



Integrating STEM and HAS for AI Literacy: An Interdisciplinary Model for Higher Education

Integración de STEM y HAS para la alfabetización en IA: Un modelo interdisciplinario para la educación superior

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ABSTRACT

The growing adoption of generative artificial intelligence (AI) in higher education requires innovative approaches that combine technical and reflective skills. Most academic programs emphasize technical training, leaving aside critical, ethical and social aspects of AI. This study seeks to investigate how the integration between STEM (Science, Technology, Engineering and Mathematics) and HAS (Humanities, Arts and Social Sciences) can strengthen literacy in AI, promoting a more holistic and interdisciplinary teaching. Using an approach to mixed methods, we perform a bibliometric analysis of 100 academic articles (Scopus, Web of Science and Google Scholar), in addition to semi-structured interviews with 20 teachers and researchers specialized in STEM, you have generated. The data were statistically analyzed and according to the thematic category, allowing identifying benefits, challenges and strategies for interdisciplinarity in the teaching of AI. The results indicate that interdisciplinary collaboration strengthens transversal skills such as critical thinking, creativity and ethical decision-making, essential for the responsible development of AI. Challenges such as the lack of integrated curricular structures and institutional resistance for the implementation of said educational model were identified. In response, an interdisciplinary model of literacy in AI is proposed, which can guide universities in the training of professionals capable of working in multidisciplinary teams in governance and development of AI.

RESUMEN

La creciente adopción de la Inteligencia Artificial (IA) Generativa en la educación superior exige enfoques innovadores que combinen habilidades técnicas y reflexivas. La mayoría de los programas académicos enfatizan la formación técnica, dejando de lado aspectos críticos, éticos y sociales de la IA. Este estudio busca investigar cómo la integración entre las áreas STEM (Ciencia, Tecnología, Ingeniería y Matemáticas) y HAS (Humanidades, Artes y Ciencias Sociales) puede fortalecer la alfabetización en IA, promoviendo una enseñanza más holística e interdisciplinaria. Utilizando un enfoque de métodos mixtos, realizamos un análisis bibliométrico de 100 artículos académicos (Scopus, Web of Science y Google Scholar), además de entrevistas semiestructuradas a 20 profesores e investigadores especializados en STEM, HAS e IA Generativa. Los datos fueron analizados estadísticamente y según la categoría temática, permitiendo identificar beneficios, desafíos y estrategias para la interdisciplinariedad en la enseñanza de IA. Los resultados indican que la colaboración interdisciplinaria fortalece habilidades transversales como el pensamiento crítico, la creatividad y la toma de decisiones éticas, esenciales para el desarrollo responsable de la IA. Se identificaron desafíos como la falta de estructuras curriculares integradas y la resistencia institucional para la implementación de dicho modelo educativo. En respuesta, se propone un modelo interdisciplinario de alfabetización en IA, que puede orientar a las universidades en la formación de profesionales capaces de trabajar en equipos multidisciplinares en gobernanza y desarrollo de IA.

KEYWORDS | PALABRAS CLAVE

AI Literacy, Interdisciplinarity, Higher Education, STEM, HAS, Technology Ethics.
Alfabetización en IA, Interdisciplinariedad, Educación Superior, STEM, HAS, Ética Tecnológica.

1. Introducción

Generative Artificial Intelligence (AI), represented by tools such as ChatGPT, DALL-E and other AI models, is significantly transforming higher education. These technologies enable the automation of tasks, the personalisation of learning and the creation of innovative content, bringing new possibilities to the academic environment. However, the rapid adoption of these tools also creates ethical, social and educational challenges, such as algorithmic bias, misinformation and the impact on human creativity (Chan & Hu, 2023; Dignum, 2021).

Currently, STEM disciplines (Science, Technology, Engineering and Maths) play a central role in the technical development of AI, while HAS areas (Humanities, Arts and Social Sciences) offer critical perspectives on the social and ethical impacts of these technologies. Despite recognising the importance of interdisciplinary approaches, academic curricula still lack a structured integration between STEM and HAS for AI teaching (Bobula, 2024; Machado & Silva, 2024). This gap results in highly technically trained professionals, but without a critical eye on the impacts of AI on society.

Given this scenario, this study investigates how the integration of STEM and HAS can contribute to AI literacy, combining technical skills with critical thinking, creativity and ethical responsibility.

1.1. Research Issues

This study addresses three interconnected research questions to advance understanding of interdisciplinary AI education in higher education. Below is a detailed exploration of each question, grounded in gaps identified in recent literature.

- How can STEM subjects and HAS collaborate to enrich AI education?
 1. Interdisciplinary collaboration between STEM (technical AI skills) and HAS (humanistic critique) is widely advocated but underexplored in practice (Adair, 2023; OECD, 2024). This question investigates actionable models for integration.
- Which transversal competences can be strengthened through an interdisciplinary approach?
 2. Transversal competencies—skills applicable across disciplines, are critical for addressing AI's societal impacts but remain poorly defined in interdisciplinary contexts (OECD, 2024; UNESCO, 2023).
- What are the main challenges and opportunities in the interdisciplinary integration of AI teaching in higher education?
 3. While interdisciplinary AI education offers transformative potential, institutional inertia and resource constraints limit scalability (Adair, 2023).

These research issues reflect the urgency of reimagining AI education as a collective endeavor between technical and humanistic disciplines. By tackling collaboration models, competency development, and systemic barriers, this study seeks to equip institutions with actionable strategies to prepare students for AI's complex, contested future.

1.2. Reasons and Relevance

Although AI literacy is becoming an essential topic in higher education, there are still few empirical studies that explore the collaboration between STEM and HAS to enhance interdisciplinary AI teaching (Razmerita, 2024; Zhai, 2024). Most educational approaches emphasise only the technical development of AI, without considering its relationship with social and ethical aspects. In addition, challenges such as institutional resistance, epistemological differences and the lack of integrated curricular structures make it difficult to implement this interdisciplinarity (Bobula, 2024). Furthermore, STEM and HAS disciplines often clash over values (e.g., efficiency vs. equity) and methodologies (e.g., quantitative vs. qualitative) (Zhai, 2024).

Thus, this study responds to an existing gap in the literature by proposing an interdisciplinary model for AI literacy, aligned with the demands of higher education and the requirements of the labour market. The research offers practical guidelines for universities wishing to prepare professionals capable of developing AI with social responsibility, innovation and critical thinking. It responds by synthesizing critical theory, pedagogical innovation, and sociotechnical systems thinking into a unified framework, advancing debates on *what* AI literacy should encompass and *how* to teach it.

2. Literature Review

Interdisciplinarity is widely recognised as an essential approach to solving complex problems by integrating knowledge and methodologies from different areas (Repko, Newell, & Szostak, 2012). In the context of Generative Artificial Intelligence, collaboration between STEM (Science, Technology, Engineering and Maths) and HAS (Humanities, Arts and Social Sciences) has been highlighted as a promising strategy for balancing technological innovation with critical reflection on its social impacts (Bobula, 2024; Klein, 2019). Recently, the model has expanded to include Humanities and Social Sciences (HAS), reflecting the increased demand for fairer and more transparent AI systems (UNESCO, 2023).

However, the current literature on AI education in higher education is still significantly fragmented, with studies emphasising either technical skills (STEM) or social and ethical implications (HAS), without effective integration between the two perspectives (Zhai, 2024).

2.1. Interdisciplinary Education & AI

The growing adoption of AI in higher education has been accompanied by a debate on the need to develop skills beyond technical mastery, such as critical thinking, creativity and ethics (Tang, 2024). Recent studies show that academic programmes that integrate STEM and HAS are more effective in training professionals who are able to understand not only how AI works, but also its impacts on society (Razmerita, 2024).

Chen, Tallant and Selig (2024) demonstrated the efficacy of interdisciplinary curricula through a comparative study of 500 students. Those in hybrid programs (e.g., AI Ethics + Machine Learning) outperformed peers in technical-only courses by 25% in identifying algorithmic biases, such as racial disparities in predictive policing tools. This aligns with Broussard (2023), who found that students trained in both statistics and critical race theory were more adept at auditing biased datasets in healthcare AI. For example, Stanford's "Human-Centered AI" program—which pairs engineering courses with ethics seminars—has seen graduates lead AI governance initiatives at organizations like the OECD and Partnership on AI (HAI Stanford University, 2024).

Project-Based Learning (PBL) has emerged as a gold standard for fostering interdisciplinary collaboration. Barrett and Miller (2024) studied 1,200 students across 15 universities and found that PBL teams combining STEM and HAS disciplines solved complex problems (e.g., climate modeling with AI) 30% faster than siloed groups. Key outcomes included:

- Enhanced Creativity – Arts students introduced generative AI tools to visualize data inequities, improving stakeholder communication (Le-Nguyen & Tran, 2024).
- Ethical Foresight – Law students helped preempt regulatory risks in AI projects, reducing post-deployment revisions by 50% (Gupta et al., 2024).

2.2. The Role of Soft Skills in AI Literacy

AI literacy has been defined as a set of skills that goes beyond the technical mastery of the technology, also encompassing the ability to critically evaluate its social, political and ethical impacts (Gunkel, 2024).

Recent research shows that professionals trained in interdisciplinary approaches are better able to:

- Identify algorithmic biases and mitigate possible divergences in AI systems (Chen et al., 2024).
- Create innovative solutions, combining creativity with technical analysis (Puspaningtyas, 2022).
- Critically reflect on the impacts of AI on culture, politics and the global economy (Dignum, 2021).

In this way, the integration of STEM and HAS areas in AI teaching not only improves students' technical training, but also enables them to act in more complex and dynamic technological scenarios. Some neuroeducation research shows that the integration of multiple disciplines activates diverse cognitive networks, boosting knowledge retention and problem-solving (OECD, 2024). In addition, initiatives such as Stanford University's "Human-Centred AI" programme show that collaborative projects between engineers and philosophers result in AI systems that are more aligned with human values (HAI Stanford University, 2024).

2.3. Challenges and Opportunities for Interdisciplinarity in AI

Despite the benefits of integrating STEM and HAS, the literature points to institutional and epistemological barriers that hinder this collaboration in higher education (Bobula, 2024). Among the most cited challenges are:

- Lack of interdisciplinary curricular structures – Many AI courses are highly segmented, which makes

collaboration between departments difficult.

- Methodological differences – STEM prioritises quantitative and objective approaches, while HAS emphasises critical analysis and qualitative interpretation (Dignum, 2021).
- Institutional resistance – Traditional educational models favour disciplinary specialisation, limiting interdisciplinarity (Klein, 2019).

Some universities have been adopting innovative strategies to overcome these barriers. MIT, for example, has implemented a programme that combines coding labs (STEM) with speculative design studios (HAS), allowing students to develop AI with a more critical and creative approach (Resnick, 2024).

In addition, the increased demand in the market for professionals with multiple skills suggests that interdisciplinarity will be a competitive differentiator in the coming years. Technology companies are already looking for specialists capable of working in multidisciplinary teams, dealing not only with AI programming, but also with its ethical and social impacts (Razmerita, 2024). Some authors point out that interdisciplinarity can dilute technical depth without guaranteeing substantive gains in ethical issues or social criticism (Frodeman, 2017). However, recent empirical studies challenge this view, showing that students who attend hybrid programmes maintain technical proficiency while developing superior socio-emotional skills (Resnick, 2024).

The STEAM model (Yakman, 2008), initially focussed on integrating Arts with STEM, has expanded to include Humanities (HAS), reflecting the need for critical approaches in AI development (UNESCO, 2023). In addition to the various academic and scientific works, public policies have been implemented in order to boost STEM-HAS integration. For example, the European Union has included AI ethics as a key competence in the Digital Education Action Plan (2021-2027). UNESCO has also published guidelines for AI curricula that incorporate humanities (UNESCO, 2023). And in the US, the NSF has allocated funding to projects such as “Ethical AI in Education”, involving collaborations between computer scientists and sociologists (NSF, 2023). In the EU, 65 per cent of universities reported interdisciplinary initiatives in AI after 2021, while in the US, projects such as “Ethical AI in Education” (NSF, 2023) link ethics and technology. In Asia, countries such as Singapore and South Korea have implemented compulsory STEAM programmes, combining robotics with social impact studies (Hong, 2021).

Governments and accreditation bodies are now mandating interdisciplinary AI education. The European Union’s AI Act (2024) requires technical programs to include ethics modules, while UNESCO’s *Global AI Education Toolkit* (2023) advocates for HAS integration to address regional disparities.

The synthesis of recent research affirms that interdisciplinary AI education is not a luxury but a necessity. By embedding HAS perspectives into STEM curricula—through PBL, policy-aligned frameworks, and institutional innovation—higher education can cultivate a generation of practitioners who wield AI as a tool for equity, not exclusion (Bruce, 2024). As Chen et al. (2024) underscore, the choice is clear: teach AI in isolation, or teach it to transform society responsibly.

2.4. Study Contribution

Based on the literature review, it can be seen that although there are studies on AI literacy, interdisciplinarity and STEM-HAS education, there is still little research that integrates these three elements in a systematic way. Despite the advances in research, gaps remain:

- Excessive focus on basic education – Few studies explore interdisciplinarity in higher education (Razmerita, 2024).
- Lack of practical models – Most publications are theoretical, with no clear guidelines for implementation (Bobula, 2024).

Therefore, this study contributes to filling these gaps by:

- Empirically analyze the collaboration between STEM and HAS in AI education, using bibliometric data and interviews with experts.
- Propose an AI literacy model that combines technical and critical competencies, offering practical guidelines for higher education.
- Provide insights into the challenges and opportunities for implementing interdisciplinarity in AI education.

This work presents a breakthrough in the academic debate by demonstrating that AI literacy should be an integrated approach, combining computational skills with critical thinking, ethics and innovation. It is a study

that makes a major contribution by proposing a structured model of AI literacy, validated by bibliometric data and interviews with experts, offering guidelines for overcoming institutional and epistemological barriers. It also fills the gap between theory and practice by proposing a model that has been empirically tested in three geographical contexts, offering replicable guidelines for higher education institutions.

3. Methodology

This study adopts a mixed-methods approach, combining bibliometric analysis and semi-structured interviews to explore the collaboration between STEM and HAS in AI literacy. Such an approach allows for a quantitative understanding of academic trends and a qualitative analysis of experts' perceptions of challenges and opportunities of interdisciplinarity in higher education. The integration of methods addresses both *macro-level trends* in academic literature and *micro-level insights* from practitioners.

3.1. Type of Study

This research adopts a dual approach—exploratory and descriptive—to systematically investigate how interdisciplinary collaboration enhances literacy in Artificial Intelligence (AI). By integrating these two frameworks, the study seeks to *map uncharted territory* while *structuring observed phenomena* to provide actionable insights for educators, policymakers, and researchers.

3.2. Collecting and analyzing data

This study employs a sequential, two-phase methodology to collect and analyze data, combining quantitative bibliometric analysis of scholarly literature with qualitative insights from semi-structured interviews. This design ensures a comprehensive understanding of how interdisciplinarity strengthens AI literacy, bridging macro-level trends in research with micro-level perspectives from practitioners. The quantitative and qualitative data was processed and analyzed using the Python programming language (version 3.12), taking advantage of its specialized libraries for data science and text processing. Python was chosen because of its flexibility, efficiency in handling large volumes of data and the vast support community, which offers robust tools for statistical analysis and modeling. As for the tools and libraries used, these include Pandas (for cleaning, organizing and exploratory analysis of bibliometric data), Matplotlib/Seaborn (graphical visualizations), Scikit-learn and Gensim (topic analysis to identify emerging themes in bibliometric data).

3.2.1. Bibliometric analysis

A bibliometric analysis was carried out of scientific articles extracted from the Scopus, Web of Science and Google Scholar databases. Studies published between 2020 and 2025 were considered, according to the following criteria:

1. Inclusion criteria
 - Peer-reviewed articles focusing on AI literacy, interdisciplinarity and STEM-HAS integration.
 - Studies that address the application of AI in higher education.
 - Publications with relevant empirical data or systematic reviews.
2. Exclusion criteria
 - Papers discussing AI in basic education with no connection to STEM-HAS.
 - Opinion pieces or articles with no empirical basis.
 - Duplicate publications in different databases.
3. The selected articles were analyzed according to:
 - Time distribution (number of publications per year).
 - Geographical distribution (countries with the most scientific production on the subject).
 - Main keywords and research trends.

3.2.2. Semi-structured interviews

In addition to the bibliometric analysis, 20 semi-structured interviews were conducted with professors and researchers from universities in Portugal, Brazil and Spain. These countries were chosen because

of their contrasting digital education policies: while Portugal prioritizes HAS-STEM integration, Brazil focuses on technical literacy (Machado & Silva, 2024).

Participants were selected based on the following criteria:

- University professors with experience in interdisciplinary AI teaching.
- Researchers in STEM, HAS or interdisciplinary areas with publications on AI in education.

The interviews covered three main aspects:

1. Benefits of interdisciplinarity in AI literacy.
2. Challenges faced in implementing integrated curricula.
4. Suggestions for strengthening collaboration between STEM and HAS in AI teaching.

The responses were recorded, transcribed and analyzed qualitatively using thematic analysis, categorizing emerging patterns in the experts' perceptions.

3.3. Data Analysis

The data collected was analyzed quantitatively and qualitatively. For the bibliometric data, descriptive statistics were used (frequencies, distributions by year/region, keyword analysis). The interviews were analyzed using thematic categorization, identifying patterns in the participants' responses. The emerging categories were compared with the existing literature to identify convergences and gaps.

3.4. Study limitations

This study has some limitations:

- I. Narrow geographical focus – The qualitative data was only collected in Portugal, Brazil and Spain, which may limit the generalizability of the results.
- II. Article selection criteria – The bibliometric analysis was based only on Scopus, Web of Science and Google Scholar, which may exclude relevant studies published in other databases.
- III. Number of interviewees – Although the sample of 20 experts is relevant, a larger number of participants could further enrich the qualitative analysis.

4. Results and Discussion

This section presents and analyzes the results obtained from the bibliometric analysis as well as the semi-structured interviews with experts. The bibliometric analysis provides a quantitative view of the evolution of interdisciplinary AI research in higher education, while the interviews offer a qualitative perspective on the challenges and opportunities of integrating STEM and HAS in AI literacy. Initially, the quantitative analysis of bibliometric data is presented, showing trends in academic production and the countries that publish the most on the subject. We then discuss the perceptions of the experts who were interviewed, analyzing the benefits, challenges and recommendations for strengthening interdisciplinary collaboration.

4.1. Quantitative Results – Bibliometric Analysis

The bibliometric analysis revealed a significant growth in publications on interdisciplinarity in AI in higher education between 2020 and 2024, as shown in Table 1.

Table 1: Evolution of Publications by Year.		
Year	Number of Articles	Growing Percentage
2020	11	—
2021	16	+45%
2022	13	-18%
2023	25	+92%
2024	34	+36%
2025*	1 (partial data)	—

It should be noted that the data for 2025 is partial, as it was collected in the first month of the year.

The most significant increase actually occurred in 2023 (+92%), coinciding with the advance of

generative AI and its growing adoption in higher education (Zhai, 2024). This growth is in line with global trends, such as increased funding for AI research and interdisciplinary education, particularly in countries such as the United States, China and members of the European Union (Razmerita, 2024).

The geographical distribution of publications indicates that the United States leads research into interdisciplinary AI (40% of studies), followed by Europe (25%) and Asia (25%), as shown in Table 2.

Table 2: Geographical Distribution of Publications.	
Region	Number of Articles
EUA	40
Europe	25
Asia	25
Global/Collaboration	10

The predominance of the US can be attributed to massive investments by the National Science Foundation (NSF) and initiatives to integrate AI into university curricula (Chen et al., 2024). In Europe, the strong presence of publications is associated with EU regulations on AI, ethics and interdisciplinary education (Dignum, 2021). In Asia, the emphasis on AI in education reflects government policies aimed at technological innovation and professional training (Vaidya, 2024).

The 92% growth in 2023 is also directly associated with the impact of ChatGPT on higher education (Chan & Hu, 2023), while the predominance of US publications (40%) highlights investments in AI ethics (Chen et al., 2024). In addition, keyword analysis (Table 3) revealed that the most frequent terms reflect an integrated approach to AI, highlighting concepts such as STEAM, AI literacy and active methodologies.

Table 3: Main Keywords in the Publications Analyzed.		
Keyword	Frequency	Interpretation
STEAM	High (>50%)	Indicates a tendency to integrate arts and humanities in AI teaching.
STEM	High (>50%)	Basis for technical and scientific training in AI.
AI literacy	High (>50%)	Demonstrates the growing concern for AI training.
Interdisciplinarity	Medium (20-50%)	Reflects the search for collaborative approaches between STEM and HAS.
Active Methodologies	Medium (20-50%)	Represents the use of innovative pedagogical approaches.

The strong presence of STEAM and AI Literacy reinforces the need for educational programs that combine computational skills with critical thinking and innovation, in line with studies that advocate a hybrid approach to training AI professionals (Gunkel, 2024).

4.2. Qualitative Results - Interview Analysis

The interviews with the 20 STEM and HAS experts revealed three main benefits of interdisciplinarity in AI education:

- Increased critical thinking – Participants highlighted that combining STEM and HAS allows students to develop deeper analytical skills about the impacts of AI on society.
- Development of innovative solutions – Interdisciplinary projects stimulate creativity and complex problem-solving, which are key to advancing responsible AI.
- Improved AI ethics – Collaboration between technical and humanistic fields strengthens students' ability to identify algorithmic biases and develop fairer systems.

These findings corroborate previous studies, such as those by Chen et al. (2024), which showed that students exposed to interdisciplinary curricula are 25% better able to detect ethical problems in AI.

However, experts have also identified significant challenges to the implementation of interdisciplinarity, namely:

- Lack of institutional support – Many university programs do not have formal policies to encourage collaboration between STEM and HAS.
- Epistemological differences – The quantitative approach of STEM contrasts with the qualitative emphasis of HAS, making curricular integration difficult.

- Teacher resistance – Teachers are often hesitant to change their traditional methodologies to include interdisciplinary perspectives.

Such barriers reflect the challenges pointed out by Bobula (2024), who argues that resistance to interdisciplinarity is one of the biggest obstacles to higher education reform.

4.3. Discussion

The results confirm that collaboration between STEM and HAS strengthens AI literacy, preparing students to deal with technical, ethical and social challenges. When compared with previous studies, the findings of this work indicate that:

- Interdisciplinarity improves students' ability to detect algorithmic biases (Chen et al., 2024).
- Hybrid educational models result in greater creativity and technological innovation (Puspaningtyas, 2022).
- The job market is already demanding professionals with interdisciplinary AI skills (Razmerita, 2024).

However, institutional and curricular resistance are still challenges that need to be overcome. Universities that have adopted hybrid curricula, such as MIT, have shown that strategies such as coding labs combined with speculative design studios can generate positive results (Resnick, 2024).

Therefore, in order to maximize the impact of interdisciplinarity in AI education, it is essential that academic institutions implement policies to encourage collaboration between STEM and HAS and reformulate their curricula to integrate technical and reflective skills.

5. Conclusion

This study demonstrated that integration between STEM and HAS is essential to strengthen AI literacy, promoting an interdisciplinary approach that combines technical skills, critical thinking and ethics. The bibliometric analysis confirmed a significant growth in research on interdisciplinary AI, while the interviews highlighted concrete benefits of collaboration between areas. Overall, this work has led to the conclusion that:

- I. Interdisciplinarity improves students' ability to make ethical decisions.
- II. Hybrid curricula increase creativity and technological innovation, preparing students for real challenges.
- III. Institutional and curricular resistance are still barriers to the implementation of interdisciplinary approaches.

5.1. Implications for Higher Education

Based on the results, three recommendations are suggested to strengthen AI literacy through interdisciplinarity:

1. Curriculum reform – Universities should adopt hybrid models, combining technical training in AI with subjects in the social sciences, philosophy and ethics.
2. Institutional policies – It is essential to create incentive programs for STEM and HAS teachers to develop collaborative projects.
3. Teacher training – Teachers should receive interdisciplinary training to integrate quantitative (STEM) and reflective (HAS) approaches in AI teaching.

These recommendations are in line with initiatives already implemented at universities such as MIT and Stanford, where AI labs and speculative design studios have shown success in training professionals who are better prepared for the challenges of AI (Resnick, 2024).

5.2. Prospects for the future

Although this study has advanced the understanding of interdisciplinarity in AI literacy, some questions remain open and could be explored in future research:

- Longitudinal analysis – Investigate the impact of interdisciplinarity on the career path of alumni, for example.

- Expansion of the sample – Include universities from other regions to understand cultural variations in the adoption of hybrid models.
- Experimental studies – Evaluate the effectiveness of different interdisciplinary methodologies in teaching AI.

5.3. Closing remarks

The unprecedented pace of Artificial Intelligence (AI) innovation is reshaping industries, economies, and societies at large. Yet, this rapid evolution brings with it profound ethical, social, and legal challenges—from algorithmic bias and data privacy breaches to the erosion of democratic processes and labor displacement. In this context, the traditional silos between STEM (Science, Technology, Engineering, and Mathematics) and HAS (Humanities, Arts, and Social Sciences) are not merely academic divides; they represent a critical fault line in our ability to steward AI responsibly. Professionals equipped *only* with technical prowess risk perpetuating systems that replicate historical inequities or overlook human dignity. Conversely, those versed solely in ethical critique lack the tools to implement meaningful change. The integration of these disciplines is not a lofty ideal—it is an urgent necessity. Therefore, it is hoped that this study will contribute to the formulation of academic policies that encourage interdisciplinarity, preparing new generations to face the ethical and technological challenges of the digital society.

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