



Balancing Learning and Integrity: Philippine Academics' Perspectives on User-Centric AI Governance


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ABSTRACT

Academic institutions are faced with strong demands to formulate a well-defined policy to ensure responsible and ethical use of artificial intelligence (AI) in their curriculum and instruction implementation. Although AI in education holds immense promise, there is a lack of comprehensive exploration on the proper development of policy frameworks and its applicability within its user environment. The study follows the case of a Philippine higher education institution on its pursuit to develop an AI governance framework. The study engaged 18 Filipino college teachers from different disciplines and academic units in an in-person focus group discussion (FGD) on January 15, 2025, in Intramuros, Manila, Philippines. Synthesis from the discussion showed that there is a pressing need for an AI governance framework fit to the needs and culture of the institution. However, they expressed a specific preference for policies that are more guidance-oriented, i.e. more educating rather than regulating but not sacrificing academic integrity. Three (3) major themes on AI usage are technological adaptation, academic engagement, and assessment outcomes. Human agency was identified as an important mediator, particularly giving emphasis to its role of adapting to its environment. The more open the environment and academic culture are on the use of AI-assisted tools, the more users are likely to become more accepting to disclose and ethically cautious on the use of AI. The study concluded with a recommendation on the importance of the autonomy of academic institutions on educational frameworks that are not reliant on benchmarking practices and focuses more on the needs of the user environment that will promote a more dynamic, innovative, and user-centric approach to AI policy governance.

RESUMO

As instituições acadêmicas enfrentam fortes demandas para formular uma política bem definida que assegure o uso responsável e ético da inteligência artificial (IA) em seus currículos e práticas de ensino. Embora a IA na educação seja extremamente promissora, há uma carência de estudos abrangentes sobre o desenvolvimento adequado de estruturas políticas e sua aplicabilidade no contexto do usuário. Este estudo acompanha o caso de uma instituição de ensino superior filipina em sua busca por desenvolver uma estrutura de governança para IA. Para isso, 18 professores universitários filipinos de diferentes disciplinas e unidades acadêmicas participaram de um grupo focal presencial em 15 de janeiro de 2025, em Intramuros, Manila, Filipinas. A síntese da discussão revelou a necessidade urgente de uma estrutura de governança para IA que se adeque às necessidades e à cultura da instituição. No entanto, os participantes expressaram uma preferência específica por políticas mais orientadas à orientação, ou seja, mais educativas do que regulatórias, sem, contudo, sacrificar a integridade acadêmica. Três temas principais sobre o uso da IA foram identificados: adaptação tecnológica, engajamento acadêmico e resultados de avaliação. A ação humana foi identificada como um importante mediador, com ênfase especial em seu papel de adaptação ao ambiente. Quanto mais aberto o ambiente e a cultura acadêmica forem em relação ao uso de ferramentas assistidas por IA, maior a probabilidade de os usuários se mostrarem mais receptivos à divulgação e cautelosos eticamente quanto ao uso da IA. O estudo concluiu com uma recomendação sobre a importância da autonomia das instituições acadêmicas em relação a estruturas educacionais que não dependam de práticas de benchmarking e que se concentrem mais nas necessidades do ambiente do usuário, o que promoverá uma abordagem mais dinâmica, inovadora e centrada no usuário para a governança de políticas de IA.

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Introduction

The role of AI in student learning is crucial. While it can support learning through various roles- like tutoring, technical writing enhancer, facilitator, and instructional aid- may result in negative effects on student motivation, engagement, and learning. Teachers should know how to scaffold the learning when designing activities involving AI technologies. These technologies can be used as facilitators, collaborators, teachers, or simply as tools in learning for students with various learning styles (Chiu et al., 2024). In addition, Giray et al. (2024) emphasizes the need to have established regulatory policies and ethical guidelines governing the use of AI in higher education.

The use of AI can free teachers from doing repetitive administrative tasks, thus directing them to enhance quality of teaching and focus on completing tasks effectively. The practical utility of these AI tools should be considered when assessing their application into classroom instruction. In addition, emphasis on principles and ethical awareness should be addressed. Educational institutions should establish policies and standards on the adoption of AI technology in their schools (Ma & Lei, 2024). Most schools are working on the right balance of using AI, thus, the need to regulate and be responsible for its use in education is the key (Piedad, et al., 2025).

AI in educations offers both opportunities and challenges. The integration of AI-assisted technologies has the potential to reshape traditional educational approaches, leading to the creation of personalized learning experiences that cater to the unique requirements and preferences of students (Bakiner, 2023). It holds the potential to yield better learning outcomes and amplify students' performances in terms of knowledge retention due to its experiential approach (Dwivedi, et.al, 2023).

The study aims to fill the gap and to contribute to the discussion of AI policy development in education in the context of the ASEAN environment. The paper explored how institutions can develop AI governance frameworks without overly relying on external benchmarks, ensuring that policies are tailored to the unique needs of students, faculty, and academic personnel, using the case of a Philippine higher education institution during its formulation of its AI Policy.

Specifically, it analyzed the role of human agency in AI-assisted learning, the extent of use of AI tools on academic engagement and assessment outcomes, and the institutional mechanisms that uphold academic integrity AI-assisted technologies.

Materials and Methods

This study adopted a qualitative design using interpretivist lens following the insights of selected academic participants from a focus group discussion (FGD) group to explore how they construct or reconstruct the applicability and efficient use of AI-assisted technologies within their learning landscape, particularly, in classroom administration.

The study happened in a Philippine higher education located in Manila City- the capital city of the Philippines. 18 Filipino professors from different disciplines were agreed to join the FGD through a referral system. The study acknowledged the inappropriate recruitment of participants that can significantly affect the results of one's study. Thus, when identifying potential research participants, researchers clarified the context of the FGD, provided them with the information, and ensured that they have direct experience on the use of AI-assisted technologies—whether as a user or as an instructor, “to establish their interest to join a proposed research study” (Manohar, et.al., 2018).

The discussion happened on January 15, 2025, started at 1:00PM Philippine Time, through an onsite plenary setting aided by two (2) researcher-observers and one (1) facilitator. Prior conducting the FGD, participants were briefed about the objectives of the study, and they were also asked for consent whether they will continue or withdraw their participation or in any case they felt uncomfortable with the questions and flow of activities. The interview lasted between 80 minutes to 150 minutes. The interview data were kept confidential and anonymized through a file kept by the first author to avoid conflict and potential manipulation of records. The observations and verbatim were compiled, cleaned, coded, and managed manually by “making the text manageable,” and making it sensible for “developing theory” (Lewins & Silver, 2007, pp. 262–267).

Results and Discussion

Participants were welcomed in a relaxed environment, however initial interactions were minimal, which created a somewhat reserved atmosphere at first among participants. This observation is significant as it sets the tone of researchers on how to proceed with the discussion. Single FGD does not only yield qualitative data but also observational data where analyses demand a more critical reflection (Nyumba, et.al, 2081). Following the introductory phase, they were briefed with the importance of perspectives in evaluating AI's role within academia. There is a close link between people's perceptions and their socio-cultural environment which is critical in decision-making and in future actions, and the facilitator thoughtfully acknowledged upon commencement of the FGD (Nyumba, et.al., 2018).

Table 1.
Response categories from participants' use of AI in classroom

Themes	Response Categories
Diverse Use of AI Tools	curriculum development
	syllabus creation
	quizzes
	lesson augmentation
	student support
	document writing
	accreditation preparation
Needs and Challenges	student overreliance
	absence of AI policy
	ethical issues on responsible use
	better human capabilities
Comparative Insights on human agency and AI dependency	absence of emotions on AI
	need for creative prompting
	better AI practices

Table 1 showed diverse use capabilities of AI from the standpoint of teachers with diverse program disciplines highlighting AI's use in classroom. Particularly, it noted the use of AI in curriculum development, syllabus creation, quiz development, lesson augmentation, student support and tutoring system. They also recognized AI-assisted technologies as equally important in document preparation and regulatory accreditation preparations. Participants emphasized its capacity to facilitate instructional and administrative efficacy since some of them also held administrative roles like college secretary, department chairperson, program coordinator, and laboratory manager.

On the other hand, participants also identified challenges associated with AI use. The most significant concern is the overreliance of students on the use of AI, which exacerbated due to the absence of a regulation. It further suggests reviewing existing AI policies adopted by other Philippine HEIs to ensure there is common AI framework existing within the academe. This discussion sparked different views on the need and challenges of adopting a common AI policy framework fit to the needs of an institution.

Technological Use and Adaptation

Participants voiced differing perceptions on the need and challenges of formulating an AI governance framework tailored in Philippine and institutional context. One participant highlighted that some students “are extensively using AI tools without hesitation”. The absence of regulation has resulted in a laissez-faire environment where AI usage is neither guided nor restricted, leading to varied unstructured practices among faculty and students. De Almeida,

dos Santos, & Farias (2021) articulate those discourses, social negotiations, and applications of AI- assisted technologies should be guided by common voices typically from a public dialogue or forum which legitimizes a need for policy framework. Policies can either be the starting point or a result of a legitimized ground point of the public (Wallach & Marchant, 2018).

Another participant mentioned the need for policy enforcement in guiding AI ethical application. He stated that “AI use could not be completely regulated or prohibited, advocating for proper guidance and education instead”. AI-assisted technologies tend to introduce biases, compromise privacies, infringe one’s creative rights and potentially cause further harm in not adequately regulated (Bakiner, 2023). However, there is currently no single AI regulation capable of addressing privacy and ethical challenges associated with the use of AI (Bakiner, 2023). A more appropriate response involves integrating diverse core value systems and developing institutional program interventions. This perspective aligns with the responses of two (2) professors who preferred an adaptive approach rather restrictive approach. They argued that setting reasonable AI usage thresholds, accompanied by a declaration of AI use, would be more effective than punitive approaches, and must focus on the use capabilities of AI rather than simply choosing either a lack of policy or strict measures.

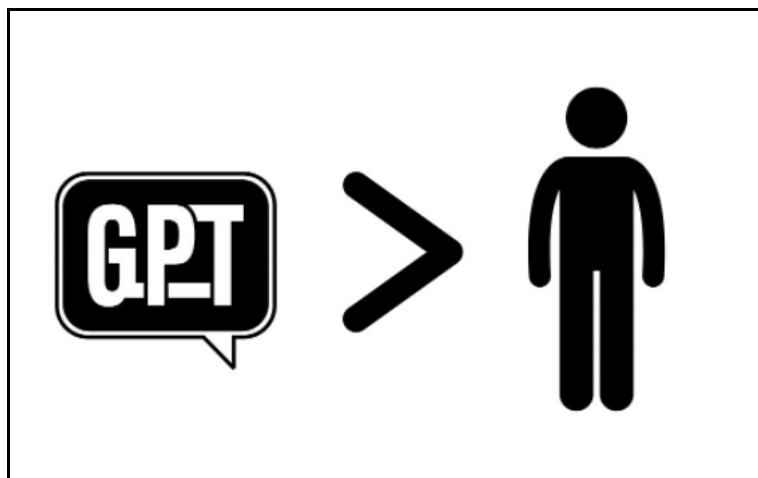
The overall emerging statements suggest that enforcing rigid guidelines may not result to a more practical and desirable approach to AI governance, rather it will only reinforce a strict measure resulting a restrictive environment; a balanced and a more adaptive approach to policy development that is appropriate to both teachers and students.

Human agency versus AI dependency

All participants agreed that AI assisted technologies are helpful when used properly and responsibly in assessments where critical skills are required. Higher education institutions that invest resources into the development of AI-driven infrastructure and expertise more often witness a favourable outcome on the academic accomplishments of students, as suggested by Altememy, et.al. (2023) in their study on the Influence of AI capabilities of HEIs on student academic performance. Adaption of new technological breakthroughs can develop an environment that is conducive for technological adaptation and innovation among students within HEIs (Okunlaya, Syed Abdullah & Alias, 2022). When users are aware of its proper use, they tend to develop better creative prompting (as shown on Table 1) and may further optimize AI use.

Figure 1.

Visualization game to choose either AI agency or human capacity



The discussion further revealed varied perceptions of human agency in AI-assisted learning. A game (figure 1 showed the dominant use of AI in most classroom activities) was facilitated among the participants, and they had to choose in which situation is necessary—AI or human agency. One (1) professor of Humanities shared his practice of encouraging students to use AI critically to stimulate independent thinking. This teaching approach shows how teacher sees AI as a strategic mediator to aid human agency in boosting learning outcomes, transforming AI from a passive tool into an active facilitator of cognitive engagement.

One participant even mentioned a criterion of 30% acceptable rate for AI use is a generally acceptable rate for student assessment but also emphasized the need to be tailored fit to the institution's educational environment. Educational platforms such as learning management tools can harness the capabilities of AI and can give remarkable capacity to tailor one's teaching methods to cater to diverse learning styles, varying paces, and individual preferences of both teachers and students (Altememy, et.al, 2023).

Conversely, a Technology professor voiced out concern over students' heavy reliance on AI, particularly for assessments that require pen and paper, even requiring the implementation of 0% AI rate policy for certain student assessments. This exchange of dialogue added to the ongoing debate as to how one views AI for education enhancement and the risks of diminishing human agency in cognitive tasks. Human agency was identified as an important mediator, particularly giving emphasis on its role of adapting to its environment. The more open the environment and academic culture are on the use of AI-assisted tools, users are likely to become more accepting to disclose and ethically cautious on the use of AI.

AI's Role in Academic Integrity and Assessment

Table 2.

AI usage across program disciplines

Discipline specific	Thematic articulation based on participants statements
Computer Science; Technology	AI-assisted technologies are utilized for programming tasks, emphasizing its role in enhancing technical skills.
Multi-Media Arts; Social Sciences	AI is integrated into creative processes, highlighting the importance of adaptation rather than restriction.
Mathematics; Psychology	AI must be restricted due to its potential undermining of logical and problem-solving skills.

Different acceptable use cases across disciplines revealed during the focus group discussion as shown on Table 2 which varies per discipline. It revealed a variety of insights and perspectives across discipline-specific pedagogical implications, reflecting differing views of AI's impact on academic engagement and learning outcomes. It further suggests that human agency plays a critical role in moderating AI's influence, having a need for a more contextual approach in terms of its applicability into teaching strategies. The integration of AI into educational contexts enhances students' cognitive skills, particularly in critical thinking wherein the need to develop the overall capacity for knowledge (Becirovic, 2023).

Xu in Côté, Togay, and Su (2022) articulated those students enrolled in academic programs with familiarity on the use of technology and focused on AI technology are more likely to become more curious and enthusiastic, potentially surpassing the efficacy of conventional educational methods. This is shown on Technology disciplines like Computer Science and Information technology where users see the relevance on the use of AI on almost all their assessments. Social Science programs, on the other hand, see its use as more of an aid to enhance their logical thinking. Programs under Mathematics and Psychology see AI use as harmful on the cognitive function of students where it can potentially replace its logical and problem-solving skills.

Critical Insights on AI adaption

Academic integrity and balancing guidance and policing on the use of appropriate AI-assisted tools are the top aspirations among participants. There is a need to tailor an AI governance specific to every user and looking at how appropriate tools can leverage and help students to achieve learning outcomes. One example is the use of AI tool on ideation of multimedia students when they draw virtual designs.

If AI is perceived as more of a deductive function rather than an inductive function for user, it could mean that conceptualization and ideation are among the exclusion on the applicability of AI on assessments. As seen on Table 2, where participants mentioned that in

disciplines such as Multi-Media Arts and Social Sciences where adaptation is defined as mainly a deductive function where ideation must come from human agency, and AI would apply a given general rule from a set of provided data points (Kent & Du Boulay, 2022). To be more accurate on the results coming from AI, users must add more data points and provide accurate prompts to be able to give logical results.

The same goes for other disciplines like Mathematics and Psychology where use of AI tools are restricted as it requires development of cognitive skills on manual computations and logical reasoning (where AI can generally do it for the learner). Additionally, mechanisms on how to integrate it within the institutional culture is also a concern that was highlighted by the participants should an AI policy be adopted in the university, specifically, concerns on maximum tolerance, academic integrity, and technology dependence.

Conclusion

The study explores the institutional need for a governance framework that balances academic integrity while also enjoying the learning capabilities of AI. Rather than adopting externally derived standards, participants emphasized the necessity for a policy tailor fit and adaptive to the distinctive academic culture and values of an HEI.

The discussion highlights the importance of leveraging institutional autonomy in policymaking, ensuring that governance frameworks are reflective of local needs rather than being derivative of external standards. Emerging themes suggests that rigid enforcement may not be practical or desirable. Instead, user-centric governance framework— one that promotes AI usage while encouraging innovation and critical thinking—would be more appropriate for changing academic landscape.

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REFERENCES

- Altememy, H. A., Mohammed, B. A., Hsony, M. K., Hassan, A. Y., Mazhair, R., Dawood, I. I., ... & Sharif, H. R. (2023). *The influence of the artificial intelligence capabilities of higher education institutions in Iraq on students' academic performance: The role of AI-based technology application as a mediator*. Eurasian Journal of Educational Research, 104(104), 267-282. <https://www.doi.org/10.14689/ejer.2023.104.015>
- Bakiner, O. (2023). *The promises and challenges of addressing artificial intelligence with human rights*. Big Data & Society, 10(2), <https://doi.org/10.1177/20539517231205476>

- Bećirović, S. (2023). *Digital pedagogy: The use of digital technologies in contemporary education*. Springer Nature. <https://doi.org/10.1007/978-981-99-0444-0>
- Bykov, I., Gladchenko, I. (2024). *How students develop creative skills and critical thinking with Chat GPT: experimental results*. *European Journal of Contemporary Education*, 4(13), 638-648, DOI: 10.13187/ejced.2024.4.638
- Chan, C. K. Y. (2023). *A comprehensive AI policy education framework for university teaching and learning*. *International journal of educational technology in higher education*, 20(1), 38, <https://doi.org/10.1186/s41239-023-00408-3>
- Chiu, T. K. F., Moorhouse, B. L., Chai, C. S., & Ismailov, M. (2023). *Teacher support and student motivation to learn with Artificial Intelligence (AI) based chatbot*. *Interactive Learning Environments*, 32(7), 3240–3256. <https://doi.org/10.1080/10494820.2023.2172044>
- Côté, A.-M., Togay, G., & Su, Z. (2022). *The Impact of Artificial Intelligence on Higher Education: Transformations, Challenges and Opportunities*. Office of the European Union, Luxembourg. <https://doi.org/10.2139/ssrn.4012883>
- De Almeida, P. G. R., dos Santos, C. D., & Farias, J. S. (2021). *Artificial intelligence regulation: a framework for governance*. *Ethics and Information Technology*, 23(3), 505-525. <https://doi.org/10.1007/s10676-021-09593-z>
- Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., & Ahuja, M. (2023). "So what if ChatGPT wrote it?" *Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy*. *International journal of information management*, 71, 102642. <https://doi.org/10.1016/j.ijinfomgt.2023.102642>
- EU Artificial Intelligence Act. (2024). *High-level summary of the AI Act, 27 Feb*, <https://artificialintelligenceact.eu/high-level-summary/>
- Filgueiras, F. (2024). *Artificial intelligence and education governance*. *Education, Citizenship and Social Justice*, 19(3), 349-361, <https://doi.org/10.1177/174619792311606>
- Giray, L., De Silos, P. Y., Adornado, A., Buelo, R. J. V., Galas, E., Reyes-Chua, E., ... Ulanday, Ma. L. (2024). *Use and impact of artificial intelligence in Philippine higher education: Reflections from instructors and administrators*. *Internet Reference Services Quarterly*, 28(3), 315–338. <https://doi.org/10.1080/10875301.2024.2352746>
- Hamal, O., Faddouli, N., Harouni, M. H. A., & Lu, J. (2022). *Artificial Intelligent in Education*. *Sustainability*, 14(5), 2862, <https://doi.org/10.3390/su14052862>
- Irwanto, I., Saputro, A. D., Widiyanti, W., & Laksana, S. D. (2023). *Global trends on mobile learning in higher education: A bibliometric analysis (2002–2022)*. *IJIET: International Journal of Information and Education Technology*, 13(2), 223-231, <http://www.ijiet.org/show-185-2408-1.html>
- Kent, C., & Du Boulay, B. (2022). *AI for Learning*. CRC Press, Taylor & Francis Group. <https://doi.org/10.1201/9781003194545>
- l-Omari, O., Alyousef, A., Fati, S., Shannaq, F., & Omari, A. (2025). *Governance and Ethical Frameworks for AI Integration in Higher Education: Enhancing Personalized*

- Learning and Legal Compliance*. Journal of Ecohumanism, 4(2), 80-86, <https://doi.org/10.62754/joe.v4i2.5781>
- Ma, S., & Lei, L. (2024). *The factors influencing teacher education students' willingness to adopt artificial intelligence technology for information-based teaching*. Asia Pacific Journal of Education, 44(1), 94–111. <https://doi.org/10.1080/02188791.2024.2305155>
- Manohar, N., MacMillan, F., Steiner, G. Z., & Arora, A. (2018). *Recruitment of research participants*. Handbook of research methods in health social sciences, 71-98. https://www.doi.org/10.1007/978-981-10-5251-4_75
- Naseer, F., Khan, M. N., Tahir, M., Addas, A., & Aejaz, S. H. (2024). *Integrating deep learning techniques for personalized learning pathways in higher education*. Heliyon, 10(11), <https://www.cell.com/action/showPdf?pii=S2405-8440%2824%2908659-6>
- OECD. (2019). *Recommendation of the Council on Artificial Intelligence*. OECD. <https://oecd.ai/en/assets/files/OECD-LEGAL-0449-en.pdf>
- O. Nyumba, T., Wilson, K., Derrick, C. J., & Mukherjee, N. (2018). *The use of focus group discussion methodology: Insights from two decades of application in conservation*. Methods in Ecology and evolution, 9(1), 20-32. <https://doi.org/10.1111/2041-210X.12860>
- Okunlaya, R. O., Syed Abdullah, N., & Alias, R. A. (2022). *Artificial intelligence (AI) library services innovative conceptual framework for the digital transformation of university education*. Library Hi Tech, 40(6), 1869-1892. <https://doi.org/10.1108/LHT-07-2021-0242>
- Piedad, E., Jr., Tabud, S. L. C., Alina-Llabado, J. A., Danao, D. A., Gironella, M. C. A., Lim, J., Francisco, A. S., & Yong, T. K. (2025). *Regulating generative AI in scholarly works: A policy brief for academic institutions in the Philippines*. Asia-Pacific Intellectual Property Management and Innovation Book Series. 6. <https://animorepository.dlsu.edu.ph/apipmibookseries/6>
- Sehgal, P., Zaidi, N. N., & Rana, S. (2024). *Application of AI in the field of education: Dynamic course generation*. International Journal for Research in Applied Science and Engineering Technology. 12(5), 31-40, <https://doi.org/10.22214/ijraset.2024.61320>
- Silver, C., & Lewins, A. (2014). *Using software in qualitative research: A step-by-step guide*. Sage Publications. <https://www.torrossa.com/en/resources/an/5018941>
- Ukeje, I. O., Elom, C. O., Ayanwale, M. A., Umoke, C. C., & Nwangbo, S. O. (2024). *Exploring an innovative educational governance framework: Leveraging artificial intelligence in a stakeholder-driven 'Open Campus Model' in South East Nigerian Universities*. International Journal of Learning, Teaching and Educational Research, 23(6), 416-440, <https://doi.org/10.26803/ijlter.23.6.19>
- Umoke, C. C., Nwangbo, S. O., & Onwe, O. A. (2025). *The Governance of AI in Education: Developing Ethical Policy Frameworks for Adaptive Learning Technologies*. International Journal of Applied Science and Mathematical Theory, 11(2), 71-88, <https://iiardjournals.org/get/IJASMT/VOL.%2011%20NO.%202%202025/The%20Governance%20of%20AI%20in%20Education%2071-88.pdf>
- UNESCO. (2021). *AI and education: Guidance for policy-makers*. UNESCO.

Wallach, W., & Marchant, G. E. (2018). *An agile ethical/legal model for the international and national governance of ai and robotics*. Association for the Advancement of Artificial Intelligence. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6191666/>.