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Unleashing analytical mastery: elevating HOTS with hybrid project-based learning in academic writing courses

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ABSTRACT

This groundbreaking study addresses a significant research gap in modern pedagogy by examining the revolutionary effects of hybrid project-based learning (HPBL) on high-order thinking skills (HOTS) in English as a foreign language (EFL) writing instruction. By employing a quasi-experimental design and incorporating the participation of 85 students as a population, this study addresses two crucial inquiries: i) the degree to which HPBL impacts the overall writing abilities of EFL students enrolled in an academic writing course and ii) how HPBL enhances the analytical capabilities of the students. The argumentative writing test was employed as a research instrument. The research demonstrates a significant writing and analytical mastery enhancement through rigorous paired sample testing and validation. This research not only makes substantial contributions to the ongoing scholarly discourse but also underscores the critical significance of further exploring the dynamic attributes of HPBL, thus further establishing its position as an indispensable element of modern language instructions.

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1. INTRODUCTION

Amidst a swiftly progressing technological age and an increasing need for interdisciplinary problem-solving abilities, it becomes imperative to prioritize the development of students' higher-order thinking skills (HOTS) [1]–[3]. Teachers, occupying a central position, are instrumental in propelling this pedagogical transformation, functioning as fundamental designers of educational reform in the twenty-first century [4]–[6]. Notwithstanding this necessity, incorporating HOTS enrichment, specifically in writing courses, presents a substantial obstacle. This difficulty is accentuated when one considers the revised Bloom's Taxonomy, which emphasizes the highest cognitive abilities, such as creativity, evaluation, and analysis, beyond simple memorization [7], [8]. In addition, a significant shortcoming endures, posing a formidable obstacle for instructors who aim to integrate critical abilities such as analysis, synthesis, and problem-solving seamlessly into writing curricula [9], [10]. The persistent nature of this discrepancy underscores the urgent requirement for novel pedagogical approaches that successfully reconcile the current divide between the theoretical underpinnings of HOTS and its tangible incorporation in writing courses. The present study investigates the transformative capacity of hybrid project-based learning (HPBL) to address the formidable challenge of integrating critical competencies into academic writing.

Derived from constructivist ideology, hybrid learning facilitates a harmonious integration of face-to-face and virtual interactions, reflecting the ever-changing demands of writing [11]–[13]. Furthermore, it has

been demonstrated that academic writing fosters critical thinking, originality, and the resolution of complex problems [14]. These results are in perfect harmony with the benefits linked to hybris project-based learning models [15]–[17].

An investigation into academic environments is revealed through the unified integration of the constructivist philosophy of HPBL and the rigorous analytical standards required for writing assignments. Research reveals the intricate fabric of educational environments. It underscores the harmonious congruence of this methodology with the overarching objective of enhancing HOTS [18]. Further investigation reveals that project-based learning not only stimulates sustained motivation and active engagement [19] but also acts as a catalyst for cultivating critical thinking skills [20], [21] and creative thinking [22], [23]. These dimensions are critical in constructing written compositions that are not only compelling but also firmly rooted in extensively researched perspectives [24], [25].

To determine the influence of HPBL on HOTS, this research investigates the potential for substantial transformations to result from this instructional approach, specifically highlighting enhancing analytical skills within academic writing. The importance of these skills in higher education provides a rationale for accentuating the cultivation of analytical capabilities in scholarly writing through implementing HPBL. Academic writing requires a rigorous analysis of ideas, going beyond mere information transmission. The primary objective of this study is to improve students' ability to engage in logical reasoning, recognize recurring patterns, and formulate supported claims by emphasizing analytical skills.

By combining the constructivist principles of HPBL with the rigorous skill requirements of academic writing, this study sets a new standard for instruction by challenging conventional methods. The research endeavors to propel a paradigm shift in writing pedagogy for the twenty-first century by presenting an innovative proposal. Examining the impact of HPBL on the development of analytical and writing proficiency among learners enrolled in an academic writing course constitutes the central research inquiry. This study aims to contribute to the ongoing discourse on developing HOTS in writing education by conducting a rigorous empirical investigation and uncovering novel insights. The pivotal questions guiding this research are twofold: i) to what extent does implementing HPBL improve writing skills among English as a foreign language (EFL) student in an academic writing course?; and ii) to what extent does the integration of HPBL enhance the analytical abilities of EFL students within the context of an academic writing course? This study not only delves into unexplored dimensions of pedagogy but also aims to provide valuable contributions to the evolving landscape of writing education, tailored to meet the multifaceted demands of our contemporary era.

2. LITERATURE REVIEW

The foundation of this research is the constructivist learning theory [26], which posits that comprehension and significance are created by learners through active participation in the learning process. By utilizing a HPBL approach [12], [25], this study engages students in hands-on assignments to enhance their academic writing proficiency and foster the development of critical thinking, problem-solving, and collaboration capabilities. Hybrid learning is superior to traditional and solely online teaching because it includes the best features [13], [11] of educational technological advancements to expand access to classroom instruction for students in rural areas. Additionally, it offers an influential commentary on teachers' positions during the pandemic [27]. Hybrid learning shortens the time it takes to complete an online transaction and boosts teachers' and students' face-to-face and digital interactions [12], offers flexibility [28], [29], enhances learning outcomes [30]–[32], and is suited to various types of learners [33]. In addition, project-based learning, an instructional approach encouraging real-world problem-solving [25], has exhibited advantages in cultivating engaged participation, motivation, innovative problem-solving, critical thinking, and critical thinking [20], [22]–[24], [34].

Considering the changing learning demands of the twenty-first century, academic writing courses are tasked with progressing beyond the traditional emphasis on grammar and structure [35]. Nowadays, educators pursue novel approaches that transmit grammatical knowledge and cultivate problem-solving, analysis, and synthesis-the constituent elements of HOTS [9], [10]. This fundamental change in teaching academic writing perfectly aligns with HPBL. Incorporating hands-on projects into the educational process through HPBL serves to develop not only conventional linguistic proficiencies but also higher-order cognitive capacities.

3. METHOD

The present study employed a quasi-experimental design to investigate the effectiveness [36] of HPBL in improving writing and analysis abilities among students enrolled in an academic writing course at an Indonesian Islamic Higher Education institution. As a result of the cluster random sampling technique, 30

students from class A were selected to comprise the experimental group from the population of 85. All participants were given detailed information about the research's objectives, methodology, and data processing. While joining the academic writing course, they voluntarily agreed to participate in the research. The subsequent Table 1 provides a comprehensive summary of the demographic data about the participants in the research.

Table 1. Demographic information of research participants

Participants	Gender	Frequency	Percentage	Semester enrolled	English proficiency
Experimental group	Male	7	23.33	4th	Low to high
	Female	23	76.67	4th	Low to high
	Total	N=30	100		

The fourteen-week investigation was divided into three phases. Phase one, “building fundamental skills” (weeks 1-6), emphasized the development of academic writing abilities through the use of a variety of resources and included a pre-test. During the second phase, "shifting toward HPBL" (weeks 7-9), students developed a solution to an English language teaching (ELT) issue through an HPBL project. The concluding stage comprised two distinct components: "The inquiry process and peer feedback" (weeks 10-11) and "composition and revision" (weeks 12-14), during which students completed a post-test after presenting, revising, and finalizing their projects. The quantitative evaluation was carried out utilizing the Argumentative Writing Test and a rubric modified from the works of Weigle [37], [38]. Using these rubrics, various facets of cognitive complexity in writing were evaluated. Expert review ensured the content validity of the instruments, and three raters assessed student essays; a focus group discussion assisted in the establishment of scoring standards. The rubrics for argumentative writing are presented in Table 2.

Table 2. Argumentative writing scoring rubric [37]

Criteria	Excellent 8	Very good 6	Average 4	Needs improvement 2
Thesis	The essay contains a clearly stated and focused thesis statement.	The written piece comprises a clearly stated argument. However, the focus would have been sharper.	The thesis phrasing sounds simple and lacks complexity. The writer does not word the thesis correctly.	The thesis statements require a clear objective and does not fit the theme in the content of the essay.
Content	The essay contains well-developed ideas. Concession and rebuttal are strongly supported with specific and relevant evidence and examples	The essay content appears illustrative and balanced. Concession and Rebuttal are adequately supported with relevant evidence and examples	The essay contains unbalanced content that requires more analysis. Concession and rebuttal are included but not adequately supported	The essay contains a lot of research information without analysis or commentary. Concession and/or rebuttal is missing
Organization	The essay contains stiff topic sentences and a controlled organization.	The essay contains a logical and appropriate organization. The writer uses clear topic sentences.	The essay has an inconsistent organization.	The essay shows the absence of a planned organization
Sentences' fluency	The essay has a natural flow, rhythm, and cadence. The sentences are well built and have a wide-ranging and robust structure that enhances reading	The ideas mostly flow and motivate a compelling reading.	The essay appears irregular and hard to read.	Readers have to go through the essay several times to give this paper a fair interpretive reading
Grammar and mechanics	There is no spelling, capitalization, punctuation or grammatical errors. The essay contains correct and varied sentence structure rich and interesting	There are few spellings, capitalization, punctuation or grammatical errors. The essay comprises minor errors in sentence structure	There are several spellings, capitalization, punctuation or grammatical errors. The essay contains several run-ons, fragments and /or unclear sentences	There are many spellings, capitalization, punctuation or grammatical errors. The essay encompasses frequent sentence errors interfere with the communication of ideas

After assessing the students' drafts utilizing the previously provided rubrics, the adapted Ellerton rubric is employed to evaluate the analysis skills in the argumentative essays as presented in Table 3. The research employed the students' grades from the academic writing course to assess their writing proficiency and analysis level. An initial examination of the data using descriptive statistics yielded a comprehensive summary, revealing valuable information regarding the distribution and central tendencies of the student's

performance. Following this, the paired t-test was utilized to examine hypotheses, considering the normal distribution of the data [39]. The null hypothesis that the data for post-test writing and post-test analysis followed a normal distribution was rejected by the tests of normality, which included the Kolmogorov-Smirnov and Shapiro-Wilk tests, because the p-values were below the conventional significance level of 0.05, as detailed in Table 4.

Table 3. Rubric for analysis skills [38]

Cognitive Skills	Accomplished 4-5	Developing 2-3	Competent 0-1
Examining ideas	Key concepts and structures are correctly identified and named.	Key concepts and structures are partially identified and named.	Key concepts and structures are inaccurately identified and named.
Argument deconstruction	The supporting evidence is described in detail.	The supporting evidence is partially clarified.	The supporting evidence is ambiguous.

Table 4. The result of the normality test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Post_test_writing	.210	30	.002	.897	30	.003
Post_test_analysis	.216	30	.001	.807	30	.000

a. Lilliefors significance correction

4. RESULTS AND DISCUSSION

4.1. To what extent does implementing HPBL promote the overall writing skills of EFL students in an academic writing course?

The utilization of HPBL proves to be a highly effective catalyst in substantially improving the writing abilities in an academic writing course. Thirty students exhibited a remarkable transformation after performing a statistical analysis of the writing scores acquired before and after the assessment. It is apparent from Table 5 encompassing the result of descriptive statistics of writing skills.

Table 5. Descriptive statistics of writing skills

		Statistics	
		Pre_test_writing	Post_test_writing
N	Valid	30	30
	Missing	0	0
Mean		31.8667	68.6000
Median		32.2857[a]	67.3333[a]
Std. Deviation		3.44146	5.48729
Range		14.00	22.00

a. Calculated from grouped data.

Table 5 showcases a significant improvement following the integration HPBL into the academic writing course. The average writing score surged from 31.87 to 68.60, with median scores reflecting a similar positive trend from 32.29 to 67.33. Notably, the post-test scores exhibited a broader range, increasing from 3.44 to 5.49, highlighting the dynamic and personalized learning experience within the HPBL framework. The present research investigates the effects of HPBL on students' writing proficiency within the context of an academic writing course. In order to provide a thorough evaluation of the efficacy of HPBL in improving student's writing abilities, we employ rigorous paired sample testing to ascertain tangible results of development, as detailed in Table 6.

The results showed that students' academic writing abilities improved significantly after implementing the HPBL. The substantial and statistically significant increase of 36.73 points in writing scores between the pre-test and post-test can be ascribed to the HPBL intervention. The results align with the proposed hypotheses, as previous studies have also underscored the positive impacts of HPBL on students' writing abilities [40]–[43]. By incorporating writing into projects directed by students as an authentic, organized inquiry, HPBL creates an ideal environment for fostering the development of sophisticated writing abilities. To effectively navigate the complexity and confusion of projects, students must engage in the following stages: planning, composition, revision, and editing [37] to comprehensively articulate concepts, ideas, and evidence. It aligns with the iterative process that academic writers employ to construct meaning [44].

Table 6. Paired sample t-test for writing skills

		Paired differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error mean	95% confidence interval of the difference Lower	Upper			
Pair 1	Pre_test_writing - Post_test_writing	-36.73333	5.86005	1.06989	-38.92151	-34.54515	-34.334	29	.000

Further investigation is warranted due to the observed variability in the post-test scores despite the anticipated progress level. The existence of a broader range and standard deviation suggests that specific students demonstrated more significant advancements relative to their peers. This phenomenon can be attributed to the self-directed components of HPBL, wherein students generate more personalized results by exerting effort and becoming invested in the learning process [45]. In conclusion, the statistically significant results validate the effectiveness of HPBL as an educational paradigm shift that promotes the development of critical twenty-first-century written communication abilities. Moreover, their contributions broaden the conceptual frameworks of academic writing instruction and strengthen the body of knowledge regarding active, contextualized learning approaches.

4.2. To what extent does implementing HPBL enhance the analysis abilities of EFL students within an academic writing course?

By statistically analyzing the pre-test and post-test analysis scores of 30 participants, this study illuminates the effect of HPBL on EFL students' development of analysis skills. It is deceptive from Table 7, encompassing the result of descriptive statistics of analysis skills. The average analysis score in Table 7 demonstrated a significant improvement, escalating from 36.00 in the pre-test to a remarkable 70.67 in the post-test; this signifies a noteworthy development in analytical aptitude. The upward trajectory is additionally supported by the median scores, which demonstrated a noteworthy increase from 36.21 to 70.91. Nevertheless, there was a noticeable rise in the variability of scores, as evidenced by the standard deviation, which rose from 5.63 in the pre-test to 7.85 in the post-test. These results indicate a higher degree of variability in student performance after implementing HPBL, which signifies a range of learning outcomes in analytics. Following this, ascertain concrete evidence of progress through a rigorous statistical analysis, placing particular emphasis on paired samples test as shown in Table 8.

Table 7. Descriptive statistics of analysis skills

		Statistics	
		Pre_test_analysis	Post_test_analysis
N	Valid	30	30
	Missing	0	0
Mean		36.0000	70.6667
Median		36.2069[a]	70.9091[a]
Std. Deviation		5.63242	7.84915
Range		20.00	20.00

a. Calculated from grouped data.

The paired samples test in Table 8 thoroughly examines the effects that HPBL has on the analytical capabilities of the participants. The results demonstrate a significant and positive improvement in analytical proficiency, as evidenced by the substantial mean difference of 34.66667 between scores obtained before and after the intervention. The critical parameter in statistical analysis, the t-value, is calculated as -23.175 with 29 degrees of freedom. This value provides additional evidence to support the significance of the observed improvement. Also, persuasive is the p-value of 0.000, which is significantly lower than the standard threshold for significance of 0.05. The statistical significance of the results is emphasized by the low p-value, which confirms that the observed enhancement in analytical scores is not coincidental. The numerical illustration highlights the effectiveness of HPBL in cultivating a significant enhancement in analytical proficiencies.

Table 8. Paired sample t-test for analysis skills

		Paired differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error mean	95% confidence interval of the difference Lower	Upper			
Pair 1	Pre_test_analysis - Post_test_analysis	-34.66667	8.19307	1.49584	-37.72601	-31.60732	-23.175	29	.000

The research results underscore the critical significance of enhancing higher-order thinking abilities in the context of scholarly writing. Recognizing the enduring difficulty instructors encounter when attempting to integrate these cognitive abilities into writing courses [1]–[3], the present study employs the innovative pedagogical approach of HPBL to tackle this educational dilemma. Building upon constructivist principles, HPBL effectively amalgamates face-to-face and virtual interactions to accommodate the ever-changing demands of writing instruction [11]–[13]. This assertion is consistent with well-established research on project-based learning, which suggests that students' critical thinking, problem-solving, and evaluative abilities are significantly enhanced through the integration of HPBL in writing [46]–[48].

The research findings highlight the congruence between the advanced approach of HPBL and the overarching goal of enhancing HOTS through the identification of conceptual alignment. The research specifically examines the correlations between the cognitive advantages linked to academic writing and those ascribed to HPBL approaches [14]–[17]. The research highlights the significance of HPBL in fostering the growth of creative and critical thinking skills [20]–[23]. These are essential elements in composing engaging written compositions firmly rooted in extensively researched viewpoints [24], [25].

Based on prior research and theoretical underpinnings that support the effectiveness of HPBL in augmenting analytical abilities, the extent of the observed improvements indicates that the outcomes were expected. The exceptional results observed in the analysis scores are probably attributable to the dynamic and individualized learning process incorporated into the HPBL framework. Finally, the study provides empirical evidence for the effectiveness of HPBL in improving analysis skills. It contributes to the ongoing discourse on pedagogical approaches in academic writing. The findings underscore the depth of the positive impact and offer valuable insights for educators seeking innovative strategies to enhance HOTS within academic writing courses.

5. CONCLUSION

Within the ever-evolving realm of education, this study aims to investigate the profound impact that HPBL has on the teaching of writing. Severe statistical analyses serve as the foundation of this research, providing insightful perspectives on the effectiveness of HPBL while exploring its intricate effects on writing and analytical abilities. Placing due notice on the study's constraints, including its restricted scope and small sample size, underscores the importance of exercising prudence when extrapolating results. Several elements, including individual learning styles, instructional approaches, and evaluation standards, are implicated in the observed variability and merit additional investigation. However, the research study substantially adds to the ongoing dialogue surrounding novel pedagogical methodologies. Although our study provides insights into the potential of HPBL to improve writing and analytical abilities, additional research is required to investigate its enduring effects and suitability in various educational settings. Future research may also investigate the efficacy of HPBL in diverse cultural contexts and its application to additional facets of language learning.

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