

Does Digital Pedagogy Matter for EFL Writing? Cybergogy, Student Engagement, and High School Students' Writing Skills

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Abstract: Writing remains one of the most demanding skills in EFL learning because it requires students to coordinate linguistic accuracy, idea development, organization, and sustained cognitive effort. In digitally mediated learning contexts, effective pedagogy and students' active engagement may play important roles in supporting writing development. This study examined the correlations among cybergogy, student engagement, and English writing skills among high school students in Serang City, Indonesia. Using a quantitative correlational design, the study included 330 Grade XI students selected from a population of 1,887. Data were collected using a validated 12-item questionnaire with a five-point Likert scale and analyzed in SPSS 26. The analysis included normality testing, Pearson correlation, t-tests, ANOVA, and coefficient of determination. The findings showed that cybergogy was significantly and positively correlated with students' writing skills ($r = 0.564$, $p < 0.001$), whereas student engagement showed a stronger positive correlation ($r = 0.688$, $p < 0.001$). Simultaneously, cybergogy and student engagement were significantly associated with writing skills ($R = 0.763$, $R^2 = 0.582$, $F = 151.121$, $p < 0.001$), explaining 58.2% of the variance in students' writing skills. These results indicate that EFL writing development is associated not only with the quality of digitally mediated pedagogy but also with students' behavioral, emotional, and cognitive engagement. The study implies that English teachers should design digital writing instruction that combines structured online activities, interactive feedback, collaborative practice, and engagement-oriented learning tasks to support students' writing development.

Keywords: cybergogy; student engagement; EFL writing skills; digital pedagogy; writing development; high school students.

1. Introduction

Digital technology has increasingly transformed the way English writing is taught and learned, offering students broader access to learning resources, online feedback, collaborative platforms, and opportunities to draft, revise, and share written work beyond the traditional classroom. In EFL contexts, these affordances are especially important because writing remains one of the most demanding language skills. Students are required to generate ideas, organize information coherently, use appropriate vocabulary and grammar, revise their texts, and regulate their writing process over time (Geng et al., 2022; Pham & Bui, 2021; Teng et al., 2022). Technology-supported writing environments can potentially address some of these challenges by providing more flexible, interactive, and feedback-rich learning experiences. Studies have shown that digital

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tools such as online writing platforms, Google Docs, wikis, automated feedback systems, and collaborative writing environments can support EFL learners' writing development when they are used to facilitate interaction, revision, peer response, and sustained writing practice (Al-Wasy, 2020; Ebadi & Rahimi, 2017; Hsu & Lo, 2018; Link et al., 2022; Valizadeh, 2022; Wen & Walters, 2022).

However, the presence of technology does not automatically improve students' writing skills. Digital access may provide learning opportunities, but it does not guarantee meaningful learning unless the tools are supported by a clear pedagogical design. In many technology-mediated learning contexts, students may remain passive, distracted, or uncertain about how to use online resources to plan, develop, and revise their writing. Previous research has emphasized that digital writing tools become educationally meaningful only when they are integrated with purposeful instruction, structured feedback, active participation, and opportunities for reflection and revision (Fu & Liu, 2022; Hafner & Ho, 2020; Tian & Zhou, 2020; Zhang & Hyland, 2018). Thus, the central issue in digital writing instruction is not simply whether technology is available, but whether the learning environment is pedagogically designed to support students' cognitive, social, and emotional involvement in writing.

Cybergogy offers a useful framework for addressing this issue because it positions digital learning as a pedagogically organized process rather than a mere transfer of instruction to online platforms. As a digital pedagogy framework, cybergogy emphasizes integrating cognitive engagement, social interaction, emotional support, learner autonomy, and technology-mediated participation into learning (Rahma et al., 2021; Satria et al., 2024; Saputro et al., 2025). In writing instruction, cybergogy is particularly relevant because students need more than access to digital materials; they need guided opportunities to plan, compose, collaborate, receive feedback, revise, and monitor their writing progress. Research on digitally mediated writing has shown that online environments can support writing development when they promote feedback use, peer interaction, revision behavior, and the use of metacognitive strategies (Conijn et al., 2022; Huang & Zhang, 2022; Qin et al., 2022; Tian et al., 2022). Therefore, cybergogy may contribute to students' writing skills by creating digital learning conditions that are interactive, structured, and responsive to the demands of the writing process.

Yet even well-designed digital pedagogy may have a limited impact if students are not actively engaged in learning. Student engagement is a key condition that determines whether learners participate meaningfully in academic tasks, persist through difficulty, and use learning opportunities productively. In language learning, engagement is commonly understood as a multidimensional construct involving behavioral, emotional, and cognitive dimensions (Bond & Bedenlier, 2019; Oga-Baldwin, 2019; Philp & Duchesne, 2016; Sulis, 2022). Behavioral engagement refers to participation, attention, effort, and persistence; emotional engagement involves interest, enjoyment, confidence, and affective connection; while cognitive engagement includes strategic thinking, deep processing, self-regulation, and investment in understanding. These dimensions are particularly important in writing because writing is recursive and effortful. Students must plan, draft, monitor, revise, and respond to feedback, often over several stages rather than in a single performance. Prior studies have shown that students who engage more actively with writing tasks and feedback are more likely to revise meaningfully and improve their texts, whereas weak engagement is associated with superficial revision and limited writing development (Alharbi, 2022; Tian & Zhou, 2020; Yu et al., 2019; Zhang & Hyland, 2022; Zheng & Yu, 2018).

For this reason, cybergogy and student engagement should be examined together rather than treated as separate concerns. Cybergogy explains how digital learning environments are pedagogically designed, while student engagement explains how students respond to and participate in those environments. A digitally mediated writing class may be well equipped with platforms and resources, but students' writing development depends on whether they actually engage with writing tasks, feedback, revision, and interaction. Conversely, students may be motivated and willing to learn, but their engagement may not translate into stronger writing skills if the digital learning environment is poorly structured. This suggests that English writing development in digital contexts may be better understood by considering the combined

roles of pedagogical design and learner engagement. Previous studies have discussed cybergogy in relation to online learning, learner perceptions, self-regulated learning, reading, and speaking skills (Amiruddin et al., 2023; Du et al., 2022; Efrizal et al., 2024; Satria et al., 2024), while research on writing has often emphasized feedback, metacognition, digital tools, and engagement separately (Qin et al., 2022; Sun & Zhang, 2022; Zhang & Hyland, 2022). However, limited empirical attention has been paid to the simultaneous relationship between cybergogy and student engagement and English writing skills, particularly among Indonesian high school students.

The present study addresses this gap by examining the correlations among cybergogy, student engagement, and English writing skills among high school students in Serang City, Indonesia. Its novelty lies in positioning EFL writing skills as an outcome associated with both digitally mediated pedagogy and students' active engagement within one correlational framework. This focus is timely because schools increasingly integrate digital learning into English instruction. Yet, stronger evidence is needed to clarify whether digital pedagogy and student engagement are meaningfully associated with students' writing performance.

If this relationship is not investigated, digital writing instruction may continue to be understood primarily as technology use rather than as an engagement-oriented pedagogical process. Schools may provide online platforms, digital resources, and learning applications without ensuring that these tools support meaningful writing practice, feedback interaction, revision, and sustained student participation. At the same time, teachers may overlook the possibility that students' engagement is a central condition for digital pedagogy to influence writing development. This may result in classrooms where technology is present but does not substantially improve writing performance. Therefore, examining cybergogy and student engagement together is important for informing English teachers, curriculum designers, and schools about how to organize digital learning environments to better support EFL writing development.

Based on this background, this study aims to examine the correlations among cybergogy, student engagement, and English writing skills among high school students in Serang City. Specifically, the study seeks to answer the following research questions: (1) Is there a significant correlation between cybergogy and students' English writing skills? (2) Is there a significant correlation between student engagement and students' English writing skills? and (3) Is there a significant simultaneous correlation between cybergogy, student engagement, and students' English writing skills?

2. Method

2.1 Research Design

This study employed a quantitative correlational design to examine the relationships among cybergogy, student engagement, and students' English writing skills. A correlational design was considered appropriate because the study sought to determine the degree and direction of association among naturally occurring variables without manipulating instructional conditions or assigning participants to treatment groups. In educational research, correlational designs are commonly used to determine whether and to what extent variables are related, while avoiding causal claims that require experimental control. Therefore, this design aligned with the study's purpose, namely to investigate whether cybergogy and student engagement were significantly associated with students' English writing skills, both individually and simultaneously. In this study, cybergogy and student engagement were treated as predictor variables, while English writing skills served as the outcome variable. The design enabled the researchers to answer three research questions: the correlation between cybergogy and writing skills; the correlation between student engagement and writing skills; and the simultaneous correlation among cybergogy, student engagement, and writing skills among high school students in Serang City.

2.2 Population and Sample

The population consisted of 1,887 Grade XI students enrolled in selected public high schools in Serang City, Indonesia. These schools were selected based on contextual and practical considerations, including the availability of Grade XI students, the presence of English teachers, accessibility for data collection, and the need to include students from varied educational backgrounds. Grade XI students were considered appropriate participants because they had already received sustained English instruction and were expected to have experience with both English writing tasks and digitally mediated learning activities.

The sample size was determined using the Slovin formula with a 5% margin of error, resulting in 330 students as participants. The use of a relatively large sample was appropriate for correlational analysis because larger samples provide more stable estimates of relationships among variables and reduce the likelihood that the findings are strongly influenced by random variation. The sample size also allowed the researchers to conduct Pearson correlation and multiple regression analyses with sufficient statistical power to examine the individual and combined relationships among the variables.

2.3 Research Variables

This study involved three main variables. The first predictor variable was cybergogy, which refers to pedagogically organized digital learning practices designed to support meaningful learning in technology-mediated environments. In this study, cybergogy was understood as students' experience of digital learning that facilitated access to learning materials, interaction, feedback, participation, and learning support in English writing instruction. This conceptualization is consistent with the view that cybergogy is not merely the use of technology but a digital pedagogy that integrates cognitive, social, and emotional dimensions of learning (Rahma et al., 2021; Satria et al., 2024; Saputro et al., 2025).

The second predictor variable was student engagement, defined as students' behavioral, emotional, and cognitive investment in learning. Behavioral engagement refers to students' participation, effort, attention, and persistence; emotional engagement refers to interest, enjoyment, confidence, and affective connection to learning; and cognitive engagement refers to strategic thinking, deeper processing, and self-regulated learning. This multidimensional understanding is supported by previous engagement research in language learning and technology-mediated education (Bond & Bedenlier, 2019; Oga-Baldwin, 2019; Philp & Duchesne, 2016; Sulis, 2022).

The outcome variable was English writing skills, referring to students' ability to produce written English by developing ideas, organizing content, using appropriate vocabulary and grammar, maintaining coherence, and demonstrating control over written expression. Writing was treated as a multidimensional skill because EFL writing requires linguistic accuracy, idea development, organization, revision, and metacognitive control (Geng et al., 2022; Qin et al., 2022; Teng et al., 2022).

2.4 Research Instrument

Data were collected using a 12-item questionnaire measured on a five-point Likert scale. The questionnaire was designed to measure students' responses related to cybergogy, student engagement, and English writing skills. Likert-type scales are widely used in educational and social science research because they allow respondents to indicate degrees of agreement with structured statements and enable researchers to transform perceptions, attitudes, and learning-related constructs into quantitative data suitable for statistical analysis (Ferrando et al., 2025; Koo & Yang, 2025).

The questionnaire was developed to represent the three constructs under investigation. Items related to cybergogy focused on students' experiences of digital learning environments, including access to learning resources, technology-mediated interaction, feedback, and learning support. Items related to student engagement reflected behavioral, emotional, and cognitive involvement in learning activities. Items related to writing skills addressed students' writing-related performance and learning experiences, including

organization, language use, and writing development. Before administration, the instrument was reviewed by expert validators in English education to establish content validity. Expert judgment is an important step in instrument development because it helps ensure that each item is relevant, clear, and aligned with the intended construct (Kania et al., 2024; Nurjanah et al., 2023). After the validation process, the instrument's reliability was assessed using Cronbach's alpha. The questionnaire obtained a reliability coefficient of 0.88, indicating good internal consistency. In quantitative research, Cronbach's alpha is commonly used to estimate the reliability of multi-item instruments, and values above 0.70 are generally considered acceptable for research purposes (Sürücü & Maslakçı, 2020; Taber, 2018). Therefore, the instrument was considered reliable for measuring the intended variables in this study.

2.5 Data Collection Procedures

Data collection was conducted after the questionnaire had been validated and its reliability confirmed. The validated instrument was administered to the 330 selected Grade XI students. Before completing the questionnaire, participants were informed of the study's purpose and instructed to respond honestly based on their actual learning experiences. Since the study employed a correlational design, no instructional treatment or experimental intervention was introduced. Instead, the data reflected students' existing experiences with cybergogy, their level of engagement, and their English writing skills in the current learning context. The students' responses were collected, checked for completeness, coded numerically on a five-point Likert scale, and prepared for statistical analysis using SPSS version 26. This procedure ensured that the data were organized systematically and suitable for descriptive and inferential statistical analysis.

2.6 Data Analysis

The data were analyzed using SPSS version 26 through several stages. First, descriptive statistics were calculated to summarize the distribution of cybergogy, student engagement, and writing skills scores. These statistics included minimum score, maximum score, mean, median, mode, variance, standard deviation, frequency, and percentage distribution. Descriptive statistics were used to provide an overview of the general profile of each variable before inferential analysis. Second, a normality test was conducted to determine whether the data met the assumptions for parametric analysis. The Kolmogorov-Smirnov test was used because the sample size was large. The results showed that the significance values for all variables were greater than 0.05, indicating that the data were normally distributed. Testing normality is important because parametric procedures such as Pearson correlation and regression require the data to reasonably meet distributional assumptions (Sathyanarayana, 2026). Third, Pearson product-moment correlation analysis was used to examine the relationship between cybergogy and students' English writing skills, and between student engagement and students' English writing skills. Pearson correlation was appropriate because the variables were treated as continuous and the normality assumption was met. This analysis enabled the researchers to determine both the direction and strength of the bivariate relationships among the variables (Suherman et al., 2025). Fourth, multiple linear regression analysis was used to examine the individual and joint relationships between cybergogy, student engagement, and students' English writing skills. The t-test was used to assess the partial significance of each predictor, while the F-test (ANOVA) was used to determine the overall significance of the regression model. Regression analysis is appropriate when researchers aim to estimate the contributions of multiple predictors to an outcome variable and to examine the model's explanatory power (Baždarić et al., 2021). Finally, the coefficient of determination (R^2) was calculated to identify the proportion of variance in students' writing skills explained by cybergogy and student engagement. R^2 is commonly used in regression analysis to assess how much of the variability in the outcome variable is explained by the predictors (Chicco et al., 2021).

3. Results

This section presents the results of the statistical analyses addressing the three research questions: the relationship between cybergogy and students' English writing skills; the relationship between student engagement and students' English writing skills; and the simultaneous relationship among cybergogy,

student engagement, and students' English writing skills. Before hypothesis testing, descriptive statistics and normality testing were conducted to summarize the data distribution and determine the suitability of parametric analysis. The data were obtained from 330 Grade XI students in Serang City and analyzed using SPSS version 26.

3.1 Descriptive Statistics and Normality Testing

The descriptive statistics showed that students' writing skills, cybergogy, and student engagement scores were distributed within moderate to moderately high ranges. Students' writing skills scores ranged from 40 to 75, with a mean score of 58.58 and a standard deviation of 5.569. This indicates that most students' writing scores clustered around the moderate level, with a relatively narrow spread. Cybergogy scores ranged from 49 to 75, with a mean of 60.64 and a standard deviation of 6.171, indicating that students generally reported moderate to moderately high levels of experience with digitally mediated learning. Student engagement scores ranged from 43 to 75, with a mean score of 61.68 and a standard deviation of 6.197, indicating that students' behavioral, emotional, and cognitive engagement in learning was relatively stronger than the other two variables.

The Kolmogorov-Smirnov normality test was conducted to assess whether the data met the assumption of normality for parametric statistical analysis. The results showed that the significance values for all variables were higher than 0.05: writing skills = 0.272, cybergogy = 0.290, and student engagement = 0.255. These results indicate that all three variables were normally distributed. Therefore, the data were appropriate for further parametric analyses, including Pearson correlation, t-tests, ANOVA, and regression analysis.

Table 1. Descriptive Statistics and Normality Test

Variable	N	Min	Max	Mean	SD	Median	Mode	K-S Sig.	Interpretation
Writing skills	330	40	75	58.58	5.569	58.00	56	0.272	Normal
Cybergogy	330	49	75	60.64	6.171	59.00	56	0.290	Normal
Student engagement	330	43	75	61.68	6.197	60.00	60	0.255	Normal

Table 1 shows that student engagement had the highest mean score, followed by cybergogy and writing skills. This suggests that although students reported relatively positive engagement and digital learning experiences, their English writing skills remained at a moderate level. The normality results further confirm that the dataset fulfilled the statistical assumptions required for subsequent inferential analysis.

3.2 Correlations among Cybergogy, Student Engagement, and Writing Skills

The first and second research questions examined whether cybergogy and student engagement were significantly correlated with students' English writing skills. Pearson product-moment correlation analysis was used because the data were normally distributed. The results showed a positive, statistically significant correlation between cybergogy and students' writing skills, with $r = 0.564$ and $p < 0.001$. This indicates that students who reported stronger cybergogy-related learning experiences tended to have higher English writing skills. The results also showed that student engagement had a stronger, positive, and statistically significant correlation with students' writing skills, with a correlation coefficient of $r = 0.688$ and a significance level of $p < 0.001$. This means that students with higher behavioral, emotional, and cognitive engagement tended to demonstrate better writing skills. Compared with cybergogy, student engagement showed a stronger relationship with writing skills, suggesting that students' active participation, effort, motivation, attention, persistence, and cognitive investment may be particularly important in writing development.

Table 2. Pearson Correlations among the Variables

Variable	Writing skills	Cybergogy	Student engagement
Writing skills	1		

Variable	Writing skills	Cybergogy	Student engagement
Cybergogy	.564**	1	
Student engagement	.688**	—	1

Note. $p < .001$. The correlation between cybergogy and student engagement was not reported in the original statistical output; therefore, it is not included in the table.

These findings answer the first two research questions. Cybergogy and student engagement were both significantly associated with students' English writing skills. However, the relationship between student engagement and writing skills was stronger than the relationship between cybergogy and writing skills. This pattern suggests that while digitally mediated pedagogy is important, students' actual engagement in learning may be more directly connected to their writing performance.

3.3 Partial Significance of Cybergogy and Student Engagement

To further examine the individual significance of cybergogy and student engagement in relation to writing skills, a partial significance test was conducted. The results showed that cybergogy had a t-value of 5.396, which exceeded the t-table value of 1.967, with a significance level of $p < 0.001$. This result indicates that cybergogy was individually and significantly associated with students' English writing skills. Student engagement had a t-value of 9.289, with a significance level of $p < 0.001$. This indicates that student engagement was also individually and significantly associated with students' English writing skills. The higher t-value for student engagement further supports the correlation results, indicating that student engagement had a stronger statistical relationship with writing skills than cybergogy did.

Table 3. Partial Significance Test of Predictors

Predictor	t-value	t-table	Sig.	Interpretation
Cybergogy	5.396	1.967	.000	Significant
Student engagement	9.289	1.967	.000	Significant

The results in Table 3 confirm that both predictor variables were individually significant. In other words, cybergogy and student engagement each had a meaningful relationship with students' English writing skills. However, student engagement appeared to be the stronger individual predictor based on its higher t-value.

3.4 Simultaneous Relationship of Cybergogy and Student Engagement with Writing Skills

The third research question examined whether cybergogy and student engagement were simultaneously significantly related to students' English writing skills. The regression model showed a strong simultaneous relationship between the two predictor variables and writing skills. The R value was 0.763, indicating a strong relationship between cybergogy, student engagement, and students' writing skills. The R^2 value was 0.582, meaning that cybergogy and student engagement together explained 58.2% of the variance in students' English writing skills. The adjusted R^2 value was 0.578, indicating that the model remained stable after adjustment for the number of predictors.

The ANOVA result showed that the model was statistically significant, with $F = 151.121$ and $p < 0.001$. This means that cybergogy and student engagement were both significantly related to students' writing skills. The standard error of the estimate was 5.073, indicating the average prediction error in estimating students' writing skills from the two predictor variables.

Table 4. Regression Model Summary

Model	R	R^2	Adjusted R^2	F	Sig.	Std. Error
Cybergogy and student engagement → writing skills	.763	.582	.578	151.121	.000	5.073

The results in Table 4 indicate that cybergogy and student engagement jointly explained a substantial proportion of the variance in students' writing skills. The R^2 value of 0.582 indicates that 58.2% of the variance in writing skills is explained by the two variables included in the model. In contrast, the remaining 41.8% may be explained by other factors not examined in this study, such as students' prior writing proficiency, vocabulary knowledge, grammar mastery, writing anxiety, teacher feedback, motivation, access to digital resources, or self-regulated writing strategies.

4. Discussion

The findings of this study show that both cybergogy and student engagement were significantly associated with students' English writing skills. Cybergogy had a positive correlation with writing skills, while student engagement showed a stronger positive correlation. More importantly, cybergogy and student engagement simultaneously explained 58.2% of the variance in students' writing skills. These results suggest that EFL writing development in digitally mediated learning environments is related not only to the availability of digital tools but also to how digital learning is pedagogically structured and to students' active participation in the writing process. This finding supports the study's central argument that technology becomes meaningful for writing development when accompanied by engagement-oriented instruction, feedback opportunities, interaction, and sustained learner involvement. In other words, digital pedagogy and student engagement appear to operate as mutually reinforcing conditions in supporting students' English writing skills.

The significant correlation between cybergogy and writing skills indicates that students who experienced stronger digitally mediated pedagogical support tended to demonstrate better writing performance. This finding is theoretically reasonable because writing in digital learning environments can provide students with wider access to learning materials, opportunities for online interaction, feedback, revision, and collaborative writing practice. Previous studies have shown that technology-supported writing can enhance EFL learners' writing development when it is integrated with purposeful instructional design, peer interaction, and revision-oriented activities (Ebadi & Rahimi, 2017; Al-Wasy, 2020; Hsu & Lo, 2018; Valizadeh, 2022; Wen & Walters, 2022). In this study, cybergogy was not understood simply as the use of technology, but as a digital pedagogical approach that supports cognitive, social, and emotional participation. Therefore, the positive relationship between cybergogy and writing skills suggests that digital learning may be more productive when structured to support students in planning, composing, interacting, revising, and reflecting on their writing.

However, the moderate strength of the relationship between cybergogy and writing skills also indicates that digital pedagogy alone is not sufficient. Technology-rich environments may provide access and flexibility, but they do not automatically guarantee better writing outcomes. Students may still use digital tools passively, become distracted, or fail to turn online learning opportunities into meaningful improvements in writing if learning activities are not clearly guided. This aligns with previous research emphasizing that the effectiveness of digital tools depends on how feedback, interaction, revision, and learner participation are pedagogically organized (Zhang & Hyland, 2018; Tian & Zhou, 2020; Fu & Liu, 2022; Hafner & Ho, 2020). Thus, the present finding reinforces the idea that the value of cybergogy lies not in digital access itself, but in the quality of instructional design that enables students to engage productively with writing tasks.

The stronger correlation between student engagement and writing skills is particularly important. Student engagement showed a higher correlation coefficient than cybergogy, suggesting that students' behavioral, emotional, and cognitive involvement may be more closely connected to writing performance than digital pedagogy alone. This finding is consistent with engagement theory, which views learning as dependent on students' effort, attention, persistence, interest, confidence, strategic thinking, and self-regulation (Bond & Bedenlier, 2019; Oga-Baldwin, 2019; Philp & Duchesne, 2016; Sulis, 2022). In writing instruction, engagement is especially critical because writing requires sustained effort across multiple stages, including idea generation, drafting, monitoring, feedback interpretation, revision, and editing. Students who are more

engaged are more likely to invest time in writing, respond to feedback, revise meaningfully, and persist when facing linguistic or organizational difficulties. This supports previous findings that students' engagement with feedback and revision is closely related to improvements in writing (Yu et al., 2019; Tian & Zhou, 2020; Alharbi, 2022; Zhang & Hyland, 2022).

The stronger role of engagement also suggests that writing development should not be reduced to instructional delivery. Even when digital pedagogy is available, students' writing skills may not improve substantially unless they are actively involved in the learning process. Engagement functions as the mechanism through which digital learning opportunities are transformed into writing development. For example, an online writing platform may provide feedback, resources, or a collaborative space. However, students must still read the feedback, understand it, apply it, revise their drafts, and monitor their progress. Without such behavioral and cognitive engagement, digital tools may remain underused. Similarly, emotional engagement matters because students who feel interested, supported, and confident are more likely to continue writing and revising. This interpretation is consistent with studies showing that positive emotions, motivation, and engagement contribute to EFL learning and writing performance (Sadoughi & Hejazi, 2021; Wang, 2022; Yu et al., 2020).

The simultaneous relationship between cybergogy, student engagement, and writing skills provides a more integrated understanding of digitally mediated EFL writing. The R^2 value of 0.582 indicates that cybergogy and student engagement together explained a substantial proportion of the variance in writing skills. This suggests that the development of writing skills in digital learning contexts is shaped by both external pedagogical design and internal learner involvement. Cybergogy may provide the structure, tools, interactional opportunities, and feedback environment, while student engagement determines how actively students make use of those opportunities. This finding supports previous arguments that effective technology-mediated learning requires interaction between instructional design and learner participation (Henrie et al., 2015; Richardson et al., 2017; Bergdahl & Hietajärvi, 2022; Stewart, 2021). In writing contexts, this interaction is especially important because writing development is gradual and process-based; students need repeated opportunities to compose, receive feedback, revise, and evaluate their progress.

This study also contributes to the literature by extending the discussion of cybergogy to EFL writing skills. Previous cybergogy studies have frequently focused on online learning, learner perceptions, self-regulated learning, speaking, or reading development (Amiruddin et al., 2023; Du et al., 2022; Saputro et al., 2025; Satria et al., 2024). The present findings show that cybergogy is also relevant to writing, a skill that requires sustained cognitive effort, metacognitive control, revision, and feedback. By examining cybergogy together with student engagement, the study offers a more comprehensive explanation of writing development in digital classrooms. It suggests that writing instruction should not treat technology and engagement as separate issues. Instead, digital pedagogy should be designed specifically to foster engagement, and engagement should be understood as a central condition for students to benefit from digital writing instruction.

The findings have several pedagogical implications. First, English teachers should design digital writing instruction that goes beyond assigning online tasks or having students submit writing via digital platforms. Digital writing activities should include clear writing goals, guided planning, structured drafting, feedback cycles, peer interaction, and revision tasks. Second, teachers should use cybergogy principles to create learning environments that support cognitive, social, and emotional participation. Cognitive support may include writing models, strategy instruction, feedback rubrics, and revision checklists. Social support may involve peer review, collaborative writing, online discussion, and teacher-student interaction. Emotional support may include encouraging feedback, manageable tasks, and opportunities for students to build confidence in writing. Third, teachers should deliberately strengthen student engagement by making writing tasks meaningful, interactive, and process-oriented. Since engagement showed a stronger relationship with writing skills than cybergogy, digital writing instruction should prioritize students' active participation, sustained effort, and reflective involvement rather than relying solely on technology use.

The results also suggest that schools should be cautious in interpreting digital learning success. Providing digital infrastructure, platforms, or online materials is important, but these resources will have limited impact if they are not accompanied by pedagogical planning and student engagement. Schools need to support teachers in developing digital pedagogical competence so that technology can be used to promote feedback-rich and engagement-oriented writing instruction. Professional development should therefore focus not only on technical skills, but also on designing online writing tasks, managing student interaction, providing digital feedback, and encouraging students to revise and reflect on their writing. In this sense, cybergogy should be implemented as a pedagogical framework, not merely as a technological innovation.

Despite its contributions, this study has several limitations. First, the study used a correlational design, so the findings cannot establish causal relationships among cybergogy, student engagement, and writing skills. Although the variables were significantly associated, it cannot be concluded that cybergogy or engagement directly caused improvement in students' writing performance. Second, the study relied on questionnaire-based data, which may reflect students' perceptions or self-reported experiences rather than direct observation of digital learning behavior. Third, the study was conducted among Grade XI students in Serang City, which may limit the generalizability of the findings to other educational levels, regions, or EFL contexts. Fourth, the model explained 58.2% of the variance in writing skills, leaving 41.8% explained by other variables not examined in this study, such as vocabulary knowledge, grammar mastery, prior writing proficiency, writing anxiety, teacher feedback quality, motivation, digital access, and self-regulated writing strategies.

Future research should address these limitations by using longitudinal or experimental designs to examine whether cybergogy-based instruction can directly improve writing skills over time. Further studies should also include performance-based writing assessments, classroom observation, digital learning analytics, or student writing portfolios to complement questionnaire data. In addition, future research may examine mediating or moderating variables, such as self-regulated learning, feedback literacy, writing anxiety, digital competence, and teacher support, to better understand how cybergogy and engagement influence writing development. Comparative studies across different school levels, regions, and digital learning contexts would also provide broader evidence on the role of cybergogy and student engagement in EFL writing instruction. This study demonstrates that students' English writing skills are significantly associated with both cybergogy and student engagement. The findings highlight that digital pedagogy matters, but its value depends strongly on students' behavioral, emotional, and cognitive engagement in the writing process. Therefore, the central implication of this study is that effective EFL writing instruction in digital contexts should move beyond mere access to technology and focus on designing learning environments that promote active engagement, meaningful feedback, collaborative participation, and sustained revision.

5. Conclusion

Effective digital writing instruction is not determined by technology access alone, but by the extent to which digital pedagogy can generate meaningful student engagement in the writing process. This study provides empirical support for this argument by showing that cybergogy and student engagement were both significantly associated with English writing skills among high school students in Serang City. While cybergogy was positively related to writing skills, student engagement showed a stronger relationship, indicating that students' behavioral participation, emotional involvement, and cognitive investment are especially important in supporting writing performance. The simultaneous analysis further demonstrated that both variables explained 58.2% of the variance in students' writing skills, suggesting that digitally mediated pedagogy and learner engagement operate as interconnected factors rather than separate influences. These findings point to the need for EFL teachers to design digital writing activities that are not only technologically supported but also pedagogically structured, interactive, feedback-rich, and engagement-oriented. Practical classroom strategies may include guided writing plans, collaborative online drafting, peer and teacher feedback cycles, revision checklists, reflective writing tasks, and digital platforms that encourage sustained participation rather than passive task completion. Nevertheless, the findings

should be interpreted within the limits of a correlational and questionnaire-based study; they indicate meaningful associations but do not establish causality or directly measure the quality of students' written products over time. Future research should therefore employ longitudinal, experimental, or mixed-methods designs, incorporate direct writing assessments, and examine additional variables, including feedback literacy, writing anxiety, grammar mastery, vocabulary knowledge, digital competence, self-regulated writing strategies, and teacher support. By foregrounding the joint role of cybergogy and engagement, this study contributes to a more nuanced understanding of EFL writing development in digital learning contexts. It reinforces the need to move from technology-centered instruction toward engagement-centered digital pedagogy.

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7. Declaration of AI Use

The authors used Grammarly and a GPT-based AI tool during manuscript preparation. Grammarly was used to check grammar, spelling, punctuation, and sentence-level clarity, while the GPT-based tool assisted with academic wording, coherence, and readability refinement. These tools were used solely for editorial support and did not generate research data, perform statistical analyses, modify results, or determine the scholarly interpretation of the findings. The authors reviewed all technology-assisted revisions and take full responsibility for the accuracy, originality, integrity, and final content of the manuscript.

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