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AI Literacy Among English Language Learners in Iran: Examining the Opportunities and Challenges

Aref Tajrishifar[1]✉ **Mohammad Hussein Norouzi** [2]

1. Department of English Language and Literature, Faculty of Foreign Languages and Literature, University of Tehran, Tehran, Iran.. Email: areftajrishifar@ut.ac.ir
2. Department of English Language and Literature, Faculty of Foreign Languages and Literature, University of Tehran, Tehran, Iran.. Email: mhnorouzi@ut.ac.ir

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ABSTRACT

In response to the rapid evolution of Artificial Intelligence (AI) technologies in language education, this study aimed to develop an AI literacy model and elucidate its instructional implications among Iranian EFL learners. An exploratory mixed-methods design was employed; in the qualitative phase, data were extracted through semi-structured interviews and Grounded Theory analysis, while in the quantitative phase, the resulting model was tested on 200 language learners using factor analysis, Structural Equation Modeling (SEM), and fit indices via SPSS and Smart PLS software. Qualitative findings revealed one central category and six primary components: 'Literacy and Awareness Levels,' 'The Role of Education and Media,' 'AI Functions,' 'Challenges and Constraints,' 'Benefits and Applications,' and 'Policy-making and Ethics,' which were organized into 27 conceptual codes. Quantitative results indicated that these components accounted for 47.85% of the total variance of the construct. Furthermore, the structural model predicted 71.4% ($R2 = 0.714$) of the variance in AI literacy, which, coupled with a Goodness of Fit (GOF) index of 0.641, signifies a robust and satisfactory model fit. The findings suggest that while AI offers opportunities such as immediate feedback, personalized learning, and enhanced motivation, it also presents challenges including diminished human interaction, lack of cultural context comprehension, content inaccuracies, and cognitive dependency. Consequently, the implementation of formal AI literacy courses, ethics-based instruction, and the development of indigenous tools are essential for the safe and effective utilization of this technology. The proposed model provides a practical framework for policymakers and language educators.

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1. Introduction

In recent decades, the rapid expansion of technologies based on artificial intelligence (AI) has brought about a fundamental transformation in technological structures, communications, economics, and education. This transformation has not only affected industries and the labor market but has also significantly altered the field of language learning, particularly English. With the emergence of AI-based tools and applications—ranging from conversational assistants and translation tools to intelligent feedback and language practice systems—flexible, individualized or collaborative, and personalized learning has become possible.

The rapid and pervasive developments of AI-based technologies in recent decades have transformed many educational models, learning structures, and ways of human interaction with knowledge. Today, AI-based tools in the form of language models, feedback systems, content generation, intelligent translation, and conversation simulators play not merely a supportive role but rather a "learning-structure changing" role in language education (Walter, 2024). In such a context, the concept of "AI Literacy" has become an essential 21st-century skill—a skill that goes beyond the ability to use tools and encompasses a critical, ethical, and cultural understanding of AI technology (Menyhei & Szoke, 2025). In other words, an AI-literate individual should be able to understand, use, evaluate, and analyze the social and cognitive implications of AI (Wu et al., 2025).

English language teaching, especially in countries where English is not the first language, has been strongly influenced by the development of AI tools. Studies indicate that utilizing AI in the learning process can increase motivation, improve self-regulated learning, enhance comprehension, and provide personalized feedback (Shafiee Rad, 2025). However, using AI without sufficient understanding may reduce human interaction, increase dependence on machines, diminish critical thinking, and lead to receiving incorrect content or cultural alienation in language learning (Prado, 2024; Lintner, 2024). Therefore, the quality of learning depends not merely on using AI but on the level of AI literacy among language learners.

The existing research gap shows that, although some international research has been conducted on AI literacy in education (Lintner, 2024), the application of AI literacy in the domain of language learning, especially in Iran, has been less investigated. Furthermore, existing tools and models are often not localized and have not considered cultural, linguistic, and educational system sensitivities in assessing AI literacy (Wu et al., 2025).

Accordingly, the first research question of the present study examines the level of AI literacy and awareness and its effect on the AI literacy model of Iranian language learners. The second question focuses on the role of policymaking, ethical considerations, and future studies in explaining this model. The third question explores how the benefits and positive applications

of AI influence the AI literacy model of language learners. The fourth question investigates the role of various AI tools in language learning and their impact on the AI literacy model. The fifth question is dedicated to the role of educational institutions (schools) and media in enhancing learners' AI literacy. Finally, the sixth question analyzes the challenges and limitations of using this technology and its impact on the aforementioned model.

Therefore, the aim of the present study is to develop a localized and context-based model of AI literacy and to identify its opportunities and challenges among English language learners in Iran, so as to provide a theoretical and practical framework for language teachers, educational policymakers, and developers of localized tools—a framework that is not only innovative and technological but also ethical, critical, and appropriate to the cultural and linguistic identity of Iran.

Table 1. Research Questions

Research Question
1. What effect does the level of AI literacy and awareness have on the AI literacy model of Iranian language learners?
2. What role do policymaking, ethical considerations, and future studies play in explaining the AI literacy model?
3. How do the benefits and positive applications of AI influence the AI literacy model of language learners?
4. What impact does the role of AI tools in language learning have on the AI literacy model of language learners?
5. What role do educational institutions (schools) and media play in enhancing the AI literacy of language learners?
6. What effect do the challenges and limitations of using AI have on the AI literacy model?

Based on the above questions and corresponding to the dimensions of the conceptual model of the research, the following hypotheses were formulated:

Table 2. Research Hypotheses

Research Hypotheses
1. The level of AI literacy and awareness has a significant effect on the AI literacy model of language learners.
2. Policymaking, ethics, and the future of AI have a significant effect on the AI literacy model of language learners.
3. The benefits and positive applications of AI have a significant effect on the AI literacy model of language learners.
4. The role of AI in learning English has a significant effect on the AI literacy model of language learners.
5. The role of education, schools, and media has a significant effect on the AI literacy model of language learners.
6. The challenges and limitations of using AI have a significant effect on the AI literacy model of language learners.

2. Research Background

Developments in artificial intelligence (AI) technologies have transformed the nature of language learning and assessment; however, the effectiveness of these tools depends less on the technology itself and more on the level of "AI literacy" of language learners. In what follows, the theoretical foundations and research background of this field are examined across four axes.

2.1. Theoretical Foundations of AI Literacy

AI literacy is a multidimensional concept that goes beyond the technical ability to work with tools. Menyhei and Szoke (2025) consider this literacy to include intellectual, ethical, and critical aspects. Wu et al. (2025) have also proposed the dimensions of technical understanding, critical evaluation, practical application, and ethical awareness. From a theoretical perspective, AI facilitates personalized learning by creating intelligent learning environments; however, due to its algorithmic nature, it may be weak in representing the cultural nuances and contextual aspects of second language acquisition (Zhao et al., 2025).

2.2. Background of International Research

International studies emphasize the duality of AI outcomes. Dou et al. (2025), in a systematic review of 230 articles, showed that the use of AI does not always lead to sustained language development and that the results are sometimes contradictory. Regarding specialized skills, Prado (2024), in a study on translators and language learners, demonstrated that use without critical understanding leads to "machine dependence" and reduced productive skills. Furthermore, Lintner (2024), critiquing existing scales, emphasized the necessity of attending to individual and cognitive differences in assessing AI literacy. On the other hand, positive findings are also noteworthy; Fan and Zhang (2024) found that AI literacy influences the intention to continue using technology by creating "enjoyment of learning," and He et al. (2025) confirmed its role in reducing anxiety and enhancing the emotional resilience of language learners.

2.3. Background of Domestic (Iranian) Research

In Iran, Khorasani (2021) pointed to the potential of emerging tools for personalizing learning but noted the lack of indigenous theoretical frameworks in this field. Esfandyari and Ghamari (2024), in examining generative models such as ChatGPT, identified opportunities such as increased classroom interaction and challenges including response inaccuracy and ethical considerations. Furthermore, Nafei et al. (2025), in an empirical study, showed that technology-based interventions, contingent upon targeted training and provision of infrastructure, improve students' language skills and motivation.

2.4. Systematic Critique and Research Gap

A review of the background literature shows that most studies (e.g., Walter, 2024; Dou et al., 2025) have focused on English-speaking societies. From a methodological perspective, existing research has largely concentrated on "assessing technical skills" and has neglected the in-depth analysis of the "identity and cultural transformations" of the language learner when encountering AI. Furthermore, in the Iranian educational context, the absence of a localized model that links the variables of "educational policymaking" and "ethics" with AI literacy is quite evident. The present study is designed with the aim of filling this gap and developing a framework appropriate to the cultural and linguistic characteristics of Iranian language learners.

3. Research Method

The present study is applied-developmental in terms of purpose and mixed-method (qualitative-quantitative) in nature, employing a sequential exploratory approach. In this approach, qualitative data were first collected and analyzed to identify the dimensions, components, and indicators of AI literacy as well as its opportunities and challenges among English language learners in Iran. Subsequently, the qualitative findings served as the basis for designing the quantitative instrument and testing the conceptual model of the research. This design was selected due to the lack of a localized and comprehensive model of AI literacy in language education and the necessity of a theoretical explanation grounded in field data.

3.1. Qualitative Phase of the Research

3.1.1. Qualitative Approach and Method

In this phase, the "Glaserian approach" was used. This approach was selected over the systematic "Strauss and Corbin" approach due to its emphasis on emergence rather than forcing in data analysis. While the Strauss and Corbin model follows a rigid, pre-determined coding paradigm (causal conditions, contextual conditions, etc.), the Glaserian approach allows the researcher to let the dimensions of AI literacy emerge directly from the raw data of the participants without imposing pre-constructed theoretical frameworks.

3.1.2. Population and Sample of the Qualitative Phase

The statistical population of the qualitative phase consisted of English language learners in Iran who had experience using AI tools in the language learning process. Sampling was conducted purposefully, and the criterion for selecting participants was familiarity with, experience in, or interest in the application of AI in learning English. The sampling process continued until theoretical saturation was reached.

3.1.3. Qualitative Data Collection Instrument

The data collection instrument was a semi-structured interview, the questions of which were designed based on the main research questions. The main axes of this interview included six key areas: level of AI literacy and awareness, the role of policymaking and ethical considerations, benefits and positive applications, the role of AI tools in learning, the role of

educational institutions and media, and the challenges and limitations of this technology. The findings derived from these interviews served as the basis for designing the questionnaire items in the quantitative phase.

3.1.4. Qualitative Data Analysis Method

The data obtained from the interviews, after recording and transcription, were analyzed in two main stages: substantive coding and theoretical coding. In the substantive coding stage (including open and selective coding), initial concepts were extracted and main categories emerged. Finally, in the theoretical coding stage, the relationships among the components were explained and the core category was identified.

3.2. Quantitative Phase of the Research

3.2.1. Quantitative Design and Method

The quantitative phase of the research was descriptive-analytical and conducted using a survey method. The aim of this phase was to empirically test the model extracted from the qualitative phase and to examine the relationships among the research constructs.

3.2.2. Statistical Population and Sampling

The target population of the study included all English language learners aged 15 to 35 in Iran who have experience using AI tools in learning. Due to the breadth of the population and administrative constraints, 200 individuals were selected as the statistical sample using convenience sampling to increase statistical power and reduce sampling error. Determining the adequacy of the sample size in this study was based on two established criteria. First, based on Kline's (2015) approach, which recommends 5 to 10 participants per item for structural modeling; given the final 27 items, a ratio of 7.4 was achieved. Second, according to the "10-times rule" in partial least squares modeling (Barclay et al., 1995; Hair et al., 2018), the sample size should be at least 10 times the largest number of structural paths leading to a construct. Since in the present research model, six paths lead to the endogenous variable, the minimum required sample was estimated to be 60. Therefore, the sample size of 200 in the present study not only exceeds the methodological minimums but also, considering the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (equal to 0.826), is fully sufficient for achieving optimal statistical power and stable model fit in Smart PLS software.

3.2.3. Quantitative Data Collection Instrument

The data collection instrument was a researcher-made questionnaire based on the findings of the qualitative phase. The questionnaire consisted of two sections: the first section covered demographic information, and the second section included items related to the six main constructs of the study (level of AI literacy and awareness, the role of education and media, the role of AI in language learning, challenges and limitations, benefits and positive applications,

and policymaking and ethics). The response scale for the items was based on a five-point Likert scale.

3.2.4. Instrument Validity and Reliability

To assess the content validity of the questionnaire, experts in the fields of language teaching and educational technology were consulted. The reliability of the instrument was evaluated by calculating Cronbach's alpha coefficient and composite reliability (CR). The values obtained for all constructs were above 0.7, indicating satisfactory reliability of the instrument. Convergent validity was confirmed through the average variance extracted (AVE), and discriminant validity was confirmed using the Fornell-Larcker criterion.

3.2.5. Quantitative Data Analysis Method

Quantitative data were analyzed at two levels. At the first level, descriptive statistics (mean, standard deviation, frequency) and preliminary tests were performed using SPSS software version 27. At the second level, in order to test the conceptual model and the causal relationships among the constructs, structural equation modeling with the partial least squares (PLS-SEM) approach was employed using SMART PLS software version 3. Model fit indices including Q^2, R^2, and GOF were calculated, and the results indicated a strong and appropriate fit for the research model.

3.2.6. Ethical Considerations

At all stages of the research, the ethical principles of research were observed. Participants took part in the study with informed consent, the confidentiality of their information was guaranteed, and the data were used solely for scientific purposes.

4. Results and Discussion

4.1. Research Findings

In this section, first, the findings derived from the qualitative data analysis based on grounded theory are presented for model development, and then the results of the quantitative analysis using structural equation modeling in SPSS27 and SMART PLS V3 software are described. The present study does not have any predetermined definitive list regarding the pattern of AI literacy and the opportunities and challenges among English language learners in Iran, and it is not possible to identify all the characteristics related to this field based on fixed boundaries. However, the findings indicate that the interviewees were able to identify key and significant items that have greatly contributed to the development of the research model. Table (3) presents the dimensions of the AI literacy assessment model and the opportunities and challenges based on themes, components, and categories, and employs the substantive and theoretical coding process to identify, classify, and analyze the indicators of each component. This table is designed for a comprehensive and systematic analysis of the various dimensions

of AI literacy and the related opportunities and challenges among English language learners in Iran.

Table 3. Dimensions of the Model for Examining Artificial Intelligence Literacy and Related Opportunities and Challenges among English Learners in Iran, Based on Themes, Components, and Indicators

Main Component	Conceptual Themes	Indicators
Level of AI Literacy and Awareness	Conceptual understanding of AI	How familiar are you with the concept of artificial intelligence?/ Are you familiar with the term machine learning?/ Which AI tools for language learning are you familiar with?/ Have you encountered any errors or limitations of AI tools?/ Does age or professional background affect your level of AI literacy?/ Is your familiarity user-level or specialized?
	Understanding model mechanisms	
	Recognizing capabilities and limitations	
	Understanding basic and technical terms	
Role of Education, School, and Media in Promoting AI Literacy	Role of national media in awareness	Is the introduction of AI in national media useful? / What is the effect of AI education in schools? / How do educational games impact children's AI literacy? / What are the consequences of lacking formal courses? / How can media promote AI culture? / How much do social media platforms increase AI literacy?
	Role of educational system in foundational literacy	
	Public awareness through media	
	Influence of social media on general awareness	
Role of AI in English Language Learning	Enhancing writing and speaking skills	How do you use AI to improve your language skills? / Which tools do you prefer and why? / Has AI helped improve understanding of grammar and vocabulary? / How do you use AI for daily practice? / How does AI simulate real conversations? / How do you prevent over-reliance?
	Preference for specific tools like ChatGPT	
	Assistance in understanding grammar and vocabulary	
	Daily interactive practice	
	Simulation of real conversations	

Challenges and Limitations of Using AI in Language Learning	Accuracy and context issues	What is the biggest problem with AI accuracy? / Have you received incorrect answers? / Does AI reduce human interactions? / How well does AI personalize individual learning styles? / How does dependence affect independent thinking? / How does AI handle Iranian cultural terms?
	Receiving incorrect responses	
	Reduced human interactions	
	Weakness in deep personalization	
	Impact on independent thinking	
Benefits and Positive Applications of AI in Language Learning	Quick access and immediate feedback	What is the biggest advantage of AI accessibility? / How does AI personalize learning? / How does it reduce educational gaps? / How does it save time and cost? / How does AI enhance motivation? / How does it promote independent learning?
	Personalized learning process	
	Reducing educational inequality	
	Saving time and cost	
	Increasing motivation and learning persistence	
Policy, Ethics, and the Future of AI	Need for formal AI courses	What courses are needed to improve AI literacy? / How can tools be localized? / How to prevent ethical misuse? / What should future research focus on? / How can AI be integrated into curricula? / How can dependence on AI be managed?
	Development of localized and culturally relevant tools	
	Ethics-centered AI education	
	Preventing academic cheating	

In the Glaserian approach, in contrast to the Strauss and Corbin (1997) approach, data analysis is conducted dynamically. In this study, conceptualization and classification of concepts were carried out directly based on the data through substantive and theoretical coding. Such an approach allowed the researcher to extract the components directly from the data without imposing pre-determined frameworks (such as the paradigmatic model). Within this framework, the conceptual codes extracted from the interviews are considered as main and sub-components and, as the main categories of the research, serve to explain AI literacy and the opportunities and challenges among English language learners in Iran.

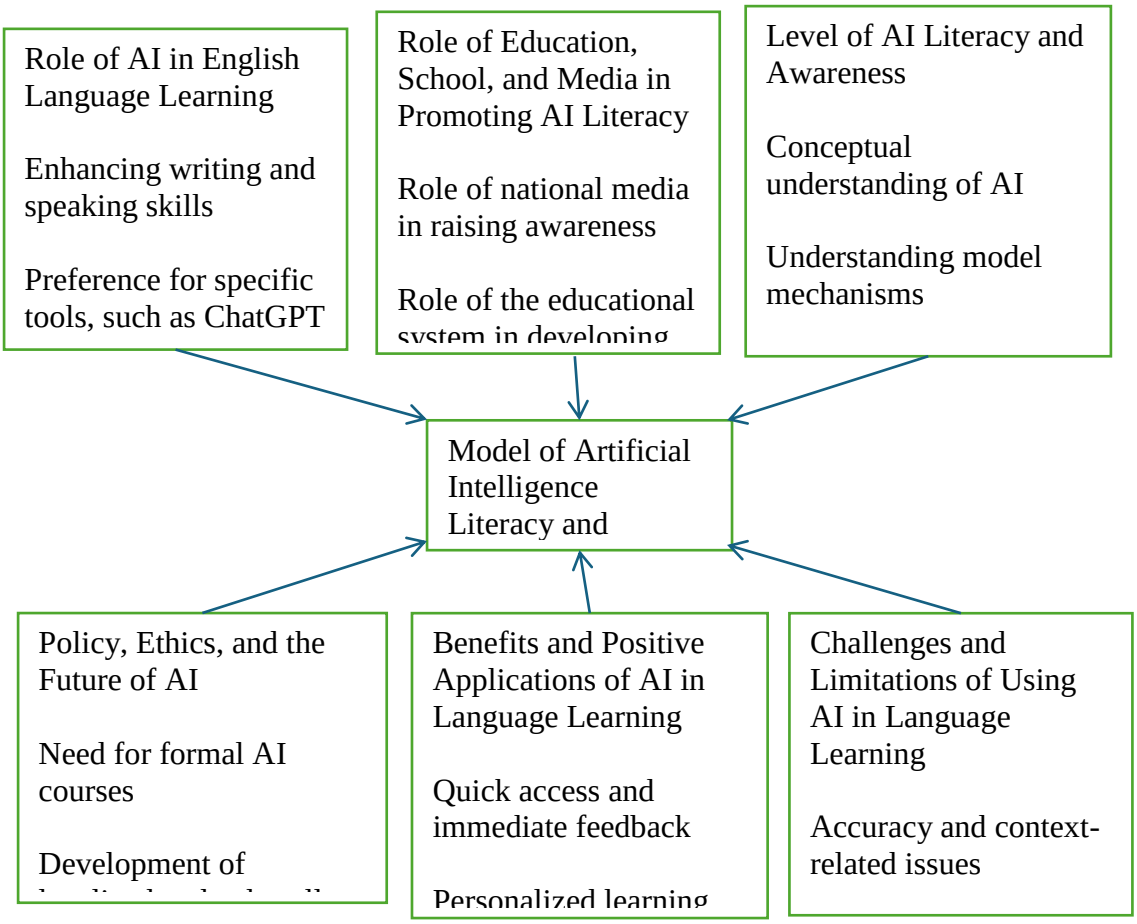

Figure 1. Theoretical Framework of the Study (Source: Research Findings)

According to the theoretical framework of the research, as illustrated, this model is divided into 1 category, 6 components, and 27 conceptual codes. In the following, structural equation analysis is used to assess the model fit reliability for explaining the target population.

The frequency distribution of participants based on language proficiency level is presented in Table 4. It is worth noting that, in order to meet international standards of language teaching and enhance the validity of the findings, the classification of proficiency levels in this study was not based solely on learners' self-reporting; rather, these levels were extracted and recorded based on the latest standardized placement tests of institutions, consistent with the Common European Framework of Reference for Languages (CEFR), across four levels: A2 (below intermediate), B1 (intermediate), B2 (upper intermediate), and C1-C2 (advanced).

Table 4. Demographic Characteristics of the Sample

Demographic Variable	Category	Frequency	Percentage
Age Group	15–25 years	144	72.0%
	25–35 years	31	15.5%
	Over 35 years	25	12.5%

Gender	Female	114	57.0%
	Male	86	43.0%
Education Level	Diploma or lower	143	71.5%
	Associate degree	10	5.0%
	Bachelor's degree	33	16.5%
	Master's degree	12	6.0%
	Doctorate	2	1.0%
Language Learning Experience	Less than 6 months	7	3.5%
	6 months–2 years	46	23.0%
	2–5 years	109	54.5%
	More than 5 years	37	18.5%
Current English Level	Below averageA2	5	2.5%
	Average B1	76	38.0%
	Above average B2	98	49.0%
	Advanced C1-C2	21	10.5%

In order to understand the AI model and the opportunities and challenges among English language learners in Iran, factor analysis was used to condense the dimensions of the variables into underlying constructs. The suitability of the data for analysis was assessed by conducting Bartlett's test and calculating the KMO statistic. The value of this statistic in the present analysis was 0.826 with a significance level of 0.000, indicating the presence of correlation among the variables and the suitability of the data for conducting factor analysis.

Table 5. KMO and Bartletts Test

Statistic	Value
KMO Measure of Sampling Adequacy	0.826
Approx. Chi-Square (Bartlett's Test)	4371.584
Degrees of Freedom	1225
Significance Level	0.000

As can be seen, the reduction of the primary variables has led to the extraction of 6 factors with eigenvalues greater than 1, which together explain more than 47.85% of the variance of the initial set—a rate that is considered high and substantial. The gap between the eigenvalues and the variance explained by the first factors and the remaining factors has decreased after rotation, and the composition of the extracted factors has become more logical. Table No. 4 shows the rotated factor loading matrix for the 6 extracted factors.

Table 6. Final Factor Analysis Characteristics for Extracting the Model of AI Literacy and Related Opportunities and Challenges among English Learners in Iran

Factors	Initial Eigenvalues		Extracted Sum of Squared Loadings after Rotation	

	Eigenvalue	% of Variance	Cumulative %	Total
Level of AI Literacy and Awareness	10.219	20.438	20.438	5.472
Role of Education, School, and Media in Promoting AI Literacy	3.653	7.305	27.743	4.994
Role of AI in English Language Learning	3.257	6.514	34.257	4.836
Challenges and Limitations of Using AI in Language Learning	2.631	5.262	39.519	3.275
Benefits and Positive Applications of AI in Language Learning	2.427	4.853	44.373	3.242
Policy, Ethics, and the Future of AI	1.738	3.475	47.848	2.104

It should be noted that the six extracted factors together explain 47.85% of the total variance. Although this value is lower than the conventional ideal in some fields (60%), in exploratory research and in emerging areas of the humanities that deal with numerous behavioral and cognitive variables, values above 40% are also considered acceptable according to methodological sources (e.g., Hair et al., 2018). This level of variance explanation indicates the complexity and multidimensionality of the "AI literacy" construct within the cultural context of Iran, which is also addressed in the research limitations section.

Based on the factor loadings or the correlations of the factors with the primary variables, they can be named as described below. In order to show the structure of the factors more clearly and to facilitate their naming, only coefficients greater than 0.5 are reported in this table, and the variables are ordered according to the magnitude of their coefficients with the factors. Rows without a coefficient indicate that the corresponding variable did not have a correlation greater than 0.5 with any of the factors, and variables with factor loadings lower than 0.5 were removed from the analysis. Based on the factor loadings or the correlations of the factors with the primary variables, they can be named as will be presented in the following.

Table 7. Rotated Factor Correlation Matrix

Items	Level of AI Literacy and Awareness	Role of Education, School, and Media in Promoting	Role of AI in English Language Learning	Challenges and Limitations of Using AI in Language Learning	Benefits and Positive Applications of AI in Language Learning	Policy, Ethics, and the Future of AI

		AI Literacy				
S1	0.811					
S2	0.813					
S3	0.793					
S4	0.780					
S5		0.827				
S6		0.840				
S7		0.581				
S8		0.840				
S9		0.765				
S10			0.808			
S11			0.651			
S12			0.753			
S13			0.654			
S14			0.654			
S15				0.654		
S16				0.654		
S17				0.653		
S18				0.542		
S19					0.785	
S20					0.871	
S21					0.711	
S22					0.698	
S23					0.651	
S24						0.672
S25						0.643
S26						0.651
S27						0.754

According to the analysis of models using the SEM-PLS method, three criteria—reliability, convergent validity, and discriminant validity—are used to assess the fit of measurement models. To determine the reliability of the questionnaire items, the internal consistency method and construct reliability method were employed; Cronbach's alpha coefficient and composite reliability were measured for each set of items. Table No. 8 shows Cronbach's alpha and composite reliability for the entire questionnaire and the variables. Since the Cronbach's alpha and composite reliability values for all constructs of the conceptual research model are greater than 0.7, the instrument has excellent reliability.

Since item RQ1-Q8 (related to the consequence of the lack of formal courses) and item RQ2-Q8 (related to the challenge of reduced human interaction) were removed from the final analysis due to lack of significance, the final number of items was reduced to 27. This led to an

improvement in the goodness-of-fit index to 0.641 and strengthened the composite reliability and convergent validity of the constructs. As the results in Table 8 show, after removing items with weak factor loadings, the factor loading values of all remaining items are greater than 0.5, indicating the homogeneity and acceptability of the measurement model. Furthermore, the results of the significance test showed that the t-statistic for all paths and items is greater than 2.58; this indicates that all relationships in the model are significant at the 99% confidence level ($p < 0.01$), and the relationship between the items and the latent variables is confirmed with high precision.

Table 8. Cronbach's Alpha, Construct Reliability, and Convergent Validity of Research Variables

Indicator	Original Sample (O)	T-statistic	P-value	Cronbach's Alpha	rho_A	Composite Reliability (CR)	AVE
RQ1_Q1 <- Level of AI Literacy and Awareness	0.807	22.741	0.000	0.815	0.816	0.878	0.644
RQ1_Q2 <- Level of AI Literacy and Awareness	0.813	28.035	0.000				
RQ1_Q3 <- Level of AI Literacy and Awareness	0.819	28.882	0.000				
RQ1_Q4 <- Level of AI Literacy and Awareness	0.768	21.410	0.000				
RQ1_Q5 <- Role of Education, School, and Media in Promoting AI Literacy	0.810	33.857	0.000	0.804	0.836	0.862	0.521
RQ1_Q6 <- Role of Education, School, and Media in Promoting AI Literacy	0.831	33.614	0.000				
RQ1_Q7 <- Role of Education, School, and Media	0.691	11.832	0.000				

in Promoting AI Literacy							
RQ1_Q8 <- Role of Education, School, and Media in Promoting AI Literacy	0.837	29.380	0.000				
RQ1_Q9 <- Role of Education, School, and Media in Promoting AI Literacy	0.648	13.267	0.000				
RQ2_Q10 <- Role of AI in English Language Learning	0.508	6.124	0.000	0.781	0.792	0.859	0.604
RQ2_Q11 <- Role of AI in English Language Learning	0.663	12.788	0.000				
RQ2_Q12 <- Role of AI in English Language Learning	0.623	9.371	0.000				
RQ2_Q13 <- Role of AI in English Language Learning	0.663	10.126	0.000				
RQ2_Q14 <- Role of AI in English Language Learning	0.819	21.120	0.000				
RQ2_Q15 <- Challenges and Limitations of Using AI in Language Learning	0.791	15.721	0.000	0.894	0.917	0.908	0.545
RQ2_Q16 <- Challenges and Limitations of Using AI in	0.512	4.682	0.000				

Language Learning							
RQ2_Q17 <- Challenges and Limitations of Using AI in Language Learning	0.773	17.059	0.000				
RQ2_Q18 <- Challenges and Limitations of Using AI in Language Learning	0.563	5.854	0.000				
RQ3_Q19 <- Benefits and Positive Applications of AI in Language Learning	0.511	6.722	0.000	0.783	0.812	0.851	0.540
RQ3_Q20 <- Benefits and Positive Applications of AI in Language Learning	0.753	22.940	0.000				
RQ3_Q21 <- Benefits and Positive Applications of AI in Language Learning	0.796	28.519	0.000				
RQ3_Q22 <- Benefits and Positive Applications of AI in Language Learning	0.793	23.696	0.000				
RQ3_Q23 <- Benefits and Positive Applications of AI	0.780	20.008	0.000				

in Language Learning							
RQ3_Q24 <- Policy, Ethics, and the Future of AI	0.679	13.968	0.000	0.780	0.791	0.858	0.603
RQ3_Q25 <- Policy, Ethics, and the Future of AI	0.783	21.389	0.000				
RQ3_Q26 <- Policy, Ethics, and the Future of AI	0.806	30.968	0.000				
RQ3_Q27 <- Policy, Ethics, and the Future of AI	0.831	36.834	0.000				

Convergent validity exists when CR is greater than 0.7. Additionally, CR must be greater than AVE. In that case, the condition for convergent validity is met. To assess convergent validity in confirmatory factor analysis, two criteria must be considered: factor loading and average variance extracted (AVE). Factor loading should be greater than 0.4, and items with factor loadings below this value should be removed. Furthermore, confirmation or rejection of the significance of factor loadings should be based on significance values (t-value). According to Table No. 8, all factor loadings are greater than 0.5, and they are also statistically significant because their t-values are greater than 1.96. In the measurement model evaluation stage, two items were removed from the final model due to low factor loading (below 0.5) and lack of significance of the t-value, in order to improve the validity and reliability of the constructs. After the removal of these items, all factor loadings were reported above 0.5, and all t-values were above 1.96. The average variance extracted (AVE) should also be greater than 0.4. The squared values of AVE are shown on the main diagonal of Table No. 4. The squares of these values are all greater than 0.4. According to the Fornell-Larcker criterion, the square root of AVE for all variables is greater than the correlation of that variable with other variables; therefore, the discriminant validity of the variables is also confirmed. Confirmatory factor analysis is used to analyze the internal structure of the questionnaire and to discover the constituent factors of each construct or latent variable.

Table 9. Discriminant Validity of Constructs Using the Fornell-Larcker Criterion

Constructs	Level of AI Literacy and Awareness	AI Literacy and Opportunities & Challenges among English Learners in Iran	Policy, Ethics, and the Future of AI	Benefits and Positive Applications of AI in Language Learning	Role of AI in English Language Learning	Role of Education, School, and Media in Promoting AI Literacy	Challenges and Limitations of Using AI in Language Learning
Level of AI Literacy and Awareness	0.802						
AI Literacy and Opportunities & Challenges among English Learners in Iran	0.796	0.910					
Policy, Ethics, and the Future of AI	0.419	0.757	0.777				
Benefits and Positive Applications of AI in Language Learning	0.415	0.721	0.570	0.735			
Role of AI in English Language Learning	0.419	0.584	0.329	0.211	0.660		
Role of Education,	0.736	0.886	0.567	0.537	0.395	0.910	

School, and Media in Promoting AI Literacy							
Challenges and Limitations of Using AI in Language Learning	0.249	0.515	0.364	0.264	0.549	0.322	0.740

Figure (2) shows the research model in the significance numbers mode. In this model, the bootstrap method (with 322 subsamples) was used to calculate the t-statistic values for all measurement equations (factor loadings) and structural equations (path coefficients).

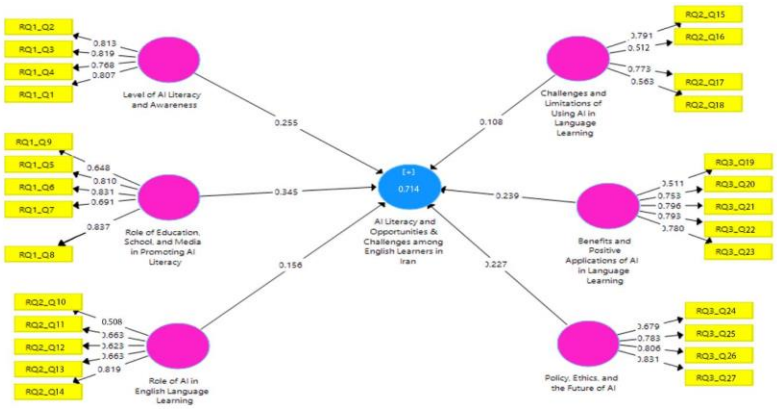

Figure 2: Initial measurement model with estimated coefficients

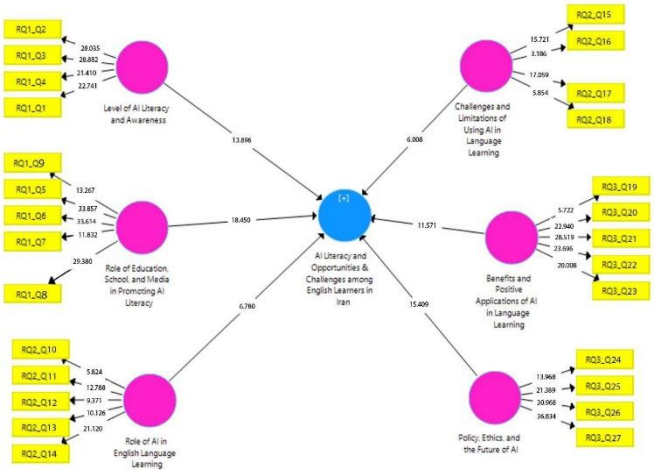

Figure 3: Initial measurement model with significance values of coefficients

According to Table 10, the variables of level of AI literacy and awareness, the role of education, schools, and media in enhancing AI literacy, the role of AI in learning English, the challenges and limitations of using AI in language learning, the benefits and positive applications of AI in language learning, and policymaking, ethics, and the future of AI together predict 0.714 (71.4%) of the variance of the endogenous variable, i.e., the necessity of an AI literacy model and the opportunities and challenges among English language learners in Iran. To assess R^2, the three values proposed by Chin (1998) are used: 0.19, 0.33, and 0.67, which respectively indicate weak, moderate, and substantial. For the aforementioned variable, the R^2 value is evaluated as "substantial."

Table 10. Explained Variance (R^2) Test

R^2 Adjusted	R^2	Endogenous Variable
0.712	0.714	AI Literacy and Opportunities & Challenges among English Learners in Iran

This test is precisely similar to the test for assessing the quality of the inner model. That is, it must be examined whether the independent (exogenous) variables together have measured the endogenous variables with appropriate quality. In other words, is the research model a suitable model for predicting the endogenous variables? The criterion for this consists of three values: 0.02, 0.15, and 0.35, indicating weak, moderate, and substantial, respectively.

VIF values for all constructs were reported between 1.4 and 2.8. The low value of this index, despite high internal correlations, indicates the model's ability to isolate the effect of each predictor on the dependent variable, and the hypothesis of severe multicollinearity, which would disrupt the estimation of coefficients, is rejected.

To ensure the absence of multicollinearity among the independent variables, the variance inflation factor (VIF) was examined. All VIF values were reported below the threshold of 5, confirming that the model does not suffer from variance inflation or severe multicollinearity.

Furthermore, to ensure the absence of multicollinearity and to confirm the model's robustness against overfitting, the variance inflation factor (VIF) was examined. The calculated values for all constructs in the model were reported between 1.4 and 2.8. Given that these values are well below the critical threshold of 5, the presence of any severe multicollinearity or structural error in the model is rejected, and the obtained fit is evaluated as genuine and reliable.

Table 11. Cross-Validated Redundancy (CV Red) for the Endogenous Variable

Endogenous Variable	CV Red	Result
AI Literacy and Opportunities & Challenges among English Learners in Iran	0.412	Strong

The overall goodness-of-fit index (GOF) in structural equation models with the partial least squares (PLS-SEM) approach was introduced by Tenenhaus et al. (2005) and is calculated as follows:

$$\text{GOF} = \sqrt{\text{average(communality)} \times \text{average}(R^2)}$$

To calculate the GOF in the present research model, first the average AVE is computed. The AVE values for the main variables are as follows:

$$\text{average(AVE)} = \frac{0.644 + 0.828 + 0.604 + 0.545 + 0.540 + 0.603}{6} \approx 0.576$$

On the other hand, given that in this study there is only one endogenous variable (AI literacy and the opportunities and challenges among English language learners in Iran), the R^2 value for this variable is 0.714.

$$\text{average}(R^2) = 0.714$$

Therefore,

$$\text{GOF} = \sqrt{0.576 \times 0.714} = \sqrt{0.412} \approx 0.641$$

This value indicates the overall quality and fit of the structural equation model. According to authoritative sources, a value above 0.36 is considered to indicate a strong model fit. The value of 0.641 in the present study indicates a very good and strong model fit.

According to the table, since the significance level in all tests is less than the error level (0.05), consequently, at the 95% confidence level, the null hypotheses are rejected and the alternative hypotheses are confirmed. That is, (level of AI literacy and awareness; the role of education, schools, and media in enhancing AI literacy; the role of AI in learning English; the challenges and limitations of using AI in language learning; the benefits and positive applications of AI in language learning; and policymaking, ethics, and the future of AI) are predictors of the variable of AI literacy model and the opportunities and challenges among English language learners in Iran.

Table 12. Hypotheses Testing: Significance, Strength, and Direction

Hypothesis	Path	B	T-Value	P-Value	Result
Level of AI Literacy and Awareness → AI Literacy and Opportunities & Challenges among English Learners in Iran	H1	0.255	13.896	0.001	Supported
Policy, Ethics, and the Future of AI → AI Literacy and Opportunities & Challenges among English Learners in Iran	H2	0.227	15.409	0.001	Supported

Benefits and Positive Applications of AI in Language Learning → AI Literacy and Opportunities & Challenges among English Learners in Iran	H3	0.239	11.571	0.001	Supported
Role of AI in English Language Learning → AI Literacy and Opportunities & Challenges among English Learners in Iran	H4	0.156	6.780	0.001	Supported
Role of Education, School, and Media in Promoting AI Literacy → AI Literacy and Opportunities & Challenges among English Learners in Iran	H5	0.345	15.690	0.001	Supported
Challenges and Limitations of Using AI in Language Learning → AI Literacy and Opportunities & Challenges among English Learners in Iran	H6	0.108	6.008	0.001	Supported

4.2. Discussion

The present study was conducted with the aim of developing a localized model of AI literacy and identifying its opportunities and challenges among English language learners in Iran. The results of the qualitative analysis based on grounded theory and the quantitative analysis using structural equation modeling provide a comprehensive picture of the dimensions of AI literacy in the context of English language teaching in Iran. In this section, the research findings are interpreted in light of the existing literature, and their theoretical implications are examined.

4.2.1. Explaining the Pivotal Role of Education, Schools, and Media in Enhancing AI Literacy

One of the most prominent findings of the present study was the strong and significant role of "education, schools, and media" in predicting AI literacy and its outcomes; this component had the highest path coefficient ($\beta = 0.345$) in the structural model. This result indicates that AI literacy is not merely an individual or technological phenomenon, but is strongly influenced by institutional, educational, and cultural contexts.

The qualitative findings also reinforce this point by pointing to the void of formal education; interviewees noted the lack of formal training, the weak role of the educational system, and the scattered impact of media on public awareness. This is consistent with perspectives in the

international literature, which emphasize that AI literacy should be strengthened through structured curricula, teacher training, and educational policymaking (Walter, 2024). Furthermore, Wu et al. (2025) emphasize the necessity of aligning AI education with cultural and linguistic contexts; an issue that becomes doubly important in the Iranian context due to linguistic, cultural, and educational differences.

4.2.2. Level of AI Literacy and Awareness as the Foundation for Meaningful Use

The results showed that the "level of AI literacy and awareness" significantly predicts the overall model of AI literacy and its opportunities and challenges (β = 0.255). The qualitative findings indicate that many language learners, although they pragmatically use tools such as ChatGPT, do not have a deep understanding of the mechanisms, limitations, and cognitive and ethical implications of AI. This result is consistent with the multidimensional definition of AI literacy—a definition that considers literacy beyond technical skill to include critical understanding, the ability to evaluate outputs, and ethical awareness (Menyhei & Szoke, 2025). In fact, the findings of the present study confirm that the lack of this level of awareness can lead to superficial, uncritical use and even cognitive dependence; an issue that has also been cautioned against in previous studies (Prado, 2024).

4.2.3. The Dual Role of AI in Language Learning: Opportunity and Challenge

The research findings showed that the "role of AI in learning English" is both interpretable as a positive factor (β = 0.156) and in interaction with other components. Language learners primarily use AI to enhance writing skills, understand grammar, expand vocabulary, and simulate conversations. These findings are consistent with the results of studies that have reported the positive impact of AI on personalized learning, self-regulation, and the reduction of language learning anxiety (Shafiee Rad, 2025).

However, the qualitative findings of the present study indicate that these benefits can turn into challenges in the absence of AI literacy. Over-dependence on tools, reduced human interaction, and weakness in understanding cultural and linguistic context were among the main concerns of language learners. These results align with the findings of Dou et al. (2025), who emphasized the contradictory and unstable learning outcomes associated with AI.

4.2.4. Challenges and Limitations: The Overlooked Yet Determining Dimension

The results of the structural model showed that although the "challenges and limitations of using AI" have a lower path coefficient compared to other components (β = 0.108), they still significantly contribute to explaining the overall model. This finding indicates that challenges are not determining factors on their own; rather, they acquire meaning in interaction with the level of literacy, education, and policymaking. The positive coefficient of challenges suggests that understanding and identifying limitations is itself a part of enhancing AI literacy among language learners.

In the qualitative analysis, issues such as content errors, weakness in deep personalization, the threat to independent thinking, and the inability of AI to represent the cultural nuances of the English language in the Iranian context were highlighted. These findings are consistent with warnings in the literature regarding "linguistic acculturation" and "the weakening of written identity" (Lintner, 2024; Lerias et al., 2024).

4.2.5. Policymaking, Ethics, and the Future: The Strategic Dimension of the Model

One of the key and thought-provoking findings of this study is the high correlation observed in the discriminant validity assessment (using the Fornell-Larcker criterion) between the two constructs of "education and media" and "AI literacy" (0.886). Although this value exceeds common statistical thresholds, it appears entirely justifiable in the Iranian educational context, because in this environment, learners' AI literacy—rather than being acquired spontaneously—is mainly a direct product of interaction with formal and informal education. This theoretical intertwining has also been reflected in the quantitative results.

Furthermore, among the central innovations of the present study is the highlighting of the component of "policymaking, ethics, and the future of AI" as a strategic pillar. The structural model findings showed that this component, with a path coefficient of 0.227, has a significant effect on the overall model of AI literacy. This result clarifies that without transparent ethical frameworks, coherent educational regulations, and the development of localized tools, the use of intelligent technologies in language learning cannot be sustainable or effective. Previous studies have also emphasized that ethics-oriented education, managing academic dishonesty, and preserving learner agency should be at the core of literacy development programs (Walter, 2024; Wu et al., 2025). The present findings, while confirming this perspective in the local context, affirm the necessity of formulating explicit educational policies.

In sum, the results show that AI literacy in English language learning is a multidimensional, context-dependent phenomenon that relies on the interaction among individual awareness, the educational system, technological opportunities, and ethical frameworks. By simultaneously explaining opportunities and challenges, the proposed model draws a realistic picture of the status of this field among Iranian language learners and thereby covers part of the existing gap in the international literature.

5. conclusion, Limitations, and Suggestions

The present study was conducted with the aim of developing and validating a localized model of AI literacy among English language learners in the Iranian educational context. The findings from the structural model analysis showed that all predicted paths in the form of six main hypotheses (H1 to H6) were confirmed at the 99% confidence level. The obtained results indicate that the six components of the study together explained 71.4% of the variance of the

AI literacy variable ($R^2 = 0.714$), demonstrating the very high predictive power of the final model. Among these, the variable "role of education and media" with the highest path coefficient was identified as the most critical driver for developing AI literacy. This finding emphasizes that awareness-raising through formal institutions and media is the foundation for the acceptance and correct use of emerging technologies. The model also showed that although AI provides unique opportunities such as personalized learning and access to instant feedback, without a critical perspective, it can bring serious challenges, including reduced intellectual independence and the weakening of authentic human interactions.

5.1. Research Limitations

Every research study, alongside its findings, faces limitations that affect the generalizability of the results. First, in this study, due to statistical issues and to improve model fit, two items were removed because of low factor loadings, indicating that some dimensions of AI literacy in the Iranian context require revision in measurement instruments. Second, the sample size was limited to 200 participants, and despite its statistical adequacy for structural modeling, this cautions against generalizing the results to the entire population of Iranian language learners. Third, the use of convenience sampling may have introduced biases in the representation of all proficiency and socioeconomic levels of language learners.

Furthermore, the findings of the Fornell-Larcker matrix showed a relatively high correlation (0.886) between the two constructs of "role of education, schools, and media" and "AI literacy and opportunities and challenges," which may indicate the strong dependence of AI literacy on education in the Iranian context, but methodologically, it may also suggest conceptual proximity between these two constructs, which requires further differentiation in future studies.

In addition to the above, in the exploratory factor analysis, the six extracted factors explained 47.85% of the variance, which is lower than the ideal criterion (above 60%). This indicates the complexity of the AI literacy construct and the necessity of revising measurement instruments in future research.

5.2. Research and Practical Suggestions

Based on the findings of the model, the following suggestions are offered for improving the quality of language education:

Practical Suggestions: Considering the confirmation of the vital role of educational institutions (H5), it is recommended that the Ministry of Education and language institutes integrate formal courses on "AI literacy and prompt engineering" into the language learners' curriculum in order to prevent superficial use and dependence on tools.

Future Research Suggestions: Future researchers are advised to implement this model comparatively across different age groups (especially children and adolescents). Furthermore, conducting experimental studies to evaluate the effectiveness of a training course designed

based on this localized model can be an important step toward operationalizing the findings of this research. Finally, investigating the role of AI in changing the "cultural identity" of Iranian language learners using in-depth qualitative methods is recommended.

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