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Developing 4Cs as future-proof skills among non-linguistic undergraduates in a tech-enhanced English language classroom

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This study examines non-linguistic university students' self-reported language learning practices and their perspectives on how a tech-enhanced English as a Foreign Language (EFL) course helps develop 21st-century skills. Based on the *Partnership for 21st Century Skills (P21)* framework, Bloom's Revised Taxonomy, and the cognitive offloading theory, the research explores how critical thinking, creativity, collaboration, and communication are integrated into a digitally enriched learning environment. Using a convergent parallel mixed-methods approach, the study collected both quantitative and qualitative data through a questionnaire created by the authors and completed by 107 undergraduates. Inferential statistics, including Pearson's chi-square (χ^2) and hierarchical cluster analysis, revealed three main dimensions of learner engagement: (1) synthesis of thinking, creativity, and collaboration skills; (2) personal initiative and informal learning; and (3) the overall impact of digital tools and teaching methods. The results showed that while students acknowledged the importance of the 4Cs, their critical engagement was moderate. The qualitative analysis revealed that students perceive generative digital tools as a helpful cognitive aid for idea generation, exploring diverse perspectives, and critical inquiry; however, they also expressed concerns about cognitive offloading in digital learning environments. Overall, the findings add to current discussions on technology-enhanced language education by highlighting the need for pedagogical scaffolding, meta-cognitive regulation, and competency-based EFL instruction to foster skills that are vital for the future.

Keywords: future-proof skills, 4Cs, non-linguistic students, English as a Foreign

Introduction

Globalization, political instability, demographic shifts, and rapid technological advancements – particularly the rise of artificial intelligence (AI) – collectively shape a future characterized by growing instability, complexity, and unpredictability. The global labor market reflects these trends, appearing ever more competitive, saturated, dynamic, precarious, and volatile (Mainga et al., 2022, p. 2), with soft skills becoming critical for enabling “employees to adapt to and thrive in ever-changing environments” (Zahn et al., 2024). According to the QS World Future Skills Index (2025), “87% of businesses worldwide have a skills gap, or will within a few years”, highlighting the urgent need for higher education institutions to deliver future-ready graduates by fostering innovation, sustainable global competition, and talent development (p. 25). Similarly, the Future of Jobs Report (2025) forecasts that “two-fifths (39%) of workers’ existing skill sets will be transformed or become outdated over 2025–2030,” with 70% of employers expecting to hire staff with new skills (World Economic Forum, 2025, p. 6).

The OECD Learning Framework 2030 declares that “education plays a vital role in developing the knowledge, skills, attitudes and values that enable people to contribute to and benefit from an inclusive and sustainable future” (OECD, 2018, p. 4). Consequently, tertiary education must adapt to ongoing global transformations by embracing technological advancements and aligning with shifting labor-market demands, focusing on nurturing future-ready graduates capable of thriving in uncertain professional landscapes (Mainga et al., 2022).

The QS World Future Skills Index (2025) identifies four critical skill categories – adaptive lifelong skills, human-centered leadership, entrepreneurial and innovative mindset, and sustainable and ethical workforce – which encompass 15 specific skills, including active learning, problem-solving, analytical skills, creativity, communication, interpersonal skills, and teamwork (p. 56). At the core of these are the widely acknowledged 4Cs – critical and creative thinking, collaboration, and communication. The development of these skills is imperative for three reasons: (a) they are inherently difficult to teach and assess, and thus are frequently underrepresented in formal curricula; (b) they are indispensable in an increasingly globalized world; and (c) they are fundamental to professional success in any career (Afandi et al., 2019, as cited in Kousloglou et al., 2023).

Conceptually, this study is grounded in the *Partnership for 21st Century Skills (P21)* (2009) framework, which positions the 4Cs as the core of future-oriented education (Thornhill-Miller et al., 2023). To map the acquisition of these skills, we use Bloom’s Revised Taxonomy, with the evaluating and creating levels at the cognitive apex (Anderson & Krathwohl, 2001), and its further extension, Bloom’s Digital Taxonomy, which accounts for the role of digital tools and pedagogical scaffolding (Churches, 2008). It is complemented by the

theory of cognitive offloading, which relies on metacognitive evaluations to strategically balance digital aid with internal processing (Risko & Gilbert, 2016). In the era of Generative Artificial Intelligence (AI), these theories converge to suggest a paradigm shift: as “generative sociotechnical systems” (Storey et al., 2025) provide students with diverse perspectives and foster higher-order skills (Essien et al., 2024), students can redirect their mental resources toward deeper critical engagement and complex creative synthesis only when they judiciously externalize lower-order processing to AI (Gerlich, 2025).

Considering the above, the English as a Foreign Language (EFL) classroom for non-linguistic majors serves as a unique twofold purpose. It is not merely a venue for linguistic acquisition but a vital ground for maintaining educational continuity through the cultivation of “skills that will spell success for our learners in the future” (Erdoğan, 2019, p.117), and developing strategic awareness empowering students to apply high-order cognitive skills to promote their learning autonomy (Kupchyk & Litvinchuk, 2025).

In Ukraine, where the dual crises of the COVID-19 pandemic and the ongoing war have necessitated a rapid, often unstructured shift to mixed-mode learning, the use of digital tools offers a unique insight into student resilience and adaptability during ongoing instability. Notably, there is a lack of empirical research exploring students’ language learning behaviors and perceptions of developing the 4Cs as future-proof skills in an EFL course, which is mandatory for all undergraduate students at non-linguistic universities in Ukraine.

Therefore, the purpose of this study is to explore the self-reported practices, perceptions, and attitudes of non-linguistic undergraduates regarding how an EFL course contributes to the development of the 4Cs. This aims to infer which pedagogical approaches and digital tools promote the 4Cs within the EFL classroom. The study offers the following novel contributions: (1) it provides a convergent parallel mixed-methods analysis that synthesizes non-linguistic university students’ self-reported learning practices and perceptions regarding the integration of the 4Cs in a technology-enhanced EFL classroom; and (2) it examines how contemporary AI usage in EFL education shifts the focus from linguistic mastery to higher-order critical and creative thinking, using Bloom’s Revised Taxonomy and the cognitive offloading theory.

Literature review

The shift to a knowledge-based economy has transformed higher education priorities, focusing on transferable skills that help graduates handle complexity, uncertainty, and cross-disciplinary problem-solving. While the P21 framework envisioned the 4Cs as an interconnected model for preparing students for the future, and a recent UNESCO report (2023) reaffirmed their importance, Thornhill-Miller et al. (2023) found a persistent gap between these high-level goals and their implementation in different educational settings.

Milligan et al. (2020) argued that “future-proofing our students means ensuring that they learn a wide range of skills, or capabilities, that will allow them to thrive in increasingly complex global workplaces” (p. 4). In the report for

the World Government Summit, Griffiths et al. (2022) claimed that “education systems must ... embrace the role of preparing humanity to address societal challenges using an array of skills that may not fit neatly within one discipline or field” (p. 20). Expanding on this dynamic, Bankins et al. (2024) modernized the structure of future work skill sets by increasing human-AI complementarity, where the human role shifts to higher-order skills of evaluation and critical engagement.

This study is grounded in two theoretical frameworks explaining cognitive processes in technology-enhanced learning: Bloom’s Revised Taxonomy and cognitive offloading. Bloom’s Revised Taxonomy (Anderson & Krathwohl, 2001) situated cognitive learning along a continuum from lower-order processes (remembering, understanding) to higher-order ones (analyzing, evaluating, creating). Churches (2008) extended this taxonomy to digital contexts, incorporating activities such as searching, tagging, remixing, and publishing, thus illustrating how technology can scaffold higher-order thinking. Cognitive offloading, originating in cognitive psychology, refers to the use of external tools to reduce cognitive load and free mental resources for complex thinking (Risko & Gilbert, 2016). In language learning, digital tools can automate routine tasks (e.g., grammar correction, recall), theoretically enabling students to mature in higher-order reasoning, creative production, and critical evaluation (Alkhatib, 2019). However, well-founded concerns are raised that the automation of cognitive tasks can create the risk of cognitive dependence on AI, reduced critical engagement, and reduced accountability, which demands educational interventions to build resilience against the potential negative impacts of AI (Gerlich, 2025).

Within tertiary EFL education, scholars have emphasized moving from purely linguistic instruction toward authentic, real-world applications. Nghia et al. (2024) highlighted the necessity to shift the focus from solely “developing linguistic abilities” to “developing English skills for students/graduates to use in real-life situations” (p. 88), while Tran et al. (2025) identified the link between English proficiency and employability as the core driver of student motivation. Notably, Thornhill-Miller et al. (2023) underscored the multidimensionality and interrelatedness of the 4Cs as elements for future-oriented education, proposing a dynamic interactionist model, termed crea-critical-collab-ication, to be advanced with pedagogical and policy frameworks.

Digital tools have amplified these content and approach shifts. Hasumi and Chiu (2024) highlighted that technology and language learning “work in tandem to deliver a comprehensive educational experience” (p. 2). A cohort of researchers explored the use of digital tools and media in developing transferable skills (Ali et al., 2024; Kousloglou et al., 2023; Kupchyk & Litvinchuk, 2025). Furthermore, Alzubi et al. (2025) claimed that generative AI tools “effectively enrich the EFL learning experience while ensuring students remain active, critical participants in their learning process” (p. 15147). However, Le (2025) observed that it may reduce students’ willingness to engage in deep, self-directed learning without proper scaffolding. Similarly, Gerlich (2025) emphasized the need for appropriate educational strategies to mitigate the “potential

cognitive costs of AI tool reliance” (p.1). Zimotti et al. (2024) underscored the crucial role of teachers’ digital competence for guiding the productive use of AI when scaffolding “activities that encourage students to use these tools and/or critique their shortcomings” (p. 19).

To operationalize the necessary pedagogical approach and ensure the effectiveness of tech-enhanced language learning, educators have increasingly adopted immersive constructivist frameworks. Jelodari et al. (2025) and Kousloglou et al. (2023) demonstrated that Project-Based Learning (PBL), inquiry-based, and experiential approaches significantly outperform traditional instruction in developing the 4Cs, especially when integrated with digital tools. Jelodari et al. (2025) found that PBL and e-PBL notably improved collaboration and communication skills. Likewise, Li and Yu (2025) implemented collaborative problem-based learning interventions in higher education and reported measurable improvements in creative thinking and problem-solving abilities.

This body of evidence calls for closer examination of how pedagogical design mediates the effectiveness of technology-enhanced interventions in developing the 4Cs within EFL contexts.

Developing the 4Cs in digital EFL contexts

Recent EFL research has demonstrated that technology-enhanced instruction extends beyond linguistic proficiency to foster the holistic experience of the 4C acquisition. However, empirical studies have examined these competencies in isolation, focusing distinctively on communication (Busso & Sanchez, 2024; Nguyen, 2025; Yeung et al., 2023), collaboration (Mende et al., 2021), including its technology-mediated dimension (Alzubi et al., 2024; Atchley et al., 2024); critical thinking (Essien et al., 2024; Li, 2023), or creativity (Chen, 2024; Alzubi et al., 2025), rather than an integrated system envisioned by P21.

Communication is the most studied of the 4Cs. The findings from Yeung et al. (2023), who conducted a qualitative analysis of teachers’ reflections, highlighted how multimodal platforms, such as Zoom and WhatsApp, can improve communication skills by offering interactive and low-stress opportunities for students to practice language skills. Busso & Sanchez (2024) conducted a literature review analyzing the pedagogical benefits, challenges, and concerns of AI-powered Japanese university EFL education. They suggested that AI has strong potential to transform the development of communicative competence by promoting authenticity, personalization, support, and comfort. Similarly, Nguyen (2025) conducted a quasi-experimental study on the role of AI in supporting communicative competence among Vietnamese university students, providing evidence that AI-powered speaking practice tools effectively increase students’ cognitive engagement and their gains in English-speaking proficiency. However, the author emphasized that the technology is effective only when mediated by the students’ cognitive effort (Nguyen, 2025).

Critical thinking is closely interwoven with language competence, together serving as the foundation for analysis, evaluation, inference, reflection, and

reasoning (Li, 2023). Tesfie Birhan (2023), in quasi-experimental research, observed that students' reflective practices are essential for connecting linguistic knowledge with higher-order reasoning. Beckman et al. (2021) showed that explicit integration of analysis, reflection, and self-regulation in language courses significantly enhanced student autonomy and evaluative skills. Bankins et al. (2024) and Essien et al. (2024) highlighted that AI tools, such as text generators, improved conceptual understanding if students were guided to critically audit the outputs, preventing superficial engagement due to cognitive offloading. The case study among Chinese EFL teachers by Li (2023) addressed the issues of teachers' conceptualizing critical thinking and examining the relevant approaches to promote it in an EFL classroom.

Collaboration, which is highly dependent on communication (Thornhill-Miller et al., 2023) and promotes cognitive knowledge construction (Mende et al., 2021), exhibits a strong complementarity with technology. Alzubi et al. (2024) claimed that technology-mediated collaboration promotes experimentation and problem-solving. Atchley et al. (2024) proposed the concept of "teamwork with technology," arguing that critical evaluation of AI outputs was a prerequisite for effective collaboration in the evolving landscape of digital learning. Thus, although impactful when addressing specific gaps, AI tools function primarily as complements to established pedagogical traditions.

Creativity is defined as the "ability to generate novel ideas, logical solutions, and rationalized plans" to respond effectively to specific problems (Chen, 2024, p. 2), and as a process, individual or group, that involves generating outcomes both original and contextually appropriate, often mediated by the use of digital instruments (Thornhill-Miller et al., 2023). Employing a descriptive survey method, Alzubi et al. (2025) tried to elicit information on the best practices of using AI in nurturing creativity. Similarly, Chen (2024) investigated the perceptions of AI-facilitated creativity by implementing digital storytelling as a multimodal output that cultivates "a strong desire to embrace and explore new ideas" (p.5). However, common concerns were voiced by the researchers about over-reliance on AI, diminished critical thinking, and a shift toward passive information consumption.

Despite the insights offered by these studies, several critical limitations remain in the current scholarship. First, empirical scrutiny has largely fragmented the 4Cs, mostly examining them as isolated competencies rather than a mutually reinforcing system envisioned by the P21 framework. Second, the prevailing focus has often favored teacher perspectives (Li, 2023; Yeung et al., 2023) or singular experimental metrics regarding specific tools (Nguyen, 2025), frequently overlooking the students' phenomenological experience of the tech-enhanced EFL course as a holistic and developmental environment.

Given that, current scholarship remains limited by fragmenting the 4Cs into isolated competencies and prioritizing teacher perspectives over student experiences. Therefore, to address the pressing need to examine non-linguistic majors' engagement with the 4Cs as an integrated system within the tech-enhanced EFL classroom, this study adopts a mixed-methods research design, structured around the following research questions (RQ):

RQ 1: How do non-linguistic university students perceive the development of the 4Cs as future-proof skills in a technology-enhanced EFL classroom?

RQ 2: How does the development of the 4C skills relate to the field of study, year of study, and English proficiency?

RQ 3: How do students perceive the role of AI in shaping their attitudes towards developing the 4Cs?

Research methods

The study adopted a convergent parallel mixed-methods design to comprehensively explore non-linguistic majors' engagement with and perceptions of the 4Cs, thereby facilitating the generation of "the quality and rigor of metainferences" (Younas, 2025, p. 2).

Participants

The study was conducted between March 20 and April 06, 2025, at the National University of Water and Environmental Engineering in Rivne, Ukraine. A convenience sampling technique was employed to analyze undergraduates' self-reported practices and capture their perceptions and attitudes toward the development of the 4Cs in technology-enhanced EFL instruction. This non-probability sampling technique was chosen for its viability under crisis conditions, as it offers a "relatively cheap, convenient, fast" means of data collection (Raifman et al., 2022, p. 40).

The survey was distributed via Google Forms to students who were readily accessible and willing to participate, drawn from EFL groups taught by the researchers. The sample size ($N = 107$) was deemed adequate for the statistical techniques employed in this study. Sample sizes exceeding 100 respondents are considered sufficient for reliability testing (Cronbach's alpha) to minimize the statistical error (Kennedy, 2022, p. 26), particularly when effect sizes are expected to be moderate. To mitigate overinterpretation, the results were discussed within the bounds of the sample characteristics and institutional setting. Moreover, the inclusion of qualitative data enhanced analytical depth, compensating for the modest sample size by providing contextualized and interpretive insights. Together, these factors support the methodological adequacy of the sample for addressing the RQs.

The study adhered to the ethical principles outlined in the Declaration of Helsinki. Participation was voluntary, informed consent was obtained, and no incentives were offered. Participants' demographic characteristics are presented in Table 1.

Table 1. Participants' demographic variables

Variables	Groups	f	%
Gender	Male	58	54.2
	Female	49	45.8
Year of study	1st	21	19.6
	2nd	66	61.7
	4th	20	18.7
Institute	Agroecology and Land Management	9	8.4
	Civil Engineering and Architecture	9	8.4
	Cybernetics, Information Technologies and Engineering	35	32.7
	Economics and Management	17	15.9
	Energy, Automation and Water Management	11	10.3
	Health	5	4.7
	Law	13	12.1
	Mechanical Engineering	8	7.5
English proficiency level	A2	14	13.1
	B1	30	28.0
	B2	61	57.0
	C1	2	1.9

The participants comprised male and female undergraduates in their first, second, and fourth years of study, representing all eight university institutes. The majority reported B2-level English proficiency, followed by B1, A2, and C1 levels. English proficiency was self-reported based on enrolment in EFL course groups, which are determined by the placement test taken at the university.

Age was not included as a demographic variable in the questionnaire. This decision was theoretically justified by the relatively homogeneous age range of the participants, as in Ukraine, undergraduate students at the university typically enroll immediately after completing secondary education at approximately 17–18 years of age and progress through each subsequent semester. Consequently, age was excluded from the primary analysis in favor of year of study, which serves as a more direct indicator of a student's educational maturity and their cumulative exposure to tech-enhanced academic practices.

Instruments

Quantitative data were collected using an author-designed questionnaire consisting of 28 closed-ended questions, structured into two main sections: Section 1 (Q1–Q4) gathered demographic information, including gender, year of study, institute, and self-reported current level of English proficiency; Section 2 contained closed-ended items that allowed respondents to select one or multiple answers based on provided instructions. Specifically, questions Q5, Q8–Q9, Q16–Q17, and Q19–Q27 employed a five-point Likert scale and showed the overall internal consistency with 0.724 Cronbach's α -coefficient; questions Q12–Q13

required participants to choose one response from four options, while questions Q6–Q7, Q10–Q11, Q14–Q15, Q18, and Q28 permitted multiple-choice responses. Additionally, Section 3 offered two open-ended questions (Q29–Q30) aimed at collecting qualitative data: (Q29) In what ways do you think AI can foster critical thinking and creativity?; (Q30) What potential challenges or negative impacts do you see in using AI for developing critical thinking and creativity?. The questions in Sections 2 and 3 enabled determining students' confidence and practices in critical thinking, creativity, collaboration, and communication in technology-enhanced EFL learning.

To ensure the content and construct validity of the questionnaire, an expert panel review was conducted prior to data collection. The panel comprised specialists in applied linguistics, EFL pedagogy, educational technology, and assessment methodology. The experts evaluated the questionnaire items for clarity, relevance, alignment with the study constructs (the 4Cs, AI, and digital tool use), and appropriateness for the target population. Based on their feedback, minor revisions were made to item wording, scale consistency, and question sequencing to enhance clarity and reduce ambiguity. This expert validation process strengthened the theoretical grounding and face validity of the instrument.

Data analysis and statistical procedures

The mixed-methods research design employed in this study is well aligned with the RQs, which collectively address measurable relationships and subjective practices, perceptions, and attitudes regarding the development of the 4Cs in technology-enhanced EFL instruction. The procedural diagram of the employed convergent parallel mixed-methods research design, combining quantitative (QUAN) and qualitative (QUAL) data, is presented in Figure 1.

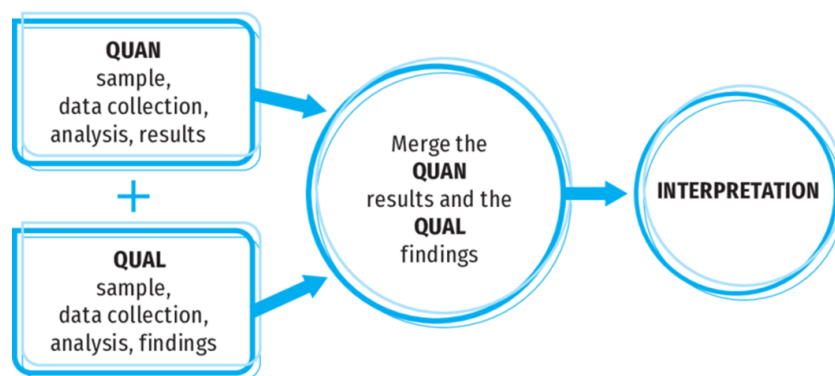


Figure 1. Convergent parallel mixed-methods research design (Piano & Creswell, 2015, p. 392)

The quantitative data collected in this study were analyzed using IBM SPSS Statistical software, version 20. To evaluate the internal consistency of the survey instrument, Cronbach's alpha coefficient (α), a widely used indicator of reliability in psychometrics, was calculated. In this study, for Likert-scale questions in Section 2, the overall Cronbach's α -coefficient was 0.724, indicating an

acceptable level of internal consistency and meeting the commonly referenced threshold. To examine statistical patterns in English proficiency, Pearson's chi-square test was employed. This analysis explored the relationships between students' self-reported confidence and engagement in the 4Cs within the context of technology-enhanced EFL instruction. Additionally, a hierarchical cluster using Ward's method with Euclidean distances was conducted to group similar data points. Ward's minimum variance method was employed to partition the dataset into distinct clusters by minimizing within-group variance (Wani, 2024, p. 1). Thus, by uncovering hidden patterns that are not readily observable through descriptive statistics alone, this analysis further strengthened the explanatory power of the quantitative findings and contributed to a more differentiated understanding of student profiles.

The qualitative data, derived from responses to open-ended questions, were analyzed using the thematic analysis and following the six-step framework proposed by Brown and Clarke (2006, as cited in Vieriu & Petrea, 2025). This approach aimed to provide a rich and nuanced understanding of students' attitudes and practices regarding AI in the EFL context. The analysis was carried out on two complementary levels: a vertical analysis that examined each participant's responses individually to capture distinct perspectives, and a horizontal analysis that explored patterns across all responses to develop a holistic view of the emerging themes.

Finally, the quantitative and qualitative findings were integrated to generate metainferences that synthesize results across methodological strands, thereby directly addressing the multifaceted nature of the research questions. By combining statistical trends with interpretive findings, the mixed-methods approach made it possible to "reveal unique insights which could not be achieved by either approach alone" (Younas et al., 2025, p. 2). This integrative approach enabled the triangulation of numerical trends with qualitative insights, thereby strengthening the interpretive validity of the research findings and facilitating the generation of metainferences. As a result, the mixed-methods integration revealed relationships and explanatory mechanisms that could not be identified through quantitative or qualitative analysis in isolation, thereby enhancing the credibility, depth, and applicability of the research.

Results and discussion

The 4Cs as future-proof skills are essential prerequisites for successful employability in today's dynamic, tech-enhanced working environment. This study examined how these competencies are cultivated among undergraduates and to what extent students acknowledge their relevance for both academic achievement and future career readiness. To explore these dimensions, participants completed a structured questionnaire designed to assess their perceptions, abilities, confidence, and engagement with the 4C-related activities within a tech-enhanced EFL course.

RQ1: How do non-linguistic university students evaluate the development of the 4Cs as future-proof skills in a technology-enhanced EFL classroom?

The quantitative data of the survey, presented in Table 2, facilitated a comprehensive multidimensional analysis of the extent to which the 4Cs were developed within a digitally enriched foreign language learning environment. Students' responses to five-point Likert-scale questionnaire items allowed identifying their self-reported levels of engagement, perceived competence in language use, abilities, skills, and practices in language learning, as well as the relevance of language instruction.

Table 2. Quantitative data based on the Likert-scale items of the questionnaire

Item description	Item	Mean	Std. deviation
Level of frequency of the use of English outside the classroom	Q5	3.00	1.0728
Level of engagement with additional English learning materials (beyond homework)	Q8	2.98	1.1242
Level of impact of EFL classes (e.g., AI, digital platforms, collaborative tasks)	Q9	3.41	1.1070
Level of encouragement to analyze, evaluate, and discuss information rather than just memorize it	Q16	3.62	1.1297
Level of participation in group discussions or projects in English	Q17	3.47	0.9935
Ability to critically evaluate information for bias and reality	Q19	3.19	0.9430
Ability to generate original ideas related to a topic	Q20	3.25	1.0288
Ability to construct well-reasoned arguments in English	Q21	2.96	1.0454
Ability to work effectively in group projects	Q22	3.21	1.0880
Ability to integrate different topics and skills learned in the EFL course to create something new (e.g., presentations, essays, projects, discussions)	Q23	3.21	0.9290
Ability to collaborate with peers to solve problems	Q24	3.44	1.0567
Ability to evaluate the reliability of a source	Q25	3.31	0.9256
Impact of EFL classes on preparation for the future workplace	Q26	3.80	1.1026
Importance of the language teacher's integration of activities that promote critical thinking, creativity, and collaboration in the classroom	Q27	3.78	0.9347

The relatively moderate level of English use by students outside the classroom (Q5, $M = 3.00$; $SD = 1.0728$) indicated the presence of a certain barrier between academic learning and the practical language application in everyday life. A similar trend correlated with the findings regarding independent study of additional materials beyond homework (Q8, $M = 2.98$), which pointed to insufficient intrinsic motivation or limited access to relevant content or platforms for self-directed learning. In addition, students' responses to a multiple-choice question (Q14) *When learning English, how do you combine required assignments with additional learning activities?* further illustrated limited engagement in self-directed language learning and use beyond formal tasks. While 24.3% reported

focusing on the assigned tasks only and 59.8% completed assignments before exploring extra materials, only 16.8% actively sought out additional resources and opportunities to apply their language skills. Although 36.4% integrated extra activities into their study routine, overall patterns suggested that independent language practice remained sporadic and of lower priority compared to in-class activities and assigned homework. Conversely, the qualitative findings suggest that students already acknowledge the potential of digital learning support, mentioning that it, e.g.:

Rn: enhances learning through adaptive feedback.

Rn: adapts learning to individuals; develops personalized learning.

This reveals a critical disconnect between recognition and actual practice. It aligns with the findings by Le (2024), who attributed the students' reluctance to use English outside the classroom to factors such as academic workload, low self-confidence, and perceived linguistic inadequacy. Consequently, explicit pedagogical scaffolding is required to support students in transitioning from passive homework completion to active, independent language use.

The reported impact of EFL classes in facilitating student adaptation to innovative digital and collaborative experiences (Q9, M = 3.41) demonstrated a gradual integration of students into a digital education paradigm, reinforcing the belief that success is found “at the cross section of technology and education” (Atchley et al., 2024, p. 3). This trend was further supported by students' reported use of various digital tools for language learning when answering questions other than Likert-scale: (Q10) *Which of the digital tools do you use to improve your English?* and (Q13) *How do you use technology when facing a challenge in learning English?*. In Q10, a majority of respondents reported using online courses and videos (65.4%), AI-based chatbots (59.8%), and video games (62.6%), followed by language learning apps (44.9%), online dictionaries and grammar checkers (38.3%), indicating a growing familiarity with technology-enhanced language learning resources. This finding was supported by students' responses to Q13, according to which only 6.5% admitted they relied on traditional methods and rarely used technology, while 36.4% of respondents claimed they used familiar digital tools, 40.4% experimented with different technologies and adapted their learning strategies, and 16.8% actively sought out new digital tools and platforms to enhance their learning experiences. However, a disconnect emerged in (Q12) *When faced with a challenging task in English, what do you usually do?*, where only 38.3% reported using online tools to assist their learning. Qualitative responses (Q30) elucidated the reasons behind this gap between high digital and AI consumption and low strategic application. Students expressed deep apprehensions that, e.g.:

Rn: AI promotes reliance on automated solutions.

Rn: AI stifles the development of problem-solving skills.

It suggests that despite broad exposure to digital resources, its limited application in problem-solving contexts (Q12) may stem from a conscious struggle against *laziness and intellectual stagnation* cited by respondents. This supports the caution by Banks et al. (2024) that, without explicit guidance, students

risk falling into superficial engagement, failing to critically evaluate digital outputs for deeper problem-solving.

In addition to individual engagement with digital tools, collaborative aspects of learning also showed promising results. This observation was supported by data on student participation in group discussions and project activities (Q17, $M = 3.47$) – a figure that, despite low variability ($SD = 0.9935$), indicated fairly active engagement of learners in communicative and learner-centered forms of instruction. These research findings are consistent with the current literature, underscoring the role of collaboration in influencing EFL students' communicative performance. For example, the results of the empirical research conducted by Alzubi et al. (2024) revealed higher students' scores within the experimental group as students enriched "their social interaction in terms of collaborative learning skills of teamwork, peer-to-peer learning, and social intelligence" (p. 41). However, responses to Q18: *What challenges do you face when participating in discussions or debates in English?* revealed that this engagement often occurred alongside certain difficulties: 69.2% of students reported struggling to find the right words during discussion to express their ideas, often due to limited active vocabulary, and over 40% cited fear of making mistakes or lack of confidence as barriers to participation. These findings are consistent with other research (Busso & Sanchez, 2024; Yeung et al., 2023), concluding that many students continued to face psychological and linguistic challenges that may limit the depth of their interaction. Beyond the aforementioned difficulties, 51.4% of students indicated a lack of background knowledge, which inhibited their active participation in discussions and debates, further limiting the depth and confidence in their communicative engagement. This highlights that university students face not only linguistic challenges but also content-related barriers that hinder their meaningful contributions to collaborative and critical discourse, a trend that echoes the work of Karim et al. (2023). This evidence corroborated the research by Berrarbi and Amrane (2025), who noted that "challenges such as language proficiency limitations, fear of judgment, and teacher-dominated discussions continue to hinder students' full engagement in critical thinking practices" (p. 280). Consequently, these findings reinforce the need for integrated instruction that simultaneously builds language proficiency and expands topical knowledge in a variety of areas, thereby empowering students to engage more confidently in academic discourse and collaborative tasks.

The results regarding the development of higher-order cognitive skills were particularly indicative. Specifically, the level of encouragement to analyze, evaluate, and discuss information (Q19, $M = 3.62$) suggested favorable conditions for fostering critical thinking. However, the indicators related to the ability to generate original ideas (Q20, $M = 3.25$), formulate well-reasoned arguments in English (Q21, $M = 2.96$), and work in group projects to create coherent outputs (Q22, $M = 3.21$) revealed latent potential that requires targeted pedagogical support to be fully realized.

Consequently, the gap between receptive critical thinking (Q19) and its productive dimensions (Q20, Q21) validated the concerns of Bankins et al. (2024)



regarding *superficial engagement*. Without rigorous guidance, students may effectively consume and analyze content but find the *cognitive investment* to be a significant hurdle (Nguyen, 2025). The relatively modest mean score in Q22 implies that successful collaboration requires more than just peer grouping; it necessitates teacher-orchestrated collaboration arrangements to cultivate the interactive knowledge-constructing environment described by Mende et al. (2021).

These findings were further corroborated by responses to Q15: *In what way do you apply and integrate different aspects of English learning?* where only a minority of students reported integrating content across disciplines (33.6%) or creating new content (22.4%). Nevertheless, almost half of the students (49.5%) indicated that they engaged multiple language skills simultaneously in projects or discussions. Conversely, 28% of respondents admitted to approaching tasks in isolation without combining topics or skills, highlighting a notable difficulty in synthesizing information and transferring knowledge across different contexts. Theoretically, this distribution suggests a bottleneck at the mid-levels of Bloom's Taxonomy. While students are comfortable *applying* skills (49.5%), they struggle to ascend to *creating* (22.4%) and *synthesizing* (33.6%), not effectively progressing to transformative knowledge construction. To address this limitation and foster students' creative and flexible language use, EFL teachers can leverage evidence-based strategies highlighted by Al-Yahyaie et al. (2022), such as active learning, scaffolding, Socratic questioning, and collaborative discussion, which are proven to promote higher-order thinking.

Also noteworthy was the indicator related to the impact of English language learning on preparation for future employment ($M = 3.80$), which reflected students' awareness of its professional relevance. This finding is consistent with the research by Karim et al. (2023), which indicates that students perceive English as even more instrumental than their first language in terms of their future employability. Supporting this, participants' responses to (Q6) *Which skills do you think are the most important for success in the future?* identified the most important skills for future success. Communication ranked the highest, selected by 82.2% of respondents, underscoring its perceived essential role in achieving success. Critical thinking followed closely, with 75.7%, highlighting its strong relevance in decision-making and problem-solving environments. Adaptability (66.4%) and problem-solving (62.6%) were also highly valued, suggesting that flexibility and the ability to address challenges were considered important for navigating and predicting the future. Creativity was selected by just over half of respondents (53.3%), indicating that while it was seen as valuable, it was not prioritized to the same extent as other cognitive or interpersonal skills. Digital literacy received the lowest ranking (33.6%), suggesting students view it as a utilitarian tool rather than a skill to be developed. This underestimates its value, as recent research links digital competence directly to improved language development (Ali et al., 2024) and sustained lifelong learning (Zheng et al., 2025).

Building on the importance of the aforementioned skills, the responses to question Q7: *In your opinion, which of the following skills are most enhanced*

by critical thinking in an EFL classroom? revealed that speaking skills ranked the highest, with 73.8%. Analyzing texts was the second most selected, with 60.7%, indicating a strong recognition of the critical thinking role in interpretive and analytical reading. Moderately selected skills were listening (57%) and problem-solving (55.1%), followed closely, showing a belief in the broader cognitive and receptive benefits of critical thinking. Reading comprehension was selected by 40.2%, suggesting it was seen as somewhat less directly affected than text analysis. Writing skills ranked lower (31.8%), indicating that while deemed important, they were perceived as less dependent on critical thinking than speaking and analytical skills. The findings reveal a clear hierarchy where students view critical thinking primarily as an interactive and analytical tool, while underestimating its vital role in the structural logic of academic writing.

To evaluate the used EFL teaching practices, students were encouraged to reflect on the classroom activities in Q11: *Which of the following activities have been used in your EFL classroom to promote critical thinking, creativity and collaboration?*, indicating that the most frequently used activities were group discussions (82.2%), analyzing and summarizing texts (53.3%), problem-solving tasks (51.4%), creative writing tasks (46.7%), evaluating different perspectives on a topic (44.9%), brainstorming sessions (39.3%), writing argumentative essays (38.3%), role-playing activities (32.7%), collaborative storytelling (31.8%), case studies (27.1%), and project-based learning (24.3%). The dominance of group discussions in the classroom directly reinforces the students' earlier perception that speaking is the primary domain of critical thinking. This suggests a clear pedagogical alignment: students associate critical thinking with oral communication, as this is the mode in which it is most frequently practiced and modeled in their learning environment. It follows that students prefer discrete, contained activities (debates and simulations) that deliver high cognitive value within a single session, rather than long-term projects that require extensive out-of-class management.

Although a range of methods and activities with varying degrees of value had already been practiced in the EFL class, students were additionally asked Q28: *Which of the following strategies do you think an EFL teacher should prioritize to develop critical thinking, creativity, and collaboration?* Students clearly valued problem-solving tasks and debates most highly (63.6%). They also strongly prioritized role-playing and real-world simulations (53.3%), digital tools and multimedia integration (46.7%), open-ended discussions and creative writing (45.8%), and group project-based learning (35.5%).

Ultimately, acknowledging the teacher's role in integrating activities to develop critical thinking, creativity, and collaboration (Q27, $M = 3.78$) underscored the relevance of a competency-based approach in contemporary pedagogy. This finding further supports the idea of heavy reliance on teachers' proficiency in applying appropriate pedagogical strategies (Kupchyk et al., 2025), which implies that professors need to be equipped with the skills required to "harness AI's power and prepare students for the demands of an increasingly AI-driven job market" (Busso & Sanchez, 2024, p. 11).

To expand on the analysis of how English language proficiency influences students’ academic and cognitive engagement, Table 3 presents the findings related to proficiency levels (ranging from A2 to C1) and their correlation with various learning and thinking behaviors. The data, organized by mean scores and significance values (χ^2 , Sig.), allowed identifying statistically outstanding trends and areas where strong correlation was observed. The analysis revealed a general tendency: as language proficiency increased (from A2 to B2/C1), most indicators showed positive progression. This suggests that higher English proficiency contributes not only to better assimilation of academic material but also to the cultivation of metacognitive and critical thinking skills. Notably, no strong correlations were observed considering the field and the year of study.

Table 3. Key relationships between the level of English proficiency and the development of the 4C skills

		Level of English proficiency				Significance values	
		A2	B1	B2	C1	Pearson Chi-square Value	Pearson Chi-square Asymp. Sig. (P)
Item description	Item	Mean	Mean	Mean	Mean		
Level of frequency of English use outside the classroom	Q5	1.93	2.87	3.31	3.00	32.655	0.001
Ability to critically evaluate information for bias and reality	Q19	2.86	3.00	3.33	4.00	22.159	0.036
Ability to construct well-reasoned arguments in English	Q21	1.93	2.83	3.26	3.00	43.502	0
Ability to work effectively in group projects	Q22	2.71	3.07	3.39	3.00	23.919	0.021
Ability to integrate different topics and skills learned in the EFL course to create something new (e.g., presentations, essays, projects, discussions)	Q23	2.64	3.07	3.41	3.00	33.432	0.01
Impact of EFL classes on preparation for the future workplace	Q26	3.43	3.97	3.87	2.00	34.643	0.001

Among all analyzed variables, the most pronounced statistically significant differences ($p \leq 0.05$) were found in several key indicators, demonstrating a deeper relationship between English proficiency and the development of the 4C skills. Notably, one of the clearest dependencies was between language competence and the level of English use outside the classroom. This indicator showed a clear upward trend: from the lowest mean score among respondents at the A2 level ($M = 1.93$) to significantly higher values among students at the B2

level ($M = 3.31$). Evidently, as language proficiency increases, students not only use the language more actively in informal contexts but also integrate it into their everyday practices, which signifies the transformation of English from an academic subject to a tool for social, professional, and cognitive functioning, which aligns with the findings by Nguyen (2025).

The highest statistical significance among all parameters was demonstrated by the indicator related to the ability to construct arguments in English. This corroborates the framework proposed by Li (2023), who posits that critical thinking is closely interwoven with language competence, serving as the necessary foundation for analysis and reasoning. Students at the lowest level (A2) reported a mean score of 1.93, while at the B2 level, there was a significant increase to 3.26. This difference is quantitative and qualitative, indicating the formation of cognitive structures necessary to operate within more complex academic discourse.

Additionally, the survey results confirmed the role of English as a means of cooperative interaction. In particular, effectiveness in group projects showed a clear dependency on language proficiency ($p = 0.021$), which further emphasized the importance of communicative confidence for participation in team-based tasks. These results are especially relevant in contemporary pedagogical approaches focused on creating a collaborative learning environment that enhances English proficiency and social engagement (Alzubi et al., 2024).

Significant findings were also observed regarding students' ability to integrate various topics and skills acquired in the EFL course to create new intellectual output. It signals the academic maturity required for interdisciplinary tasks like presentations, essays, projects, and discussion or debate scenarios.

Particular attention should be drawn to the indicator related to the critical evaluation of information for bias and reliability. Its statistical significance ($p = 0.036$) and high mean score among C1-level students ($M = 4.00$) indicated that the ability to critically interpret content in a foreign language is an essential component of both information and academic literacy. This quantitative mastery was contextualized by qualitative responses, where students demonstrated awareness of digital risks, mentioning:

Rn: AI creates echo chambers and reinforces biases.

Rn: AI increases the risk of spreading biased or inaccurate information.

Rn: AI-generated ideas lack human depth or ethical consideration.

Finally, an interesting effect was observed regarding the perceived impact of English classes on preparation for future employment. At first sight, it seems paradoxical that students with the lowest proficiency level expressed the greatest confidence in the practical value of English ($M = 3.43$), while among C1-level respondents the mean score dropped to 2.00. This inverse trend may reflect a shift in perspective: at early stages of language learning, expectations regarding its professional utility may be overly optimistic, whereas at advanced levels, students may develop a more nuanced understanding of what constitutes employability, recognizing that English is just one of many required skills, similar to holding a driving license.

To provide a more comprehensive view of the interplay of the structural

connections, hierarchical cluster analysis (Figure 2) was employed to map the key academic and life competencies emerging in the EFL context. This analysis yielded a dendrogram identifying three clusters (Table 4), categorized by functional significance.

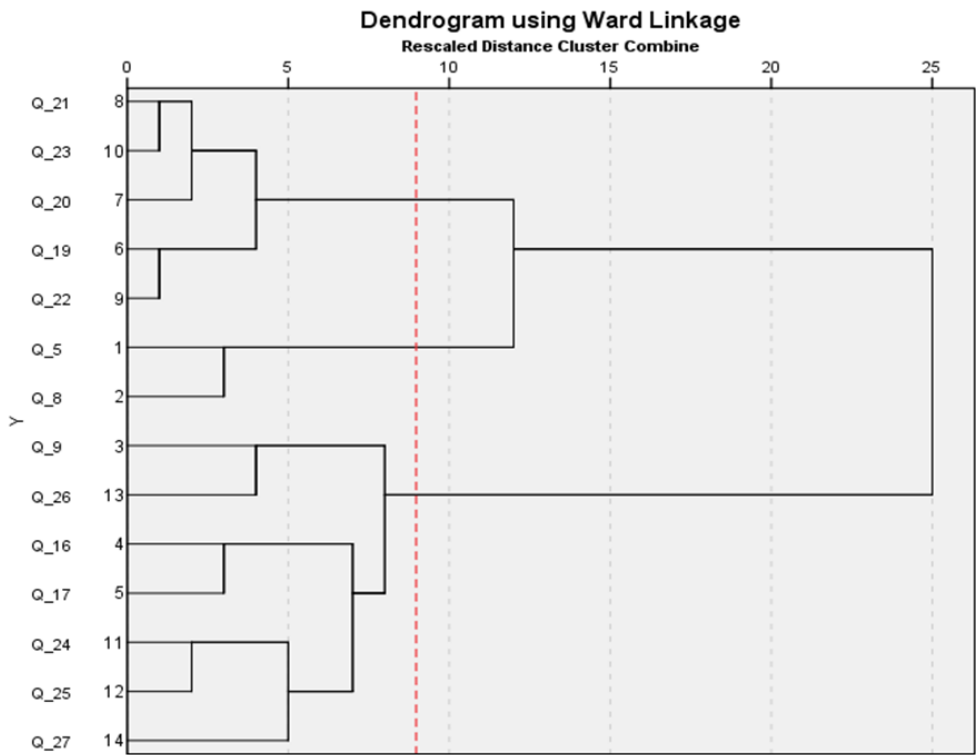


Figure 2. Dendrogram of clustering indicators using Ward’s method

The first cluster included competencies related to cognitive activity, creative thinking, and the ability to engage in reasoned communication. It can be tentatively described as *competency synthesis of thinking, creativity, and collaboration*, reflecting the integrated nature of the goals in modern EFL instruction.

The second cluster encompassed aspects that reflected learner autonomy beyond the classroom. It represented the *personal initiative and informal learning* component, emphasizing the importance of learner autonomy as a key factor in effective language acquisition.

The third and most comprehensive cluster brought together indicators that characterized the systematic impact of English language instruction on students’ overall educational outlook. It can be described as an *integrative impact of digital tools and relevant teaching methods*, encompassing the development of critical thinking, digital literacy, and career orientation.

Table 4. Clusters of non-linguistic students’ confidence and practices in the 4Cs within the EFL learning context

Cluster	Item description	Code	Item mean value	Cluster mean value
Cluster 1	Ability to critically evaluate information for bias and reality	Q19	3.19	3.16
	Ability to generate original ideas related to a topic	Q20	3.25	
	Ability to construct well-reasoned arguments in English	Q21	2.96	
	Ability to work effectively in group projects	Q22	3.21	
	Ability to integrate different topics and skills learned in the EFL course to create something new (e.g., presentations, essays, projects, discussions)	Q23	3.21	
Cluster 2	Level of frequency of the use of English outside the classroom	Q5	3.00	2.99
	Level of engagement with additional English learning materials (beyond homework)	Q8	2.98	
Cluster 3	Level of impact of EFL classes (e.g., AI, digital platforms, collaborative tasks)	Q9	3.41	3.16
	Level of encouragement to analyze, evaluate, and discuss information rather than just memorize it	Q16	3.62	
	Level of participation in group discussions or projects in English	Q17	3.47	
	Ability to collaborate with peers to solve problems	Q24	3.44	
	Ability to evaluate the reliability of a source	Q25	3.31	
	Impact of EFL classes on preparation for the future workplace	Q26	3.80	
	Importance of the language teacher’s integration of activities that promote critical thinking, creativity, and collaboration in the classroom	Q27	3.78	

In summary, the clustering results demonstrated that modern EFL education extends beyond linguistic competence and encompasses a broad range of metaskills that are highly relevant in a globalized academic and professional environment. It also necessitates the integration of digital tools that play a facilitative role in developing these competencies, offering new spaces for communication, context creation, and student autonomy. This approach to analysis not only helped structure the influence of the educational process but also identified priority areas for improving EFL curricula.

RQ 3: How do students perceive the role of AI in shaping their attitudes towards developing the 4Cs?

The inclusion of two open-ended questions in the questionnaire focused on the educational potential and threats of AI in language learning, providing valuable insights into students’ perspectives. The responses reflected a variety of views, echoing the broader educational discourse where there is no unanimous position among educators regarding the role of AI in language education and

its “dual-edged nature ... in cognitive development” when cognitive tasks are delegated to external tools, potentially reducing the student engagement in deep, reflective thinking and thus leading to cognitive offloading (Gerlich, 2025, p. 2). The thematic analysis of responses to the questions aimed to identify common patterns in how students perceived potential benefits and drawbacks of AI, as well as to gauge their readiness to engage with emerging technologies in a cognitively meaningful way. Thus, Table 5 presents thematically categorized students’ responses regarding the perceived opportunities of AI in fostering critical thinking and creativity, while Table 6 summarizes the reported threats and limitations.

Table 5. In what ways do you think AI can foster critical thinking and creativity?

Thematic category	Frequency	Example responses
Idea generation and brainstorming	42	AI is a great and fast tool for getting new ideas and verifying information. AI acts as a brainstorming partner, a thought catalyst.
Exposure to multiple perspectives	31	AI presents multiple perspectives, prompting users to question their biases and consider alternatives. AI presents diverse viewpoints.
Stimulating critical analysis and inquiry	30	AI helps find sources with good questions for thinking, some sites with articles to read and discuss. AI allows users to experiment quickly, test hypotheses, and iterate on creative projects without high costs or resource constraints.
Problem-solving and simulations	25	AI enhances problem-solving through simulations. AI analyzes large amounts of information. AI generates unconventional ideas, scenarios, and case studies. AI suggests new approaches to problem-solving.
Automation of routine tasks	12	AI automates routine or repetitive tasks, freeing up mental space for more creative endeavors. AI automates routine tasks.
Personalized support and adaptive learning	11	AI adapts learning to individuals. AI develops personalized learning, e.g., English-learning programs. AI assigns individual tasks; AI helps students manage tasks. AI creates personalized content. AI is a tool to work with a person’s needs.
Creative tool (writing, art, projects)	8	AI assists in creative writing and art. AI iterates on creative projects without high costs or resource constraints.
Reflection and self-expression platform	6	AI provides different perspectives. AI makes people think harder about what is true or wrong. AI enhances learning through adaptive feedback. AI helps users think more deeply and innovatively.
No benefit/negative view	5	AI cannot foster critical thinking and creativity. AI makes people more stupid and leads to lower critical thinking. AI is limited in use. AI can hinder critical thinking.

As shown in Table 5, students identified several opportunities associated with AI, the most common being idea generation, exposure to multiple perspectives, and stimulating critical analysis and inquiry. This suggests that EFL instruction should move beyond AI as a content generator and instead utilize its potential as a tool for fostering cognitive engagement, encouraging students to question, analyze, synthesize, compare, and reflect rather than passively consume AI-generated outputs.

Table 6. Negative impacts of AI on critical thinking and creativity

Thematic category	Frequency	Example responses
Over-reliance/dependency	51	AI promotes reliance on automated solutions. AI discourages independent problem-solving. Over-reliance can stifle the development of problem-solving skills.
Reduced critical thinking	42	AI decreases/kills deep thinking. AI reduces people's ability to think independently, so that they accept AI's suggestions without questioning or analyzing.
Creativity suppression/unoriginality	27	Overuse of AI may limit original thought/genuine creativity. Easy accessibility to a lot of ideas will discourage people from creativity. AI promotes template-based ideas and weakens originality.
Laziness/loss of motivation	21	AI makes students take the class more lightly. AI leads to laziness.
Bias/inaccuracy/echo chambers	17	Algorithm-driven content can create echo chambers and reinforce biases AI increases the risk of spreading biased or inaccurate information.
Ethical concerns and cheating	12	AI-generated ideas may lack human depth or ethical consideration.
Emotional and cognitive shallowing	11	AI lacks emotional insight. AI simplifies complex topics, limiting deep understanding, analysis, and conclusion. AI lowers cognitive effort. AI leads to intellectual stagnation. Language models are the fire that Prometheus gave to humanity. They are the nuclear bomb that will destroy thinking and development.
No or low concern/neutral views	8	I do not see any challenges or negative impacts when using AI. I do not see anything bad; it just deepens the way people use it.
Philosophical/extreme concerns	5	Language models will make people dumber in the long run. As soon as these models were made available to the mortal people in February 2023, I immediately realized that it marked the beginning of the end.

Table 6 exposes anxieties that AI over-reliance fosters *intellectual stagnation* and passive dependency, where template-based solutions and echo chambers

threaten to erode independent critical thought and creativity. Yet, a broader analysis of the qualitative data suggests a more nuanced reality: AI can facilitate strategic cognitive offloading rather than mere replacement. To realize this potential, instruction must target the evaluating level of Bloom's taxonomy. This requires shifting students from passive consumption to active interrogation through tasks such as developing prompting strategies, comparing alternative responses, evaluating outputs, and justifying their own ideas.

Finally, triangulating quantitative, qualitative, and cluster data confirms that technology-enhanced EFL instruction meaningfully contributes to the 4Cs, though results are pedagogically contingent. While cluster analysis reveals these skills function as an integrated competency set, qualitative findings highlight a distinct tension: students value AI for ideation yet fear it fosters passive cognitive offloading. Consequently, the effective development of future-proof skills depends less on the mere presence of digital tools and more on intentional pedagogical mediation – developing strategies that align language proficiency with structured cognitive challenges to ensure technology supports, rather than replaces, independent thought.

Conclusions and implications

This study confirms that a tech-enhanced EFL university course for non-linguistic majors can serve as a platform for developing future-proof skills. EFL proficiency emerges as a threshold condition for the development of higher-order cognitive abilities aligned with the P21 framework, indicating that EFL instruction should move beyond basic communicative competence toward analytical, reflective, and collaborative skill development. The findings highlight that fostering the 4Cs in tandem requires holistic and integrated approaches, as their development is interdependent rather than sequential or isolated.

The findings of this study have important implications for EFL instruction. Pedagogically, students' engagement depends on both instructional design and background knowledge, highlighting the need for structured scaffolding to support independent, active language use and effective collaboration. At the same time, technological considerations suggest that digital tools and AI should function as augmentative partners that enhance iterative learning, critical engagement, and higher-order thinking rather than replace cognitive effort. Curricularly, fostering the 4Cs holistically requires integrated, scaffolded, and technology-enhanced instruction, enabling coherent cognitive growth and effective transfer of skills across academic and professional contexts. Together, these implications underscore the necessity of aligning pedagogy, technology, and curriculum to maximize the development of future-proof skills in EFL learners.

Limitations and future research directions

While this study provides valuable contributions to EFL pedagogy, several limitations should be acknowledged. First, the study relies primarily on

self-reported data regarding students' language learning practices and perceptions. Second, the research was conducted with a limited sample size drawn from a specific demographic of non-linguistic majors within the single national context of Ukraine.

Considering the limitations, future research should focus on broader comparative studies and pedagogical interventions when designing and testing AI-integrated scaffolding models that prevent cognitive offloading while still leveraging digital efficiency.

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Appendix A

Author-Designed Questionnaire

This questionnaire explores your confidence and habits in critical thinking, creativity, collaboration, and the use of technology in EFL learning

Section 1: Background Information

1. What is your gender?
 - male
 - female
2. What is your year of study?
 - 1st
 - 2nd
 - 3rd
 - 4th
3. What institute do you study at?
 - Institute of Economics and Management
 - Institute of Law
 - Institute of Agroecology and Land Management
 - Institute of Civil Engineering and Architecture
 - Institute of Mechanical Engineering
 - Institute of Cybernetics, Information Technologies and Engineering
 - Institute of Energy, Automation and Water Engineering
4. What is your level of English proficiency?

- A2
 - B1
 - B2
 - C1
5. How often do you use English outside the classroom? (*5-point Likert scale*)
6. Which skills do you think are most important for success in the future? (Select all that apply)
- Critical Thinking
 - Communication
 - Digital Literacy
 - Adaptability
 - Creativity
 - Problem-Solving

Section 2: Critical Thinking, Creativity, and Collaboration

7. In your opinion, which of the following skills are most enhanced by critical thinking in an EFL classroom? (Select all that apply)
- Reading comprehension
 - Writing skills
 - Speaking skills
 - Listening skills
 - Problem-solving
 - Analyzing texts
 - Others (please specify)
8. How often do you explore additional English learning materials beyond your homework assignments? (*5-point Likert scale*)
9. Do you feel your EFL classes help you become more adaptable to new learning methods (e.g., using AI, digital platforms, collaborative tasks)?
- Yes, very much
 - Somewhat
 - Not really
 - Not at all
10. Which of the following digital tools do you use to improve your English? (Select all that apply)
- AI-based chatbots (e.g., ChatGPT)
 - Language learning apps (e.g., Duolingo, Babbel)
 - Online courses and videos (e.g., YouTube, Coursera)
 - Online dictionaries and grammar checkers
11. Which of the following activities have been used in your EFL classroom to promote critical thinking, creativity, and collaboration? (Select all that apply)
- Debates
 - Group discussions
 - Case studies
 - Problem-solving tasks

- Evaluating different perspectives on a topic
 - Writing argumentative essays
 - Analyzing and summarizing texts
 - Brainstorming sessions
 - Creative writing tasks
 - Role-playing activities
 - Project-based learning
 - Collaborative storytelling
 - Others (please specify)
12. When faced with a challenging task in English, what do you usually do?
- Try different ways to solve it
 - Ask for help immediately
 - Avoid it
 - Use online tools to assist me
13. How do you use technology when facing a challenge in learning English?
- I mostly rely on traditional methods and rarely use technology.
 - I use familiar digital tools (e.g., online dictionaries, translation apps) but don't explore new ones.
 - I actively seek out new digital tools and platforms to enhance my learning.
 - I experiment with different technologies and adapt my learning strategies based on what works best.
14. When learning English, how do you combine required assignments with additional learning activities? (Select all that apply)
- I complete my assignments first, then explore extra materials if I have time.
 - I actively seek out additional materials to complement my coursework.
 - I only focus on the assigned work and do not engage in extra activities.
 - I integrate extra activities into my study routine (e.g., watching English videos, reading articles, using language apps).
 - Other (please specify)
15. In what ways do you apply and integrate different aspects of your English learning? (Select all that apply)
- I connect ideas from different lessons when writing or speaking.
 - I use multiple skills (listening, reading, speaking, writing) together in projects or discussions.
 - I create new content (e.g., blog posts, presentations, creative writing) based on what I've learned.
 - I experiment with using new vocabulary and grammar structures in different contexts.
 - I do not usually combine topics or skills; I focus on each task separately.
 - Other (please specify)
16. How often are you encouraged to analyze, evaluate, and discuss information rather than just memorize it? (5-point Likert scale)
17. How often do you participate in group discussions or projects in your EFL classes? (5-point Likert scale)

18. What challenges do you face when participating in discussions or debates in English? (Select all that apply)
 - Difficulty finding the right words to express my ideas.
 - Fear of making mistakes.
 - Not having enough background knowledge on the topic.
 - Not enough opportunities to participate in class discussions.
 - Other (please specify)
19. How confident are you in your ability to critically evaluate information for bias and reliability? (5-point Likert scale)
20. How confident are you in your ability to generate original ideas in response to a topic? (5-point Likert scale)
21. How confident are you in your ability to construct a well-reasoned argument in English? (5-point Likert scale)
22. How confident are you in your ability to work effectively in group projects? (5-point Likert scale)
23. How confident are you in your ability to combine different topics and skills learned in your EFL course to create something new (e.g. presentations, essays, projects, discussions)? (5-point Likert scale)
24. How confident are you in your ability to collaborate with peers to solve problems? (5-point Likert scale)
25. How confident are you in your ability to evaluate the credibility of a source? (5-point Likert scale)
26. Do you believe that EFL classes are preparing you for the future workplace? (5-point Likert scale)
27. To what extent do you believe an EFL teacher should actively integrate activities that promote critical thinking, creativity, and collaboration in the classroom? (5-point Likert scale)
28. Which of the following strategies do you think an EFL teacher should prioritize to develop critical thinking, creativity, and collaboration in students?
 - Problem-solving tasks and debates
 - Project-based learning and group work
 - Open-ended discussions and creative writing
 - Role-playing and real-world simulations
 - Digital tools and multimedia integration
 - Other (please specify)

Section 3: Open-Ended Questions

29. In what way do you think AI can foster critical thinking and creativity?
30. What potential challenges or negative impacts do you see in using AI for developing critical thinking and creativity?