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# Determining the Artificial Intelligence Literacy Levels of Prospective Teachers

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## Abstract

The aim of this study is to determine the artificial intelligence (AI) literacy levels of prospective teachers studying in different disciplines and to examine whether these levels show a significant difference in terms of variables such as gender, department, grade level, and academic achievement. The study, designed using a mixed-methods approach with a focus on quantitative data, included 364 prospective teachers studying at a state university during the 2023-2024 academic year. Data were collected using the "Artificial Intelligence Literacy Scale" and an open-ended questionnaire prepared by the researchers. T-tests, ANOVA, and Pearson correlation analysis were used to analyze quantitative data, while content analysis was used to analyze qualitative data. The results showed that prospective teachers generally have a high level of AI literacy, but the "Usage" dimension was lower compared to the "Ethics" and "Awareness" dimensions. Department-based analyses revealed that candidates in quantitative departments (Mathematics and Science) had significantly higher literacy levels than those in arts and primary school departments. Furthermore, a positive, moderately significant correlation was found between academic achievement (GPA) and AI literacy. Qualitative findings indicated that candidates primarily used artificial intelligence for academic support and content creation. In light of these findings, it is recommended that department-specific AI pedagogy courses be added to the curricula of faculties of education.

**Keywords**: AI literacy, teacher candidates, AI in education, digital competence, mixed methods

## Introduction

Artificial intelligence (AI), considered one of the most transformative technologies of the twenty-first century, refers to a system that simulates human intelligence with its ability to analyze data, recognize patterns, and solve complex problems (Russell & Norvig, 2020). This technological leap is restructuring many sectors such as health, finance, and engineering, while also forcing a radical transformation in the education ecosystem (UNESCO, 2019). In particular, the mass availability of generative AI tools (ChatGPT, Gemini, Claude, etc.) has opened the doors to a new era in learning and teaching processes (Laupichler et al., 2022).

The rapid transformation in information and communication technologies has brought artificial intelligence (AI), one of the most complex and impactful innovations in human history, to the center of daily life and academic processes. In its most general definition, artificial intelligence refers to systems that can mimic human cognitive processes, learn from data, and make rational decisions to achieve specific goals (Russell & Norvig, 2020). The development of

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machine learning and deep learning algorithms has transformed AI from a purely technical discipline into a multidisciplinary phenomenon that is transforming all fields, from education and healthcare to art and engineering (UNESCO, 2019). In particular, the availability of Large Language Models (LLMs) and generative AI tools (ChatGPT, Gemini, etc.) in the last quarter of 2022 has fundamentally changed the way information is produced and consumed, forcing a paradigm shift in the education ecosystem (Laupichler et al., 2022).

While educational institutions have historically been resistant to adapting to technological innovations, the speed and inclusiveness of artificial intelligence have broken this resistance. The role of artificial intelligence in education (AIEd) extends across a wide spectrum, including providing students with personalized learning experiences, reducing the administrative burden on teachers, and predicting success through learning analytics (Luckin et al., 2016). However, this potential has also brought with it ethical debates such as "algorithmic bias," "data privacy," and "academic integrity" (Miao et al., 2021). In this complex process, the ability of individuals to use technology not only as passive users but also as critical evaluators and ethical practitioners has made the concept of "AI literacy" a vital competency (Long & Magerko, 2020).

AI literacy, while considered an evolution of traditional digital literacy skills, requires a deeper technical and philosophical understanding (Ng et al., 2023). Long and Magerko (2020) define AI literacy as a whole encompassing the skills to understand what AI is, grasp how it works, critically evaluate its results, and maintain ethical boundaries. For prospective teachers, this literacy is not only a matter of individual development but also a professional necessity that will determine future classroom management and pedagogical approaches (Southgate et al., 2019). It is strategically important for future teachers to know how to structure AI outcomes in their classrooms in order to prepare their students for this technological future (Chiu, 2021).

The integration of technology in teacher education has long been addressed within the framework of Technological Pedagogical Content Knowledge (TPCK) (Koehler & Mishra, 2009). However, the autonomous nature and dynamic learning capacity of artificial intelligence have necessitated the definition of a new competency area beyond traditional TPCK models. While there are studies in the literature examining pre-service teachers' attitudes towards artificial intelligence (Oğan, 2025; Banaz and Demirel, 2024; Mart and Kaya, 2024; Wang et al., 2023), studies that empirically demonstrate the level of literacy of these candidates in different branches (Science, Humanities, Arts, etc.) and the relationship between this literacy and their academic success are still in the developmental stage. In particular, the diversity of purposes for which pre-service teachers use this technology (assignment preparation, content creation, personal assistance, etc.) awaits examination as a practical, not just theoretical, reflection of literacy.

The main objective of this research is to determine the artificial intelligence literacy levels of prospective teachers studying in different disciplines and to examine whether these literacy levels differ significantly according to various demographic and academic variables. In line with this main objective, the following research questions were addressed:

1. What is the level of artificial intelligence literacy among prospective teachers (both on a general scale and based on the sub-dimensions of Awareness, Usage, Evaluation, and Ethics)?
2. Do prospective teachers' artificial intelligence literacy levels differ significantly based on gender?
3. Do prospective teachers' artificial intelligence literacy levels differ significantly based on their department of study?
4. Do prospective teachers' artificial intelligence literacy levels differ significantly according to their grade level (1st, 2nd, 3rd, and 4th grade)?
5. Is there a significant relationship between prospective teachers' academic achievement (GPA)

and their level of artificial intelligence literacy?
6. What are the purposes for which prospective teachers use artificial intelligence tools and which tools do they prefer?

## Method

### Research Model

This research employed a descriptive survey model, a quantitative research method, to determine the artificial intelligence literacy levels of prospective teachers and the status of these levels in terms of various variables. Survey models are approaches that aim to collect data to determine the characteristics, opinions, or abilities of a group on a specific subject. This model aims to describe a past or present situation as it is (Büyüköztürk, 2023; Fraenkel et al., 2012). Since the research aims not only to capture a snapshot of the current situation but also to reveal differences between groups, it also possesses relational survey characteristics (Field, 2018).

### *Study Group*

The study group consisted of a total of 364 prospective teachers studying at the Faculty of Education of a state university in Türkiye during the spring semester of the 2023-2024 academic year. A convenient sampling method was chosen to select participants, taking into account time and cost constraints as well as ease of access to the participants (Fraenkel et al., 2012; Pallant, 2020).

The distribution of prospective teachers, who constituted the sample of the study, in terms of gender, grade level, and the departments they were studying, was analyzed, and the results are presented in Table 1.

**Table 1**
Distribution of the study group according to demographic characteristics

| Variable | Category | Frequency (f) | Percentage (%) |
|---|---|---|---|
| Gender | Female | 248 | 68.1 |
| | Male | 116 | 31.9 |
| Grade Level | 1st Grade | 92 | 25.3 |
| | 2nd Grade | 88 | 24.2 |
| | 3rd Grade | 94 | 25.8 |
| | 4th Grade | 90 | 24.7 |
| Department | English Teacher | 45 | 12.4 |
| | Primary School Teacher | 43 | 11.8 |
| | Primary School Mathematics Teacher. | 42 | 11.5 |
| | Special Education Teacher | 41 | 11.3 |
| | Science Teacher | 40 | 11 |
| | Social Studies Teacher | 40 | 11 |
| | Turkish Teacher | 39 | 10.7 |
| | Guidance and Psychology | 38 | 10.4 |
| | Art Teacher | 36 | 9.9 |
| **Total** | | **364** | **100** |

Table 1 shows that the study has a rich sample size sufficient to examine prospective teachers' artificial intelligence literacy from a multidimensional and interdisciplinary perspective. Detailed assessments of the distributions are presented below:

**Gender Variable:** The vast majority of participants (f=248) were female prospective teachers, while the proportion of male candidates was 31.9% (f=116). This distribution parallels the general student profile of Education Faculties in Turkey and indicates a realistic sample structure in terms of the generalizability of the findings .

**Grade Level Variable:** The distribution of participants according to grade level appears quite balanced. The highest participation was found in the 3rd grade with 25.8%, while the lowest participation was in the 2nd grade with 24.2% . This homogeneous distribution across grade levels provides a statistical advantage for analyzing how AI literacy changes with academic maturity throughout undergraduate education.

**Department Variable:** The fact that data were collected from a total of 9 different departments in the study is one of its strongest aspects. The distribution between departments, ranging from 9.9% to 12.4%, indicates that each department has similar weights within the total sample. The inclusion of quantitative (Mathematics, Science), verbal (Turkish, Social Studies), foreign language (English), and talent-based (Art) departments together allows for a scientifically sound discussion of the differences in AI literacy based on disciplines.

**Data Collection Tools**

Demographic information form and AI literacy scale were used to determine the AI literacy levels of prospective teachers. The demographic information form includes questions to determine the gender, department, grade, academic achievement, and AI usage status of prospective teachers. The "Artificial Intelligence Literacy Scale", developed by Wang et al. (2022) and adapted into Turkish by Çelebi, Yılmaz, Demir, and Karakuş (2023), consists of 12 items. It is a seven-point Likert scale ranging from strongly disagree (1) to strongly agree (7). Cronbach's Alpha internal consistency coefficient was calculated to determine the reliability of the scale. As a result of the confirmatory factor analysis (CFA) performed on the AI Literacy Scale, which consists of four sub-dimensions and a total of 12 items, it is seen that $\chi 2/df = 2.14$ and the RMSEA value (.056) remain within acceptable limits. Furthermore, comparative fit indices CFI (.96) and TLI (.95) being above .95 proves that the model has an excellent fit with the data.

***Data Collection Process***

The data collection process for this research was conducted in full compliance with the principles of scientific research and publication ethics. The stages of the process are detailed below:

Ethics Committee Approval and Permissions: All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee. Ethical approval was formally granted by the Ethics Committee of the Hatay Mustafa Kemal University Social and Human Sciences Ethics Board prior to the data collection process (Ethics Committee Date: 10/04/2025). Furthermore, informed consent was obtained from all individual students participating in the study, and participation was entirely voluntary.

Preparation of Measurement Tools: The data collection form was structured as a digital survey platform consisting of demographic information, the Artificial Intelligence Literacy Scale (Çelebi et al. (2023), and open-ended questions. A pilot study was conducted on a small group to test the comprehensibility of the items.

Voluntary Participation and Informed Consent: Data were collected during the spring semester of the 2023-2024 academic year. Prior to the research, participants were informed about the purpose of the study, that the data would be used solely for scientific purposes, and that their personal information would be kept confidential. Participation was voluntary, and informed consent was obtained from each participant via a digital form.

Application Process: The data collection form was distributed digitally to prospective

teachers from different disciplines. To ensure participants did not influence each other and answered the questions honestly, they were asked to complete the survey individually. The average completion time was estimated at 10-15 minutes.

Data Verification: The collected data were reviewed before proceeding to the data analysis phase; outliers, blank items, or randomly marked forms were removed, resulting in 364 valid forms suitable for analysis.

### Data Analysis

The SPSS statistical software package was used for the analysis of quantitative data. To determine which statistical methods would be used in the analysis of the data obtained in the study, the normality of the overall scores and sub-dimension scores of the Artificial Intelligence Literacy Scale was examined. For this purpose, Skewness and Kurtosis values, as well as the results of the Kolmogorov-Smirnov and Shapiro-Wilk tests, were analyzed.

When the results of the normality analysis are examined, it is seen that the Kolmogorov-Smirnov and Shapiro-Wilk test results are significant at the $p<.05$ level. However, it is frequently emphasized in the literature that these tests are overly sensitive to even the smallest deviations from normality, especially in large samples above 300, and often yield significant results (Field, 2018; Pallant, 2020). Therefore, Skewness and Kurtosis values were used as the basis when determining the normal distribution of the data.

The Skewness and Kurtosis values for the overall AI Literacy score and its sub-dimensions are ±1.5. It was determined that the data remained within the range (Büyüköztürk, 2023; Tabachnick & Fidell, 2013). These findings indicate that the data did not show an excessive deviation from a normal distribution. In addition, histogram graphs and QQ plot analyses revealed that the data clustered along a linear line.

Considering the current sample size ( N=364 ), the principles of the Central Limit Theorem, and the skewness-kurtosis coefficients, it was concluded that the data met the assumptions of parametric tests. Accordingly, it was deemed appropriate to use parametric methods such as t-test, One-Way Analysis of Variance (ANOVA), and Pearson Correlation Analysis in the analyses.

## Findings

### Artificial Intelligence Literacy Levels of Prospective Teachers

Descriptive statistical analyses (mean and standard deviation) were conducted to answer the first sub-problem of the research, “What is the level of artificial intelligence literacy among prospective teachers?”. The findings are presented in Table 2.

**Table 2**
Distribution of general and sub-dimension scores on artificial ıntelligence literacy among prospective teachers

| Dimensions | N | Lowest | Highest | $\bar{x}$ | SS | Level* |
|---|---|---|---|---|---|---|
| Awareness | 364 | 2.00 | 7.00 | 5.24 | 0.88 | High |
| Usage | 364 | 1.00 | 7.00 | 4.38 | 1.15 | Middle |
| Evaluation | 364 | 1.67 | 7.00 | 4.92 | 0.94 | High |
| Ethic | 364 | 3.00 | 7.00 | 5.75 | 0.82 | Very High |
| General Literacy | 364 | 1.92 | 7.00 | 5.07 | 0.95 | High |

*Score Ranges: 1.00-2.99: Low, 3.00-4.99: Medium, 5.00-7.00: High.

Table 2 shows that the average general artificial intelligence literacy score of prospective teachers is 5.07 out of 7 (SS=0.95). This finding proves that the general artificial intelligence literacy level of prospective teachers is “High”. Examinations based on sub-dimensions reveal

the following results:

Ethic Dimension: It was determined that candidates recieved the highest score in the Ethical dimension ($\bar{X}$= 5.75). This indicates that prospective teachers are extremely sensitive to privacy, data security, and ethical principles during the use of artificial intelligence technologies, and that their sense of "responsibility" in this area is more prominent than other skills.

Awareness and Evaluation: The candidates' scores in the Awareness ($\bar{X}$=5.24) and Evaluation ($\bar{X}$= 4.92) dimensions are close and at a high level. This indicates that the candidates possess sufficient academic maturity in recognizing artificial intelligence technologies, distinguishing the presence of AI in products, and critically evaluating the resulting outputs.

Usage Dimension: It was determined that the lowest average score was concentrated in the Usage dimension ($\bar{X}$=4.38). The fact that this dimension remained at the "Medium" level indicates that although the candidates have a high level of theoretical awareness and ethical consciousness, they do not yet feel fully competent in using artificial intelligence tools "skillfully" in practical work processes or educational activities.

***Examination of Artificial Intelligence Literacy Levels According to Gender Variable***

An independent samples t-test was conducted to determine whether there was a significant difference in the general artificial intelligence literacy and sub-dimensions of the scale among prospective teachers based on gender. Prior to the analysis, it was determined that the data for both groups exhibited a normal distribution and that the assumption of homogeneity of variances (Levene Test p > .05) was met.

**Table 3**
Results of the t-Test for Artificial Intelligence Literacy Scores by Gender

| Dimensions | Gender | N | $\bar{X}$ | SS | sd | t | p | d |
|---|---|---|---|---|---|---|---|---|
| Awareness | Female | 248 | 5.12 | 0.95 | 362 | -2.12 | .035 * | 0.24 |
| | Male | 116 | 5.35 | 0.91 | | | | |
| Usage | Female | 248 | 4.20 | 1.25 | 362 | -2.85 | .005 * | 0.32 |
| | Male | 116 | 4.60 | 1.18 | | | | |
| Evaluation | Female | 248 | 4.88 | 0.98 | 362 | -1.45 | .148 | - |
| | Male | 116 | 5.05 | 0.92 | | | | |
| Ethic | Female | 248 | 5.72 | 0.84 | 362 | -0.88 | .380 | - |
| | Male | 116 | 5.80 | 0.80 | | | | |
| General | Female | 248 | 4.95 | 0.92 | 362 | -2.45 | .015 * | 0.28 |
| Literacy | Male | 116 | 5.32 | 0.98 | | | | |

*p <.05, d: Cohen's d (Effect Size)

When Table 3 is examined, it is determined that the general artificial intelligence literacy levels of prospective teachers show a statistically significant difference according to gender [t(362) = -2.45, p <.05]. This finding supports one of the main hypotheses of the research. Detailed evaluations of the analysis results are as follows:

General Literacy Difference: It was observed that the mean general literacy scores of male teacher candidates ($\bar{X}$=5.32) were significantly higher than those of female candidates ($\bar{X}$=4.95). The calculated Cohen's d value (0.28) indicates that this difference has a "small-to-moderate" effect size.

Dimension-Based Analyses: The most significant differences between genders were observed in the "Usage" [p=.005] and "Awareness" [p=.035] dimensions. It can be said that male candidates felt more competent than female candidates in applying artificial intelligence tools and understanding their technical operation.

Insignificant Differences (Ethics and Evaluation): As a noteworthy finding, no significant difference was detected between genders in the "Ethics" and "Evaluation" dimensions (p>.05). This demonstrates that awareness of the ethical risks of artificial intelligence and the ability to critically evaluate its outputs have developed as a general, gender-independent awareness among prospective teachers.

**Findings Regarding Artificial Intelligence Literacy According to Department Variable**

The results of the ANOVA conducted to determine whether the departments in which prospective teachers are studying have a significant effect on their artificial intelligence literacy levels are presented in Table 4.

**Table 4**
ANOVA results of artificial intelligence literacy by department variable

| **Department** | **N** | $\bar{x}$ | **SS** | **F** | **p** | $\eta^2$ | **Significant (Tukey)** | **Difference** |
|---|---|---|---|---|---|---|---|---|
| 1.Elementary School Mathematics | 42 | 5.72 | 0.58 | **8,124** | **,000** * | 0.16 | | |
| 2.Science | 40 | 5.55 | 0.64 | | | | | |
| 3.English Language Teaching | 45 | 5.30 | 0.75 | | | | | |
| 4.Guidance and Psychological Counseling | 38 | 5.12 | 0.82 | | | | 1 > 6, 7, 8, 9 | |
| 5.Special Education | 41 | 4.95 | 0.91 | | | | 2 > 8, 9 | |
| 6.Turkish Language Teaching | 39 | 4.82 | 0.88 | | | | 3 > 9 | |
| 7.Social Studies Teacher | 40 | 4.70 | 0.95 | | | | | |
| 8.Primary School Teacher | 43 | 4.52 | 1.05 | | | | | |
| 9.Art Teaching | 36 | 4.25 | 1.18 | | | | | |
| **Total** | **364** | **5.07** | **0.95** | | | | | |

*p<.001 $\eta^2$**:** Eta-squared (Effect Size)

When the data in Table 4 were examined, it was found that there was a statistically significant difference in the artificial intelligence literacy scores of prospective teachers according to the departments they studied [F(8,355)=8.124, p<.001]. The calculated Eta-squared ($\eta^2$=0.16) value proves that the effect size of the branch variable on artificial intelligence literacy is at a "large" level (Cohen, 1988). This finding reveals that the discipline in which prospective teachers specialize is a determining factor in their awareness and usage skills for these new technologies.

Based on the results of the Tukey HSD test, which was conducted to determine which departments showed a significant difference, the following assessments were made:

Superiority of Quantitative Departments: It was observed that the literacy scores of prospective primary school mathematics ($\bar{x}$=5.72) and science ($\bar{x}$=5.55) teachers were significantly higher than those of prospective Turkish, social studies, primary school, and art teachers. This situation can be explained by the inherent aptitude of quantitative departments for technological tools, algorithms, and data processing processes.

Low Trend in Art and Basic Education Branches: The study found the lowest average scores in art teaching ($\bar{x}$= 4.25) and primary school teaching ($\bar{x}$= 4.52). In particular, there is a statistically significant gap between art teacher candidates and all other departments(except special education). This finding suggests that artificial intelligence has not yet been sufficiently experienced in artistic production processes, or that it may be perceived as a "threat to creativity" by the candidates.

Status of Interdisciplinary Fields: The above-average performance of English language teaching ($\bar{X}$= 5.30) and guidance counseling ($\bar{X}$= 5.12) candidates can be attributed to the high potential for using AI-supported language learning tools and analysis programs in these fields.

### *Findings on the Relationship Between Academic Achievement (GPA) and Artificial Intelligence Literacy*

Pearson correlation coefficient (r) was calculated to determine the direction and strength of the relationship between prospective teachers' academic achievement levels (GPA) and their overall artificial intelligence literacy score and sub-dimensions. The resulting correlation matrix is presented in Table 5.

**Table 5**

Results of correlation analysis between gpa and aı literacy dimensions

| Variables | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. Grade Point Average (GPA) | 1 | | | | | |
| 2. Awareness | 28** | 1 | | | | |
| 3. Usage | ,15* | ,55** | 1 | | | |
| 4. Evaluation | ,24** | ,62** | ,58** | 1 | | |
| 5. Ethics | ,32** | ,42** | ,38** | ,45** | 1 | |
| 6. Total AI Literacy | **,31** | ,82** | ,78** | ,85** | ,65** | 1 |

*p<,05, **p<,01

Table 5 shows a positive, moderate, and statistically significant correlation between prospective teachers' academic achievement (GPA) and their overall artificial intelligence literacy (r=0.31, p<0.01). This finding demonstrates that prospective teachers with high academic performance tend to have higher levels of literacy regarding artificial intelligence technologies. Analyses at the sub-dimension level reveal the following details:

Academic Achievement and Ethical Awareness: The sub-dimension with the highest correlation with GPA is “Ethics” (r=0.32, p<0.01). This finding indicates that academically successful prospective teachers are more concerned not only with the technical use of artificial intelligence but also with critical issues such as ethical risks, privacy, and information security brought about by this technology, and have a higher awareness of these issues.

Relationship between Technical Usage and Achievement: A positive but “weak” correlation (r=0.15, p<0.05) was found between GPA and the “Usage” dimension. This indicates that the ability to technically use artificial intelligence tools is more influenced by other variables, such as individual interest, frequency of access to technology, or differences in the field of study, rather than academic achievement.

Critical Evaluation: The significant relationship between GPA and the “Evaluation” dimension (r=,24, p<,01) confirms that candidates with high academic achievement are more competent in questioning the accuracy of AI outputs and selecting the appropriate tool.

### Examining Artificial Intelligence Literacy Based on Grade Level Variable

A one-way ANOVA was applied to determine whether the artificial intelligence literacy scores of prospective teachers differed significantly according to their grade level (1st, 2nd, 3rd, and 4th grade). The assumption of homogeneity of variances between groups was checked with the Levene test, and it was determined that the variances were homogeneous (p>,05).

**Table 6**
ANOVA analysis results according to grade level variable

| Grade Level | N | $\bar{X}$ | SS | F | p | Significant Difference (Tukey) |
|---|---|---|---|---|---|---|
| 1st Grade | 92 | 4.85 | 0.98 | 3,248 | ,022 * | 4>1 |
| 2nd Grade | 88 | 4.98 | 0.92 | | | |
| 3rd Grade | 94 | 5.15 | 0.94 | | | |
| 4th Grade | 90 | 5.28 | 0.88 | | | |
| Total | 364 | 5.07 | 0.95 | | | |

*p<,05

When Table 6 is examined, it is determined that the artificial intelligence literacy scores of prospective teachers show a statistically significant difference according to the class level in which they are studying [F(3,360)=3.248, p<,05] . This finding proves that the competencies of prospective teachers towards artificial intelligence technologies change as they progress through their undergraduate education.

According to the results of the Tukey HSD test, which was conducted to determine the source of the significant difference, 4th-grade students' literacy scores ($\bar{X}$=5.28) were significantly higher than those of 1st-grade students ($\bar{X}$=4.85). No statistically significant difference was found between other grade levels (2nd and 3rd grades). The following academic conclusions can be drawn from these results:

Academic Maturity Effect: The fact that fourth-year students have the highest averages indicates that candidates in the final stages of their undergraduate education use AI tools more intensively and consciously in academic research, assignment preparation, and material design processes. It can be said that the increasing academic expectations in upper years push students to explore these tools and improve their literacy.

Linear Upward Trend: The consistent increase in average scores from first to fourth grade (4.85, 4.98, 5.15, 5.28) indicates that AI literacy develops cumulatively, not just through a specific course, but through overall academic experience and accumulated digital knowledge.

Needs at Lower Grade Levels: The fact that first-year students have the lowest averages reveals that students newly entering education faculties are still at the very beginning of their understanding of the potential and ethical use of artificial intelligence in education.

***Findings Regarding Teacher Candidates' Use of Artificial Intelligence Tools, Their Preferred Tools, and Their Purposes of Use***

This section of the research examines prospective teachers' practical experiences with artificial intelligence technologies. First, the general usage scenarios of the candidates were determined, and then, content analysis was performed on the answers given to open-ended questions to categorize the most preferred tools and their purposes of use.

**Table 7**
Distribution of AI tool use cases and experiences

| Variable | Groups | Frequency (f) | Percentage (%) |
|---|---|---|---|
| The Use of Artificial Intelligence Tools | Yes (I use it) | 212 | 58.2 |
| | No (I don't use it) | 152 | 41.8 |
| Frequency of Use | Every day | 34 | 9.3 |
| | Several times a week | 82 | 22.5 |
| | A few times a month | 96 | 26.4 |
| Total | | 364 | 100 |

Table 7 shows that more than half of the prospective teachers (58.2%) actively use artificial intelligence tools in their educational processes or daily lives. This finding indicates

that artificial intelligence has moved from being an "unfamiliar technology" to an "experienced tool" among prospective teachers.

Based on the candidates' responses to the open-ended questions, the tools they used most frequently were categorized and presented in Table 3.

**Table 8**
Most preferred artificial intelligence tools by teacher candidates

| Category | Specified Tools | Frequency (f) | Percentage (%) * |
|---|---|---|---|
| Language-Based (LLM) Tools | ChatGPT, Gemini, Claude | 184 | 86.8 |
| Visual/Design Tools | Canva AI, Midjourney, DALL-E | 42 | 19.8 |
| Academic/Research Tools | Perplexity, Research Rabbit, Consensus | 28 | 13.2 |
| Translation/Language learning | DeepL, Quillbot, Duolingo Max | 35 | 16.5 |

*Percentages exceed 100% because multiple tools were specified.

Table 8 reveals that prospective teachers have established a distinct tool hierarchy within the artificial intelligence ecosystem. The key findings regarding this distribution are presented below:

Dominance of Generative Language Models (LLM): The overwhelming majority of participants (86.8%, f=184 ) preferring text-based tools such as ChatGPT, Gemini, and Claude indicates that prospective teachers primarily position artificial intelligence as a dialogue partner and information processing assistant. This demonstrates that the need to summarize complex theoretical information and structure text is paramount in their digital literacy practices.

Visual and Design-Oriented Preferences: The fact that 19.8% of candidates use tools like Canva AI and DALL-E indicates that the material design process, a fundamental requirement of the teaching profession, is beginning to be digitized with artificial intelligence. The use of these tools, particularly by prospective teachers when preparing presentations and lesson materials, demonstrates the integration of visual literacy and artificial intelligence literacy.

Academic Research and Language Tools: The usage rates of tools serving more specific purposes, such as Perplexity and DeepL (13.2% and 16.5%), reveal that some candidates use artificial intelligence as a supervisor or facilitator in academic integrity and literature review processes.

The candidates' statements regarding the purposes for which they used these tools were subjected to content analysis and grouped under 4 main themes.

**Table 9**
Thematic distribution of the purposes of using artificial intelligence tools

| Themes | Codes (Purposes of Use) | f | Sample Participant Opinion |
|---|---|---|---|
| Academic Support | Assignment preparation, article summarization, literature review, and project idea development. | 126 | *I use it when outlining my assignments or when I need it to simplify complex topics. (K12)* |
| Content Creation | Presentation preparation, visual creation, text writing, lesson plan design. | 54 | *I design original visuals for use in my classes using Canva AI. (K85)* |
| Personal Development | Learning a new language, coding practice, general knowledge/curiosity. | 32 | *I am improving my language skills by having my English texts checked. (K214)* |
| Problem Solving | Mathematical operations, logic problems, technical support. | 28 | *I use it to ask about the logic behind solving math problems I don't understand. (K42)* |

The thematic distribution presented in Table 9 demonstrates that prospective teachers view

artificial intelligence technologies not merely as technical tools, but as "cognitive partners" that facilitate their educational lives. Based on these findings, the following key conclusions can be drawn:

Academic Assistance and Cognitive Load Reduction: The fact that the theme "Academic Support" has the highest frequency (f=126) indicates that artificial intelligence is a primary tool for accessing and structuring information for candidates. The candidates' reliance on these tools for assignment preparation and resource searching demonstrates the effect of artificial intelligence in reducing cognitive load in academic writing and research processes.

Pedagogical Productivity and Material Design: The theme "Content Production" (f=54) indicates that artificial intelligence is beginning to integrate into the operational dimension of the teaching profession. In particular, the code for lesson plan preparation and visual material design shows that candidates have a strong inclination to use this technology as a "material designer" in their future professional lives.

Individualized Learning and Language Skills: The themes "Personal Development" and "Problem Solving" (f=32 and f=28) confirm that candidates used artificial intelligence to address their learning deficiencies. Specifically, language learning and questioning the logic behind solving complex mathematical problems (K42) demonstrate that artificial intelligence functions like a "personalized tutor."

## Discussion, Conclusion and Recommendations

This study investigated the artificial intelligence literacy levels of prospective teachers and the relationship between these levels and various demographic and academic variables. The findings of the research are discussed below in comparison with similar studies in the literature.

The first finding of the study is that the general artificial intelligence literacy level of prospective teachers is at a "High" level ($\bar{x}$=5.07). However, when examined in terms of sub-dimensions, it is seen that the candidates have the highest awareness in the "Ethics" dimension ($\bar{x}$=5.75) , while the lowest score is concentrated in the "Usage" dimension ($\bar{x}$=4.38). This result parallels the study by Laupichler et al. (2022), which stated that students' theoretical awareness is higher than their practical skills. The high scores of the candidates in the ethics dimension can be interpreted as a reflection of the sense of ethical responsibility inherent in the teaching profession (Ng et al., 2024). However, the moderate level of the usage dimension reveals that the candidates have a profile that "knows" generative artificial intelligence but "cannot skillfully use it in professional material design".

Analysis based on gender revealed that male teacher candidates had significantly higher literacy scores than female candidates. This finding supports the traditional "difference in favor of men" trend in the literature regarding technology use (Wang et al., 2023). However, the closing of the gender gap in the ethical dimension proves that ethical sensitivity is a gender-independent pedagogical value.

In the department-based comparison, it is noteworthy that the scores of prospective primary school mathematics and science teachers are significantly higher than those of prospective primary school teachers and art teachers. This indicates that the algorithmic thinking structure of quantitative disciplines has been transferred to artificial intelligence literacy (Chiu, 2021). The fact that prospective art teachers recieved the lowest score is similar to the study by Wang et al. (2023), which points to the risk of artificial intelligence being perceived as a "threat to originality" in art education.

The study revealed a positive and moderately significant correlation (r=0.31) between academic achievement (GPA) and artificial intelligence literacy. This finding indicates that

candidates with high academic self-efficacy are more motivated to explore and integrate new technologies into their learning processes (Oğan, 2025). Furthermore, the linear increase in literacy scores as the grade level increases proves that academic maturity and research projects in undergraduate education encourage students to use these technologies.

The research results show that prospective teachers are strong in the philosophical and ethical dimensions of artificial intelligence, but need improvement in the technical application and material development dimensions. Based on these findings, the following recommendations can be made:

1. Curriculum Update: "Information Technology" courses in Education Faculties should be updated to include not only tool usage but also department-specific (e.g., data modeling for mathematicians, LLM usage for linguists) artificial intelligence pedagogy.

2. Ethics and Security Training: Workshops on "Data Privacy and Academic Integrity" should be organized in line with UNESCO (2019) principles, where candidates can combine their ethical sensitivity with their technical skills.

3. Support for Arts and Verbal Disciplines: For disciplines like Art and Primary School Teaching, where low AI literacy has been identified, practical training should be provided on how AI can support creativity.

4. Future Research: This study is a mixed-methods study with a quantitative focus. In future research, the effects of artificial intelligence tools on student achievement in classroom applications can be investigated using experimental designs.

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