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Assessing AI Literacy among Iranian Pre-Service EFL Teachers: Levels, Predictors, and Challenges: A Mixed Methods Design

Mohammadreza Tusi Nasrabadi[1], Setareh Haji[2], Saghar Afshari[3]

1. Department of English language teaching, Farhangian University, Tehran, Iran, mohammadrezatusi1@gmail.com
2. Ministry of Education, Tehran, Iran
3. Ministry of Education, Tehran, Iran

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ABSTRACT

Objective: This study aims to explore the degree of AI literacy among Iranian pre-service EFL teachers at Zanjan University and provide insights into its key components for future pedagogical planning.

Methods: Given the descriptive, quantitative nature of the study, a five-point Likert scale questionnaire was used to assess AI literacy across six constructs among 53 participants in a teacher education program (15 male, 38 female). The instrument was developed by Ayanwale et al. (2024) and was re-tested again for ensuring its reliability and validity in our own specific research context.

Results: The results indicated higher levels of AI literacy in lower-order cognitive skills (according to Blooms taxonomy) such as “use and apply AI” and “know and understand AI”, and lower levels in higher-order skills like; “create AI” and “detect AI”. Furthermore, the analysis demonstrated that “know and understand AI” construct was a significant predictor of overall AI literacy, followed by “AI emotion regulation” and “use and apply”. The study also compared AI literacy levels based on prior AI training, and identified the perceived challenges of applying AI tools in education.

Conclusions: Pre-service EFL teachers demonstrated uneven AI literacy, with stronger performance in foundational skills and weaker in advanced competencies. These results highlight the need for targeted teacher education initiatives to enhance higher-order AI literacy skills and address barriers to effective classroom integration.

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Introduction

The extensive intertwined role of technology in the current era has drastically transformed different aspects and practices of our lives. These include educational settings, in particular the context of EFL. The implementation of technology in EFL classes has been underway for a long time and its impact on learning is a subject of debate. Technology is reported to have a significant effect on the enhancement of vocabulary, grammar, reading, speaking, and even listening skills (Al-Maashani & Mudhsh, 2023). In addition to the mentioned skills, its strong positive impact on writing in EFL and ESL has been detected through several studies (Al-Wasy, 2020) .

Recent years have witnessed an astonishing evolution of technology. The advancement of artificial intelligence, has led to a disruptive impact on various sectors and industries (Rashid, 2024). Once again, language teaching and learning, like any other field, has been dominated by these enhancements. These influences are considerable enough that some may propose a need for a more dynamic model in language teaching and learning, the AI-assisted approach in ELT. AI chatbots demonstrate a strong positive impact on students' academic performance; they foster their language skills along with their psychological and emotional well-being (Liu et al., 2025). They promote both internal and external motivation (even motivation to communicate), engagement, eagerness, and confidence among students and in the majority of cases students have declared a positive attitude towards learning English with the help of AI tools (AlTwijri & Alghizzi, 2024). Wei (2023) reported a significant impact of AI tools on English learning achievement, L2 motivation, and self-regulated learning. By providing a supportive learning environment and personalized feedback, these tools can also boost students' self-esteem, reduce anxiety levels, and cultivate students' autonomy by appreciating each student's learning pace (Kabilovna & Aleksandrovna, 2024). In addition to its discussed benefits, ELT faculty members perceive AI tools (ChatGPT in particular) as valuable complementary tools that strengthen traditional teaching methods (Mohamed, 2024). Considering all the benefits that AI-based technology offers, the shift in ELT trends toward AI-assisted methods appears to be strongly probable and predicts a promising direction for the future of language education. However, the practical implementation of these tools in the classroom necessitates EFL teachers possessing essential knowledge and competence (or in broader terms, AI literacy) regarding these rising technologies .

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Ding et al. (2024) highlight a framework (provided by Zhao et al.) of four main domains of AI literacy for teachers. This framework includes: "1. Knowing and Understanding AI; that is, comprehending fundamental AI concepts with enhanced AI familiarity, 2. Applying AI applications; utilizing them in teaching practices and leveraging their potential to enhance teaching and learning experiences, 3. evaluating AI applications; examining the potential and limitations of AI implementation, and 4. AI ethics; aligning AI integration in teaching with ethical standards and educational values (AI bias, student privacy, equity and fairness, etc.) ."

Enhancing teachers' AI literacy improves their competency in utilizing AI tools in the classroom and reduces issues arising from their inefficient knowledge and experience with AI technology. It also assists them in designing effective pedagogical strategies while considering ethical issues, making them more efficient in the dynamic environment of AI-augmented education (Ding et al., 2024). So, it can be concluded that fostering teachers' AI literacy would lead to more effective pedagogical practices and appropriate integration of AI tools in the classroom. Additionally, teachers equipped with AI literacy can better guide students in becoming informed and critical users of AI. AI literacy is important for pre-service teachers as well, as it equips them with the skills necessary to address the challenges and opportunities of artificial intelligence and, therefore, ensures they can use AI tools to promote creativity, cooperation, and customized learning for students in the classroom (Ayanwale et al., 2024) .

However, despite the importance of AI literacy, studies suggest the lack of AI literacy among teachers, which makes them incapable of the effective utilization of these tools in learning, teaching, and assessment (Chiu et al., 2023, Hur, 2025). Moreover, teachers may not yet feel confident about effectively integrating AI tools into classrooms, and need further training and experience regarding the matter (Kundu & Bei, 2025, Hur, 2025, Chiu et al., 2023). However, this insufficiency can be addressed through careful and research-based training programs. A study by Ding et al. (2024) compared teachers' AI literacy levels before and after AI training. Initially, only 28% of the participants reported having basic AI knowledge and experience with AI integration in education, while the result of the post survey demonstrated that 85% reported a heightened sense of AI literacy and confidence concerning AI integration in pedagogical practices. They also expressed eagerness about the potential opportunities that AI can offer in EFL contexts .

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In the Iranian EFL context, a few studies have attempted to investigate teachers' digital skills and their perceptions regarding AI. For instance, Taherkhani and Ghaleei (2024) investigated the digital competence of Iranian in-service EFL teachers using a questionnaire. Their findings showed that in-service EFL teachers had a moderate to high level of digital skills. Ghiasvand, Kogani, and Alipoor (2024) explored the preparedness of Iranian and Italian EFL teachers regarding the integration of AI tools into their teaching. Using semi-structured interviews, the findings showed that Italian teachers generally felt ready to adopt AI tools in their classes, while Iranian EFL teachers reported being unprepared to do so. Furthermore, Khajavi and Ezhdehakosh (2025) conducted a study about the perspectives of pre-service language teachers about incorporating AI tools in education. By using semi-structured interviews, they discovered that participants showed a strong interest in AI. Furthermore, participants particularly highlighted AI's role in improving classroom interaction as well as its role in giving timely feedback to students.

However, despite these valuable insights, research on AI literacy among pre-service EFL teachers in Iran is still limited. Current studies have mostly focused on in-service EFL teachers. Furthermore, they have mostly used qualitative methods such as interviews to examine pre-service and in-service teachers' readiness for AI and also their perceptions regarding AI usage in education. Hence, there is a need for more quantitative research for examining AI literacy among pre-service EFL teachers in Iran. Moreover, existing work has largely overlooked which specific AI literacy components are most critical for effective teacher preparation. This gap limits our understanding of how-to best design teacher training programs to equip future educators with the skills they need in an AI-augmented classroom environment. Considering the rapid advancements in AI-based technologies addressing these gaps is very important to ensure that future EFL teachers are well-prepared for integrating AI tools into their teaching practices.

Therefore, this study aims to explore the levels of AI literacy among Iranian pre-service EFL teachers who are on the verge of entering the teaching profession. Unlike previous studies that mostly relied on qualitative research designs and explored pre-service teachers' attitudes towards AI or general digital skills, this study adopts a mixed-methods research design and aims to explore the levels of pre-service EFL teachers' AI literacy across six key constructs. This study also fills the gap by evaluating the role of factors such as prior AI training in Iranian EFL context. In addition, this study aims to determine the strongest predictor aspect of AI literacy, which may

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benefit future pedagogical decisions. Furthermore, this study contributes to the literature by providing evidence-based insights that can inform the design of future teacher training programs. To further interpret the results of AI literacy among final-year pre-service EFL teachers, we decided to use Bloom's Revised taxonomy (Anderson & Krathwohl, 2001) as our theoretical framework and map each construct from the questionnaire onto levels of Bloom's Revised Taxonomy (see Table 1 in Appendix). Bloom's taxonomy of educational objectives (Bloom, 1956) offers a valuable framework for shaping how AI literacy is defined and also for creating tools to measure it (Carolus et al., 2023). Using this framework in this study helps us break down AI literacy into specific components—ranging from simply knowing and understanding AI concepts to applying, analyzing, and creating AI tools .

Specifically, the current study attempts to answer the following questions:

RQ1: How do pre-service EFL teachers perform across different dimensions of AI literacy, as categorized by Bloom's Taxonomy?

RQ2: which AI literacy construct can best predict the overall AI literacy among Iranian pre-service EFL teachers?

RQ3: Is there a significant difference in AI literacy between Iranian pre-service EFL teachers who have received prior AI training and those who have not?

RQ4: How does prior AI training influence AI literacy score across each construct?

RQ5: How do pre-service EFL teachers perceive the challenges of applying AI tools in education?

Material and Methods

This study adopted a mixed-method research design to evaluate the level of AI literacy among final-year pre-service EFL teachers. Given the increasing importance of integrating artificial intelligence in education, this study aimed to find out whether final-year TEFL students at Zanjan Farhangian University have enough AI literacy for their future career as English language teachers.

Participants and Sampling

The study was conducted in two departments of Zanjan Farhangian University, one comprising male students and the other female students. The target population consisted of all final-year pre-service EFL teachers in these departments. Final-year EFL students were selected as our population because they are on the verge of entering the education system, and thus, the level of

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their AI literacy is highly important. Our study used a convenience sampling method, which means final-year students who were accessible and willing to participate were considered the sample of the study. Out of a total population of 71 students, 53 completed the questionnaire, which produces a response rate of 74.64%. Of the 53 participants, 28% was male and 71% was female, and their ages ranged from 21 to 27 years.

Instruments

This study used a questionnaire to investigate the AI literacy of final-year pre-service EFL teachers in Zanjan Farhangian University. The questionnaire consisted of two main sections. The first section gathered demographic data such as participants' age, gender, and whether they had received any prior training in artificial intelligence. Furthermore, before moving on to the AI literacy section, in an open-ended question, we asked participants about their opinions about the challenges of using AI in education and also the name of AI tools they most frequently use in their everyday lives. The second section of the questionnaire focused on measuring participants' AI literacy. In order to collect data on the participants' artificial intelligence literacy, we used a questionnaire from the study by Ayanwale et al. (2024), titled "Examining artificial intelligence literacy among pre-service teachers for future classrooms." This questionnaire was selected because it aligned well with the objectives of our study, which focuses on pre-service EFL teachers. Ayanwale et al. (2023) used this questionnaire with a similar population—pre-service teachers—and employed Structural Equation Modeling (SEM) to find out about the relationships among the different constructs of AI literacy. This instrument was developed based on prior literature, including works by Ng et al. (2022), Long and Magerko (2020), Ajzen (1985), and Carolus et al. (2023). The AI literacy questionnaire consists of eight constructs: AI emotion regulation, AI ethics, AI problem-solving, AI detection, AI knowledge and understanding, AI use and application, AI creation, and AI persuasion literacy. Although the original study by Ayanwale (2024) established the construct validity and reliability of the questionnaire, due to the fact that our population was limited to pre-service EFL teachers in a different context, we decided to run the tests again to ensure the instrument's appropriateness for our specific research context.

Data Collection Procedure

The questionnaire was distributed in person to final-year pre-service EFL teachers. Furthermore, for some of them, the questionnaire was sent via Google Forms by sharing the link with them

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through Telegram application. Before participants completed the questionnaire, they were provided with a brief description of the research objectives. They were informed that their participation was completely voluntary. Furthermore, in the first part of the questionnaire we assured them that their responses would remain anonymous and confidential. The data collection period lasted for two weeks. In total, 53 participants completed the questionnaire, which represents 74.64% of the target population.

Data Analysis

To analyze the responses collected from the AI literacy questionnaire, we used SPSS (Version 27). First, we assessed the internal consistency of each construct using Cronbach's alpha. This helped us understand whether the items in each construct were reliably measuring the same concept. We also examined corrected item-total correlations to identify items that weakened the overall reliability. We decided to remove any item that significantly reduced a construct's alpha value or showed little alignment with the rest of the items.

After conducting reliability testing, we conducted an exploratory factor analysis (EFA) to examine the questionnaire's construct validity. We used principal axis factoring as the extraction method. Before extracting factors, we checked the Kaiser-Meyer-Olkin (KMO) measure to evaluate whether the sample size is adequate for EFA, and also Bartlett's test of sphericity to ensure sufficient inter-item correlations.

Furthermore, we ran descriptive statistics to explore participants' levels of AI literacy across the remained constructs. For each construct, we calculated means, standard deviations, and categorical frequency distributions. We also examined skewness values to understand the direction and symmetry of response distributions. In order to analyze data for the rest of the research questions of our study, we conducted linear regression tests to find out which construct of AI literacy best predicts the overall AI literacy of participants. The rest of the responses were analyzed using t-tests between different group of participants, cross-tabulations to find out any potential patterns between prior AI training and AI literacy level, and also thematic analysis of participants' responses to the open-ended question in the questionnaire.

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Results

Reliability Analysis

To ensure the internal consistency of the questionnaire, reliability analysis was conducted for each of the eight constructs. For the first construct (Q1–Q4), Cronbach's alpha was 0.695, slightly below the threshold of 0.70. Since Q2 had a low corrected item-total correlation (0.318) and its removal raised alpha to 0.730, we excluded it. The second construct (Q5–Q8) showed acceptable reliability (α=0.709). The third construct (Q9–Q10) was borderline (α=0.694), but no improvement was achieved by removing items, so both were retained. The fourth construct (Q11–Q12) showed poor consistency (α=0.463, r=0.307) and was excluded. The fifth construct (Q13–Q15) demonstrated acceptable reliability (α=0.765) and was retained. The sixth construct (Q16–Q18) had low reliability (α=0.475) and was omitted. The seventh construct (Q19–Q20) showed strong consistency (α=0.846, r=0.736) and was retained. The final construct (Q21–Q23) had α=0.653, with adequate item-total correlations, but Q22 showed poor factor alignment and was removed. Although this reduced reliability to α=0.591, the decision was necessary for construct validity.

Construct Validity

An exploratory factor analysis (EFA) using principal axis factoring with Direct Oblimin rotation was conducted on 16 items (Q1, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q13, Q14, Q15, Q19, Q20, Q21, Q23) to examine the underlying factor structure of the adapted AI literacy questionnaire in our specific context. A Varimax rotation was also tested for comparison, which merged conceptually distinct constructs. The Factor Correlation Matrix showed small to moderate correlations among factors, supporting the appropriateness of the oblique rotation. The Kaiser-Meyer-Olkin (KMO) measure (.625) and Bartlett's test of sphericity ($p < .001$) confirmed the adequacy of the sample and sufficient item correlations for EFA. Six factors were extracted based on eigenvalues >1 and scree plot inspection, accounting for 63.75% of total variance. The sixth factor had an eigenvalue slightly below 1 (0.824) but was retained due to theoretical alignment, meaningful item groupings, and interpretability. The Pattern Matrix revealed six distinct factors largely corresponding to the theoretical framework. The first factor (Use and Apply AI; Q1, Q3, Q4) and second factor (AI Persuasion; Q19, Q20) aligned well with expectations. The third factor (Create AI; Q13, Q14, Q15) and fourth factor (Detect AI; Q9, Q10) also showed appropriate alignment, although some items cross-loaded. The fifth factor (Know and Understand AI) partially

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aligned, with Q8 loading appropriately but other items deviating. The sixth factor (AI Emotion Regulation) largely aligned, though Q23 loaded onto factor four. Overall, the EFA results indicate acceptable alignment between the extracted factors and the theoretical structure, supporting the construct validity of the instrument. Minor discrepancies and item mismatches were observed, likely influenced by the moderate KMO value and the limited sample size (N=53). Given the theoretical importance of the original framework and its effect on internal consistency, no modifications were made to the instrument's structure.

Item-level communalities were also examined to support item retention decisions. Q2 (0.695) was excluded due to its negative impact on internal consistency. Q11 and Q12 had moderate communalities but low inter-item correlations (α = .463), and Q16–Q18 (.501, .517, .429) were removed for reliability concerns. Q22 (0.318) was also excluded as it disrupted factor extraction, which was necessary to maintain construct validity despite a slight reduction in reliability.

Descriptive Statistics (RQ1)

Descriptive statistics were used to examine pre-service EFL teachers' levels of AI literacy across six constructs: Use and Application of AI, Knowledge and Understanding of AI, AI Detection, AI Creation Ability, AI Persuasion Resistance, and Emotion Regulation (Table 1). For interpretation, values were categorized as Low (1.00–2.49), Moderate (2.50–3.49), and High (3.50–5.00). The highest mean was for Use_Apply_AI (M=4.16, SD=0.59), indicating high literacy, while the lowest was for Create_AI (M=2.18, SD=0.92), indicating low literacy. Knowledge and Understanding of AI (M=3.50, SD=0.74) and Detect_AI (M=3.39, SD=0.79) fell around the moderate range. AI Persuasion Resistance (M=3.56, SD=1.00) and Emotion Regulation (M=3.74, SD=0.78) indicated higher literacy levels. Overall, participants showed strong competencies in using AI tools, acceptable persuasion resistance and emotion regulation, but more variation in knowledge, detection, and especially AI creation ability.

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Table 1. Descriptive Statistics for Questionnaire Constructs

	N	Range	Minimum	Maximum	Mean	SD	Variance	Skewness	Std. Error of Skewness
use_apply_Al	53	2.67	2.33	5.00	4.16	.59	.34	-.61	.33
Know_uderstand_Al	53	3.00	2.00	5.00	3.50	.74	.55	-.17	.33
Detect_Al	53	4.00	1.00	5.00	3.39	.79	.63	-.51	.33
create_Al	53	3.33	1.00	4.33	2.19	.92	.85	.64	.33
persuasion_Al	53	4.00	1.00	5.00	3.57	1.00	1.00	-.55	.33
emotion_ Al	53	4.00	1.00	5.00	3.75	.78	.61	-1.09	.33
Valid N (listwise)	53								

Regression Analysis (RQ2)

Six linear regression tests were conducted separately in order to discover which construct most strongly predicts general AI literacy. Logical justification for choosing this approach over multiple regression is to avoid R square of 1.00, hence the dependent variable (Total AI literacy) is the sum of construct scores, mathematically the R square of 1 is expected. Therefore, the linear regression with each construct score serving as predictor, and the dependent variable of total AI literacy (excluding the items of the construct served as predictor) was carried out individually for each of the six constructs. The results are presented at Table 2 and served as the basis of comparison.

Table 2. Results of the Regression Analysis

Construct	Adjusted R^2	Beta (Standardized)	Coeff. Sig. (p-value)	Meaning
Use and apply	.155	.414	.002	significant
Know and understand	.368	.617	<.001	significant
Detect AI	.118	.367	.007	significant
Create AI	.042	.246	.076	Not significant
AI Persuasion	.001	.143	.307	Not significant
AI Emotion	.243	.508	<.001	significant

By inspecting the table, it is clear that *know and understand* construct is the remarkable predictor of general AI literacy. (β= .617, P<.001). This construct explains nearly 37% of the variance in AI literacy. Subsequently the *AI emotion regulation* construct is the second significant predictor of the overall AI literacy with the β=.508 and the P value of <.001 that accounts for 24% of the variance. The *Use and apply* construct are still a significant predictor of AI literacy with respectively lower strengths in comparison with the prior constructs. (β=.414, P=.002, Adj R^2=.155). The last constructs of *AI creation, AI persuasion, and AI detection,* exhibited moderate or non-significant predictive power.

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RQ3: Is There a Significant Difference in AI Literacy between Pre-service EFL Teachers Who Have Received Prior AI Training and Those Who Have Not?

Out of 53 participants, 12 (22.6%) reported having received prior AI training and 41 (77.4%) had not. Assumptions of normality and homogeneity of variance were met. An independent samples t-test (Table 3) revealed a significant difference between the groups, $t(51)=2.378$, $p=.021$. Participants with prior training ($M=58.92$, $SD=4.60$) scored higher than those without ($M=53.15$, $SD=7.99$), with a mean difference of 5.77 points (95% CI [0.90, 10.64]). The effect size was moderate to large (Cohen's $d=0.78$).

Table 3. Independent Samples t-Test Results for AI Literacy Scores Based on Prior AI Training

Group	*F*	*Sig.*	*t*	*df*	*Sig.*(2-tailed)	Mean Difference	Std. Error	95%CI Lower	95%CI Upper
Equal variances assumed	3.528	.066	2.378	51	.021	5.77033	2.42672	.89848	10.64217
Equal variances not assumed			3.166	32.116	.003	5.77033	1.82278	2.05797	9.48268

We also explored whether male and female participants differed in AI literacy. Male participants scored higher on average than female participants, and the difference was statistically significant. Further details can be found in Table 2 in the Appendix.

RQ4: Does Prior AI Training Significantly Influence Pre-service EFL Teachers' Levels of AI Literacy Across Six Key Constructs?

To examine whether prior AI training influenced AI literacy across six constructs, cross-tabulations and chi-square tests were used. Each construct was categorized as low, moderate, or high level of literacy. The results are as follows:

Use and Apply AI: Most participants reported high literacy, regardless of training (trained: 91.7%, untrained: 95.1%); $\chi^2(2, N=53)=1.159$, $p=.560$.

Know and Understand AI: 75% of trained vs. 53.7% of untrained participants reported high confidence; $\chi^2(2, N=53)=2.260$, $p=.323$.

Detect AI: High confidence was reported by 58.3% of trained and 58.5% of untrained participants; $\chi^2(2, N=53)=1.025$, $p=.599$.

Create AI: 50% of trained participants reported low ability vs. 78% of untrained; high ability was 25% vs. 9.8%. $\chi^2(2, N=53)=3.660$, $p=.160$.

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AI Persuasion: High confidence was similar in both groups (trained: 66.7%, untrained: 63.4%); $\chi^2(2, N=53)=1.008$, $p=.604$.

Emotion Regulation: Most participants reported high confidence (trained: 75%, untrained: 78%); $\chi^2(2, N=53)=0.906$, $p=.636$.

In conclusion, while some constructs—particularly Know and Understand AI and Create AI—showed trends favoring participants with prior AI training, these differences did not reach statistical significance. The clearest difference was seen in the Create AI category. However, It is possible that the small sample size and also the small number of trained individuals (n=12) may have limited the statistical power to detect significant differences between prior training and AI literacy.

RQ5: What challenges do pre-service EFL Teachers Perceive in Using AI Tools in Educational Settings?

To explore the participants' views on the challenges of using AI tools in education, an open-ended question was included in the AI literacy questionnaire: "In your opinion, what are the main challenges of using AI tools in educational settings?" Thematic analysis was used to analyze participants' responses to the question. Finally, 10 themes were identified. Results of the thematic analysis indicated that "ethical concerns" was the most recurring theme, followed by "decline in Cognitive and Creative Skills" and "AI-Produced Content Issues". The themes are presented below according to their frequency of occurrence in participants' responses.

Ethical Concerns (16 responses, 30%)

Ethical concerns were the most frequently mentioned challenge by pre-service EFL teachers. Participants' concerns about ethical issues regarding AI integration in education comprised 30% of total responses, which suggests the urgency of addressing these issues in educational settings. For instance, Participant 4 wrote: "Plagiarism, authenticity, and creativity decline."

Decline in Cognitive and Creative Skills (13 responses, 24.5%)

This theme was seen in 13 responses from the participants. This theme mostly focuses on concerns that AI use might reduce students' critical thinking, creativity, or overall mental engagement. Participants expressed concerns about loss of creativity among students, reduced critical thinking, suppressed student potential, and underuse of human intelligence.

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For instance, participant 6 wrote: “Creativity, critical thinking, logical assessment and… are in danger.”

AI-Produced Content Issues (13 responses, 24.5%)

Several participants mentioned that AI sometimes provides incorrect, misleading, or repetitive content that lacks creativity or academic reliability.

Participant 2 wrote: “It may have wrong answers while I'm not aware of them and mislead students.”

Inequity and Access Issues (8 responses, 15%)

Participants also raised concerns about technological, financial, and geographical limitations of applying AI tools in education.

Participant 16 wrote: “Not all the students have equal access to technology and internet…..”

Over-Reliance on AI and Decreased Motivation (6 responses, 11.3%)

Some participants feared that constant use of AI could lead to laziness among students. They also expressed concerns that AI may reduce students’ motivation to think independently and put in effort toward academic success.

Participant 10 wrote: “By using AI, students won’t try hard and they won’t seek knowledge as much as they should. They may become lazy and illiterate.”

Teacher Training and Support (6 responses, 11.3%)

A lack of teacher awareness and preparedness in applying AI in educational contexts was mentioned as a significant barrier. Moreover, some participants emphasized the need for teacher training programs to educate teachers on effectively integrating these tools into the classroom.

Participant 16 mentioned: “Educators may require training to integrate AI tools effectively into their teaching practices…”

Prompting Difficulties (5 responses, 9.4%)

Several participants reported difficulties in crafting effective prompts while working with AI tools. This suggests that teacher training curricula should incorporate lessons on effective AI prompt writing.

Privacy and Security Concerns (5 responses, 9.4%)

Concerns over data privacy and the security of personal information were another notable theme in participants’ responses.

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Participant 45 emphasized: “Some main challenges are data privacy and security, and also ethical concerns.”

Cultural and Contextual Mismatch (3 responses, 5.6%)

A few participants believed that AI-generated content did not align with local educational needs, especially within Iranian schools.

For instance, participant 18 wrote: “In some conditions, the information provided by AI tools is not suitable for Iranian schools and students.”

Ambiguous or Unclear Responses (1 response, 1.8%)

One of the responses was vague or did not clearly align with any specific theme.

Moreover, to identify the AI tools most used by participants, responses were collected and counted in Excel. ChatGPT was the most frequently mentioned tool (50 times; over 50% of total responses) (Table 4).

Table 4. Frequency and Percentage of AI Tools Reported by Pre-Service EFL Teachers

AI tool	Frequency	Percentage
1.Chatgpt	50	53%
2.Deepseek	13	13%
3.Copilot	8	8.5%
4.Perplexity	6	6.3%
5.Canva	3	3.1%
6.Grammarly	3	3.1%
7.Gemini	3	3.1%
8.Grok	1	1.06%
9.Consensus	1	1.06%
10.Beauty apps	1	1.06%
11.Bing	1	1.06%
12.Duolingo	1	1.06%
13.Gamma	1	1.06%
14.Vindize	1	1.06%
15.MidJourney	1	1.06%
Total	94	100%

Discussion

This study examined the AI literacy of final-year Iranian pre-service EFL teachers across six key constructs of AI literacy. Overall, participants demonstrated stronger literacy in constructs aligned with lower-order thinking skills in Bloom’s taxonomy. Furthermore, foundational knowledge of AI was the strongest predictor of total AI literacy. Prior AI training was associated with higher

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overall literacy but did not yield statistically significant differences across individual constructs. Below is a detailed discussion of the main research questions in our study.

RQ1: How Do Pre-service EFL Teachers Perform across Different Dimensions of AI Literacy, as Categorized by Bloom's Taxonomy?

As mentioned before; in order to better interpret the results, we used bloom's taxonomy as our theoretical framework. In conclusion, the findings show a clear trend: final-year pre-service EFL teachers demonstrated higher literacy in AI literacy constructs which aligned with the lower levels of Bloom's Taxonomy, such as remembering, understanding, and applying. However, for most constructs that aligned with higher-order thinking skills—analyzing, and creating—there was a considerable decrease in participants' scores. This gap highlights the need for teacher training programs that do not only focus on operational use of AI, but also enhance higher-order competencies related to it. Enhancing these higher-order competencies is essential in order for future educators to engage with AI in critical, thoughtful, and innovative ways in the classroom.

RQ2: Which AI Literacy Construct Can Best Predict the Overall AI Literacy among Participants?

The results of regression analysis indicated that foundational knowledge was the strongest predictor of overall AI literacy, followed by emotion regulation and practical application of AI. The observations of Ayanwale and his colleges (2024) regarding the AI literacy among pre-service teachers are partially consistent with the outcomes of the current study. Their study implemented Structural Equation Modeling (SEM) to investigate the predictive relationship between constructs. In their study "know and understand construct" was also proved to be a significant predictor of other constructs, specifically, with use and apply, AI detection abilities, and AI creation capacities. However, in contrast to our findings their study doesn't report any significant predictive power for use and apply construct. The existing differences can be attributed to contextual and methodological factors. Their study involved larger and more diverse sample in terms of the educational disciplines and years, though current study focuses specifically on final-year EFL pre-service teachers.

RQ3: Is There a Significant Difference in AI Literacy between Pre-service EFL Teachers Who Have Received Prior AI Training and Those Who Have Not?

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The results of the t-test revealed that there was a significant difference between the two groups. In fact, participants who mentioned that they had received prior AI training received higher scores than the other group. A similar finding was in Frimpong's (2022) study. Frimpong (2022) examined how AI training influences the readiness of pre-service teachers to work with AI. Using a pre-and post-test design, the study found that after the participants completed the training, their AI readiness had improved significantly. Furthermore, the importance of AI training programs can be seen in the perspectives of pre-service teachers. For instance, Pokrivcakova (2023) used a cross-sectional survey with 137 pre-service EFL teachers and found that over 64% of participants supported the idea of including AI education in their university curriculum and generally had positive expectations about the role of AI in teaching and learning.

RQ4. Does Prior AI Training Significantly Influence Pre-service EFL Teachers' Levels of AI Literacy across Six Key Constructs?

When we explored whether pre-service EFL teachers with prior AI training differed from those without it across various constructs of AI literacy using cross tabulations some meaningful patterns still emerged through cross tabulations that are worth discussing. The clearest patterns were seen in these two constructs: "know and understand AI", and "create AI".

Regarding Bloom's taxonomy, the absence of any patterns between trained and untrained participants in more practical constructs like use and apply AI (apply), detect AI (analyze), AI persuasion literacy (evaluate) and AI emotion regulation (affective domain) may suggest that existing AI training programs might still be too theoretical or general, and that they lack a focus on practical and higher-order skills. As Ng et al. (2021) observed in their review of AI literacy literature, most educational efforts mostly focus on foundational knowledge and everyday application, and fewer programs encourage more advanced thinking skills such as evaluating AI systems or creating AI tools. However, they argue as learners enter higher education, they should be supported in applying their prior knowledge in designing, building, and critically assessing AI applications. In conclusion, it should be noted that AI training programs for pre-service teachers should try to include all levels of cognitive development, from basic understanding to more advanced cognitive skills.

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RQ5: How Do Pre-service EFL Teachers Perceive the Challenges of Applying AI Tools in Education?

As mentioned before, we did thematic analysis of participants' responses to the open-ended question in our questionnaire. The most frequently mentioned theme was "ethical issues followed by "decline in cognitive and creative skills" and "AI-produced contents". Our results are consistent with the findings of previous studies about pre-service teachers' perceptions about challenges of AI in education. For instance, in their study about pre-service teachers' perceptions of AI challenges, Kalniņa et al. (2024) found that participants had this belief that AI may cause students to think and also solve problems in uniform ways. This finding suggests the possibility of decrease in students' creativity due to AI usage, which is consistent with our findings. Furthermore, it can be seen that our participants are aware of AI challenges in educational settings and that they have a critical perspective toward inclusion of AI in their teaching practices. This aligns with the view of Pedro et al. (2019), who emphasize the necessity of encouraging a critical understanding of AI among teachers. This way, teachers can help their students to be familiar with both benefits and drawbacks of AI tools. Hence, it is imperative that teacher training programs address all challenges related to AI and promote a critical view about AI among future teachers (Pokrivcakova, 2019; Tucker, 2019, as cited in Taşçı & Tunaz, 2024).

These findings provide insights into AI literacy among final-year pre-service EFL teachers at Zanjan Farhangain University, but several limitations should be noted. First, the small sample size of the study (N=53) limits generalizability to broader populations. Moreover, the sample included only final-year students, which may not reflect the experiences of pre-service teachers from other academic years. Only 12 participants had prior AI training, and the variability in type, depth, and quality of this training likely influenced performance which limits conclusions about its impact. Furthermore, the study relied on self-reported data, which may introduce social desirability bias and does not measure actual AI literacy skills. Moreover, although we used an AI literacy questionnaire that was validated in another study, we did not conduct any pilot study before collecting data which may potentially affect its ability to capture all aspects of AI literacy. Future research should address these limitations by including larger and more diverse samples, identifying the type and quality of prior AI training, and considering longitudinal or experimental designs to find out about AI literacy development or evaluate training programs' effectiveness. Mixed-

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method approaches, such as combining surveys with classroom observations, could provide richer insights into pre-service teachers' AI literacy.

Conclusion and implications

This study aimed to explore Iranian pre-service EFL teachers' AI literacy and whether prior AI training influenced their AI literacy scores. Guided by Bloom's taxonomy, our study revealed that Iranian pre-service EFL teachers are generally more confident in AI literacy constructs that aligned with lower-order skills including "use and apply AI" and "know and understand AI". However, their confidence in higher-order constructs was generally lower, with "create AI" receiving the lowest mean score among all. Furthermore, cross tabulations, although not statistically significant, revealed noticeable patterns only in two constructs of AI literacy: "create AI" and "know and understand AI in favor of the trained participants. This may suggest that existing AI training programs do not equally address all levels of Bloom's taxonomy. These findings align with Walter (2024), who emphasizes the need for a culture of AI use that includes questioning, investigating, and critically evaluating AI, not merely executing tools.

Furthermore, thematic analysis of our participants' responses to the open-ended question indicates that they are aware of AI challenges in education and they have a critical view towards it. Furthermore, the analysis highlights the significance of teacher training programs that do not only focus on raising pre-service teachers' technical knowledge of AI, but also try to provide pre-service teachers with the skills required to address those challenges. This view is also mentioned by previous literature. As Kohnke et al. (2025) argue, addressing artificial intelligence limitations, ethical concerns, bias, and privacy should be included in both pre-service training programs and also in continuous professional development of teachers. This way, pre-service teachers can have a critical view towards AI. Furthermore, regression analysis indicated that foundational AI knowledge is the strongest predictor of AI literacy, supporting Ayanwale et al.'s (2024) findings that solid understanding of AI fundamentals strengthens overall AI competencies.

Building on our findings, it is essential that teacher training programs in the Iranian EFL context integrate foundational AI literacy modules early in the curriculum to ensure that all pre-service teachers develop a solid understanding of necessary AI concepts and terminology. These programs should be carefully designed so that they enable pre-service teachers to progress from basic understanding to higher-order AI literacy skills. For example, alongside modules on basic AI tool

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usage, programs should incorporate project-based assignments where pre-service teachers design AI-assisted lesson plans, critically assess AI outputs, and explore ethical issues related to AI. Universities could offer workshops that teach the integration of AI in classrooms. Finally, fostering reflective practices among pre-service teachers will encourage them to thoughtfully consider the ethical, pedagogical, and practical challenges posed by AI which can prepare them to integrate these technologies responsibly and effectively in their future classrooms.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the ethics committee of Farhangian University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors contributed to the study conception and design, material preparation, data collection, and analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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