DiSIGMA PUBLICATIONS

Journal of Language and Culture in Education
ISSN: 2945-2864
Issue 1, Volume 1, Pages 104-113, July 2024
DOI: 10.5281/zenodo.12817808
https://lce.disigma.gr/index.php/lce

*Available online at* **https://lce.disigma.gr/index.php/lce**

# AI Literacy Among University Students majoring in humanities in Greece and Cyprus

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## Abstract

Recent research indicates that Artificial Intelligence (AI) is poised to transform every aspect of human life, including education, the arts, industry, the job market, healthcare, and commerce. This paper aims to define AI Literacy and present the findings of a study conducted among university students in Greece and Cyprus to evaluate their AI literacy levels. The study utilized a five-point self-report questionnaire designed specifically for this investigation. A total of 91 Humanities majors participated in the research. Results indicate that students possess medium to low AI literacy but demonstrate a strong desire to learn more about AI and keep abreast of developments in the field. This study is significant as it represents the first attempt in Greek literature to define AI literacy and provide empirical data on the AI literacy of students in Greek and Cypriot universities, which should leverage a substantial investment in AI across the campus to innovate their curricula, develop activities that foster interdisciplinary engagement, and ensure students are prepared for their careers.

**Key Words:** AI education, future's skill development, learning strategies, computing education, futures literacy.

# 1 Introduction

Recent studies highlight a forthcoming transformative era where Artificial Intelligence (AI) will revolutionize various facets of human existence, spanning education, the arts, industry, labor markets, healthcare, and commerce (Burgsteiner et al., 2016; Casal-Otero et al., 2023; Ghallab, 2019). This trend is highlighted by the significant annual investment of over 90 billion dollars in AI research, and it necessitates the creation of a workforce with advanced computer literacy and the ability to leverage AI in their work. Higher education systems have evolved with the primary mission of preparing students for the workforce. Consequently, colleges and universities should continually adapt their curricula to align with employer needs (Cantú-Ortiz et al., 2020). A globally recognized need is, for individuals entering the workforce, to possess greater AI knowledge and skills to tackle 21st-century challenges (Buckingham Shum & Deakin Crick, 2016; Cantú-Ortiz et al., 2020). Reports from the NSCAI (2021), NASEM (2018), and the World Economic Forum (2022) consistently mandate the modification of university curricula to meet these workforce knowledge and skill requirements. However, there are limited university-level initiatives that embrace a holistic approach to integrating AI into the curriculum. Stanford University, for instance, inaugurated the Human-Centered Artificial Intelligence Institute (HAI) in 2019, but this initiative is introduced only within the computer science and electrical and computer engineering departments. Other institutions like Harvard, MIT, and Carnegie Mellon have introduced courses or programs centered on exploring the ethics and ramifications of AI, which adopts a broader view of incorporating AI education in Higher Education institutions.

Furthermore, in this new landscape, those who are literate in AI will replace those who do not possess similar skills. This shift carries the risk of creating new forms of 'digital inequality' and exclusion (Selwyn, 2004), leading to significant social issues such as the inability to find employment and consequent unemployment, or individual problems such as the inability to use voice recognition systems and other technological products (Yi, 2021).

It is equally important to broaden the base of AI users, both to ensure that its design and use are inclusive and do not reinforce inequalities and stereotypes based on demographic variables (age, gender, etc.) and to address the observed underrepresentation of people of different educative backgrounds (e.g. humanities) skin colors, or women in AI (Lee et al., 2021).

Given this context, the purpose of this paper is to investigate the AI literacy of Humanities majors attending universities in Greece and Cyprus. We begin with a literature review focused on the concept of AI literacy, followed by the presentation of our study results. The contribution of this work is significant as it represents the first attempt in Greek-language literature to define AI literacy and to investigate the AI literacy of students from a population that is supposedly underrepresented in the field of AI.

# 2 Literature Review

## 2.1 From functional to AI literacy

Language is a multi-faceted system that facilitates human communication. Its written form, as both a cognitive and social activity, enables people to communicate without being in the same place or time, thus acquiring a «storage» function that allows information to be recorded in text. Consequently, written language has become the primary medium for distributing information.

To access information that is beneficial and enhances one's life, one must be literate, meaning able to read and write. The absence of literacy results in social exclusion and stigmatization. Initially, literacy was closely linked to the concept of alphabetic literacy. In its current form, however, it refers to an individual's ability to «function effectively in various environments and communication situations, using texts of written and spoken language, as well as non-linguistic texts (e.g., images, diagrams, maps,

etc.)» (Mitsikopoulou, 2001). According to Yi (2021), literacy encompasses the three Rs (Reading, wRiting, aRithmetic), which include the abilities of writing, reading, and arithmetic. These skills, necessary for individuals to meet the demands of today's job market, are often referred to as functional literacy.

These skills are developed through school literacy, which has traditionally been associated with teaching reading, writing, and arithmetic, as well as cultivating soft skills such as logical thinking, the ability to handle abstract concepts and hypothetical questions, the development of communication skills, and cognitive skills like understanding grammatical rules.

As literacy became closely linked with schooling, and since schools are primary vehicles of ideology that educate citizens according to the needs of each era, various literacy theories beyond functional literacy have been formulated to address the different educational needs of members of modern societies. For example, social literacy (Gee, 1990, 2005) posited that reading and writing a text are the result of a complex social process closely connected to established social practices, broader social dynamics, different forms and structures of power, social class, gender, identity, and more. From this perspective, social participation depends on how one connects socially through literacy. This theoretical framework introduced a social dimension to the concept of literacy.

Halliday's framework of functional grammar further expanded this dimension. It argued that language is perceived as a set of choices. These choices are not random but ideologically determined, as they construct different representations of reality. Simultaneously, grammatical elements are indicators of social relations and ideologies. For instance, the structure of a sentence should not be approached in the traditional way, but rather as a set of categories that highlight specific ways of viewing reality, favoring certain social groups over others. From this perspective, Halliday's Systemic Functional Grammar and its successors are considered the most comprehensive linguistic theory that equally addresses linguistic competence and linguistic usage (Gavriilidou et al., 2021).

On the other hand, the pedagogy of critical literacy emerged as a comprehensive educational approach, aiming to equip students with all the necessary tools to:

- Recognize the ideological underpinnings of language and texts, which involves understanding how diverse perspectives are shaped by linguistic elements, grammar, vocabulary, and information organization, often to the benefit of certain social groups over others.
- Foster critical awareness to identify and resist explicit or implicit messages that perpetuate oppression, reinforce gender stereotypes, or discriminate based on factors like gender or diversity.
- Challenge the notion of what is considered normal or neutral, and engage in textual negotiation to explore alternative viewpoints and interpretations of issues.

In the context of critical literacy, teaching is a situated practice, grounded in the experiences of the students and the discourses they participate in throughout their lives. At the same time, it is an open-ended teaching approach based on critical framing, focusing on the interpretation of the social and cultural context of the meaning produced. Finally, it is a transformative practice that transfers the production of meaning into new contexts.

Lastly, as social structures change and technology advances rapidly, new forms of literacy are deemed necessary for language speakers to access and derive information from different communication channels. Thus, with the development of cinema and television, visual literacy (Salomon, 1982; Kress & Van Leeuwen, 2020) cultivates the ability not only to read, interpret, and 'consume' visual forms related to visual communication but also to critically assess and create visual concepts and produce visual messages. Similarly, with the rapid development of technology and the use of computers, technological and digital literacy ensures the ability to use technologies, information, and communications to find, evaluate, create, and communicate information, requiring both cognitive and technical skills. Technological/

digital literacy is closely linked with futures literacy, which, according to UNESCO (2021), is defined as the technology that allows people to:

- Better understand their future role in what they (pre)see and do,
- Enhance their imagination,
- Improve their ability to accept change and invent.

In other words, a person literate in futures is able to understand the rapid changes happening around them and possesses all the skills necessary to decide why and how to use their imagination to introduce the non-existent future into the present (Miller, 2018).

Hence, it becomes evident that the notion of literacy has evolved over time to encompass the diverse skills demanded by individuals within societies, facilitating their adjustment to evolving social landscapes. The accumulation of past theories and subcategories of literacy forms the foundation, equipping us with the essential conceptual framework needed to delineate the concept of AI Literacy, a task we will undertake in the subsequent subsection.

## 2.2. AI Literacy: Advancing Fourth-Generation Literacy

As noted in the preceding subsection, the concept of literacy has undergone significant evolution to help individuals grasp the intricacies of the society they inhabit. Initially, it transitioned from an individual cognitive approach to a broader social perspective. Subsequently, advancements in technology and a deeper understanding of its functioning empowered individuals to engage in social activities through novel communication channels. Thus, while reading, writing, and numeracy were foundational skills in the era of written correspondence, proficiency in using electronic devices became (and remains) indispensable in the age of computers and digital applications, leading to the emergence of Information and Communication Technology (ICT) Literacy and Technological Literacy.

Presently, we find ourselves in the era of Artificial Intelligence, reshaping our lifestyles, entertainment, work, and modes of communication. No longer confined to human interaction, communication now extends to machines. In this epoch, individuals must effectively address novel challenges such as deepfakes (the fabrication of highly realistic synthetic media, including images, videos, and recordings, which appear authentic but are entirely fabricated or extensively manipulated), misinformation, and biases in data sourced from the AI, all while navigating security concerns. Competence, security, and ethical conduct in the AI necessitate literacy in this domain.

But how do various forms of literacy intersect? Just as technological literacy cannot exist in isolation from social and functional literacy, AI Literacy presupposes individuals who are proficient in technological, social, and functional domains. Hence, we conceptualize AI literacy as fourth-generation literacy (refer to Figure 1). Following this assertion, we will endeavor to validate this perspective by defining the concept, delineating its constituent skills, and elucidating its purpose.

In contemporary literature, there exists several definitions for AI literacy, shaped by various perspectives. Aoun (2017) characterizes AI literacy as the ability to comprehend the features and functionalities of AI and utilize it effectively. Long & Magerko (2020) posit that AI literacy entails individuals critically evaluating, employing, and proficiently communicating with AI. Yi (2021) defines AI literacy as not only the adept use of AI but also the critical acknowledgment of its cultural impact. Yi asserts that AI literacy is a pivotal skill essential for navigating the ever-changing societal landscape influenced by NT advancements. Lee et al. (2021) broaden the scope of AI literacy to encompass understanding AI's fundamental concepts, processes, and its seamless integration into everyday life.Moreover, juxtaposing AI literacy with digital literacy reveals a significant distinction. Digital literacy necessitated familiarity with technology, machines, and devices, as individuals utilized computers or mobile phones as conduits for

communication in various aspects of life. However, with the emergence of AI, individuals no longer solely interact with machines as intermediaries but directly engage and communicate with them (e.g., through the use of Siri). Consequently, individuals form connections with AI entities, interact with AI algorithms, albeit without comprehending their inner workings or grasping the ethical dimensions of AI usage and its impact on their lives. Essentially, they lack awareness of technology's current and future ramifications on their lives, as well as the evolving role machines play in human relationships (Fadel et al., 2024). This aspect is a fundamental constituent of AI literacy.

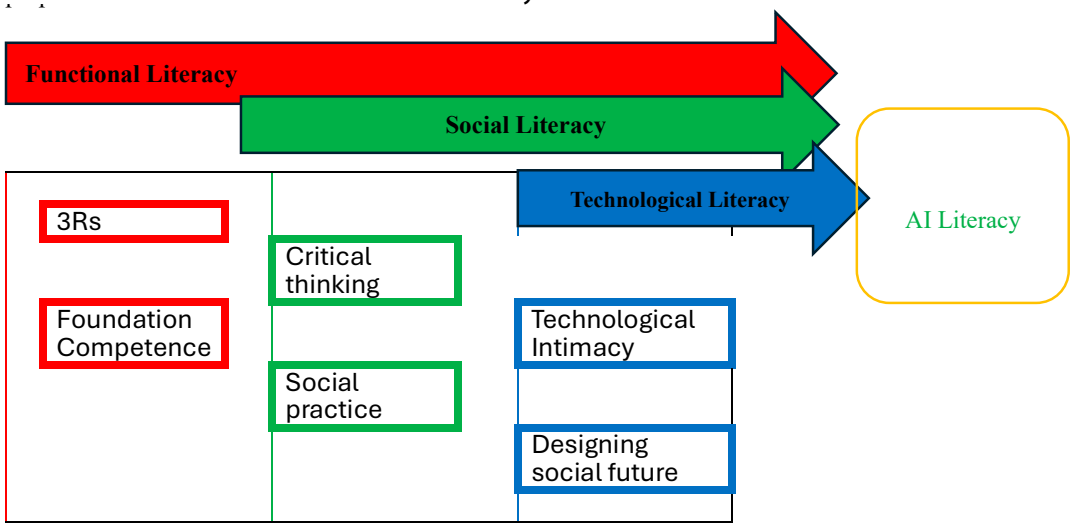


**Figure 1** *Relationship of AI Literacy with Functional, Social, and Technological Literacy (adapted from Yi (2021: 357))*

Literacy in the digital age encompasses all the skills required to progress in the era of technology. This includes mastering reading, writing, and numeracy as basic skills, social capability to critically understand society as a social practice, and technological adaptability to flexibly adjust to technological advancements in order to design one's future. Moreover, it is closely linked to the literacy of the future (UNESCO), as it allows social subjects to rely on data and technological achievements to anticipate the future for their benefit (Yi, 2021). Consequently, the fundamental skill required for literacy in the digital age is metacognition, while the purpose it serves is anticipation.

**Table 1** *Types of Literacy, Skills, and Purposes*

| ***Type*** | Functional Literacy | Social Literacy | Technological Literacy | AI Literacy |
|---|---|---|---|---|
| ***Skill*** | 3Rs | Critical thninking | Technological Intimacy | Metacognition |
| ***Purpose*** | Foundation competence | Social practice | Designing so-cial future | Anticipatio |

Anticipation is deemed necessary to ensure that in the new learner-centered and personalized learning model that is soon to dominate, students will be able to use metainformation to evaluate the quality of learning resources and data offered by personalized learning systems. On the other hand, the concept of anticipation as the purpose of literacy in the digital age ensures that in a rapidly changing, complex, ambiguous, and uncertain world, individuals are able to adapt to changes, navigate proficiently in modern complex societies, anticipate future problems by finding sustainable solutions, and generally plan their future lives by reflecting on the consequences in the future of the choices they make in the present (Howells, 2018; Yi, 2021). The concept of anticipation is closely linked to the so-called transformative skills mentioned in the OECD Future of Education and Skills 2030: Conceptual Learning Framework. These skills enable a personalized learning environment where each student creates their own motivation

for learning, connects it with other educational experiences, and collaborates with other students to design their own learning processes. The technological capability developed through this process can allow students to collect and analyze data based on their skills. Students no longer learn and evaluate within a fixed educational program, as we know it today, but can design and acquire the educational content they need through subjective information collection and analysis (Yi, 2021). This subjectivity (see personalization) in learning and the resulting knowledge will help them plan their future, anticipate uncertain realities, and foresee the future by influencing future changes with their actions.

# 3 The study

## 3.1 Purpose, aims and hypotheses

Drawing from relevant studies published to date, the primary objective of this research was to examine self-perceived AI literacy among university students specializing in humanities in Greece and Cyprus. Building upon existing literature, we anticipated encountering a relatively low level of reported AI literacy within our sample.

Additionally, we aimed to explore the impact of gender on AI literacy. We hypothesized that female participants would exhibit significantly lower mean scores both overall and across individual questionnaire items.

Finally, we investigated the impact of the educational system.

## 3.2 Participants

The sample consisted of 90 participants (20 males, 70 females,) from Greece (N=73) and Cyprus (N=17) all majoring in Humanities.

## 3.3 Instrumentation

The instrument for data collection used in this study was a Likert-scale, self-report questionnaire developed for the assessment of AI literacy (see table 1). The development of the test specification necessitated a clear definition of AI literacy to guide the construction of the instrument's items. To achieve this, we adopted a functional approach, meticulously reviewing all relevant literature and compiling a comprehensive list of reference skills that constitute AI literacy (see literature review above). The questionnaire ultimately comprised 15 items. To ensure content validity, we employed the method of multiple judges. Expert qualitative feedback was sought to determine if the items accurately represented the behaviors to be assessed, were expressed in the simplest possible language, had clear and unambiguous wording, and included a sufficient number of representative items to provide an adequate sample of the behaviors in question. Based on this feedback, several items were reworded for clarity and accuracy. Internal consistency was assessed using Cronbach's Alpha, which yielded a value of 0.89.

## 3.4 Statistics

Descriptive statistics were used to calculate means and standard deviations. Two separate ANOVAs were conducted to examine the effects of 'gender' and 'educational system'.

## 4 Results

As shown in Table 1, the overall sample demonstrates a moderate to low level of AI literacy, underscoring the necessity of integrating AI education into universities, not solely within STEM disciplines but also across other academic fields. The lowest mean is found in item 9: «I have hands-on experience with programming languages commonly used in AI development (e.g., Python, R),» indicating that humanities students particularly lack practical experience with AI. Conversely, the highest mean was in item 10: «I understand the importance of data privacy and security in the context of AI systems,» suggesting that students are aware of the challenges related to security and privacy when using AI.

Furthermore, statistically significant differences in means between men and women were observed in only two items of the questionnaire. Men reported actively seeking opportunities to learn more about AI and staying updated on advancements in the field ($F=6.33$; $p<.05$) (item 8), as well as having hands-on experience with programming languages commonly used in AI development (e.g., Python, R) ($F=6.64$; $p<.05$) (item 9), and can articulate the differences between narrow AI and general AI ($F=4.23$; $p<.05$) (item 11).

Additionally, statistically significant differences emerged between Greek and Cypriot participants across items 7 ($F=4.27$; $p<.05$) , 9 ($F=9.23$; $p<.05$), 10 ($F=7.19$; $p<.05$), and 11 ($F=4.21$; $p<.05$), indicating a somewhat superior AI literacy among Greek participants, particularly concerning the limitations and risks associated with AI technology, encompassing its potential for error and misuse.

**Table 1** *Descriptive statistics for AI literacy questionnaire items by gender and educational system*

| Items | Men Mean/ SD | Women Mean/SD | Greek Mean/ SD | Cypriot/ Mean/SD | TOTAL Mean/ SD |
|---|---|---|---|---|---|
| 1. I understand the basic concepts of artificial intelligence (AI) such as machine learning, neural networks, and deep learning. | 3.60±1.23 | 3.36±1.05 | 3.45±1.01 | 3.23±1.39 | 3.41±1.09 |
| 2. I can identify real-world applications of AI in various indus-tries (e.g., healthcare, finance, transporta-tion) | 3.40±1.39 | 3.41±.99 | 3.49±1.02 | 3.05±1.29 | 3.41±1.09 |
| 3. I am aware of the ethical considerations and potential societal impacts associated with the use of AI technology | 3.45±1.39 | 3.34±1.05 | 3.41±1.05 | 3.17±1.42 | 3.37±1.13 |
| 4. I have a basic under-standing of how AI algorithms make de-cisions and predic-tions | 2.95±1.43 | 3.04±1.08 | 3.06±1.14 | 2.82±1.23 | 3.02±1.16 |
| 5. I am confident in my ability to critically evaluate AI-driven in-formation or recom-mendations presented to me | 3.45±1.23 | 3.31±1.08 | 3.43±1.02 | 2.94±1.39 | 3.34±1.11 |
| 6. I know how to dis-tinguish between bi-ased and unbiased AI systems | 3.25±1.33 | 3.00±1.06 | 3.16±1.09 | 2.59±1.17 | 3.05±1.12 |
| 7. I am familiar with the limitations and constraints of AI technology, includ-ing its potential for error and misuse | 3.55±1.15 | 3.32±1.11 | 3.49±1.00* | 2.88±1.45 | 3.38±1.12 |
| 8. I actively seek oppor-tunities to learn more about AI and stay updated on advance-ments in the field | 4.05±.94* | 3.30±1.23 | 3.43±1.21 | 3.59±1.23 | 3.47±1.21 |

| Items | Men Mean/ SD | Women Mean/SD | Greek Mean/ SD | Cypriot/ Mean/SD | TOTAL Mean/ SD |
|---|---|---|---|---|---|
| 9. I have hands-on ex-perience with pro-gramming languages commonly used in AI development (e.g., Python, R) | 2.95±1.57* | 2.17±1.06 | 2.51±1.21* | 1.65±1.06 | 2.34±1.23 |
| 10. I understand the im-portance of data pri-vacy and security in the context of AI sys-tems | 3.35±1.23 | 3.71±1.22 | 3.79±1.10* | 2.94±1.48 | 3.63±1.22 |
| 11. I can articulate the differences between narrow AI and gen-eral AI | 2.90±1.25* | 2.31±1.08 | 2.56±1.15* | 1.94±.97 | 2.44±1.14 |
| 12. I am knowledgeable about the role of AI in shaping the future of work and em-ployment | 3.70±1.22 | 3.37±1.04 | 3.52±1.00 | 3.11±1.36 | 3.44±1.08 |
| 13. I believe that AI has the potential to ad-dress global chal-lenges such as cli-mate change and poverty | 3.40±1.23 | 3.07±.98 | 3.15±1.03 | 3.12±1.11 | 3.14±1.04 |
| 14. I feel comfortable discussing AI-related topics with peers, in-structors, or profes-sionals | 3.50±.95 | 3.14±1.08 | 3.29±1.01 | 2.94±1.25 | 3.22±1.06 |
| 15. I am interested in pursuing further edu-cation or career op-portunities related to artificial intelligence | 3.75±1.25 | 3.54±1.18 | 3.55±1.18 | 3.76±1.25 | 3.59±1.19 |

*sig p<.05

## 5 General discussion and conclusions

The objective of this study was to assess self-perceived AI literacy among university students majoring in humanities in Greece and Cyprus. The findings confirmed our initial hypothesis, revealing a moderate to low level of AI literacy among participants. Additionally, we sought to investigate the influence of gender on AI literacy. While our hypothesis that female participants would score significantly lower across individual questionnaire items was partially supported, further analysis is required to fully understand these differences.

Moreover, our examination of the impact of the educational system on self-reported AI literacy revealed statistically significant differences, with Greek students reporting somewhat higher AI literacy levels. These findings underscore the importance of integrating AI education across all levels of education, particularly in higher education institutions. This will ensure that students are equipped with the necessary knowledge and skills to navigate ethically an increasingly AI-driven world.

However, to date, the integration of AI into curricula has predominantly been confined to select STEM disciplines such as data science, computer science, and engineering (Cantú-Ortiz et al., 2020; Kandlhofer et al., 2016, Southworth et al., 2023). While these disciplines are crucial, given their emphasis on programming and AI development expertise, there is a growing recognition of the urgent need for broader AI education across Higher Education Institutions (Ng et al., 2021). Current AI education initiatives at higher education institutions remain largely limited in scope. AI should not be viewed merely as a set of isolated tools; rather, it represents a comprehensive set of skills and approaches for transdisciplinary inquiry that should permeate the entire educational experience of learners. Integrating AI into the core curriculum objectives of universities is essential.

Some institutions, such as the University of California, San Diego, the University of Washington, and the University of California, Berkeley, have embraced this cross-disciplinary approach (Southworth et al., 2023). However, a significant gap persists in the content, methods, depth and breadth of AI education. This is a critical concern because AI poses pedagogical challenges encompassing a wide range of fundamental skills, approaches, and ethical considerations, and therefore should be an integral component of any high-quality higher education curriculum (Cantú-Ortiz et al., 2020; Ng et al., 2021, Southworth et al., 2023).

Greek and Cypriot universities should integrate AI education throughout their curricula and create opportunities for student engagement in AI literacy across all disciplines. Such AI Across the Curriculum initiative at Greek universities should aim to make AI education a fundamental aspect of every student's academic experience. The ultimate goal of this initiative should be to develop an AI-ready workforce equipped with essential 21st-century skills that meet the needs of both the workforce and government globally.

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