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Mapping global ethical AI principles into Indonesian higher education: a framework for responsible institutional implementation

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ABSTRACT

Artificial intelligence (AI) is an essential component of higher education's digital revolution. But its application unlocks a chain of ethics issues that must be resolved in an organized manner. This study uses mapping between United Nations Educational, Scientific, and Cultural Organization (UNESCO) and Organisation for Economic Co-operation and Development (OECD) guidelines and illustrates whether both guidelines can actually be implemented by Indonesian universities. In this study, a literature review and analysis of the content of the AI policy framework at the international level were conducted which were then applied to understand the operating environment in higher education. The findings in this study emphasize eight contextually meaningful ethical norms such as fairness, transparency, accountability, data protection, sustainability, inclusion, AI literacy, and ethical governance. Each of these values is combined with real-world practices such as algorithmic audits, multidisciplinary coordination, regulations for data encryption, and the formation of an AI ethics committee. In addition, this study produces a strategic narrative that can serve as a guide for universities in Indonesia when developing AI systems. The contribution of this study is the creation of a framework that can be applied to provide information to stakeholders on how to align AI-based applications with international standards while remaining oriented towards local values and laws in Indonesia.

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1. INTRODUCTION

In recent years, artificial intelligence (AI)-based technologies have increasingly become an important part of higher education environments [1], [2], with all their potential to analyze transformative learning, simplify administration, and as research support tools [3], [4]. The AI approach is evolving by integrating existing operations in universities such as assessment applications to learning and support systems for assessment [4]–[6]. With all its advantages, AI brings serious ethical issues [7], [8] such as algorithmic bias, transparency, and violations of data privacy [9].

At the global level, United Nations Educational, Scientific, and Cultural Organization (UNESCO) and Organisation for Economic Co-operation and Development (OECD) have responded to these concerns

by formulating a series of general ethical principles for using AI in the context of education [10]. UNESCO's recommendations on AI and the principles for the use of AI based on the OECD emphasize that AI-based applications must uphold human rights, increase transparency, responsibility, fairness, and can promote sustainable development [10], [11]. These principles are designed as ethical anchors and regulatory references for industry, government, and educational institutions.

In Indonesian higher education, AI implementation has been increasingly picking up speed [12]–[15], but institutional sensitivity and ethical control mechanisms are present in limited or fragmented forms. As AI is being employed by universities throughout digital learning spaces, admissions systems, and campus activities, the ethical foundations of these technologies remain underdeveloped or absent [16], [17]. The mismatch between record tech adoption and slow ethical catch-up calls for urgent re-examination of AI deployment, utilization, and governance within the university setting [16], [18].

This study bridges that gap by mapping systematically UNESCO and OECD's ethical AI principles into concrete implementation strategies for higher education institutions (HEIs) in Indonesia. Rather than theorizing ethical AI as an idealized or abstract concept, this study breaks down each principle; fairness, transparency, and accountability into concrete steps to be followed by universities. These steps include algorithmic auditing, interdisciplinary collaboration in AI research and development, use of explainable artificial intelligence (XAI) tools, ethical data governance policy implementation, and establishing an internal AI ethics committee.

Besides, the study provides a structured framework that is strengthened by expected consequences, stakeholder roles, and measurable performance markers. By bringing physical meaning to the model for implementation, the study aims not only to promote ethical awareness but facilitate institutional transformation that allows AI utilization to be aligned with international best practice and regional education values. In sum, this paper contributes to the growing discourse on AI ethics by bridging normative frameworks with grounded, context-sensitive application. It provides a roadmap for Indonesian universities to proactively manage ethical risks while harnessing AI's full potential to improve the quality, equity, and integrity of higher education.

2. ETHICAL ARTIFICIAL INTELLIGENCE: CONCEPTUAL FOUNDATION

The ethical AI debate has been increasing increasingly in academe and policy circles, driven by growing AI dominance in critical decision-making across sectors, including education. As testing yields to pervasive application in HEIs, the imperative to articulate ethical guardrails is now most imperative. Ethical AI is the development and deployment of AI technologies in accordance with ethical values and moral standards [19]–[21], such that such technologies are utilized in means that are fair, transparent, and respectful of human rights and human dignity. Previous research, have laid down theoretical foundations for ethical AI on the basis of principles of beneficence, non-maleficence, autonomy, justice, and explicability [22]. These same principles also find resonance across various international models of AI ethics, with adaptations according to the governance, organizational cultures, and degrees of technological advancement.

2.1. UNESCO's recommendation on the ethics of artificial intelligence

The 2021 UNESCO's recommendation on the ethics of AI is the global normative AI ethics framework supported by 193 member states [11], [23], [24]. UNESCO's framework promotes values of human agency, environmental sustainability, data privacy, cultural diversity, and solidarity. UNESCO's framework specifies 10 ethical principles and 11 policy action areas, including governance, capacity-building, and ethical impact assessment [25]. UNESCO, in education, demands AI systems that enhance teacher and learner empowerment, reduce bias, and expand access and equity [26]. The framework consists of eight core ethical principles that are particularly relevant to education, public services, and social governance [27].

i) Human rights and fundamental freedoms: this principle is useful for providing an understanding that AI must be subject to human rights law and not be classified as a violation of civil liberties. In addition, this principle is based on the protection of AI users from monitoring, profiling, and manipulation and ensures that user dignity, privacy, and freedom are maintained.
ii) Environmental and societal well-being: in this principle, AI must be in accordance with the goals of sustainability and the common good by prioritizing energy-efficient systems. Also, the use of AI is prioritized to solve global problems such as climate change, poverty, and health.
iii) Inclusiveness and non-discrimination: in this principle, AI is designed to avoid social inequality. This principle also regulates an inclusive system and also considers elements of culture, gender, language, and the abilities of each person.

iv) Transparency and explainability: stakeholders are expected to be able to observe how AI works. This is expected to provide encouragement towards the development of clear, logical AI systems, clearly defined data sources, and easy-to-understand rationales.
v) Responsibility and accountability: users are required to be fully responsible for the results produced by AI-based systems. In order for the system used to be safe and reliable, a human monitoring mechanism, proper channels for correcting misunderstandings, and organizational supervision that focuses on ethics need to be created.
vi) Data protection and privacy: AI-based systems are required to be able to protect personal data and also ensure that the data remains confidential, accurate, and secure. This means that there must be user consent where this mechanism must comply with laws such as the Indonesian personal data protection (PDP) law to respect the privacy rights of each user.
vii) Human oversight and determination: AI are supportive, not replacing the role of humans in decision-making. Every decision-maker must remain in control either by being directly involved in the decision-making process or by overseeing ethical decision-making.
viii) Awareness and literacy: to implement AI wisely, users must understand its workflow. Building AI literacy is expected to help users think critically and ask relevant questions.

2.2. OECD's artificial intelligence principles

The principles governing the use of AI formulated by OECD in 2019 have been supported by more than 40 countries [28]. Therefore, it can be said that this framework is quite reliable to be used as a guide. The OECD principles have been included in the national AI planning of most countries in the world [10]. Table 1 shows comparison of UNESCO and OECD AI principles.

Table 1. Summary comparison of UNESCO and OECD AI principles

Principle	UNESCO focus	OECD focus
Human rights	Human dignity and freedoms	Human-centered values
Sustainability	Ecological balance	Inclusive growth and SDGs
Inclusiveness	Eliminating bias and accessibility	Social inclusion
Transparency	System traceability and clarity	Decision-making logic
Accountability	Clear governance and redress	Traceability and auditability
Privacy	Consent and data security	Embedded under fairness
Human oversight	Human-in-the-loop	Emphasized in accountability
Literacy	AI education and awareness	Indirectly supported in enabling environments

The values of the OECD guidelines are the use of AI as a responsible and supportive innovation product [29]. This framework has five principles [10], [30] namely:

i) Inclusive growth, sustainable development, and well-being: AI is expected to facilitate broad benefits for the world community such as economic growth, poverty alleviation, and supporting sustainable development goals (SDGs).
ii) Human-centred values and fairness: this principle emphasizes freedom, dignity, and justice in AI-based systems. Also, demanding protection from discriminatory situations and providing freedom and respect for every individual's rights.
iii) Transparency and explainability: regulators and users must know why the AI systems reach a particular decision. This transparent algorithmic decision is open to scrutiny.
iv) Robustness, security, and safety: AI must be technologically credible and protected from harmful malpractices. Systems should be safe-tested and methodically scrutinized to prevent unintentional harm.
v) Accountability: AI developers and deployers will be held responsible for outcomes. This includes record-keeping, auditability, and resource mechanisms in case there are negative consequences.

2.3. Artificial intelligence in higher education in Indonesia

AI technologies in higher education are applied for an enormous range of applications such as intelligent tutoring systems, predictive analytics of student performance, automated grading, plagiarism detection, and administrative simplification. Despite the innovations' potential for enhanced efficiency and customization, they introduce new ethical conflicts. These include algorithmic bias, surveillance, non-consent, and transparent decision-making [31].

In the Indonesian context, AI education research is only starting to take shape, very often limited to technical development or adoption studies [12]. Ethical concerns are often overlooked or treated superficially [32]. It is rare for Indonesian universities to have AI ethics boards or clearly defined policies in place regarding the use of AI in teaching and administration. This underscores the pressing need for a

formalized ethical AI system in alignment with global standards as well as socio-cultural and regulatory environments of Indonesia.

Despite the existence of global ethical standards, their translation into operational guidelines and practices is uneven [19], [33], [34]. The barriers are low levels of AI literacy among staff, poor technical infrastructure to facilitate ethical protection, low levels of stakeholder participation, and lack of clearly defined accountability processes. This research gap offers a possibility that the study could provide a contextualized, operational guidebook to ethical AI adoption in Indonesian HEIs.

3. RESEARCH METHOD

This study follows a qualitative interpretive approach, combining literature-based documentary analysis, and comparative ethical framework mapping to design a localized AI ethics implementation model for HEIs in Indonesia. The steps of research are as follows:

i) Documentary analysis of international frameworks: the research began with an in-depth reading and analysis of two globally acclaimed ethical guidelines which are: the 2021 UNESCO recommendation of the ethics of AI and the 2019 OECD principles of AI.

ii) Comparative framework mapping: a mapping exercise was conducted to identify overlaps, divergences, and complementary points between the UNESCO and OECD frameworks. Ethical principles from both sources were compared and synthesized systematically to produce a consolidated set of normative values relevant to the Indonesian higher education context.

iii) Contextualization to Indonesian HEIs: the synthesised ethical values were subsequently contextualised to reflect the realities of AI adoption and management in Indonesian higher education sector. This entailed studying local policies, institutional capacities, cultural norms, and national digital transformation agendas.

iv) Development of the ethical AI framework: through the mapping and contextualisation process, the study developed a contextualised AI ethics framework for Indonesian HEIs. The framework spells out: eight main ethical principles: fairness, transparency, accountability, data protection, sustainability, inclusion, AI literacy, and ethical governance, implementation strategies such as algorithmic auditing, interdisciplinarity coordination, and the set-up of ethics committees, anticipated outcomes (e.g., increased trust, responsible AI deployment, and compliance with global and national standards), and main stakeholders (e.g., university leadership, data protection officers, expert faculty members, IT departments, and ethics boards. The framework is not merely a theoretical contribution but also a practical roadmap for Indonesian universities to adopt AI practices in accordance with international ethics and considering local conditions.

4. RESULTS AND DISCUSSION

Based on the mapping of recommendation on the ethics of AI by UNESCO year 2021 and 2019 OECD ethical AI principles, this study developed a contextualized framework tailored to Indonesian HEIs. The framework identifies eight core principles. It also provides practical implementation strategies, associated outcomes, and relevant stakeholders (Table 2).

The firstly, fairness and non-discrimination, is derived from UNESCO principle 3 (articles 26–28) and OECD principle 2 (article 1.2). It is stated that AI systems are to be developed and utilized in such a way as to promote inclusion and not perpetuate existing prejudice. In the Indonesian context, it has particular implications for student admissions, financial aids provision, and grading systems. This is achieved through institutions carrying out algorithmic fairness audits, data made demographically representative, and inclusive decision models. Equal treatment of all students irrespective of gender, ethnicity, or socio-economic status is what is being aimed for. Outcome diversity and lack of evidence of recorded algorithmic bias are the key indicators of success.

The secondly, transparency and explainability, takes inspiration from UNESCO principle 4 (articles 29–31) and OECD principle 3 (article 1.3). This norm is the foundation of the stakeholder expectation that ranges from students to instructors to administrators who are informed about how AI systems arrive at decisions. At universities, this involves those systems that are used within grading, recommendation, or administrative automation. XAI is to be utilized wherever achievable, with extensive documentation and transparency to algorithmic rationale. Through facilitating this user knowledge and understanding of AI systems, universities facilitate democratic and participatory decision-making. These key performance indicators (KPIs) can be articulated by the proportion of XAI solutions and users' positive feedback on decision clearness.

The third principle is accountability and responsibility, which is aligned to unesco principle 5 (articles 32–34) and OECD principle 5 (article 1.5). It stresses that institutions must have clear lines of accountability for the development, deployment, and monitoring of AI systems. Practically, this can involve the hiring of AI ethics officers, the establishment of internal ethics review boards, and the formulation of reporting protocols for AI failures or abuse. Accountability will make certain that AI systems are not launched without human oversight and that harm caused by automation can be addressed properly. The expected outcome is institutional clarity of ownership and prompt response to ethical breaches, tracked through the number of cases reported and response resolution time.

Table 2. Ethical AI framework for higher education in Indonesia

Ethical principle	UNESCO principle and article	OECD principle and article	Key stakeholders	Implementation practices	Expected outcomes	KPI
Fairness/non-discrimination	Principle 3– inclusiveness and non-discrimination (art. 26–28)	Principle 2– human-centered values and fairness (art. 1.2)	University leaders, IT dept, admission office	Fair algorithm policies, diverse training datasets, inclusive access in AI tools	Reduced bias in admissions and evaluations	Percentage of fair AI audit outcomes; representation ratio in AI-supported processes
Transparency and explainability	Principle 4– transparency and explainability (art. 29–31)	Principle 3– transparency and explainability (art. 1.3)	Faculty, ICT governance, developers	XAI tools, open AI decision records, data provenance logs	Increased trust in AI decisions	Percentage of AI systems with explainable modules; feedback from users
Accountability and responsibility	Principle 5– responsibility and accountability (art. 32–34)	Principle 5– accountability (art. 1.5)	Rectorate, legal office, AI ethics committee	Role-based accountability charts, ethical audits, reporting mechanisms	Clear responsibility lines in AI operations	Number of accountability reports/year; time to resolve incidents
Privacy and data protection	Principle 6– data protection and privacy (art. 35–38)	Principle 2– human-centered values and fairness (art. 1.2)	Data officers, legal unit, students	Consent protocols, PDP-general data protection regulation (GDPR) compliance, encryption, access control	Enhanced trust and legal compliance	Number of systems with privacy audit; reported breaches (target: 0)
Sustainability (green AI)	Principle 2– environmental and societal well-being (art. 18–21)	Principle 1– inclusive growth, sustainable development (art. 1.1)	IT Dept, procurement unit, facilities	Energy-efficient AI design, carbon tracking, server optimization	Eco-responsible AI ecosystem	Decrease Campus energy consumption; green infrastructure certification
Inclusiveness and equity	Principle 3– inclusiveness and non-discrimination (art. 26–28)	Principle 1– inclusive growth and well-being (art. 1.1)	Student affairs, accessibility office	Multilingual AI systems, tools for disabilities, rural access	Bridging the digital divide	Increase AI adoption by underrepresented groups; accessibility audit score
AI and digital literacy	Principle 8– awareness and literacy (art. 45–46)	Not explicitly listed; aligned with enabling principles	Faculty, curriculum devs, students	Training workshops, curriculum updates, ethical AI bootcamps	Informed and competent use of AI	Number of trained personnel; pre/post-test score gains
Human oversight and ethical governance	Principle 7 – human oversight and determination (art. 39–41)	Principle 5– accountability (art. 1.5)	Rectorate, AI ethics committee, national regulator	Creation of AI Ethics boards, impact review protocols, human-in-the-loop mechanisms	Human-centric, supervised AI deployment	Percentage of AI systems reviewed by human experts; policy updates/year

The fourth principle, privacy, and data protection, is based on UNESCO principle 6 (articles 35–38) and is again aligned with OECD principle 2 (article 1.2). AI systems are likely to deal with sensitive data,

particularly in education, where students' records, performance data, and behavioral analysis are involved. Compliance with Indonesia's PDP law, and alignment with global standards such as the GDPR, is essential. Implementation includes secure data storage, consent-based data collection, and regular privacy audits. The desired result is compliance and institutional trust, and the measurable KPIs are the volume of data breaches and the percentage of encryption coverage of AI systems.

Sustainability, which is the fifth principle, takes a loan from UNESCO principle 2 (articles 18–21) and OECD principle 1 (article 1.1). It addresses the environmental impact of AI systems, encouraging universities to use energy-efficient hardware and software and adopt sustainable procurement practices. As universities are expanding digital infrastructure, there needs to be an effort to measure and mitigate the carbon footprint of AI. Green cloud computing, server optimization, and life-cycle assessment of AI tools are a few among the practices that enable sustainability. The primary outcomes are reduced energy consumption and green certification obtained, with energy consumption levels as a KPI.

The sixth principle, inclusiveness and equity, resonates with the significance of accessibility and equal opportunity, promoted by UNESCO principle 3 (articles 26–28) and OECD principle 1 (article 1.1). This principle stipulates that AI systems must benefit all groups, for instance, rural students, individuals with disabilities, and linguistic minorities. Universities may implement multilingual AI systems, provide screen readers and assistive technology, and create systems that function well with poor internet connectivity. The goal is to close the digital divide and not let any group fall behind in the digital revolution. KPIs may be adoption rates by underprivileged groups and institutional rankings in digital inclusion surveys.

AI and digital literacy, seventh principle, is consistent with UNESCO principle 8 (articles 45–46). Though not directly under OECD principles, it is covered by OECD's enabling environments under principles 1.1 and 2. The principle urges the development of human capacities to understand and critically engage with AI. Universities are encouraged to incorporate ethical AI modules in curricula, conduct interdisciplinary workshops, and provide faculty development programs. The outcome is a more conscious university community that can use and challenge AI responsibly. Indicators of success are the number of trainees and improvements in literacy tests.

The final principle, human oversight and ethical governance, is supported by UNESCO principle 7 (articles 39–41) and OECD principle 5 (article 1.5). This principle ensures that human judgment is at the forefront of all AI operations. Institutions need to set up AI ethics committees, conduct risk and impact assessments, and enforce "human-in-the-loop" designs in automated decision systems. The goal is to avoid over-dependence on AI so that the systems augment and not substitute human decision-making. The KPIs are the number of reviews by the ethics board and the percentage of AI systems with human oversight mechanisms. Put briefly, this framework provides Indonesian universities with a pathway to the ethical adoption of AI, bridging global norms and national context. It translates grand ethical concepts into actionable steps and measurable indicators, enabling universities to develop systems that are smart but also fair, equitable, and transparent.

5. CONCLUSION

The implementation of AI in higher education in Indonesia has both promising possibilities and ethical challenges. This study provides a grounded approach to linking UNESCO and OECD AI ethics principles and university institutional practice. Eight top-level principles—fairness, transparency, accountability, privacy, sustainability, inclusiveness, literacy, and human oversight—were associated with particular stakeholders, implementation approaches, and measurable KPIs. The framework offers practical recommendations for universities willing to integrate AI in ethical, responsible, and compliant manners while being mindful of local traditions and institutional environments. To further improve the study, future research would benefit from empirically testing the framework in Indonesian universities, quantifying institutional preparedness, and tracking stakeholder responses. Comparison studies of implementation between or across disciplines or between private and public universities can provide more nuanced outcomes. In addition, there are ethical issues of generative AI in education that require study, such as AI literacy shortcomings in rural schools and responsiveness to national AI policies. These steps will make good governance of ethical AI in higher education adaptive, evidence-led, and inclusive.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [DL], upon reasonable request.

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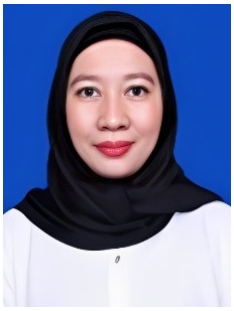

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