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Research Article

EXPLORING AUTONOMOUS LANGUAGE LEARNING STRATEGIES AMONG EFL UNIVERSITY STUDENTS IN DIGITAL ERA

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Abstract

Digital technologies have reshaped language learning by providing EFL university students with access to online resources, mobile applications, artificial intelligence tools, and interactive platforms. This study aimed to identify the autonomous language learning strategies employed by EFL university students in the digital era and examine the factors associated with their use. A quantitative cross-sectional survey was conducted with 250 undergraduate students selected through proportionate stratified random sampling. Data were collected using a validated questionnaire covering cognitive, metacognitive, memory, compensation, affective, social, and digital-resource management strategies, then analyzed through descriptive statistics, correlation, t-tests, analysis of variance, and multiple regression. The findings showed that students used autonomous learning strategies at a high level, with metacognitive strategies receiving the highest mean score, followed by digital-resource management and cognitive strategies. Affective strategies were the least frequently employed. Digital literacy, motivation, and daily digital-learning duration were significantly related to strategy use, while digital literacy emerged as the strongest predictor. The study concludes that learner autonomy in digital contexts depends not only on technological access but also on students' capacity to plan, evaluate, regulate, and ethically integrate digital resources. Universities should therefore provide explicit instruction in strategic learning, critical digital literacy, and responsible artificial intelligence use.

Keywords: Autonomous Learning, Digital Literacy, EFL Students

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INTRODUCTION

The rapid development of digital technology has significantly transformed the ways university students access information, communicate, and learn foreign languages. English as a Foreign Language learners are no longer dependent exclusively on classroom instruction, printed textbooks, or direct explanations from lecturers (M. Liu et al., 2025; C. Wang & Canagarajah, 2024). Digital platforms, artificial intelligence applications, mobile learning tools, online dictionaries, language-learning applications, podcasts, video-sharing platforms, and virtual communities provide extensive opportunities for students to develop their English proficiency independently. This transformation has encouraged a shift from teacher-centered language instruction toward learning environments that provide learners with greater control over their learning processes (Lee & Jeon, 2024; Shahini et al., 2025).

Autonomous language learning has consequently become an important concept in contemporary English language education. Learner autonomy generally refers to the ability and willingness of learners to take responsibility for determining learning objectives, selecting appropriate materials, choosing learning strategies, monitoring progress, and evaluating outcomes (Al-Bogami & Alahmadi, 2025; Zafar et al., 2025). University students are expected to possess a higher degree of independence because academic learning requires initiative, self-regulation, critical thinking, and personal responsibility. The digital era strengthens these expectations by providing flexible learning resources that can be accessed regardless of place and time. Access to technology, nevertheless, does not automatically ensure that students can manage their language learning effectively (Chu, 2025; Sabaté-Dalmau & Moncada-Comas, 2023).

Digital learning environments have expanded the range of strategies that EFL university students can employ outside formal classrooms. Students may improve vocabulary through mobile applications, practice pronunciation using speech-recognition systems, develop listening skills through podcasts, interact with international speakers through social media, or use generative artificial intelligence to obtain explanations and feedback (C.-C. Lin, 2024; Long et al., 2025). These practices indicate that autonomous learning has become increasingly diverse, personalized, and technologically mediated. A systematic examination is required to understand how students select, combine, and evaluate digital strategies in relation to their academic needs, language proficiency, motivation, and learning conditions (Molefi et al., 2024; H. Zhang, 2025).

The availability of digital resources has created a misleading assumption that university students naturally possess the competence required for autonomous language learning. Many students are able to operate digital devices but may lack the metacognitive awareness needed to set realistic goals, select credible resources, regulate study time, and assess their own language development (S. Shi & Zhang, 2025; Yuan & Liu, 2025). Digital familiarity should not be equated with learning autonomy because technological competence and strategic learning competence represent related yet distinct capacities. Students may frequently access English-language content without engaging in deliberate practices that produce meaningful improvement in language proficiency (C.-H. Lin et al., 2025; X. Wang & Wang, 2024).

The unstructured use of digital tools may also expose learners to distraction, superficial engagement, misinformation, and excessive dependence on automated assistance. Social media platforms can provide authentic language input, but they can simultaneously reduce sustained attention and encourage passive consumption (Alrashdan et al., 2024). Artificial intelligence tools may support writing, translation, and grammar correction, yet uncontrolled reliance on such tools may weaken students' opportunities to formulate ideas, solve linguistic problems, and evaluate language independently (H. Liu et al., 2025). These contradictions illustrate that digital technology can either promote or hinder learner autonomy depending on the strategies, purposes, and self-regulatory behaviors adopted by students (Fereydoonfar, 2025; Y. Wang et al., 2024).

Limited empirical understanding of students' actual autonomous learning practices presents another important problem. Institutional expectations often emphasize independent learning without sufficiently examining what students do beyond the classroom, why they choose particular digital resources, how consistently they apply specific strategies, and what difficulties they experience (Nam et al., 2023). Differences in digital literacy, motivation, language proficiency, socioeconomic background, learning preferences, and access to reliable technology may influence the quality of autonomous learning. Research that merely measures the frequency of technology use may overlook the strategic reasoning and contextual factors underlying students' choices.

The primary objective of the study is to explore the autonomous language learning strategies employed by EFL university students in the digital era. The investigation is expected to identify the digital platforms, applications, resources, and learning activities that students use to improve their English skills independently (Cui et al., 2023; Tomisu et al., 2025). Attention should be directed toward strategies related to vocabulary acquisition, grammar development, reading comprehension, academic writing, listening practice, pronunciation, and oral communication. The study should also examine whether students use these strategies systematically or only in response to immediate academic demands (Teng, 2025).

The study also aims to investigate the ways students plan, monitor, regulate, and evaluate their autonomous language learning. This objective places emphasis on the metacognitive and self-regulatory dimensions of digital learning rather than concentrating solely on the types of technology being used (Al Fraidan & Al-Harazi, 2023; Y. Liu & Chang, 2024). Goal setting, time management, resource selection, progress monitoring, self-assessment, and strategy modification represent essential components of effective learner autonomy. An examination of these processes can reveal whether students function as active managers of their learning or remain dependent on external instructions despite having access to digital resources (Rezai et al., 2024; Zarrati et al., 2024).

The research further seeks to identify the factors that facilitate or constrain students' use of autonomous language learning strategies. Personal motivation, self-efficacy, digital literacy, prior learning experiences, perceived usefulness of technology, lecturer support, peer interaction, and institutional learning culture may influence students' engagement in independent learning (Arani, 2025; Bailey et al., 2023). Technical limitations, information overload, uncertainty regarding resource quality, lack of feedback, and difficulty maintaining learning consistency may also restrict autonomous practices. Understanding these factors is expected to provide a more contextualized explanation of how learner autonomy develops within digitally mediated EFL education (Bobrowicz et al., 2024; Mohammadi et al., 2023).

Previous studies on learner autonomy have extensively discussed students' responsibility, motivation, self-regulation, and strategy use in foreign-language learning. A substantial portion of this literature was developed within conventional classroom settings or during the early stages of technology-enhanced language learning (Dahri et al., 2024; Shen et al., 2025). Such studies provide important theoretical foundations, but they may not fully capture the current complexity of digital learning environments characterized by mobile applications, social networking, adaptive learning systems, artificial intelligence, and user-generated content. Contemporary autonomous learning requires learners to navigate a wider and less structured range of resources than earlier research contexts generally considered (Li et al., 2024; Y. Shi et al., 2025).

Existing research on digital language learning has frequently concentrated on the effectiveness of a particular application, platform, or instructional intervention. Studies may evaluate mobile-assisted language learning, online vocabulary applications, digital games, learning management systems, or artificial intelligence tools as separate technological resources (Han, 2025; Wuttiphan & Kwangmuang, 2025). This approach offers valuable evidence regarding specific technologies but provides limited insight into how students

independently combine multiple resources in their daily learning practices. Learners commonly move across applications and platforms, suggesting that autonomous learning should be examined as a strategic ecosystem rather than as the use of a single digital tool (Chang & Sun, 2024; Jiang & Vásquez, 2025).

Research involving EFL university students has also tended to rely heavily on quantitative surveys that report attitudes, perceptions, readiness, or frequency of strategy use. Numerical patterns alone may not adequately explain the intentions, decision-making processes, contextual pressures, and reflective judgments that shape autonomous learning. Limited attention has been given to the relationship between students' reported autonomy and their actual ability to evaluate digital information, sustain learning routines, and reduce dependence on automated support. The present study addresses this gap by exploring both the observable strategies and the underlying reasoning that informs students' digitally mediated language-learning behavior.

The novelty of this study lies in its examination of autonomous language learning as a multidimensional practice shaped by the interaction between learner agency, self-regulation, digital literacy, and technological affordances. The study does not treat digital technology as an inherently beneficial learning solution. Digital resources are instead analyzed as tools whose educational value depends on students' ability to select, manage, evaluate, and integrate them into purposeful learning activities. This perspective provides a more critical interpretation of autonomy by distinguishing active strategic learning from frequent but unreflective technology use.

Another original contribution concerns the exploration of students' strategy repertoires across multiple language skills and digital environments. The study is designed to reveal how learners combine formal and informal resources, individual and collaborative activities, receptive and productive language practices, as well as human and automated feedback. Such an approach can identify patterns of strategy integration that may remain invisible in studies limited to one application or one linguistic skill. The findings may generate a contextual framework explaining how EFL university students construct personalized learning pathways within rapidly changing digital environments.

The importance of the study is supported by its potential theoretical, pedagogical, and institutional contributions. Theoretically, the findings may extend current understandings of learner autonomy by incorporating critical digital literacy and responsible artificial intelligence use into autonomous language-learning practices. Pedagogically, the results may help lecturers design activities that gradually develop goal setting, strategy selection, self-monitoring, resource evaluation, and reflective learning. Institutionally, the study may inform policies and support systems that promote equitable, ethical, and effective digital learning. Evidence from this research is therefore expected to contribute to the development of university students who are not merely technologically active but also strategically independent, critically aware, and responsible language learners.

RESEARCH METHOD

Research Design

This study employed a quantitative survey design to identify autonomous language learning strategies used by EFL university students in the digital era. The design was selected because it enabled the researchers to collect standardized numerical data from a relatively large group of participants and describe patterns of strategy use systematically. The study focused on students' independent learning practices involving digital devices, online platforms, mobile applications, artificial intelligence tools, social media, digital dictionaries, video-sharing platforms, podcasts, and other internet-based language resources. The survey approach also allowed the researchers to examine the frequency and relative dominance of various strategies

employed by students beyond formal classroom instruction (Yi-Ming Kao et al., 2025; Y. Zhang, 2025).

The research adopted a cross-sectional approach in which data were collected from participants at a single point in time. Autonomous language learning strategies were examined through several dimensions, including cognitive, metacognitive, memory-related, compensatory, affective, social, and digital-resource management strategies. The investigation emphasized how students planned their learning activities, selected digital materials, practiced language skills, monitored progress, managed motivation, interacted with other language users, and evaluated learning outcomes. Descriptive quantitative analysis was used as the primary analytical framework because the main objective was to identify and classify the strategies most frequently employed by EFL university students.

Research Target/Subject

The population of the study consisted of undergraduate students who were learning English as a foreign language at a selected university. Eligible participants included students who were actively enrolled during the period of data collection, had completed at least one university-level English course, and regularly used digital technology for academic or personal learning purposes (Lee & Jeon, 2024; C. Wang & Canagarajah, 2024). Students from different semesters were included to obtain a broader representation of autonomous learning experiences, digital competencies, and language-learning practices. The population was considered relevant because university students are increasingly expected to manage their learning independently while using diverse digital resources inside and outside the classroom.

A sample of 250 students was selected through proportionate stratified random sampling. The sampling technique was applied to ensure that students from different academic years or study levels were adequately represented. Participant selection was conducted by dividing the population into semester-based strata and randomly selecting respondents from each group according to its proportion in the total population. Students who did not provide informed consent or submitted incomplete questionnaires were excluded from the final analysis. The sample size was considered sufficient for descriptive survey analysis and for producing a reliable representation of autonomous language learning strategies within the investigated population.

Research Procedure

The research procedure began with the development and contextual adaptation of the questionnaire. Relevant theoretical frameworks and previous empirical studies on learner autonomy, language-learning strategies, self-regulated learning, and digital language education were reviewed to formulate the instrument indicators. Draft questionnaire items were then evaluated by experts and revised according to their comments. The revised instrument was piloted to assess readability, item performance, completion time, validity, and reliability. Necessary modifications were made before the questionnaire was distributed to the main participants (Shahini et al., 2025; Zafar et al., 2025).

Ethical approval and institutional permission were obtained before data collection. Participants received information explaining the purpose of the study, the voluntary nature of their participation, the confidentiality of their responses, and their right to withdraw without academic consequences. Informed consent was obtained from every participant. The questionnaire was distributed electronically through an online survey platform to facilitate efficient access and data management. Participants were given clear instructions and sufficient time to complete all questionnaire sections independently.

Completed responses were screened to identify missing data, duplicate submissions, inconsistent response patterns, and incomplete questionnaires. Valid data were coded and analyzed using statistical software. Frequencies, percentages, means, and standard deviations

were calculated to describe participant characteristics and determine the level of use of each autonomous language learning strategy. Mean scores were ranked to identify the most and least frequently used strategies. Strategy-use levels were categorized as low, moderate, or high based on predetermined score intervals. The findings were interpreted according to the relevant strategy dimensions to explain how EFL university students managed autonomous language learning in digital environments.

Instruments, and Data Collection Techniques

Data were collected using a structured questionnaire on autonomous language learning strategies in digital environments. The instrument was adapted from established language-learning strategy frameworks, particularly the Strategy Inventory for Language Learning, and was modified to reflect contemporary digital learning practices. The questionnaire consisted of two main sections. The first section gathered demographic information, including gender, age, semester, English-learning experience, average duration of digital technology use, and types of digital platforms commonly accessed for language learning. The second section measured autonomous learning strategies through statements covering cognitive, metacognitive, memory, compensation, affective, social, and digital-resource management dimensions.

Responses were recorded using a five-point Likert scale ranging from 1, representing "never," to 5, representing "always." Cognitive items measured activities such as summarizing digital texts, practicing vocabulary through applications, and using online exercises. Metacognitive items examined goal setting, planning, monitoring, and self-evaluation. Social and affective items assessed interaction with peers, communication with native or proficient speakers, anxiety management, and motivation maintenance. Digital-resource management items evaluated students' ability to select credible sources, combine multiple platforms, organize digital materials, manage screen time, and use artificial intelligence responsibly.

Instrument validity was assessed through expert judgment involving specialists in English language teaching, educational technology, and research methodology. The experts evaluated the relevance, clarity, representativeness, and contextual appropriateness of each item (Al-Bogami & Alahmadi, 2025; Chu, 2025). A pilot test was conducted with students who possessed characteristics similar to those of the main sample but were not included in the final study. Item-total correlation analysis was used to examine item validity, while Cronbach's alpha was calculated to determine internal consistency. A coefficient of at least 0.70 was considered acceptable for establishing the reliability of the questionnaire and its respective dimensions.

RESULTS AND DISCUSSION

A total of 250 EFL university students completed the questionnaire, and all submitted responses were included in the final analysis after the data-screening process. The participants consisted of 94 male students (37.6%) and 156 female students (62.4%). Their ages ranged from 18 to 23 years, with a mean age of 20.31 years and a standard deviation of 1.27. The sample included 61 second-semester students (24.4%), 66 fourth-semester students (26.4%), 64 sixth-semester students (25.6%), and 59 eighth-semester students (23.6%). Most participants reported using digital technology for language-learning purposes between one and three hours per day. Mobile phones were the most frequently used devices, followed by laptops and tablets. YouTube, online dictionaries, artificial intelligence chatbots, social media, language-learning applications, and podcast platforms were the most commonly reported digital resources.

The overall results indicated that the participants employed autonomous language learning strategies at a moderately high level. The total mean score across all strategy dimensions was 3.74 on a five-point scale, with a standard deviation of 0.46. Metacognitive strategies obtained the highest mean score, followed by digital-resource management,

cognitive, social, compensation, memory, and affective strategies. The relatively high metacognitive score suggested that many students regularly planned, monitored, and evaluated their language-learning activities. The lower score for affective strategies indicated that students experienced greater difficulty in managing anxiety, sustaining confidence, and regulating emotional responses during independent language learning. Table 1 presents the descriptive statistics for each strategy dimension.

Table 1. Descriptive Statistics of Autonomous Language Learning Strategy Dimensions

Strategy Dimension	Number of Items	Mean	Standard Deviation	Strategy Level	Rank
Metacognitive strategies	7	4.02	0.55	High	1
Digital-resource management strategies	6	3.93	0.58	High	2
Cognitive strategies	8	3.84	0.52	High	3
Social strategies	6	3.71	0.64	High	4
Compensation strategies	5	3.63	0.61	Moderate	5
Memory strategies	6	3.58	0.57	Moderate	6
Affective strategies	5	3.44	0.69	Moderate	7
Overall strategy use	43	3.74	0.46	High	—

The dominance of metacognitive strategies reflected the participants' awareness of the need to organize their own learning in digitally mediated environments. Students commonly reported setting weekly learning targets, identifying weaknesses in particular language skills, monitoring task completion, and checking whether their learning activities contributed to measurable improvement. Digital platforms appeared to support these behaviors by providing flexible access to learning materials, automated progress records, immediate feedback, and opportunities for repeated practice. Goal setting and self-monitoring were especially common among students who used mobile applications and online learning platforms regularly.

The strong use of digital-resource management strategies showed that participants did not rely on a single application or platform. Many students combined online dictionaries, video-sharing platforms, artificial intelligence tools, social media content, and electronic learning materials according to specific learning needs (C.-C. Lin, 2024; Sabaté-Dalmau & Moncada-Comas, 2023). Resource selection was often based on accessibility, ease of use, perceived reliability, and relevance to academic assignments. Some students still reported difficulty evaluating the credibility of online information and controlling the amount of time spent on nonacademic digital activities. This pattern indicated that frequent technology use did not always correspond to strong critical digital literacy.

Item-level analysis revealed that the most frequently used autonomous learning strategy was searching for unfamiliar vocabulary through online dictionaries, with a mean score of 4.31 and a standard deviation of 0.66. Watching English-language videos with subtitles ranked second, followed by using artificial intelligence tools to obtain grammar explanations, setting personal learning targets, and repeating digital audio materials to improve listening comprehension. These practices demonstrated a preference for strategies that provided immediate linguistic support, multimodal input, and direct access to explanations. Students appeared to select practical activities that could be integrated easily into daily routines and academic tasks.

The least frequently used strategies included maintaining a written learning journal, recording emotional responses after learning activities, initiating direct conversations with native English speakers, participating in international discussion forums, and conducting systematic monthly self-evaluations. These strategies required sustained reflection, interpersonal confidence, or long-term commitment, which may have made them less attractive

than activities that produced immediate results. Table 2 presents the five most frequently and five least frequently employed strategies.

Table 2. Most and Least Frequently Used Autonomous Language Learning Strategies

Rank	Strategy Item	Mean	Standard Deviation	Category
1	I use online dictionaries to check unfamiliar vocabulary.	4.31	0.66	High
2	I watch English-language videos with subtitles.	4.24	0.71	High
3	I use artificial intelligence tools to obtain grammar explanations.	4.18	0.74	High
4	I set personal targets for improving my English skills.	4.12	0.72	High
5	I replay digital audio materials to improve listening comprehension.	4.08	0.70	High
39	I evaluate my language-learning progress every month.	3.12	0.86	Moderate
40	I participate in international online discussion forums.	3.04	0.93	Moderate
41	I initiate conversations with native English speakers online.	2.96	0.97	Moderate
42	I record my emotional reactions after independent learning.	2.84	0.91	Moderate
43	I maintain a written journal of my language-learning activities.	2.73	0.95	Moderate

Independent-samples t-test results showed a statistically significant difference between male and female students in overall autonomous language learning strategy use. Female students obtained a higher mean score of 3.81, compared with 3.63 among male students, $t(248) = 3.07$, $p = .002$. The effect size was small to moderate, with Cohen's $d = 0.40$. Significant gender differences were also found in metacognitive and social strategies, while differences in cognitive, memory, compensation, affective, and digital-resource management strategies were not statistically significant. These findings suggested that gender was related to some aspects of autonomous learning but did not explain all variations in students' strategy use.

A one-way analysis of variance identified significant differences in autonomous strategy use across semester groups, $F(3, 246) = 4.86$, $p = .003$, $\eta^2 = .056$. Eighth-semester students obtained the highest overall mean score, whereas second-semester students recorded the lowest score. Post hoc comparisons using the Tukey test indicated that eighth-semester students used autonomous strategies significantly more frequently than second-semester students. Differences between the other semester groups were not statistically significant. Academic experience appeared to support the gradual development of planning, resource evaluation, and self-monitoring skills, although the relatively small effect size indicated that semester level was not the only influential factor.

Table 3. Inferential Analysis of Autonomous Strategy Use

Comparison or Predictor	Statistical Test	Test Value	Significance	Effect Size
Male and female students	Independent-samples t-test	$t(248) = 3.07$	.002	$d = 0.40$
Semester groups	One-way ANOVA	$F(3, 246) = 4.86$	.003	$\eta^2 = .056$

Daily digital-learning duration	One-way ANOVA	$F(2, 247) = 8.14$	$< .001$	$\eta^2 = .062$
Digital literacy and strategy use	Pearson correlation	$r = .52$	$< .001$	Moderate
Motivation and strategy use	Pearson correlation	$r = .47$	$< .001$	Moderate
English proficiency and strategy use	Pearson correlation	$r = .29$	$< .001$	Weak

Pearson correlation analysis revealed a positive and statistically significant relationship between digital literacy and overall autonomous language learning strategy use, $r = .52$, $p < .001$. Students with stronger abilities to locate, evaluate, organize, and apply digital information tended to use autonomous learning strategies more frequently. Motivation also showed a significant positive relationship with strategy use, $r = .47$, $p < .001$. English proficiency had a weaker but significant relationship with autonomous learning, $r = .29$, $p < .001$. These results indicated that autonomous strategy use was more closely associated with digital competence and learning motivation than with language proficiency alone.

Multiple regression analysis was conducted to determine the combined contribution of digital literacy, motivation, English proficiency, daily digital-learning duration, and semester level to autonomous strategy use. The regression model was statistically significant, $F(5, 244) = 31.62$, $p < .001$, and explained 39.3% of the variance in overall strategy use. Digital literacy emerged as the strongest predictor, $\beta = .36$, $p < .001$, followed by motivation, $\beta = .31$, $p < .001$, and daily digital-learning duration, $\beta = .17$, $p = .004$. English proficiency and semester level did not remain significant after the other variables were controlled. The findings suggested that students' capacity and willingness to manage digital learning resources were more influential than their formal academic level.

A respondent-level profile was constructed to illustrate how the statistical patterns appeared in an individual survey response. Respondent 137 was a sixth-semester student who reported using digital resources for approximately two hours per day. The student obtained a mean score of 4.43 for metacognitive strategies, 4.33 for digital-resource management, 4.13 for cognitive strategies, and 3.17 for affective strategies. The response pattern showed frequent use of learning targets, online dictionaries, English-language videos, artificial intelligence explanations, and self-correction tools. Emotional regulation and direct interaction with international speakers were used less consistently.

The profile demonstrated that high autonomous strategy use did not necessarily occur equally across all dimensions. Respondent 137 displayed strong planning, monitoring, and digital-resource selection but showed moderate confidence in communicative situations. The student frequently used artificial intelligence to clarify grammar and generate practice questions, yet rarely used the technology to produce complete assignments. This pattern suggested a relatively responsible form of digital autonomy because the tool was used as instructional support rather than as a substitute for independent academic work. The profile also reflected the broader statistical finding that affective strategies remained less developed than metacognitive and digital strategies.

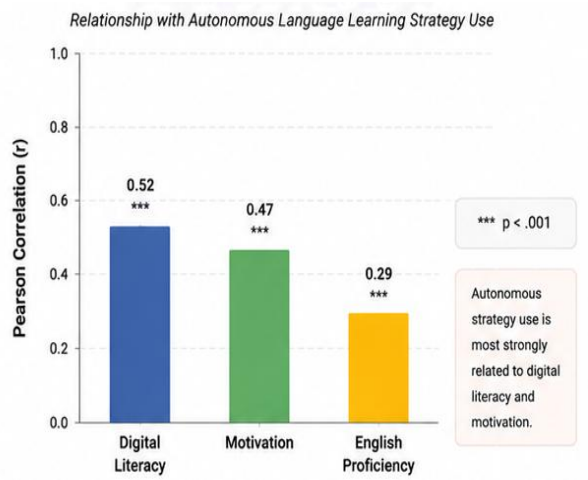

Figure 1. Pearson Correlation Analysis

The respondent-level pattern illustrated the central role of strategic purpose in determining whether digital technology supported autonomy. The student did not use digital tools merely because they were available. Each platform served a specific learning function, such as vocabulary consultation, listening repetition, pronunciation checking, grammar clarification, or progress monitoring. This purposeful combination of resources reflected a form of learner agency in which technology was selected according to personal goals. The pattern supported the quantitative relationship between digital literacy and autonomous strategy use.

The lower affective score in the illustrative profile also clarified why students could appear highly autonomous in technical activities while remaining hesitant in social communication. Digital tools offered safe and controllable environments for practice, but they did not automatically eliminate anxiety or increase willingness to communicate with other people (Long et al., 2025; Molefi et al., 2024). Students could repeatedly watch videos, complete exercises, or interact with artificial intelligence without confronting the uncertainty of real-time communication. This distinction emphasized that digital independence should not be interpreted solely as technological engagement because emotional regulation and social participation remained important components of comprehensive learner autonomy.

The overall findings showed that EFL university students used autonomous language learning strategies frequently in the digital era, particularly strategies involving planning, self-monitoring, online resource selection, vocabulary consultation, and multimodal exposure. Students demonstrated an ability to integrate several digital tools into their independent learning routines. The preference for online dictionaries, videos, and artificial intelligence explanations indicated that accessibility, immediacy, and personalized support shaped their strategic choices. Less frequent use of reflective journals, international communication, and emotional-regulation strategies revealed that autonomy remained uneven across cognitive, social, and affective dimensions.

The inferential results confirmed that autonomous language learning was influenced more strongly by digital literacy, motivation, and the intensity of purposeful digital learning than by academic semester or English proficiency alone. Technology appeared to support autonomy when students possessed the competence to evaluate resources and the motivation to regulate their own learning. High levels of digital access should therefore not be treated as evidence of complete learner autonomy. Effective autonomy required the integration of technological competence, strategic awareness, emotional regulation, critical evaluation, and responsible use of artificial intelligence.

The findings demonstrate that EFL university students employed autonomous language learning strategies at a generally high level in digitally mediated learning environments. Metacognitive strategies emerged as the most frequently used category, followed by digital-

resource management and cognitive strategies. This pattern indicates that many participants were actively involved in setting learning targets, selecting appropriate resources, monitoring their learning activities, and assessing their progress. Online dictionaries, English-language videos, artificial intelligence applications, podcasts, and mobile learning platforms had become integral components of students' independent learning routines.

The results also reveal that autonomous strategy use was not equally developed across all dimensions. Students reported frequent engagement in activities that provided immediate linguistic assistance, including searching for vocabulary meanings, watching subtitled videos, replaying audio materials, and requesting grammatical explanations from artificial intelligence tools. Affective strategies received the lowest mean score, particularly those involving anxiety management, emotional reflection, and confidence building. Social strategies requiring direct interaction with proficient or native English speakers were also used less consistently than individual digital learning activities.

Inferential analysis identified significant differences in overall strategy use according to gender, semester level, and daily digital-learning duration. Female students reported higher autonomous strategy use than male students, although the effect size indicated that the difference was not large. Senior students, especially those in the eighth semester, showed higher levels of strategy use than students in the second semester. Students who spent more time on purposeful digital language-learning activities also tended to report stronger autonomous learning practices.

Digital literacy and motivation displayed the strongest relationships with autonomous language learning strategies. Regression analysis showed that digital literacy was the most substantial predictor of overall strategy use, followed by motivation and daily digital-learning duration. English proficiency and semester level were associated with strategy use in separate analyses, but their contributions became nonsignificant after other variables were statistically controlled. These findings suggest that autonomous language learning was more closely connected with students' capacity to manage digital resources and their willingness to regulate learning than with formal academic status or language proficiency alone.

The prominence of metacognitive strategies is consistent with previous research portraying planning, monitoring, and self-evaluation as central characteristics of autonomous language learners. Earlier studies commonly found that learners who established personal goals and observed their own progress were more likely to sustain independent learning activities (Yuan & Liu, 2025; H. Zhang, 2025). The present findings extend this understanding by showing that metacognitive practices are increasingly embedded within digital environments. Progress indicators, automated feedback, learning histories, and personalized recommendations may help students monitor their learning more easily than in conventional independent-learning settings.

The strong position of digital-resource management strategies supports studies emphasizing the growing importance of digital literacy in language learning. Previous investigations have shown that successful digital learners do not merely access technology but also evaluate, organize, and integrate information from different sources. The participants in the present study frequently combined dictionaries, videos, artificial intelligence applications, and social media resources. This result differs from research that examines one application in isolation because students' actual practices appear to involve movement across several platforms rather than dependence on a single technology.

The comparatively low use of affective strategies resembles findings from studies reporting that students often possess cognitive learning techniques without having equally strong abilities to regulate anxiety and maintain confidence. Digital environments may reduce some forms of communicative pressure, but they do not necessarily develop emotional resilience. Students can practice privately through applications without facing immediate evaluation from lecturers or peers. Such conditions may make independent practice more

comfortable while limiting opportunities to manage anxiety in authentic interpersonal communication.

The observed gender and semester differences partially correspond with previous research, although such patterns have not been consistent across all educational contexts. Some studies report stronger strategy use among female students, particularly in metacognitive and social dimensions, while other investigations identify no meaningful gender differences after motivation and proficiency are considered (S. Shi & Zhang, 2025; X. Wang & Wang, 2024). The small effect size found in this study warns against interpreting gender as a determining factor. The higher scores among senior students may reflect accumulated academic experience, but they may also be associated with greater awareness of learning demands, exposure to research tasks, or preparation for graduation requirements.

The dominance of metacognitive and digital-resource management strategies signals a transformation in the nature of learner autonomy. Autonomous learning is no longer defined only by studying without direct teacher supervision. Contemporary autonomy involves the ability to navigate a complex digital ecosystem, distinguish useful resources from distracting content, and make informed decisions about when and how technology should be used. Students' learning independence has therefore become inseparable from their digital judgment and self-regulatory competence.

The high frequency of online dictionary use, subtitled video consumption, and artificial intelligence consultation indicates that students prefer resources that are accessible, responsive, and immediately useful. This tendency reflects a broader shift toward on-demand learning in which students expect explanations, examples, and corrective feedback to be available at the moment of difficulty. Such immediacy can support personalized learning, yet it may also reduce learners' willingness to tolerate uncertainty or engage in prolonged problem solving. The findings therefore represent both an expansion of learning opportunities and a possible weakening of productive struggle.

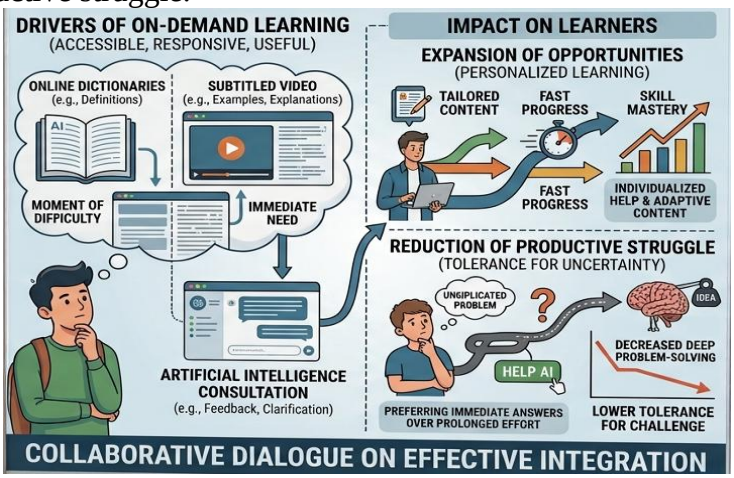

Figure 2. The on Demand Learning Shift: Digital Resources & Productive Struggle

The low affective-strategy scores signify that technological independence should not be mistaken for complete learning autonomy. Students may appear highly independent because they can locate resources and complete tasks without direct assistance, but they may still struggle with confidence, frustration, anxiety, and communicative risk. Genuine autonomy requires more than technical self-sufficiency. Emotional regulation, perseverance, reflective awareness, and readiness to interact with others remain essential for sustained language development.

The weak unique contribution of English proficiency suggests that strategic autonomy is not an automatic consequence of being a more proficient language learner. Students with higher proficiency may possess broader linguistic knowledge, but they do not necessarily plan, monitor, or regulate their learning more effectively. Learners with moderate proficiency may

demonstrate strong autonomy when they are digitally literate and highly motivated. This finding signals that autonomy should be treated as a developable educational capacity rather than as a secondary outcome that naturally emerges from language achievement.

The findings have important implications for EFL pedagogy because university students require explicit preparation for autonomous digital learning. Lecturers should not assume that students know how to select reliable online materials merely because they use smartphones, social media, or artificial intelligence frequently. Instruction needs to incorporate digital-resource evaluation, goal setting, strategy selection, time management, and self-assessment. These competencies should be treated as learning outcomes rather than as personal abilities that students are expected to acquire independently.

Curriculum designers should integrate structured autonomous-learning tasks into language courses. Students can be asked to develop individual learning plans, document the resources they use, explain why particular platforms were selected, and reflect on the effectiveness of their strategies. Digital portfolios, weekly learning logs, self-assessment rubrics, and progress reports can make autonomous processes visible and open to pedagogical guidance. Such activities may gradually shift students from reactive technology use toward deliberate and evidence-based learning decisions.

Artificial intelligence literacy should become a specific component of autonomous language education. Students need guidance on using AI tools for explanation, practice, brainstorming, feedback, and revision without allowing these tools to replace original thinking. Responsible use requires the ability to evaluate generated information, identify possible errors, protect personal data, and disclose AI assistance when required. Autonomous learning in the digital era must therefore include ethical judgment alongside technological and linguistic competence (Alrashdan et al., 2024; C.-H. Lin et al., 2025).

Institutional support is also necessary because autonomy develops within social and educational conditions rather than through individual effort alone. Universities should provide access to reliable digital resources, language-learning platforms, academic support services, and opportunities for authentic communication. Lecturer training should address the design of learning environments that balance independence with scaffolding. Policies should encourage innovation while protecting students from privacy violations, misinformation, excessive dependency, and inequitable access to technology.

The high use of metacognitive strategies may be explained by the flexibility and visibility offered by digital learning tools. Many applications allow learners to set targets, track completed activities, receive performance summaries, and repeat materials according to their personal needs. These functions can stimulate planning and monitoring even when students have not received extensive formal training in metacognition. The structure embedded in digital platforms may therefore support certain autonomous behaviors by making learning progress easier to observe.

The popularity of online dictionaries, videos, and artificial intelligence tools can be attributed to their immediate practical value. University students frequently face assignments, presentations, reading tasks, and communication demands that require rapid access to vocabulary, grammar explanations, pronunciation models, or textual feedback. Digital tools reduce the time and effort needed to obtain such assistance. Students are likely to continue using strategies that produce visible short-term benefits, especially when those strategies fit naturally into their existing digital habits.

The low use of affective and interpersonal strategies may result from the psychological safety offered by individual digital practice. Watching videos, consulting an AI chatbot, or completing application-based exercises does not expose learners to direct social judgment. Real-time communication requires spontaneous language production and creates a greater possibility of misunderstanding or embarrassment. Students may therefore select low-risk

digital activities while avoiding interactions that could strengthen communicative confidence over time.

The strong association between digital literacy and autonomous learning may be explained by the decision-making demands of online environments. Learners encounter an enormous volume of materials with varying levels of quality, difficulty, accuracy, and relevance. Digitally literate students are better positioned to identify credible sources, compare explanations, organize information, and match tools with specific learning objectives. Motivation strengthens this process by sustaining effort, while daily learning duration provides more opportunities to apply and refine strategies.

Future pedagogical practice should move beyond providing access to digital resources and focus on developing strategic users of technology. Lecturers can begin by assessing students' existing autonomous learning practices at the start of a course. The assessment can identify whether students understand goal setting, resource evaluation, progress monitoring, and responsible artificial intelligence use. Instructional support can then be differentiated according to the specific weaknesses identified within the student group.

Future learning activities should deliberately strengthen affective and social strategies because these dimensions were less developed than metacognitive and digital-resource management strategies. Courses can include low-risk speaking tasks, peer feedback sessions, virtual exchanges, reflective confidence scales, and guided interaction with international communities. Gradual exposure to authentic communication may help students transfer confidence from private digital practice to interpersonal language use. Emotional reflection should be integrated into learning journals rather than treated as an optional activity.

Further research should examine autonomous language learning through longitudinal and mixed-methods designs. Cross-sectional survey data can identify patterns and associations, but they cannot establish how students' strategies develop over time or whether specific digital practices directly improve language achievement. Interviews, digital-learning diaries, platform analytics, classroom observations, and think-aloud protocols could reveal differences between reported strategy use and actual behavior. Experimental or quasi-experimental studies could also evaluate the effects of autonomy-training programs on strategic competence and language performance.

Future investigations should explore the quality rather than only the frequency of digital strategy use. Frequent use of artificial intelligence, videos, or online dictionaries does not necessarily indicate deep learning. Research needs to examine how students verify information, transform digital input into personal knowledge, and avoid passive dependence on automated assistance. The next stage of autonomous language-learning research should therefore focus on critical, ethical, reflective, and sustainable engagement with technology as essential dimensions of learner autonomy in the digital era.

CONCLUSION

The most important finding of this study is that autonomous language learning among EFL university students in the digital era was characterized by the strong use of metacognitive, digital-resource management, and cognitive strategies, while affective and interpersonal strategies remained less developed. Students demonstrated considerable independence in setting learning goals, selecting digital materials, monitoring progress, and using online dictionaries, videos, podcasts, mobile applications, and artificial intelligence tools. The distinctive finding lies in the unequal development of autonomy across strategy dimensions. High technological engagement did not automatically produce comprehensive learner autonomy because many students remained less confident in regulating anxiety, sustaining emotional resilience, and participating in authentic communication. Digital literacy and motivation also showed stronger associations with autonomous strategy use than English

proficiency and semester level, indicating that effective autonomy depended more on learners' capacity and willingness to manage digital learning than on formal academic status alone.

The study contributes conceptually by expanding the understanding of learner autonomy from an individual capacity for independent study into a multidimensional competence involving self-regulation, critical digital literacy, responsible technology use, emotional control, and strategic integration of multiple resources. Autonomous language learning in contemporary higher education should therefore be viewed as the ability to make informed, purposeful, and ethical decisions within a complex digital learning ecosystem. The research also provides a methodological contribution through the use of a multidimensional questionnaire that incorporated conventional language-learning strategies and digital-resource management practices. This integrated framework offers a more contextually relevant approach for examining how EFL students combine metacognitive, cognitive, social, affective, and technology-mediated strategies in their everyday learning.

The limitations of this study arise primarily from its cross-sectional survey design, reliance on self-reported data, and focus on students from a limited institutional context. The findings describe patterns and statistical relationships but cannot establish causal effects or confirm whether reported strategies were consistently applied in actual learning situations. Social desirability, memory limitations, and differences in participants' interpretation of questionnaire items may also have influenced the responses. Future research should employ longitudinal, mixed-methods, experimental, or quasi-experimental designs involving more diverse universities and student populations. Digital learning diaries, interviews, classroom observations, platform analytics, and think-aloud protocols could be used to compare reported practices with observable behavior. Further investigation should also examine the quality of artificial intelligence use, the development of affective autonomy, and the long-term influence of autonomous learning strategies on language proficiency, academic achievement, and responsible digital participation.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) used Google Gemini to assist in improving grammar, language quality, and overall readability of the text. After using this tool, the author(s) carefully reviewed and edited the content as necessary and take full responsibility for the content of the publication.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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