

Cadets' Psychological Needs Satisfaction and AI Literacy in EFL: The Mediating Role of Writing Motivation

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Abstract

The growing importance of AI literacy within education context has prompted questions regarding the psychological factors that support its development in EFL contexts, particularly in a military-style higher education, where such relationships remain underexplored. Framed within Self-Determination Theory, this study investigates the levels of cadets' basic psychological needs satisfaction, writing motivation and AI literacy. It further examines the relationships between psychological needs satisfaction, writing motivation, and AI literacy, and probes the mediating role of writing motivation. A quantitative design was employed involving 69 third-year police cadets enrolled in an English language course. Spearman's rank-order correlation and mediation analysis using PROCESS Model 4 with 5,000 bootstrap samples were utilized to analyze the data. The findings revealed cadets demonstrated high levels of basic psychological needs satisfaction, writing motivation and AI literacy. Additionally, significant positive correlations were found among the variables ($r_s = .453-.594$, $p < .001$), and writing motivation partially mediated the relationship between psychological needs satisfaction and AI literacy (indirect effect = 0.1738, 95% CI [0.0573, 0.3285]). These results suggest that fulfillment of psychological needs plays an important role in enhancing student motivation and, in turn, promotes AI literacy in EFL learning environments.

Keywords: AI literacy, cadets, mediation analysis, psychological needs satisfaction, writing motivation

INTRODUCTION

Artificial intelligence (AI) is increasingly integrated into EFL learning, making AI literacy an important capability for learners who engage with AI-supported language tasks. In EFL writing, AI tools can provide personalized support and facilitate learners' engagement with writing activities, but effective use requires learners to understand and critically evaluate AI-generated information (Deshen et al., 2026; Fang et al., 2025). At the same time, writing motivation remains important in shaping learners' willingness to engage in and persist with L2

writing, particularly in AI-mediated environments where learners must navigate both linguistic and technological demands (Pan & Zhang, 2025). These considerations suggest that AI literacy in EFL writing should be examined not only as a technological capability but also in relation to learners' motivational and psychological conditions.

For cadets in a military-style higher education context, the learning environment may be particularly relevant to understanding their engagement with English and emerging educational technologies. Their learning takes place within a highly structured institutional setting, where regimented schedules, disciplinary expectations, and competing training demands may limit opportunities for flexible and autonomous learning (Siswadie & Santiar, 2026; Waluyo et al., 2025). Such contextual conditions may create challenges for sustaining learners' motivation and engagement in foreign language learning (Siswadie & Santiar, 2026). Within this context, motivation may also be relevant to how learners engage with emerging educational technologies. Recent research has identified a significant relationship between AI literacy and learner motivation (Zhao, 2025), while psychological need satisfaction and motivational beliefs have been associated with the development of AI literacy (Wang et al., 2025). Examining the relationship between writing motivation and AI literacy among cadets can therefore provide context-specific insight into how motivational and technological dimensions of EFL learning intersect within a highly structured professional education environment.

As AI literacy and writing motivation have become increasingly important in EFL learning, researchers have sought to clarify its nature and dimensions. AI literacy is generally understood as a multidimensional construct rather than a single technical skill. A foundational framework proposed by Ng et al.

(2021) conceptualizes AI literacy through four interrelated dimensions: knowing and understanding AI, using and applying AI, evaluating and creating AI, and addressing ethical issues. Importantly, this conceptualization positions AI literacy beyond the ability to operate AI tools, emphasizing learners' capacity to understand, apply, evaluate, and use AI responsibly. This framework has provided a basis for subsequent conceptualizations and empirical measures of AI literacy (Deshen et al., 2026).

Writing motivation can be conceptualized through Self-Determination Theory (SDT), developed by Ryan and Deci (2000). SDT proposes that motivation and engagement are influenced by the extent to which social environments support three basic psychological needs: autonomy, competence, and relatedness. The theory holds that intrinsic motivation grows stronger when the environment supports feelings of competence, for instance through helpful feedback, appropriate challenges, and fair evaluation (Ryan & Deci, 2000).

This perspective is particularly relevant to AI literacy because learners' satisfaction of autonomy, competence, and relatedness has been found to be associated with their development of AI literacy (Wang et al., 2025). Within this framework, autonomy may be relevant to learners' ability to make purposeful decisions about when and how to use AI, while competence may support their ability to understand, apply, and evaluate AI effectively. Relatedness may also contribute by providing meaningful social interaction and learning support in developing AI literacy.

Drawing on these conceptual foundations, researchers have explored how AI literacy relates to various educational outcomes. Previous research has examined associations between AI literacy and variables such as engagement, self-efficacy, autonomy, and academic performance. For example, studies of pre-service teachers have found that AI

literacy correlates with emotional engagement, self-regulated learning, autonomy, and competence (Deshen et al., 2026). Evidence also suggests that learning environments built around AI can shift student motivation, self-efficacy, and engagement in meaningful ways (Bećirović et al., 2026). Other research has shown that productive use of AI tools helps students stay engaged with writing and produce higher-quality work (Fang et al., 2025). The relationship between AI literacy and writing motivation has attracted considerable scholarly interest. Pan and Zhang (2025) reported that AI literacy had a stronger influence on writing self-efficacy than teacher affective support, suggesting that knowing how to use AI tools plays a bigger role in how competent students feel. Moreover, because AI literacy can give students more control over their writing, it may strengthen their sense of autonomy—a finding that highlights how complex motivation in L2 writing really is. Even so, most research has concentrated on measurable outcomes like writing scores or tool use, leaving the connection between AI literacy and writing motivation relatively underexplored (Pan & Zhang, 2025).

Although research on AI literacy has expanded, several gaps remain. Empirically, existing studies have examined factors such as school support and basic psychological need satisfaction in relation to AI literacy among teachers (Wang et al., 2025; Yang & Li, 2026), but the relationships among basic psychological need satisfaction, writing motivation, and AI literacy have received limited attention among EFL students. Theoretically, although Self-Determination Theory is well established in educational psychology, its application to AI literacy remains relatively underexplored, particularly in explaining how the satisfaction of basic psychological needs may contribute to AI literacy and, in turn, relate to learners' motivation (Bećirović et al., 2026). Methodologically, this gap also points to a

need for research that moves beyond examining bivariate associations to investigate whether motivation functions as a potential mechanism linking basic psychological need satisfaction and AI literacy. Contextually, research on AI literacy has predominantly focused on Western and East Asian educational settings, with comparatively limited attention to Indonesian EFL learners and, more specifically, cadets in military-style higher education institutions, whose learning occurs within distinctive disciplinary and educational environments. Taken together, these gaps suggest the need to examine not only whether basic psychological need satisfaction, writing motivation, and AI literacy are related, but also how these variables may be connected within the context of Indonesian EFL education.

This study addresses these gaps by examining how AI literacy, BPNS, and writing motivation relate to one another among Indonesian EFL university students, with a focus on military-style academy cadets. Using SDT as a guiding framework, the study treats BPNS—autonomy, competence, and relatedness—as a key psychological factor linked to motivation in AI-mediated EFL writing. Its goals are threefold: to gauge levels of psychological needs satisfaction, writing motivation, and AI literacy; to analyze the relationships among these variables in AI-assisted writing settings; and to determine whether writing motivation mediates the link between psychological need satisfaction and AI literacy among cadets. By probing these correlations and the possible mediating role of motivation, the research aims to deepen our understanding of the psychological and technological factors that shape EFL learners' writing experiences in an age of AI-integrated education.

METHODOLOGY

This study employed a quantitative cross-sectional design to examine the associations among basic psychological needs satisfaction, writing motivation, and AI literacy among EFL learners. The study was theoretically grounded in Self-Determination Theory (SDT), which explains that human motivation develops through the fulfillment of three fundamental psychological needs: autonomy, competence, and relatedness. Within this framework, basic psychological needs satisfaction was examined as the predictor variable, writing motivation was investigated as a potential mediating pathway, and AI literacy was considered the outcome variable.

A cross-sectional design was selected because it enables the examination of relationships among variables through statistical analysis based on data collected at a single point in time. However, given the non-longitudinal nature of the design, the mediation analysis in this study was interpreted as examining indirect associations among variables rather than establishing causal relationships.

The study was conducted at a military-style higher education institution located in Central Java, Indonesia. The participants were third-year cadets enrolled in a compulsory IELTS course. A convenience sampling strategy was applied because participants were selected based on their accessibility and willingness to participate in the study.

Initially, 101 cadets completed the online questionnaire. Before conducting statistical analyses, data screening procedures were performed to identify potentially invalid response patterns. Particular attention was given to reverse-coded items because inconsistent responses between positively and negatively worded statements may indicate inattentive responding.

In the writing motivation scale, one reverse-coded item was included: "I do not enjoy writing in English." Among the collected responses, 32 participants demonstrated contradictory response patterns by simultaneously indicating agreement with positive writing motivation statements and strong agreement with the reverse-coded negative statement. These response patterns suggested inconsistency within the same construct. Therefore, these 32 cases were excluded from subsequent analyses to improve the reliability of the dataset. After the screening process, the final analytical sample consisted of 69 participants.

Participation was voluntary, and respondents were informed that their responses were anonymous and would be used exclusively for research purposes. No personally identifiable information was collected during questionnaire administration.

Data were collected using a structured questionnaire consisting of three main instruments measuring AI literacy, writing motivation, and psychological needs satisfaction. All instruments were adapted from established theoretical frameworks and previously validated measurement scales. The adaptation process focused on maintaining the original theoretical constructs while ensuring contextual relevance for Indonesian EFL learners.

AI literacy was measured using a 14-item instrument adapted from Ng et al. (2021). The instrument covers four dimensions of AI literacy: knowledge, application, evaluation, and ethics. The items assessed learners' understanding of AI concepts, ability to use AI tools for learning purposes, ability to evaluate AI-generated information, and awareness of ethical considerations related to AI use.

Writing motivation was assessed using an adapted version of the Academic Motivation

Scale (AMS) developed by Vallerand et al. (1992). Although the original AMS was designed to measure general academic motivation, the present study contextualized the instrument within English writing activities in the IELTS learning environment.

The adaptation involved modifying the wording of items to specifically refer to writing-related experiences while maintaining the original motivational dimensions. The scale consisted of 11 items representing intrinsic motivation, extrinsic motivation, and amotivation. Examples of adapted items include statements related to enjoying English writing activities, perceiving writing as important for academic and future goals, and willingness to engage in writing tasks. This contextual adaptation was intended to measure learners' motivational orientations toward English writing activities rather than general academic motivation.

Psychological needs satisfaction was measured using a 12-item scale adapted from Ryan and Deci (2000). The instrument consisted of three dimensions: autonomy, competence, and relatedness, with four items representing each dimension.

All instruments employed a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Negatively worded items were reverse-coded before analysis.

To ensure contextual appropriateness, the adapted instruments were reviewed based on their theoretical alignment, clarity of wording, and suitability for the Indonesian EFL learning context. The adaptation process focused on preserving the conceptual meaning of each construct while modifying item expressions to fit the research setting.

Internal consistency reliability was evaluated using Cronbach's alpha coefficient. The AI literacy scale demonstrated high reliability

with Cronbach's alpha of $\alpha = .905$ across 14 items. The writing motivation scale showed good internal consistency with $\alpha = .896$ across 11 items. Meanwhile, the psychological needs satisfaction scale demonstrated high reliability with $\alpha = .903$ across 12 items. These values exceeded the commonly accepted reliability threshold of $\alpha \geq .70$.

The questionnaire was developed using Google Forms and distributed through class communication channels. Before completing the questionnaire, participants received information regarding the purpose of the study, confidentiality procedures, voluntary participation, and their right to withdraw from participation without academic consequences.

The survey required approximately 10 minutes to complete, and data collection was conducted over a seven-day period. The anonymous survey format was implemented to minimize potential response pressure, particularly considering the hierarchical characteristics of the institutional context.

Statistical analyses were conducted using SPSS version 32. Composite scores for each construct were calculated by averaging the corresponding item responses. Descriptive statistics, including means and standard deviations, were calculated to describe participants' levels of psychological needs satisfaction, writing motivation, and AI literacy.

Because the data distribution did not meet normality assumptions, Spearman's rank-order correlation analysis was initially conducted to examine the relationships among variables.

To examine the potential mediating role of writing motivation, mediation analysis was performed using Hayes' PROCESS macro Model 4 in SPSS. In the mediation model, psychological needs satisfaction was entered

as the independent variable (X), writing motivation as the mediator (M), and AI literacy as the dependent variable (Y).

The analysis examined direct and indirect associations among variables. The indirect effect was tested using bootstrapping procedures with 5,000 bootstrap samples and a 95% confidence interval. An indirect effect was considered statistically significant when the confidence interval did not include zero.

RESULTS AND DISCUSSION

Results

Participants consisted predominantly of male cadets (91.3%), with females representing a small minority (8.7%). Majority of the respondents fell within the 21- to 22-year-old age group (56.5%) and described themselves as intermediate-level writers (75.4%). In terms of technology engagement, nearly half of them reported frequent use of AI with ChatGPT listed as the dominant choice (84.1%).

Table 1. Reliability test

Scale	Cronbach's Alpha	Number of Items
BPNS	.903	12
Motivation	.896	11
AI Literacy	.905	14

Before conducting the main statistical analyses, the internal consistency of the measurement instruments was assessed using Cronbach's alpha coefficients. As presented in Table 1, all three scales demonstrated high reliability, with alpha values exceeding the recommended threshold of .70. The psychological needs satisfaction scale showed excellent internal consistency ($\alpha = .903$; 12 items), while the writing motivation scale also demonstrated high reliability ($\alpha = .896$; 11 items). Similarly, the AI literacy scale produced a high reliability coefficient ($\alpha = .905$; 14 items).

These results indicate that the items within each instrument demonstrated strong internal consistency and consistently measured their respective constructs. The alpha coefficients, which were close to or above .90 across all scales, suggest a high level of measurement reliability. However, reliability coefficients were interpreted as evidence of internal consistency rather than construct validity, as validity assessment requires additional evidence beyond Cronbach's alpha.

Table 2. Normality test

Variable	Statistic	Df	Sig
BPNS	.132	69	.005
Motivation	.157	69	<.001
AI Literacy	.179	69	<.001

The normality assumption was examined using the Kolmogorov-Smirnov test. As shown in Table 2, the decision regarding normality was based on the significance value (Sig.). A significance value below .05 indicates that the data significantly deviates from a normal distribution. The results showed that psychological needs satisfaction (Sig. = .005), writing motivation (Sig. < .001), and AI literacy (Sig. < .001) were not normally distributed. Therefore, Spearman's rank-order correlation was employed for correlation analysis, while bootstrapping procedures using Hayes' PROCESS Macro were applied for mediation analysis.

Cadets' Levels of BNPS, Writing Motivation and AI Literacy

Table 3. Descriptive Statistic of Main Variables

Variable	N	Min	Max	Mean	Std. Deviation
BPNS	69	27	60	50.01	8.668
Motivation	69	32	55	48.58	6.379

AI Literacy	69	42	70	62.74	7.318
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Descriptive analysis revealed that participants reported relatively high levels across all three measured constructs. To facilitate interpretation based on the five-point Likert scale, total mean scores were converted into average item scores by dividing the mean total score by the number of items in each scale.

Basic psychological needs satisfaction yielded a total mean score of 50.01 (SD = 8.668), corresponding to an average item score of 4.17 on the five-point scale. This indicates that participants generally reported positive perceptions regarding the fulfillment of autonomy, competence, and relatedness. Nevertheless, the standard deviation suggests variability in participants' perceptions of psychological needs satisfaction.

Writing motivation demonstrated a mean total score of 48.58 (SD = 6.379), corresponding to an average item score of 4.42. This finding indicates that participants generally reported high motivation toward English writing activities. Compared with BPNS, the smaller standard deviation suggests that responses regarding writing motivation were relatively more consistent among participants.

AI literacy showed the highest mean score among the three constructs, with a total mean score of 62.74 (SD = 7.318), corresponding to an average item score of 4.48. This indicates that participants generally reported high levels of AI literacy, including perceived knowledge, application ability, evaluation skills, and ethical awareness related to AI use.

Overall, the descriptive findings indicate that participants reported relatively high levels of psychological needs satisfaction, writing motivation, and AI literacy. The variation reflected by the standard deviations suggests that individual differences remained present across all measured constructs.

Relationships Among BPNS, Writing Motivation and AI Literacy

Table 4. Spearman Correlation Analysis

Variable	1	2	3
1. AI Literacy	—	.578***	.594***
2. Motivation	.578***	—	.453***
3. BPNS	.594***	.453***	—

Correlation analysis revealed significant positive associations among all three constructs. Spearman's rank-order correlation coefficients (ρ) were used as both indicators of the direction and strength of associations among variables. The magnitude of the coefficients was interpreted as an effect size, with values around .10, .30, and .50 representing small, moderate, and large associations, respectively.

The association between AI literacy and writing motivation was positive and statistically significant, showing a moderate-to-large effect size ($\rho = .578$, $p < .001$). This finding indicates that cadets who reported higher levels of AI literacy also tended to report stronger motivation toward writing activities. Similarly, AI literacy demonstrated a significant positive association with psychological needs satisfaction, with a relatively strong correlation effect ($\rho = .594$, $p < .001$). This suggests that higher levels of basic psychological needs satisfaction were associated with higher AI literacy scores among participants.

The relationship between writing motivation and psychological needs satisfaction was also positive and statistically significant, although comparatively smaller in magnitude ($\rho = .453$, $p < .001$), indicating a moderate association. Cadets reporting greater satisfaction of autonomy, competence, and relatedness also tended to report higher levels of writing

motivation. This pattern is consistent with the theoretical assumption of Self-Determination Theory that psychological need satisfaction is related to motivational outcomes.

Overall, the correlation findings demonstrate significant relationships among psychological needs satisfaction, writing motivation, and AI literacy. However, because the data were collected using a cross-sectional design, these associations should be interpreted as statistical relationships rather than evidence of causal effects.

The Mediating Role of Writing Motivation

Table 5. Mediation Analysis

Path	B	SE	T	P	95% CI
BPNS → Motivation (a)	0.3461	0.0793	4.36	< .001	[0.1878, 0.5045]
Motivation → AI Literacy (b)	0.5020	0.1131	4.44	< .001	[0.2762, 0.7278]
BPNS → AI Literacy (c')	0.3266	0.0832	3.92	< .001	[0.1604, 0.4928]
Indirect effect (a × b)	0.1738	0.0698	—	—	[0.0573, 0.3285]

Mediation analysis was conducted using Hayes' PROCESS Macro Model 4 with 5,000 bootstrap samples. Statistical significance of indirect effects was determined based on 95% bootstrap confidence intervals that excluded zero. Before examining the indirect association between psychological needs satisfaction, writing motivation, and AI literacy, a mediation model was estimated using Hayes' PROCESS Macro Model 4. In this model, psychological needs satisfaction was specified as the predictor variable, writing motivation as

the mediator, and AI literacy as the outcome variable.

The first regression model examined the association between psychological needs satisfaction and writing motivation. The model was statistically significant, $F(1,67) = 19.03$, $p < .001$, explaining 22.1% of the variance in writing motivation ($R^2 = .221$). Psychological needs satisfaction showed a significant positive association with writing motivation ($B = 0.346$, $SE = 0.079$, $t = 4.36$, $p < .001$, 95% CI [0.1878, 0.5045]). This finding indicates that cadets reporting higher levels of autonomy, competence, and relatedness satisfaction also tended to report stronger motivation toward English writing activities.

The second regression model examined whether psychological needs satisfaction and writing motivation jointly explained variation in AI literacy. The overall model was statistically significant, $F(2,66) = 33.05$, $p < .001$, explaining 50.0% of the variance in AI literacy ($R^2 = .500$). Writing motivation demonstrated a significant positive association with AI literacy ($B = 0.502$, $SE = 0.113$, $t = 4.44$, $p < .001$, 95% CI [0.2762, 0.7278]). This result suggests that participants with higher writing motivation also tended to report higher levels of AI literacy.

After accounting for writing motivation, psychological needs satisfaction remained significantly associated with AI literacy ($B = 0.327$, $SE = 0.083$, $t = 3.92$, $p < .001$, 95% CI [0.1604, 0.4928]). This indicates that psychological needs satisfaction was related to AI literacy both directly and through its association with writing motivation.

The indirect association between psychological needs satisfaction and AI literacy through writing motivation was statistically significant ($B = 0.174$, $BootSE = 0.070$, 95% BootCI [0.0573, 0.3285]). Because the bootstrap confidence interval did not include zero, the indirect effect was considered

statistically significant. The completely standardized indirect effect was 0.206 (95% BootCI [0.0763, 0.3534]), indicating a meaningful indirect association between psychological needs satisfaction and AI literacy through writing motivation.

Overall, the mediation analysis suggests that writing motivation partially accounts for the association between psychological needs satisfaction and AI literacy. However, because the study employed a cross-sectional design, these findings should be interpreted as evidence of statistical associations rather than causal relationships.

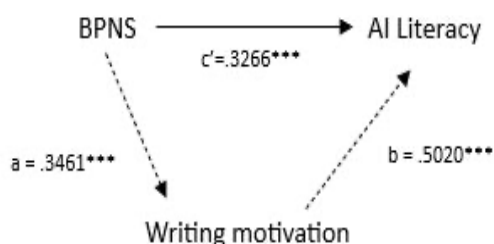


Figure 1. mediation model of writing motivation

The visual model presents the statistical relationships among psychological needs satisfaction, writing motivation, and AI literacy. The model illustrates both the direct association between psychological needs satisfaction and AI literacy and the indirect association through writing motivation. Specifically, psychological needs satisfaction is examined in relation to writing motivation and AI literacy, while writing motivation represents the potential pathway linking psychological needs satisfaction with AI literacy. The model provides a visual representation of the direct and indirect relationships tested in the mediation analysis.

Discussion

The present study examined the relationships among basic psychological needs satisfaction, writing motivation, and AI literacy among

EFL cadets in a military-style higher education institution. The findings demonstrated that participants reported relatively high levels of psychological needs satisfaction, writing motivation, and AI literacy. Among these constructs, AI literacy showed the highest descriptive score, followed by writing motivation and psychological needs satisfaction. Furthermore, correlation analysis revealed significant positive associations among all three variables, while mediation analysis indicated that writing motivation statistically accounted for part of the relationship between psychological needs satisfaction and AI literacy.

These findings provide empirical evidence that psychological and motivational factors are associated with learners' AI-related competencies in an EFL learning context. However, because the study employed a cross-sectional design, the findings should be interpreted as statistical associations rather than evidence of causal relationships.

The present study found that AI literacy obtained the highest mean score among the measured constructs, indicating that participants reported relatively strong confidence in understanding, applying, evaluating, and considering ethical aspects of AI technologies. This finding aligns with the conceptualization of AI literacy proposed by Ng et al. (2021), who described AI literacy as a multidimensional competency involving AI knowledge, application skills, evaluation ability, and ethical awareness.

The relatively high level of AI literacy observed in this study may reflect the increasing integration of AI technologies into academic activities. Demographic information revealed that a substantial majority engaged with AI technologies on a frequent basis, with 44.9% reporting regular use and another 17.4% indicating very frequent use. This pattern suggests AI tools have become embedded in routine learning behaviors. Such repeated

hands-on experience likely cultivated greater ease, assurance, and practical skill when applying AI for academic work. Previous studies suggest that engagement with AI-supported learning environments can provide learners with opportunities to develop familiarity with AI tools and strengthen technology-related competencies. For example, Lyu and Salam (2025) found that AI-powered personalized learning significantly improved learners' digital literacy, motivation, and self-efficacy, suggesting that structured interaction with AI-mediated learning environments may contribute to the development of AI-related competencies.

Nevertheless, this interpretation should be considered within the scope of the present study. Although previous research provides empirical support for the potential role of AI-supported learning environments, AI exposure, usage patterns, and interaction quality were not directly measured in this study. Therefore, future research should examine how different forms of AI engagement contribute to the development of AI literacy among language learners.

The elevated writing motivation uncovered in this research can be meaningfully examined through the framework of SDT as articulated by Ryan and Deci (2000). This theoretical perspective highlights how autonomy, competence, and relatedness serve as foundational pillars for nurturing intrinsic drive and psychological health. Within AI-supported writing contexts, these digital tools may grant learners expanded autonomy over their composing processes—whether through brainstorming assistance, revision support, or immediate evaluative feedback. Such features can amplify students' perceptions of capability and agency regarding writing tasks, which in turn strengthens their motivation to write. Other researchers have reached similar conclusions, finding that learning environments augmented by AI can favorably

shape learner motivation, involvement, and self-belief through more individualized and encouraging educational experiences (Lyu & Salam, 2025; Pan & Zhang, 2025).

The strong motivational profile may also connect to where participants stood in terms of writing ability. The vast majority (75.4%) were intermediate-level writers, with smaller numbers at either the beginner or advanced stages. Cadets at the intermediate level might view AI as a helpful companion in navigating writing difficulties, especially concerning grammar, word choice, structural organization, and the generation of ideas. Consequently, these technologies may ease writing-related anxiety while boosting learner confidence and eagerness to take on writing activities. This aligns with previous work showing that AI-integrated writing settings can reinforce engagement and motivation by buttressing writing performance and self-assurance (Lyu & Salam, 2025; Pan & Zhang, 2025).

Despite recording the lowest mean of the three variables, psychological needs satisfaction still landed in the high category, signaling that learners generally encountered supportive psychological conditions within their educational environment. SDT maintains that fulfilling needs for autonomy, competence, and relatedness fuels optimal motivation, engagement, and personal flourishing (Ryan & Deci, 2000). The competence dimension may have held particular significance in this study, given that cadets who regularly worked with AI tools likely cultivated stronger beliefs in their own effectiveness when tackling writing assignments. AI technologies deliver prompt assistance, customized feedback, and adaptive guidance. These constitute all factors that can deepen learners' feelings of competence throughout the writing journey. Studies have similarly emphasized that AI-enhanced educational contexts can strengthen learner confidence, involvement, and

perceived capability through responsive, personalized learning experiences (Lyu & Salam, 2025; Yang & Li, 2026).

Taken together, these findings paint a picture of participants who were motivationally engaged, psychologically supported, and technologically ready for AI-assisted writing endeavors. Incorporating AI into cadets' learning routines appears to have fostered not merely AI literacy but also heightened writing motivation and psychological need fulfillment. These results underscore SDT's explanatory power for understanding motivational and psychological dynamics within AI-enhanced learning while supporting the multifaceted conception of AI literacy advanced by Ng et al. (2021), which emphasizes the diverse competencies needed for productive engagement with AI technologies.

The findings demonstrated a significant positive association between psychological needs satisfaction and writing motivation. This result aligns with Self-Determination Theory (SDT), which proposes that satisfaction of autonomy, competence, and relatedness facilitates learners' motivational processes (Ryan & Deci, 2000). Empirical evidence from foreign language learning contexts supports this theoretical assumption. Agawa and Takeuchi (2016) found that the fulfillment of competence needs had a significant positive influence on Japanese EFL learners' motivation, highlighting the role of psychological need satisfaction in shaping motivational outcomes in language learning.

Consistent with this perspective, the present study showed that overall basic psychological needs satisfaction was positively associated with writing motivation among EFL learners. However, because the current study examined basic psychological needs satisfaction as an overall construct rather than analyzing autonomy, competence, and relatedness separately, the findings do not indicate which

specific psychological need dimension is most strongly associated with writing motivation. Future research should investigate the differential contributions of each psychological need dimension in AI-supported writing contexts.

The present study also found a significant positive association between writing motivation and AI literacy. This result indicates that participants who reported stronger motivation toward writing activities also tended to report higher levels of AI literacy.

The positive association between writing motivation and AI literacy suggests that learners' motivational orientations may be related to their engagement with AI-related competencies. One possible explanation is that learners who are more motivated toward writing activities may demonstrate greater willingness to explore and utilize available technological resources, including AI-based writing tools. Through such engagement, learners may gain greater familiarity with AI functions and develop their ability to evaluate and apply AI technologies in learning contexts. Supporting this interpretation, Zhang and Kang, (2026) found that AI literacy profiles were associated with motivational and technological factors, suggesting that learners' motivational characteristics may contribute to differences in AI literacy development. However, the present study examined writing motivation as an overall construct and did not investigate specific motivational dimensions or behavioral patterns underlying AI literacy development.

However, the relationship between motivation and AI literacy may involve multiple underlying factors. For example, learners' prior technological experience, digital confidence, and learning opportunities may also contribute to AI-related competencies. Because these factors were not examined in the current study, interpretations regarding the behavioral

processes underlying this relationship should be correspond with greater engagement with considered exploratory. technological resources.

The findings further showed that psychological needs satisfaction was positively associated with AI literacy. This result is supported by recent research suggesting that psychological factors are relevant to AI literacy development. Wang et al. (2025), for example, demonstrated that basic psychological need satisfaction was associated with university students' AI literacy through self-regulated learning strategies. Their findings suggest that autonomy, competence, and relatedness may represent important psychological conditions supporting learners' engagement with AI technologies.

The current findings are consistent with these previous studies by showing that learners who reported greater psychological needs satisfaction also tended to report higher AI literacy. Nevertheless, the present study does not establish that psychological needs satisfaction directly develops AI literacy. Instead, the findings indicate that these constructs are statistically related within the studied context.

The mediation analysis provided additional insight into the relationship among psychological needs satisfaction, writing motivation, and AI literacy. The findings showed that writing motivation statistically accounted for part of the association between psychological needs satisfaction and AI literacy. This suggests that writing motivation represents a potential pathway through which psychological factors are related to AI literacy.

This finding is theoretically consistent with SDT, which emphasizes that psychological need satisfaction supports autonomous motivational processes (Ryan & Deci, 2000). When learners experience autonomy, competence, and relatedness, they may develop stronger motivational orientations toward learning activities, which may

The current finding also complements recent research examining psychological factors and AI-related learning outcomes. Wang et al. (2025) found that psychological need satisfaction was associated with AI literacy through learning-related processes, suggesting that AI literacy development may involve both technological and psychological dimensions.

CONCLUSION

The findings of this study revealed that cadets demonstrated high levels of BPNS, writing motivation, and AI literacy. The study also found significant positive correlations among BPNS, writing motivation, and AI literacy, indicating that the fulfillment of psychological needs is associated with stronger motivation and higher AI literacy levels. Furthermore, writing motivation was found to partially mediate the relationship between BPNS and AI literacy, suggesting that psychologically supportive learning environments may indirectly enhance cadets' AI literacy through increased motivation in writing activities. These findings contribute to the existing literature on Self-Determination Theory and AI integration in language education by providing empirical evidence on the psychological and motivational factors influencing AI literacy development among cadets. The study also offers practical insights for educators and institutions in designing learning environments that support students' psychological needs, strengthen writing motivation, and foster effective AI literacy in academic contexts.

Several limitations should be considered. First, the cross-sectional design limits interpretation of causal relationships among variables. Future longitudinal studies could examine whether changes in psychological needs satisfaction and writing motivation precede changes in AI literacy over time. Second, the study relied on self-reported measures, which may not fully

represent learners' actual AI practices or writing behaviors. Future research could combine questionnaires with performance-based assessments of AI literacy and writing tasks. Third, although writing motivation was identified as a potential mediating pathway, other variables may also contribute to AI literacy development, including AI usage patterns, digital self-efficacy, technological experience, and instructional support. Future studies may incorporate these factors to develop a more comprehensive understanding of AI literacy development in EFL contexts.

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