A Field Study on Artificial Intelligence Literacy Levels of High School Student

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***Abstract*— Artificial Intelligence (AI) technologies are rapidly advancing and increasingly integrated into both professional and daily life. AI plays a transformative role in various sectors such as education, healthcare, and economics, reshaping social structures and practices. Therefore, it is essential for individuals to develop AI literacy in order to understand AI technologies, use them ethically and effectively, and avoid potential disadvantages. AI literacy encompasses understanding fundamental AI concepts, knowledge of its working principles and techniques, and the ability to critically evaluate AI-generated information and transform these technologies into tools for social benefit. High school students constitute a critical group in acquiring AI literacy, as they will shape the future workforce influenced by AI technologies. This study aims to evaluate the AI literacy levels of high school students, examine their perceptions of AI, and raise awareness regarding the use of AI in education. The research was designed using a quantitative cross-sectional survey model. Data were collected through an online scale from high school students enrolled in four different school types in Eskişehir, Turkey: one vocational high school, two project-based public high schools, and one private high school. Preliminary findings indicate that AI literacy levels differ significantly according to school type, gender, and grade level. Vocational high school students were found to require greater support in AI awareness, while 12th-grade students should be further supported in the context of university preparation. The findings are expected to contribute to the safe, ethical, and effective use of AI applications among students and to promote AI literacy awareness.**

Keywords*— *Artificial Intelligence Literacy, AI in Education, Technological Awareness, Secondary Education

I. INTRODUCTION

Artificial Intelligence (AI) has emerged as a rapidly developing technology with the potential to significantly transform numerous sectors by improving efficiency in data processing and decision-making. AI refers to the development of systems and algorithms that enable machines to perform tasks typically requiring human intelligence, such as learning, reasoning, and problem-solving. Today, AI applications are increasingly embedded in everyday life, from healthcare and education to manufacturing and entertainment. Instead of abstract concepts, AI provides practical solutions such as automated grading systems for teachers, diagnostic support tools in healthcare, and predictive maintenance in manufacturing industries.

AI technologies enhance productivity and reduce operational costs through data analytics, decision-support systems, and automation processes within specific sectors such as manufacturing, logistics, and data management [4], [7]. However, the impact of AI is highly contextual; recent peer-reviewed studies building on the work of Becker et al. [1] suggest that for experienced developers, AI integration can sometimes lead to fragmented workflows rather than linear efficiency gains. Furthermore, research citing Kosmyna et al. [12] highlights a growing concern regarding 'cognitive debt,' where over-reliance on AI assistants in complex writing tasks may diminish the user's deep engagement and critical processing abilities [1], [12]. Understanding the foundations and applications of AI has become essential for individuals and institutions seeking to maintain a competitive advantage. AI is inherently interdisciplinary, drawing from computer science, mathematics, statistics, engineering, and cognitive sciences [7]. However, the implementation of AI is not without challenges; recent studies suggest that without adequate literacy and ethical frameworks, AI can lead to increased technical complexity and unintended algorithmic biases that may hinder overall organizational performance [13], [16].

A. Concept and Historical Development of AI

AI is defined as a system of algorithms and computational models developed to simulate human intelligence [2]. The field

traces back to the 1950s when Alan Turing introduced the Turing Test, questioning whether machines could exhibit intelligent behavior. Since the 1990s, increased computational power and big data have accelerated its evolution from symbolic logic to modern models that underpin diverse applications across global networks [4]. Inherently interdisciplinary, the field draws from computer science, mathematics, statistics, and engineering [2], [7] to provide transformative solutions in sectors such as healthcare, finance, and security.

B. Core AI Concepts

Artificial intelligence encompasses several subfields, including machine learning, deep learning, natural language processing (NLP), image processing and computer vision. Additionally, AI plays a foundational role in information retrieval and the web, where intelligent algorithms optimize search engines and personalize user experiences on a global scale [3], [13].

C. Artificial Intelligence in Education

In education, AI analyzes student performance data to provide personalized learning experiences. Additionally, virtual tutors and chatbot systems support out-of-class learning processes, making education more accessible and adaptive to individual learner needs.

D. Importance of AI Literacy

Artificial intelligence literacy is essential for individuals and communities to use this technology consciously and effectively. AI literacy facilitates individuals' ability to evaluate the influence of AI-based systems on decision-making processes, while simultaneously fostering awareness of critical issues such as ethics, data privacy, and accountability. Therefore, promoting AI literacy and critically assessing the effects of AI on individuals and society are of paramount importance. AI literacy enables individuals to develop the competencies necessary to understand AI technologies, use them responsibly, and engage with them effectively [6].

AI literacy is a fundamental component of digital literacy that can be fostered from early childhood through interactions with intelligent agents, such as toys, robots, and chatbots, in concrete learning contexts [16]. While AI offers personalized learning and automated assessment, specialized environments like speech synthesis and virtual reality contribute significantly to active learning interventions [15]. However, early exposure poses risks of encountering inaccurate information; thus, structured AI literacy education is essential to promote critical thinking, safeguard ethical values, and develop responsible usage skills [9]. By addressing potential adverse effects, educators can ensure that AI technologies serve as secure and effective tools for student engagement and academic benefit [10].

E. Goals And Contributions

This study evaluates AI literacy levels among high school students in Eskişehir, Turkey, addressing the research gap in secondary education. By comparing vocational, private, and project-based schools, it examines how diverse curricula influence technological awareness. The core contributions include: (i) identifying literacy disparities based on school type and gender, (ii) highlighting support needs for vocational and 12th-grade students, and (iii) providing empirical data for inclusive AI curricula. Building on established AI frameworks, this research empirically investigates how institutional and demographic factors shape AI literacy in high schools.

F. Paper Structure

The remainder of this paper is organized as follows. Section II describes the methodology, including the research design, participant demographics, and the data collection instrument. Section III presents the statistical findings derived from t-tests and ANOVA analyses. Section IV provides a detailed discussion of the results in the context of the current literature, followed by Section V concludes the study; and Section VI provides practical recommendations.

II. METHODOLOGY

This section outlines the methodological framework utilized to investigate the artificial intelligence literacy levels among students across various educational institutions.

A. Research Design

This study aims to examine the artificial intelligence literacy levels of students from different schools with respect to various variables. The research was designed using a quantitative methodology based on a cross-sectional survey model, and data were collected through an online scale. Within the scope of the study, students' AI literacy levels were analyzed in terms of gender, grade level, and the type of school they attend.

B. Population and Sample

The population of the study consists of high school students enrolled in Eskişehir during the 2024–2025 academic year. The sample comprises 222 students selected from this population who are attending Şehit Murat Tuzsuz Vocational and Technical Anatolian High School, Eskişehir Anatolian High School, Şehit Mehmet Şengül Science High School, and Private İki Eylül Anatolian High School.

C. Data Collection Instrument

The study was conducted in accordance with the ethical standards of the Turkish Ministry of National Education (MEB). Formal research permission was granted by the Eskişehir Provincial Directorate of National Education (Approval Date: 12.01.2025, No: E-88074293-020-124004983) and authorized by the Eskişehir Governor's Office. The research instrument (Artificial Intelligence Literacy Scale) was reviewed and approved by the Research Evaluation Commission for its alignment with constitutional rights and ethical values. Participation was entirely voluntary, and informed consent was obtained in line with the Law on the Protection of Personal Data (KVKK).

To ensure data quality, a rigorous cleaning process was applied; only participants who completed the entire scale were included in the final analysis, ensuring no missing values in the processed dataset. A total of 222 valid responses were selected

for statistical processing after excluding incomplete submissions. Participation was entirely voluntary, and informed consent was obtained from all participants prior to their involvement.

The survey method was employed for data collection. The first three items of the questionnaire consisted of demographic questions prepared by the researchers, including school type, grade level, and gender. The second section included the *Artificial Intelligence Literacy Scale*, originally developed by Wang et al. [14] and adapted into Turkish by Çelebi et al. [16]. To provide a clear understanding of the assessment criteria, the 12 items categorized under four distinct factors are explicitly defined in TABLE I below:

TABLE I. EXPLICIT DEFINITION OF THE 12 AI LITERACY SCALE ITEMS

FACTOR	ITEM ID	DEFINITION / STATEMENT CONTENT
Awareness	S1	I can identify AI applications in my daily life.
	S2	I recognize the basic concepts and terminology of AI.
	S3	I am aware of the presence of AI in various sectors (health, education, etc.).
Usage	S4	I can use AI-based tools to solve simple tasks.
	S5	I am able to interact with AI agents (e.g., chatbots) effectively.
	S6	I can apply AI technologies to enhance my learning processes.
Evaluation	S7	I can distinguish between AI-generated and human-generated content.
	S8	I am able to evaluate the accuracy of information provided by AI.
	S9	I can identify the limitations and potential errors of AI systems.
Ethics	S10	I am aware of the importance of data privacy when using AI.
	S11	I understand the potential for algorithmic bias in AI decisions.
	S12	I consider ethical principles and social responsibility in AI usage.

The scale comprises 12 items and four factors: Awareness, Usage, Evaluation, and Ethics. Responses were rated on a 7-point Likert scale ranging from "Strongly Agree" (7) to "Strongly Disagree" (1), with three items allocated to each factor.

The Cronbach's alpha coefficient calculated to assess the reliability of the 12-item scale was 0.779. Cronbach's alpha is a statistical measure used to evaluate the internal consistency and reliability of a scale. Since values between 0.70 and 0.79 are considered to indicate acceptable reliability, the obtained coefficient of 0.779 demonstrates an acceptable level of reliability and sufficient internal consistency. This value indicates that the items function consistently with one another and that the scale is capable of producing reliable results.

D. Data Collection Procedure

The research data were collected in January 2025. After obtaining the necessary permissions, the scale was converted into an online form to facilitate broader participation and access to a larger number of students.

Prior to the administration of the scale, participants were informed that the data would be used solely for research purposes, would not be shared with third parties, and that participation in the study was entirely voluntary. The students completed the questionnaire on a voluntary basis, and a total of 222 students participated in the study. Descriptive analyses were employed to determine the students' levels of artificial intelligence literacy, and the data were analyzed using the SPSS software.

III. FINDINGS

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is an important indicator for assessing the suitability of data for factor analysis. KMO values range between 0 and 1, with values between 0.80 and 0.89 considered "very good." The obtained value of 0.823 falls into the "very good" category, indicating that our data are highly suitable for factor analysis.

Prior to conducting parametric tests, the normality of the data distribution was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The results indicated that the data followed a normal distribution ($p > 0.05$), and skewness and kurtosis values were within the acceptable range (+1.5 to -1.5), justifying the use of Independent Samples t-tests and One-Way ANOVA

Communalities represent the proportion of a variable's total variance explained by the factor analysis. These values range from 0 to 1, with values of 0.40 or higher indicating that the variable is well-related to the factor structure. In the analysis, all variables had communalities above 0.40, meaning that there were no items that needed to be removed from the scale. This indicates that all items contribute sufficiently to the factor structure and are appropriate to retain, suggesting that the scale demonstrates good reliability and validity. Additionally, the Cronbach's alpha coefficient for the scale was determined as 0.779, confirming acceptable internal consistency.

A. General AI Literacy Levels

The descriptive statistics for the four factors of the AI Literacy Scale—Awareness, Usage, Evaluation, and Ethics—were analyzed to determine the overall literacy profile of the participants. The summary of these factors is presented in TABLE II.

TABLE II. DESCRIPTIVE STATISTICS FOR AI LITERACY FACTORS

FACTOR	NUMBER OF ITEMS	KEY FINDINGS / MEAN TRENDS
AWARENESS	3 Items (S1-S3)	High overall awareness, but varies by school type.
USAGE	3 Items (S4-S6)	Students show moderate interaction with AI agents.
EVALUATION	3 Items (S7-S9)	Significant differences found across different school types.
ETHICS	3 Items (S10-S12)	Significant gender differences observed in items S10, S11, and S12.

B. Analysis by Gender

An Independent Samples t-test was conducted to determine whether there were statistically significant differences between male and female participants. An Independent Samples two-tailed t-test was conducted to determine whether there were statistically significant differences between male and female participants. The significance level was set at 0.05. In the analysis, the mean scores, standard deviations, and standard errors for each item were calculated separately for male and female participants. As a result of the analyses, significant differences were observed for items 10, 11, and 12, and these results are presented in TABLE III.

TABLE III. INDEPENDENT SAMPLES T TEST RESULTS BY GENDER

Item	Gender	N	t	p
10	Male	126	-3.783	<0.05
	Female	95		
11	Male	126	-2.519	0.012
	Female	95		
12	Male	126	-3.660	<0.05
	Female	95		

These results indicate that gender is a significant factor influencing the mean scores for certain items. No significant differences were observed for the other items.

C. Analysis by School Type

A One-Way ANOVA was conducted to identify literacy differences across school types (significance level). Results, summarized in TABLE IV, revealed significant disparities for items S1, S6, S8, S9, and S10, primarily between Şehit Murat Tuzsuz Vocational and Technical Anatolian High School (MTAL) and other institutions such as EAL, Özel AL, and FL. Conversely, no significant differences were found for the remaining items (S2, S3, S4, S5, S7, S11, and S12), indicating that school type is a selective variable affecting specific AI literacy dimensions rather than a universal factor."

TABLE IV. ANOVA RESULTS RELATED TO THE SCHOOL TYPE VARIABLE

ITEM ID	FACTOR	SIGNIFICANCE (P)	OBSERVED TREND / POST-HOC
S1	Awareness	$p < 0.05$	Significant difference across school types.
S6	Usage	$p < 0.05$	Vocational high school (MTAL) differs from others.
S8	Evaluation	$p < 0.05$	Academic high schools show higher evaluation scores.
S9	Evaluation	$p < 0.05$	Significant variation in identifying AI errors.
S10	Ethics	$p < 0.05$	Ethical awareness differs significantly by school type.

Detailed F-values and post-hoc comparisons (e.g., Scheffe or Tukey) confirm that students in vocational schools (MTAL) may require more targeted support in these specific areas compared to science and private high schools.

Grade level differences were examined using a One-Way ANOVA () across 9th, 10th, 11th, and 12th grades. Results indicated that a significant difference existed only for item S11 (,), specifically between 12th-grade students and their peers in the 9th and 10th grades. No significant disparities were found for the remaining items (S1–S10 and S12), suggesting that grade level is not a determining factor for most AI literacy dimensions, except for specific advanced competencies represented by S11.

IV. DISCUSSION

The findings of this study demonstrate that high school students generally possess a foundational awareness of artificial intelligence, yet their literacy levels fluctuate significantly across different demographics. The higher literacy scores observed in project-based and private high schools, compared to vocational schools, suggest that access to specialized curricula and technological resources plays a critical role in shaping AI competencies. This aligns with recent literature emphasizing the "digital divide" in emerging technologies within secondary education.

Furthermore, the significant gender differences found in ethical awareness (Items S10-S12) indicate that female students may approach AI with a more cautious and ethically-driven perspective. This result highlights the need for gender-inclusive AI training that addresses both technical utility and social responsibility.

The significant differences found in items S1, S6, S8, S9, and S10 across school types suggest a 'digital divide' in AI exposure. As Haenlein and Kaplan [7] suggest, high-resource environments like science and private high schools likely provide more interdisciplinary technological contexts. Conversely, the lower awareness in vocational schools (MTAL) highlights a need for targeted digital competency frameworks as discussed by Wang et al. [16].

The higher sensitivity of female students toward ethical issues (S10-S12) aligns with research by Karakuş et al. [9], emphasizing that AI literacy is not just technical but deeply rooted in social responsibility and ethical judgment.

The specific difference in item S11 (algorithmic bias) among 12th graders might be attributed to their advanced cognitive development and critical thinking skills required for university entrance preparations, consistent with findings by Elçiçek [6] that literacy levels evolve with academic maturity.

It is important to acknowledge that the evaluation of AI literacy in this study is based on a self-report questionnaire, which inherently introduces a degree of subjectivity. Participants' responses reflect their perceived competence rather than their objective technical performance. This subjective assessment may lead to "overestimation" or "underestimation" of actual skills, a common phenomenon in self-efficacy studies. Furthermore, while a quiz-like instrument (objective knowledge test) could mitigate this subjectivity by measuring actual problem-solving abilities, it was not utilized in this specific field study for two primary reasons. First, the objective was to capture the "attitudinal" and "perceptual" landscape of high school students across diverse school types, for which the Likert-scale model is statistically robust. Second, the rapid evolution of AI technologies makes standardized quiz-based metrics quickly outdated. However, future research should consider a hybrid approach, combining self-reported literacy scales with performance-based assessments to achieve a more comprehensive cross-validation of AI competencies.

V. CONCLUSION

In this study, the effects of gender, school type, and grade level on students' responses to specific items were examined statistically. The findings indicate that these variables significantly influenced perceptions for certain items.

Analyses regarding the gender variable revealed significant differences between male and female students for items S10, S11, and S12. These differences may stem from gender-based variations in perceptions or experiences, suggesting that approaches to these items may differ according to gender. Specifically, it appears that questions related to the use or perception of AI technologies are interpreted differently based on gender.

Comparisons among school types showed significant differences for items S1, S6, S8, S9, and S10. Notably, Şehit Murat Tuzsuz Vocational and Technical Anatolian High School (MTAL) exhibited different results compared to the other schools. This may reflect differences in educational approaches, curriculum content, or students' perceptions of technology across school types. These differences are likely to influence students' overall attitudes toward AI technologies.

Analyses across grade levels revealed a significant difference only for item S11. In particular, 12th-grade students demonstrated distinct perceptions compared to 9th- and 10th-grade students. This variation may be attributed to differences in knowledge levels, experience, future concerns, or preparation for higher education.

Overall, the study suggests that perceptions of AI technologies are influenced by gender, school type, and grade level. Gender differences were significant for certain items, while notable differences were observed across school types. However, regarding grade level, only 12th-grade students exhibited a different approach.

These findings provide important insights into how AI technologies are perceived and utilized in education. They highlight the need for educational institutions to update curricula by considering students' attitudes and approaches toward technology. Moreover, it is essential to develop programs tailored to school types and grade levels that promote ethical responsibility, technical knowledge, and critical thinking skills.

Future research should examine the effects of AI technologies in education more comprehensively and investigate how different variables shape these effects in greater detail. Educational institutions should consider factors such as gender, school type, and grade level to better understand students' attitudes toward these technologies and to develop effective instructional strategies accordingly.

These findings confirm that AI literacy in secondary education is a multi-dimensional construct influenced by institutional and demographic variables, necessitating a 'one-size-fits-all' curriculum to be replaced by adaptive educational strategies.

VI. RECOMMENDATION

Based on the findings of this study, it has been revealed that variables such as gender, school type, and grade level can influence students' perceptions and evaluations of AI technologies. Regarding perceptual differences and attitudes toward technology between genders, the significant differences observed in items S10, S11, and S12 are noteworthy for identifying gender-based perceptual variations. To better understand the underlying reasons for these differences and to examine male and female students' attitudes toward technology in greater depth, comprehensive qualitative studies could be conducted. Such research could reveal differences in students' perspectives on technology and contribute to the development of more effective educational approaches.

Investigations could also be carried out on items that showed differences among schools, particularly focusing on the significant differences between Şehit Murat Tuzsuz MTAL and the other schools. It is important to determine whether these differences stem from educational approaches or from students' perceptions. The emergence of varying perceptions according to school type indicates that existing curricula may not be suitable for all types of schools. Therefore, curricula could be revised to include content tailored to different school types. Additionally, special educational programs could be designed,

particularly for students in vocational and technical schools, to raise awareness about AI technologies.

Educational programs could be adapted according to grade levels, taking into account that 12th-grade students exhibited different perceptions compared to other grades. Grade-appropriate instructional materials and content could be developed, and guidance services or seminars could be organized to enhance 12th-grade students' awareness of AI technologies, particularly in preparation for higher education. Furthermore, more detailed analyses could be conducted to determine whether the observed differences among grade levels are solely due to grade level or influenced by other factors.

Following the suggestions of Kong et al. [11], educational programs should prioritize fostering critical evaluation skills over mere tool usage to prepare students for the complexities of an AI-driven workforce.

REFERENCES

[1] J. Becker et al., "Measuring the impact of early-2025 AI on experienced open-source developer productivity," *arXiv preprint arXiv:2507.09089*, 2025.

[2] C. Bleakley, "Artificial intelligence emerges," in *Artificial Intelligence: Foundations and Applications*, Oxford University Press, 2020, pp. 75–92.

[3] L. Chen, P. Chen, and Z. Lin, "Artificial intelligence in education: A review," *IEEE Access*, vol. 8, pp. 75264–75278, 2020.

[4] C. Çelebi, U. Demir, and F. Karakuş, "A systematic review of studies on artificial intelligence literacy," *Necmettin Erbakan University Ereğli Faculty of Education Journal*, vol. 5, no. 2, pp. 535–560, 2023.

[5] C. Çelebi, F. Yılmaz, U. Demir, and F. Karakuş, "Artificial intelligence literacy: An adaptation study," *Instructional Technology and Lifelong Learning*, vol. 4, no. 2, pp. 291–306, 2023.

[6] M. Elçiçek, "An examination of students' artificial intelligence literacy," *Journal of Information and Communication Technologies*, vol. 6, no. 1, pp. 24–35, 2024.

[7] M. Haenlein and A. Kaplan, "A brief history of artificial intelligence: On the past, present, and future of artificial intelligence," *California Management Review*, vol. 61, no. 4, pp. 5–14, 2019.

[8] Y. Jiang, X. Li, H. Luo, S. Yin, and O. Kaynak, "Quo vadis artificial intelligence?" *Discover Artificial Intelligence*, vol. 2, no. 4, 2022.

[9] A. Karakuş, Ş. Geçgel, and M. Çetin, "An emerging paradigm: Artificial intelligence literacy," *International Journal of Active Learning*, vol. 8, no. 1, pp. 50–63, 2024.

[10] A. Karatzas and K. Zogopoulos, "Literacy and artificial intelligence: Applications and concerns," *IOSR Journal of Humanities and Social Science*, 2024.

[11] S. C. Kong, W. M. Y. Cheung, and O. Tsang, "Evaluating an artificial intelligence literacy programme for empowering and developing concepts, literacy and ethical awareness in senior secondary students," *Education and Information Technologies*, vol. 28, no. 4, pp. 4703–4724, 2023.

[12] N. Kosmyna et al., "Your brain on ChatGPT: Accumulation of cognitive debt when using an AI assistant for essay writing task," *arXiv preprint arXiv:2506.08872*, 2025.

[13] H. Lu, Y. Li, M. Chen, H. Kim, and S. Serikawa, "Brain intelligence: Go beyond artificial intelligence," *Mobile Networks and Applications*, vol. 23, pp. 368–375, 2017.

14] F. orandín-Ahuerma, "What is artificial intelligence?" *International Journal of Research Publication and Reviews*, 2022.

[15] N. Solichah and N. Shofiah, "Artificial intelligence (AI) literacy in early childhood education: A scoping review," *Psikologika: Jurnal Pemikiran dan Penelitian Psikologi*, 2024.

[16] B. Wang, P. L. P. Rau, and T. Yuan, "Measuring user competence in using artificial intelligence: Validity and reliability of the artificial intelligence literacy scale," *Behaviour & Information Technology*, vol. 42, no. 9, pp. 1324–1337, 2023.

[17] W. Yang, X. Hu, I. Yeter, J. Su, Y. Yang, and J. Lee, "Artificial intelligence education for young children: A case study of technology-enhanced embodied learning," *Journal of Computer Assisted Learning*, vol. 40, pp. 465–477, 2023.