Bridging AI Literacy, the AI Act, and Academia: An Interdisciplinary Approach to Embedding AI Literacy in Teaching Academic Writing

Chrysanthi Melanou, Baden-Wuerttemberg Cooperative State University, Germany

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Abstract

The increasing use of generative artificial intelligence (AI) tools in higher education raises urgent pedagogical, ethical, and legal questions. At the same time, the introduction of the European AI Act in 2024 has reinforced the need for structured and responsible AI implementations. This paper presents the design, implementation, and empirical evaluation of an interdisciplinary course that equips students with technical, ethical, legal, and applied AI competencies, with a specific focus on academic writing. These competencies were defined in alignment with the requirements of the EU AI Act, ensuring that the course reflects both regulatory expectations and academic values. The course was launched in October 2024 and has since reached over 700 students across different faculties through a modular format, offering comprehensive, compact, and introductory versions. AI fundamentals, prompt design, and reflective practices are embedded into the academic writing process, enabling students to use AI tools critically and transparently across all writing phases. The course fosters not only operational proficiency but also a deeper understanding of the limitations and implications of AI technologies. A post-course quantitative survey was conducted with 52 students enrolled in the compact format to evaluate perceived learning outcomes. Results indicate increased confidence in planning, critical reflection, and source evaluation, as well as acceptance of the institutionally hosted chatbot. Students expressed a strong interest in further curricular integration of AI literacy and called for domain-specific adaptations. The study provides empirical insights into scalable, adaptable, and pedagogically meaningful ways of embedding AI literacy into higher education.

Keywords: AI literacy, academic writing, EU AI Act, higher education, interdisciplinary teaching

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Introduction

The increasing use of generative artificial intelligence (AI) tools in higher education is reshaping academic practices, particularly in the domain of academic writing. Tools based on Large Language Models (LLMs), such as ChatGPT, are now easily accessible and often used by students with limited institutional guidance. While these systems offer opportunities for supporting idea generation, drafting, and revision, their uncritical or unsupervised application poses significant ethical, pedagogical, and legal concerns, especially considering academic integrity and authorship (Ros & Samuel, 2024). At the same time, the introduction of the European Union's Artificial Intelligence Act (European Parliament and Council of the European Union, 2024) in 2024 has established the world's first comprehensive legal framework for AI systems, extending obligations to both developers and institutional users, including universities (Thelisson & Verma, 2024).

The EU AI Act adopts a risk-based approach, classifying AI systems into categories ranging from minimal to unacceptable risk, and imposes strict obligations on providers and users of high-risk applications (Olimid, 2024). Education is not directly categorized as a high-risk sector. However, it is increasingly viewed as a sensitive domain, especially when AI tools are used to generate or influence academic work. AI-supported educational systems that affect student assessment or academic performance may fall into risk-sensitive categories. This classification depends on how the tools function and what types of data they use (Saarela et al., 2025, p. 8). In this context, educational institutions face a dual responsibility: to ensure compliance with evolving legal standards and to foster responsible, critical engagement with AI systems among students (Council of Europe, 2024, p. 29).

However, while the legal landscape is rapidly evolving, educational responses remain fragmented. There is a growing need for curricular models that integrate technical understanding with ethical reasoning and legal awareness. Existing discussions around AI literacy emphasize operational familiarity with AI systems, but often lack structured pedagogical frameworks that guide reflective and compliant use (Liu & Xiao, 2025, p. 486).

To address this gap, an interdisciplinary university course was developed that combines technical training in AI fundamentals with critical reflection on legal and ethical implications. It focuses specifically on the context of academic writing, aiming to help students understand how to use AI tools not as shortcuts, but as pedagogically valuable resources when applied with transparency, integrity, and methodological clarity. The course aligns with the governance ambitions of the EU AI Act and promotes responsible digital citizenship in academic contexts (Tadimalla & Maher, 2024, p. 2).

This paper presents the design, implementation, and evaluation of the course, which was offered in modular formats to accommodate diverse institutional needs. It also discusses empirical findings from a student survey, offering insights into how such training influences AI literacy, ethical awareness, and academic behavior.

Teaching Concept and Course Design

The interdisciplinary course on AI literacy and academic writing was developed to address a dual challenge: the growing, often unguided and unsupervised use of generative AI tools by students for academic purposes, and the emerging legal responsibilities outlined in the EU AI Act. The course is designed to equip students not only with technical knowledge, but also

with reflective and ethical competencies required for responsible AI use in line with regulatory expectations of the EU AI Act (Tadimalla & Maher, 2024). With a specific focus on academic writing within university contexts, the course promotes the development of applied AI skills that support students in integrating AI meaningfully and responsibly into their writing processes. Rather than positioning AI tools as shortcuts, the curriculum emphasizes their pedagogical value when used with critical awareness, ethical sensitivity, and methodological clarity (Amini et al., 2025).

Technical Foundations

The course begins by establishing a technical understanding of how generative AI systems, particularly LLMs, operate. Students are introduced to the inner workings of LLMs, including how they process human language through probabilistic prediction based on extensive linguistic datasets. Concepts such as tokenization, contextual embedding, and autoregressive Text generation are explored to help students grasp not only the logic behind the output, but also typical sources of errors and misunderstandings.

To support this, students engage with basic principles of computational linguistics and natural language processing (NLP). These insights help them understand how syntactic structures, semantic relationships, and statistical co-occurrences shape the behavior of AI models. The course also addresses typical weaknesses of such systems, including factual inaccuracies, hallucinated content, and cultural or epistemic bias.

An essential component of this technical foundation is prompt design. Students learn how the structure, wording, and intent of a prompt directly affect the quality and relevance of the AI's output. Different prompting techniques, such as zero-shot, role-based, or iterative prompting, are discussed and tested in applied exercises. By experimenting with varied input strategies, students begin to see AI not as an autonomous agent but as a responsive tool whose output quality depends heavily on human input and framing.

Ethical Competencies and Legal Dimensions

Building on these foundations, the course addresses ethical and legal questions related to AI use in academia. This includes topics such as transparency and authorship, the boundaries of fair use in individual and group assignments, and the risk of over-reliance. Special attention is given to academic integrity, examining when AI assisted work may cross the line into misconduct.

In parallel, students examine legal considerations such as data protection under the General Data Protection Regulation (GDPR), institutional policies on AI tool usage, and the often-overlooked implications of agreeing to terms of service for commercial tools. By exploring these dimensions, students develop a deeper understanding of the broader regulatory and institutional context in which their AI use takes place.

Critical Reflection and Social Impact

Another core element of the course is the cultivation of critical reflection and awareness of AI's societal implications. Students are encouraged to examine their own motives, usage patterns, and dependencies when working with AI tools. The curriculum invites discussion on

sustainability (e.g., energy consumption of LLMs), social equity (e.g., unequal access to tools), and algorithmic bias.

Through these discussions, the course fosters a reflective mindset that links AI literacy with broader questions of social responsibility and inclusive academic practices. Students are encouraged to view AI not only as a functional aid but also as a cultural and ethical phenomenon.

Applied Competencies: Prompting and the Writing Process

A key objective of the course is to foster applied competencies among students, specifically, those needed to engage in academic tasks such as academic writing. These competencies are practiced using the structural framework of the academic writing process, based on Kruse's (Kruse, 2007) model outlining the key stages of scholarly writing.

To translate the course's conceptual and ethical foundations into practice, students are guided in the targeted use of a GDPR-compliant, university hosted AI assistant. The AI tool is integrated across all major phases, of the writing process; from identifying a topic and planning an outline to formulating a rough draft, revising arguments, and finalizing formatting and citations. This process-oriented approach provides a concrete framework for exploring how and where AI tools can support academic work meaningfully.

In each phase, students apply specific prompting techniques, experiment with different formulations, and compare AI generated outputs. They assess whether responses meet academic standards, identify strengths and limitations, and reflect on when AI support enhances learning. In doing so, students learn to distinguish between helpful and inappropriate AI use, developing key academic skills including critical thinking, structured argumentation, and source literacy.

Through this guided practice, students develop both competence and confidence in navigating AI-supported writing processes. The aim is not to replace human academic work with automated output, but to encourage intentional, transparent, and responsible use of AI aligned with academic values and institutional expectations.

Modular Course Formats

To accommodate different institutional conditions and practical boundaries, the course was designed as a modular offering with three delivery formats. Although the core components (technical, ethical, legal, and applied competencies) remain the same in each version, the depth and intensity of instruction vary depending on the time available. The comprehensive format consists of 24 teaching units and allows for thorough exploration and extended hands-on practice. It is particularly suited for students preparing for their final thesis or working on advanced academic projects and has so far been completed by 37 participants. The compact version includes eight units and focuses on essential competencies and their application in academic writing, making it a practical fit for integrations into existing curricula. This version was attended by 52 students and serves as the basis for the evaluation presented in this paper. The introductory version comprises four units and offers a brief overview aimed at raising awareness among larger student groups. It is especially useful for early-stage students who are just beginning to engage with AI in an academic context and has already reached over 700 participants across different faculties. This modular design enables flexible

implementation across faculties while ensuring a coherent and consistent learning experience that reflects the course's overall pedagogical framework.

Empirical Evaluation

To assess the effectiveness of the AI literacy course in academic writing, an empirical evaluation was conducted during the spring semester 2025. The evaluation focused on the compact course format consisting of eight teaching units, which was integrated into the curriculum of the Faculty of Business under IT Competencies and Academic Writing. A total of 52 students form the fourth semester, enrolled in the Digital Business Management and Banking programs, participated in the study.

The evaluation aimed to measure changes in students' self-perceived AI literacy and their ability to engage with AI tools in academic contexts. A post-course quantitative survey captured students' confidence levels in planning, critical reflection, source evaluation, and risk awareness. Additional items explored their practical use of AI tools, their experiences with the institutionally provided AI chatbot, and their perspectives on the future integration of AI literacy into subject-specific curricula.

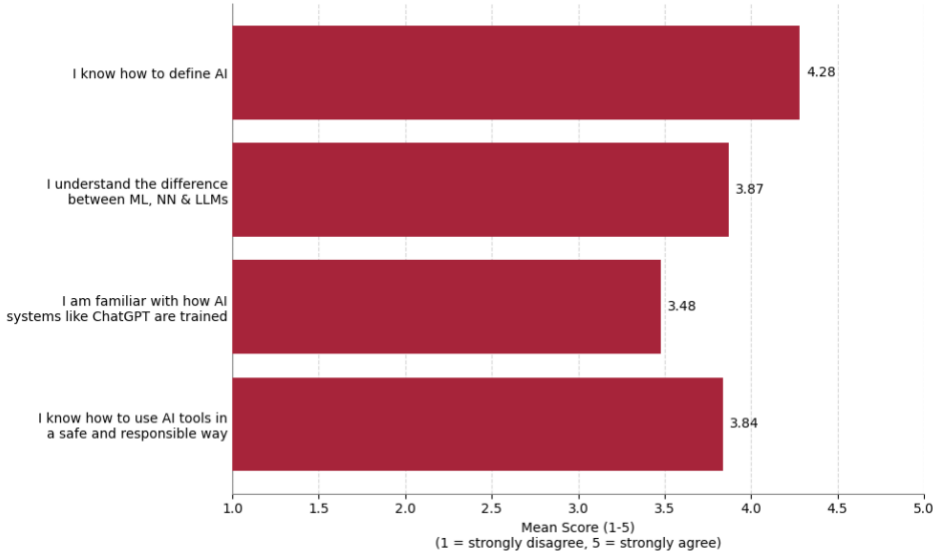
Results and Interpretation

The results of the post-course empirical survey reveal a differentiated but overall positive picture of students' AI-related competencies and attitudes.

Self-Perceived AI

As shown in Figure 1, students reported high levels of confidence in fundamental AI concepts. The ability to define AI received the highest average agreement (M = 4.28), followed by understanding the difference between machine learning, neural networks, and large language models (M = 3.87). Slightly lower ratings were found in items related to technical system knowledge, such as understanding how models like ChatGPT are trained (M = 3.48). Confidence in responsible use was also strong (M = 3.84), suggesting that students not only grasp foundational concepts but also show awareness of ethical aspects.

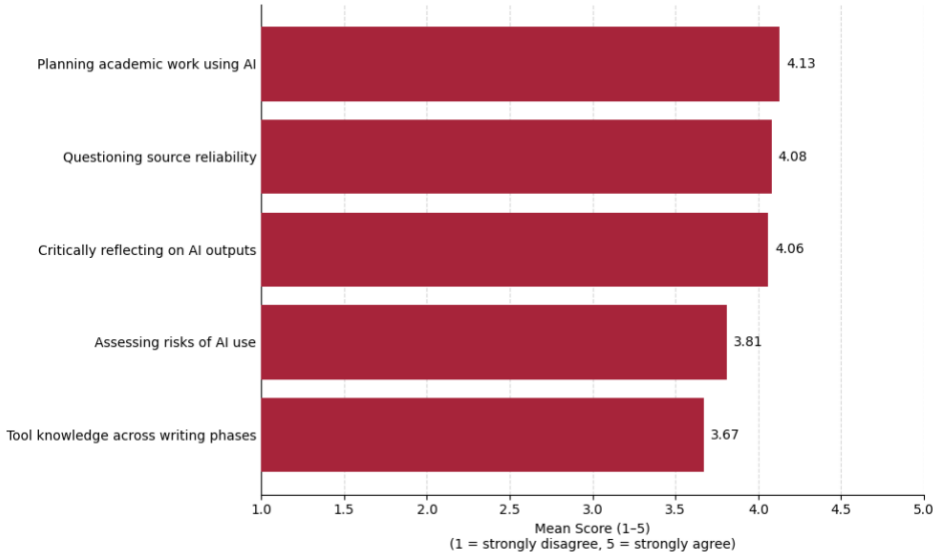
Figure 1
Self-Perceived AI-Literacy



AI Competencies

Figure 2 illustrates students' self-assessment across specific competencies. The ability to plan academic work using AI was rated highest (M = 4.13), followed by source criticism (M = 4.08) and critical reflection on AI outputs (M = 4.06). These results highlight a high degree of metacognitive engagement. Slightly lower, but still positive ratings were given to assessing AI-related risks (M = 3.81) and knowledge about AI tools across the writing process (M = 3.67), suggesting potential for further practice-oriented integration.

Figure 2
AI-Competencies

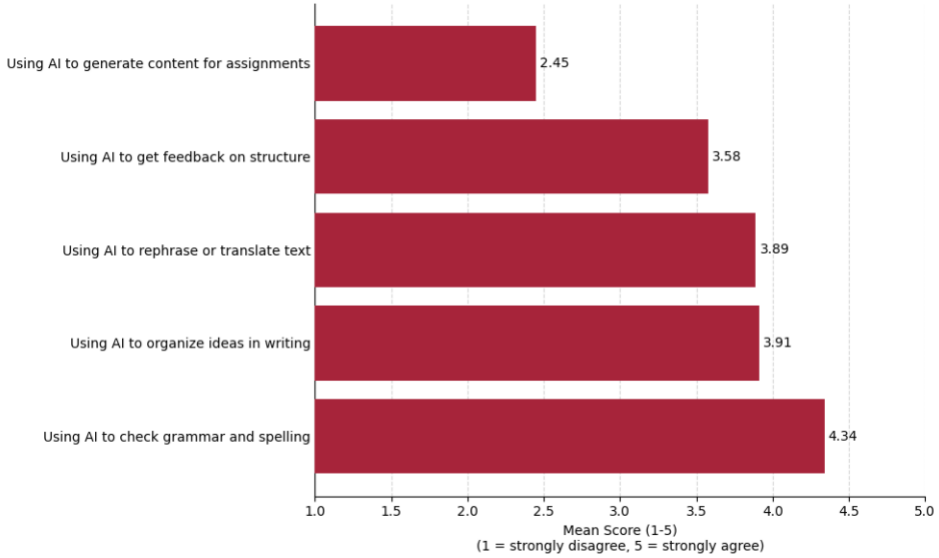


Use of AI Tools

As shown in Figure 3, students indicated a varied pattern of tool usage. The most common use cases were checking grammar and spelling (M = 4.34), organizing ideas (M = 3.91), and

rephrasing or translating text (M = 3.89). AI was used less frequent for structural feedback (M = 3.58), and very low agreement was found in using AI to generate content for assignments (M = 2.45). The results indicate that students engaged with AI as a supportive tool and not as a substitute for academic work. This reflects the course's intended learning goals.

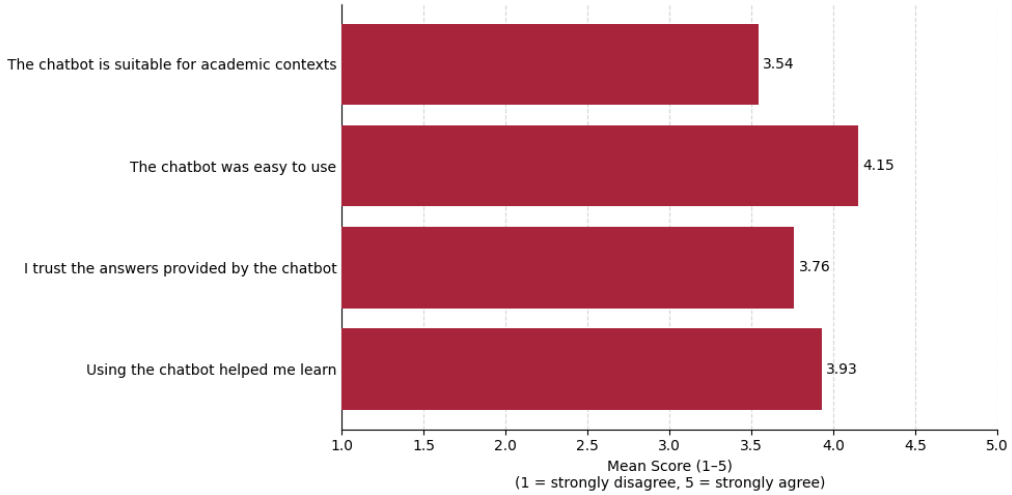
Figure 3
Use of AI Tools



Feedback on the Institutional Chatbot

Figure 4 summarizes students' feedback of the university-provided chatbot. Overall ratings were positive. Students found the chatbot easy to use (M = 4.15), helpful for learning (M = 3.93) and generally trustworthy (M = 3.76). Although the suitability for academic contexts was rated somewhat lower (M = 3.54), the results indicate that the tool was accepted and effectively integrated into the learning process.

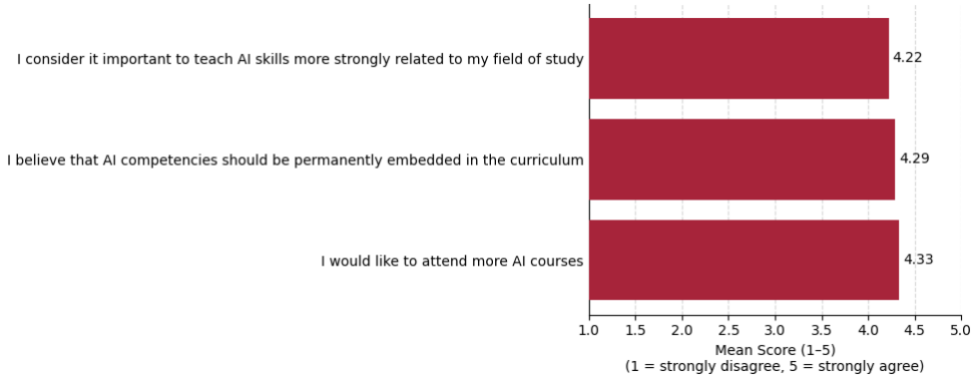
Figure 4
Feedback on the Institutional Chatbot



Integration Needs

Figure 5 shows a strong demand for further curricular integration of AI literacy. Students expressed a high level of agreement with statements such as the importance of domain-specific AI training (M = 4.22), the need for permanent curricular embedding (M = 4.29), and the desire to attend more AI-related courses (M = 4.33). These responses underline that students not only value the course content but also see clear potential for its continued expansion across study programs.

Figure 5
Integration Needs



Standard Variations in Responses

Standard deviations across the surveyed dimensions ranged between approximately 0.4 and 0.7, indicating a generally consistent response pattern within the participant group. The lowest variability was observed in areas related to tool usage for grammar checking and the planning of academic work with AI, suggesting high agreement and shared practices. By contrast, slightly higher standard deviations were found in items concerning the suitability of the institutional chatbot and students' views on the future integration of AI in curricula. These findings may reflect differing prior experiences, individual academic needs, or levels of trust in institutional infrastructures. Overall, the limited spread of responses supports the interpretation that the course content was broadly accessible and relevant, while also pointing to specific domains where further differentiation or tailoring may be beneficial.

Results and Implications

Considering all findings, the evaluation results suggest that the compact course format was effective in enhancing students' AI literacy, reflective awareness, and confidence in using AI tools in academic contexts. High mean values across all dimensions indicate that key learning goals were met, while the limited variation in responses supports the conclusion that the course structure and content were broadly suitable for the diverse student group.

The consistently high levels of agreement regarding future integration underline students' desire for sustained and subject-specific AI education. At the same time, slightly more varied responses in areas such as technical understanding and trust in institutional tools point to potential areas for refinement. These insights offer valuable basis for the future course development and institutional strategies to embed AI literacy in higher education in a scalable, adaptable, and pedagogically grounded way.

Conclusion

The integration of generative AI into higher education, along with the new legal responsibilities introduced by the EU AI Act, requires a structured and responsible approach to AI literacy. To address this need, an interdisciplinary course on AI and academic writing was developed, implemented, and evaluated. The course aims to build technical understanding, raise awareness of ethical and legal questions, and support students in using AI tools in a thoughtful and appropriate way. Its modular structure makes it easily adaptable to different study programs and timeframes.

Evaluation results show that even a compact course format can help students become more confident and competent in using AI for academic purposes. Students used AI tools to support their writing rather than to replace their own thinking, which reflects the course's focus on responsible application. They also expressed a clear interest in further curricular integration and in more subject-specific examples, underlining the relevance of AI literacy across disciplines.

As AI continues to influence academic work and learning, universities have a key role in preparing students for its challenges and opportunities. AI literacy should not only be about using tools but also about understanding how they work, what their limitations are, and how to use them fairly and transparently. The course illustrates how legal, ethical, and pedagogical aims can be integrated into a flexible and transferable, and future-oriented teaching model.

Looking ahead, further development of the course may include enhanced disciplinary differentiation, extended prompting practice, and deeper integration into academic programs. In addition, future research could investigate long-term learning outcomes, students' reflective practices, and the institutional impact of embedding AI literacy into the broader curriculum. These steps will be essential to ensure that AI literacy becomes not just an individual competence, but a sustainable and embedded element of higher education.

Beyond regulatory obligations, universities also carry an educational responsibility to ensure that students can navigate a rapidly evolving knowledge landscape shaped by automated decision-making technologies, data-driven processes, and changing norms of authorship and assessment. Embedding AI literacy into higher education is therefore not only a matter of legal compliance, but also a prerequisite for academic equity, quality assurance, and inclusive participation.

Future Strategies may benefit from embedding AI literacy into broader digital competence frameworks at national and European levels, fostering coherence across institutions while allowing disciplinary and contextual differentiation.

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Contact email: chrysanthi.melanou@dhbw.de