2(2), 75–79. <https://doi.org/10.1016/j.hpe.2016.01.004>
- Zhao, X., & Wang, D. (2026). The impact of ChatGPT's feedback on L2 Chinese learners' writing outcome, confidence, and emotions: A mixed-method quasi-experimental study. *Assessing Writing*, 68, 101027. <https://doi.org/10.1016/j.asw.2026.101027>