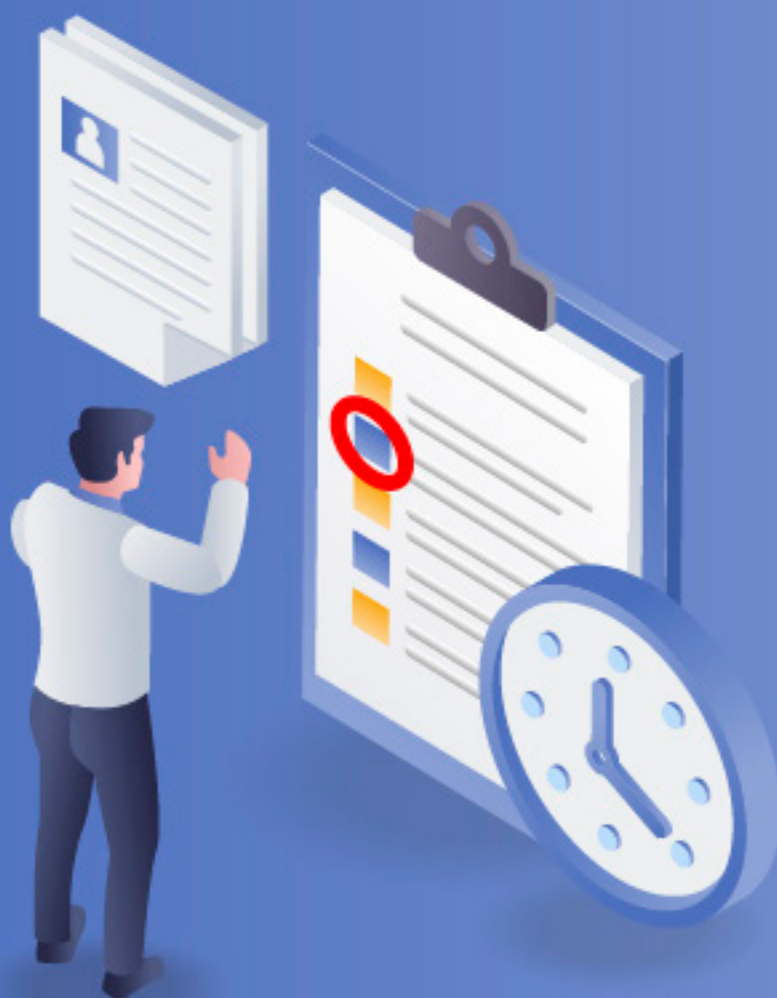




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Artificial Intelligence in Education (AIED): Frameworks, Benefits, Challenges, and Policy Implications for Philippine Basic Education

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ABSTRACT

Artificial Intelligence (AI) represents a paradigm shift in the education sector, offering transformative opportunities for teaching, learning, and educational management. This paper aims to examine the potential benefits and challenges of AI in education, as well as the existing policy and legal frameworks governing its application. An integrative literature review was employed to achieve this objective. Relevant peer-reviewed journal articles and scholarly documents were retrieved primarily from ScienceDirect and Springer and were synthesized using thematic analysis. The review revealed that AI offers significant benefits, including enhanced instructional delivery, personalized learning, and improved administrative efficiency. However, it also presents critical challenges related to data privacy and security, technological capacity and skills limitations, ethical concerns, algorithmic bias, and equity. Furthermore, the review found that while several international and national legal and policy frameworks exist to regulate AI, these frameworks remain fragmented and largely generalized, particularly in addressing the unique needs of the education sector. Therefore, there is a need for collaborative efforts among policymakers, educational leaders, teachers, and other stakeholders to develop a context-responsive AI governance framework that supports the responsible, ethical, and equitable integration of AI in Philippine basic education.

INTRODUCTION

Artificial Intelligence (AI), as one of the major outcomes of technological advancement, has become an important factor in teaching and learning for both teachers and learners. As AI continues to proliferate in educational environments, it becomes essential for policymakers, educational institutions, and stakeholders to understand the potential benefits and the emerging challenges associated with its application. Various studies have shown that AI in education (AIED) has the potential to revolutionize teaching methodologies, personalize learning experiences, and streamline administrative processes.

However, despite its promising advantages, the integration of AI in education also raises important concerns related to data privacy, ethical concerns, infrastructure, resource constraints, among others. This paper aims to review the numerous benefits and challenges that associated with AI in education and the various frameworks that guide and govern its application. This review sought to provide policy implications for Philippine Basic Education.

MATERIALS AND METHODS

This paper employed an integrative literature review to synthesize existing theoretical and empirical literature on Artificial Intelligence in Education (AIED). The review included quantitative, qualitative, and conceptual studies that examined AI frameworks, benefits, challenges, governance, and policy implications. Relevant peer-reviewed journal articles and scholarly documents were retrieved primarily from ScienceDirect and Springer.

The collected literature was synthesized using thematic analysis, through which recurring concepts and themes related to AI in education were identified, compared, and organized. Artificial intelligence tools, including ChatGPT and Google Gemini, were used to assist in organizing and synthesizing the literature. However, the interpretation, critical analysis, and conclusions remained solely the responsibility of the author.

LITERATURE REVIEW

Definition of Artificial Intelligence Across Selected Regions

Pointedly, there is no standard and single definition of artificial intelligence (European Union, 2020). In fact, it has been defined in various terms and sources (Arias C.R., 2022; Collins *et al.*, 2021). Despite of these many definitions, some common patterns are identified (Cox, A. M., & Mazumdar, S., 2024).

The various definitions of AI emphasize different elements (Table 1). Each definition share some elements with the other ones, while for certain characteristics the positions are different. The European Union, United States of America, and Organization of Economic Cooperation and Development consistently defined AI as machine-based system capable of generating outputs - such as predictions, recommendations, or decisions - based on data inputs and predefined objectives. Similarly, the United Kingdom defined AI as technology enabling device with the ability to perceive, interpret, and make recommendations, predictions, or decisions. In contrast, China defined AI as functional unit with the capability

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to perform functions that are generally associated with human intelligence such as reasoning and learning

These definitions indicates that AI can be understood as a multidimensional concept shaped by technological,

Table 1: Definitions of Artificial Intelligence (AI) Across Selected Regions and Institution

Country/Institution	AI Definition	Elements
European Union (after the proposal of the Council of the European Union)	machine-based system designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments.	Machine-Based System
United Kingdom	Technology enabling the programming or training of a device or software to a) perceive environments through the use of data; b) interpret data using automated processing designed to approximate cognitive abilities; c)make recommendations, predictions or decisions with a view to achieving a specific objective.	Technology Enabling Devise or Software
United States of America	Machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments. Artificial intelligence systems use machine and human-based inputs to a)perceive real and virtual environments; b)abstract such perceptions into models through analysis in an automated manner; c)use model inference to formulate options for information or action.	Machine-Based System
China	The capability of a functional unit to perform functions that are generally associated with human intelligence such as reasoning and learning	Functional Unit
Organization or Economic Cooperation and Development	Machine-based system that is capable of influencing the environment by producing an output (predictions, recommendations or decisions) for a given set of objectives. It uses machine and/or human-based data and inputs to (i) perceive real and/or virtual environments; (ii) abstract these perceptions into models through analysis in an automated manner (e.g., with machine learning), or manually; and (iii) use model inference to formulate options for outcomes. AI systems are designed to operate with varying levels of autonomy	Machine-Based System

Source: Chiappini, D. (2024)

functional, and governance perspectives. However, these variation among these definitions underscore the importance of adopting a context-appropriate definition. In this study, the definition provided by the Department of Education (DepEd order no. 003, s. 2026) is adopted. Accordingly, AI is defined as the capability of computer system to perform tasks that typically require human intelligence, such as perception, learning, reasoning, problem-solving, language interaction, and creative work.

Areas of Artificial Intelligence (AI)

AI comprises of several areas and classifications. These areas are Machine Learning, Deep Learning, and Generative AI. Machine Learning is a subfield of Artificial Intelligence that uses data collected and analysis to solve tasks, improve performance, and make accurate predictions in health care, finance, security, data management, and trend analysis (Banh, L., & Strobel, G., 2023; Pandey, D., Niwaria, K., & Chourasia, B., 2019; Mohri, M., Rostamizadeh, A., & Talwalkar, A., 2018).

Deep Learning (DL) is more advance subset of ML since it leverages and allows artificial neural networks to learn complex data representation and detect correlations in large data sets with multiple levels of abstraction (Banh, L., & Strobel, G., 2023; Kim, K. G., 2016; LeCun, Y., Bengio, Y., & Hintown, G., 2015). Generative AI, including Generative adversarial network (GAN), Variational autoencoder (VAE), Transformer, and Latent diffusion model (LDM), are trained to understand complex data distributions, which allows them to produce outputs that closely resemble real-world data (Banh, L., & Strobel, G., 2023).

Although that there are other areas of artificial intelligence, particular attention is given to the emerging use and implication of generative AI (GenAI). It is a model that create new output (e.g. text, code, audio, images, or video) in response to prompts, based on their training data (Borgonovi *et al.*, 2025). Moreover, GenAI can mimic human logic, writing and even creativity, mirroring some human thought processes and putting into question the

relevance of some of the skills, principles, formulas and processes taught in classroom today, including basic such as writing, grammar and even logic and discourse (The World Economic Forum, 2024). ChatGPT, Claude, Llama, and Gemini are some of the generative AI tools. Particularly, there are students that are increasingly turning to ChatGPT to help them with various tasks, from writing essays to solving complex problems (The World Bank, 2024).

Artificial Intelligence in Education (AIED)

Artificial Intelligence (AI) influences and transforms every aspect of education. A key distinction between AI as a tool for learning and as a subject of learning must be made primarily. The former concerns on how AI tools and applications can be used to enhance

teaching and learning processes. While the latter is involve on how AI system function and their ethical and societal implications (Borgonovi *et al.*, 2025).

There are four primary categories of AIED application, namely: 1) Adaptive learning and personalized tutoring, 2) Intelligent assessment and management, 3) Profiling and prediction, and 4) Emerging technologies or products. Each of this categories has its corresponding sub-categories (Figure 2). Among these applications, adaptive learning and personalized tutoring are the most studied. This category of AIED application aims to customize the learning process and create an adaptive learning environment for learners based on their knowledge level, learning style, emotional state, and interest preferences (Wang *et al.*, 2024).

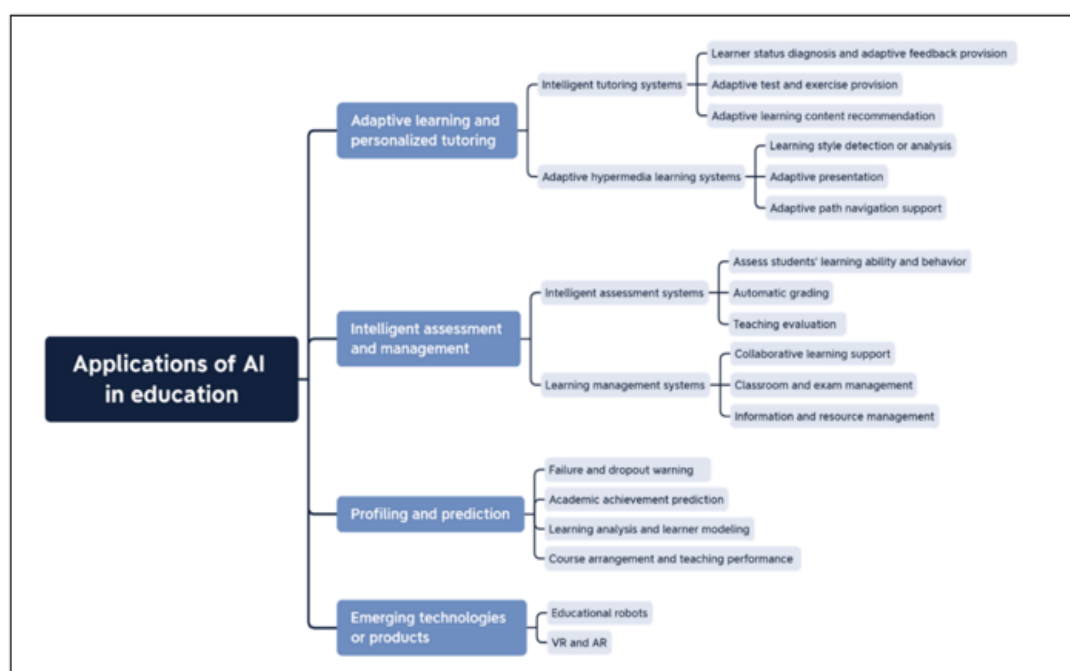


Figure 1: Artificial Intelligence Application

RESULTS AND DISCUSSIONS

Benefits of Artificial Intelligence Application among Teachers

Artificial Intelligence provides numerous benefits for the teachers (Table 2). Initially, AI supports teachers in designing, generating, and developing lesson plans, instructional material, and learning activities. It can propose, organize, produce, and assist teaching approaches, resources, discussion prompts, and instructional design processes, enabling teachers to construct more effective and captivating learning experiences (Li, Z., Wang, C., & Bonk, C. J., 2026; Reimers *et al.*, 2026; Fenta, A., 2025; Choi *et al.*, 2024; ElSayary, A., 2024).

Moreover, AI improve teaching efficiency and reduced workload as it automated repetitive and instructional tasks such as grading, drafting communications, organizing course materials, and managing records (Reimers *et al.*, 2026; Fenta, A., 2025; Van Den Berg, G., 2025; Giannakos

et al., 2025). AI as well plays significant role in enhancing assessment and feedback processes as it allows teachers in creating assessment questions across different cognitive levels, generating feedback, and evaluating student work (Giannakos *et al.*, 2025; Van Den Berg, G., 2025; Fenta, A., 2025). In addition, AI enables teachers to provide personalized learning experiences by analyzing student's learning needs, strengths, and preferences (Fenta A., 2025; Ng *et al.*, 2025; Giannakos *et al.*, 2025; Katyara *et al.*, 2025; Wafik *et al.*, 2025).

Furthermore, AI support professional development and continuous learning for teachers. Its platforms provide instructional guidance, pedagogical suggestions, and on-demand coaching. AI tools also facilitate self-directed professional development, helping teachers develop teaching strategies, reflect on practice, and enhance their instructional competencies (Reimers *et al.*, 2026; Prilop *et al.*, 2025; Majid, I., & Lakshmi, Y. V., 2022). Finally, AI

Table 2: Benefits of Artificial Intelligence Application among Teachers

Theme	Description	Sources
AI-Assisted Lesson Planning and Content Development	Artificial intelligence assists teachers in designing lesson plans, generating instructional materials, and developing learning activities. AI tools can suggest teaching strategies, curate resources, generate discussion prompts, and support instructional design processes, allowing educators to create more effective and engaging learning experiences.	Li, Z., Wang, C., & Bonk, C. J. (2026); Reimers, F., Azim, Z., Palomo, MR., Thony, C. (2026); Fenta, A. (2025); Choi, G. W., Kim, S. H., Lee, D., & Moon, J. (2024); ElSayary, A. (2024).
Improved Teaching Efficiency and Reduced Workload	AI technologies automate repetitive administrative and instructional tasks such as grading, drafting communications, organizing course materials, and managing records. This reduces teachers' workload and enables them to focus more on teaching, student interaction, and instructional improvement.	Reimers, F., Azim, Z., Palomo, MR., Thony, C. (2026); Fenta, A. (2025); Van Den Berg, G. (2025); Giannakos, M., Azevedo, R., Brusilovsky, P., Cukurova, M., Dimitriadis, Y., Hernandez-Leo, D., Järvelä, S., Mavrikis, M., & Rienties, B. (2025)
Enhanced Assessment and Feedback Processes	AI tools assist teachers in creating assessment questions across different cognitive levels, generating feedback, and evaluating student work. These capabilities enable more timely and targeted feedback, which supports improved teaching and learning outcomes.	Giannakos, M., Azevedo, R., Brusilovsky, P., Cukurova, M., Dimitriadis, Y., Hernandez-Leo, D., Järvelä, S., Mavrikis, M., & Rienties, B. (2025); Van Den Berg, G. (2025); Fenta, A. (2025)
Support for Personalized and Adaptive Instruction	AI enables teachers to provide personalized learning experiences by analyzing student data and generating customized learning materials, explanations, and activities based on students' learning needs, strengths, and preferences.	Fenta A. (2025); Ng, D. T. K., Chan, E. K. C., & Lo, C. K. (2025); Giannakos, M., Azevedo, R., Brusilovsky, P., Cukurova, M., Dimitriadis, Y., Hernandez-Leo, D., Järvelä, S., Mavrikis, M., & Rienties, B. (2025); katyara, priya, Soomro, S., Naich, M., & Harjani, N. D. (2025); Wafik, H. M. A., Prince, S. K. A., Promise, A. R., Rahman, M. A., Jahan, J., & Mallik, S. K. (2025)
Professional Development and Continuous Learning for Teachers	AI platforms support teachers' professional growth by providing instructional guidance, pedagogical suggestions, and on-demand coaching. AI tools also facilitate self-directed professional development, helping teachers develop teaching strategies, reflect on practice, and enhance their instructional competencies.	Reimers, F., Azim, Z., Palomo, MR., Thony, C. (2026); Prilop, C. N., Mah, D.-K., Jacobsen, L. J., Hansen, R. R., Weber, K. E., & Hoya, F. (2025); Majid, I., & Lakshmi, Y. V. (2022)
Facilitating Collaboration and Professional Learning Communities	AI-supported platforms can foster collaboration among educators by enabling knowledge sharing, discussion of pedagogical strategies, and collaborative problem-solving within professional learning communities.	Reimers, F., Azim, Z., Palomo, MR., Thony, C. (2026)

fosters collaboration among educators as it enables of pedagogical strategies, and collaborative problem-solving within professional learning communities (Reimers *et al.*, 2026).

Challenges among Teachers

Based on existing literature, the AI application challenges among teachers include Technological Capacity and Skills Limitations; Training and Professional Development Needs; Infrastructure, Resource, and Financial Constraints; Technological Compatibility and System

Constraints; Policy, Curriculum, and Institutional Gaps; Awareness and Work Engagement Issues; Ethical, Bias, and Equity Concerns; Data Privacy, Security, and Legal Risks; Transparency, Reliability, and Accuracy Issues; and Risk of Misuse and Academic Integrity Issues (Table 3). Technological Capacity and Skills Limitations exists as teachers faces difficulties in adopting AI due to limited technical competence and interpreting complex AI outputs, thus reducing their confidence and willingness to integrate AI into teaching practices (Abdelaal, N. M., & Al Sawi, I., 2024; Dimitriadou, E., & Lanitis, A., 2023;

Celik *et al.*2022). Training and Professional Development Needs highlight that there is a pressing need for

Table 3: AI Application Challenges among Teachers

Theme	Description	Source
Technological Capacity and Skills Limitations	Teachers face difficulties in adopting AI due to limited technical competence, challenges in adapting to new technologies, and difficulties interpreting complex AI outputs. These limitations reduce confidence and willingness to integrate AI into teaching practices.	Abdelaal, N. M., & Al Sawi, I. (2024); Dimitriadou, E., & Lanitis, A. (2023); Celik, I., Dindar, M., Muukkonen, H., & Järvelä, S. (2022)
Training and Professional Development Needs	There is a pressing need for sustained and specialized professional development to equip teachers with the necessary skills for effective AI integration. Without continuous training, AI adoption remains limited and inconsistent.	Matos, T., Santos, W., Zdravevski, E., Coelho, P. J., Pires, I. M., & Madeira, F. (2025); John Jr, G. A. (2025)
Infrastructure, Resource, and Financial Constraints	Inadequate infrastructure, lack of AI tools, unreliable internet connectivity, insufficient equipment, and financial limitations hinder teachers' ability to adopt and experiment with AI-based teaching approaches.	John Jr, G. A. (2025); Ahmed, S., Khalil, M. I., & Mohamed, F. (2022)
Technological Compatibility and System Constraints	Compatibility issues between AI technologies and existing teaching strategies or systems prevent some educators from integrating AI into their instructional practices.	Ahmed, S., Khalil, M. I., & Mohamed, F. (2022)
Policy, Curriculum, and Institutional Gaps	The absence of clear curriculum guidelines, institutional standards, and policy frameworks creates uncertainty and discourages teachers from fully integrating AI into classroom instruction.	Yedjou, C. G., Tchakoua, C. T., Tchounwou, M., Latinwo, L., Eidahl, K., Alo, R. A., & Liu, H. (2024); Cheng, E. C. K., & Wang, T. (2023)
Awareness and Work Engagement Issues	Teachers' awareness and understanding of AI significantly influence their engagement, acceptance, and actual use of AI-based technologies in academic activities.	Rahiman, H. U., & Kodikal, R. (2024)
Ethical, Bias, and Equity Concerns	Educators express concerns about algorithmic bias, ethical implications, and the risk of reinforcing existing inequalities, which may lead to unfair or inaccurate educational outcomes.	John Jr, G. A. (2025); Matos, T., Santos, W., Zdravevski, E., Coelho, P. J., Pires, I. M., & Madeira, F. (2025); Fernández-Miranda, M., Román-Acosta, D., Jurado-Rosas, A. A., Limón-Dominguez, D., & Torres-Fernández, C. (2024)
Data Privacy, Security, and Legal Risks	AI applications collect and process large volumes of sensitive student data, raising serious concerns related to privacy, consent, data ownership, security, and potential misuse.	Abdelaal, N. M., & Al Sawi, I. (2024); Yedjou, C. G., Tchakoua, C. T., Tchounwou, M., Latinwo, L., Eidahl, K., Alo, R. A., & Liu, H. (2024); Dimitriadou, E., & Lanitis, A. (2023)
Transparency, Reliability, and Accuracy Issues	AI systems often lack transparency and may generate biased, outdated, or inaccurate information, which undermines trust and poses risks in academic contexts that require accuracy and accountability.	John Jr, G. A. (2025); Matos, T., Santos, W., Zdravevski, E., Coelho, P. J., Pires, I. M., & Madeira, F. (2025); Asy'ari, M., & Sharov, S. (2024)
Risk of Misuse and Academic Integrity Issues	Concerns persist regarding the misuse of AI tools in academic settings, potentially compromising teaching quality, professional judgment, and academic integrity.	Asy'ari, M., & Sharov, S. (2024)

sustained and specialized professional development to equip teachers with the required skills for effective AI application (Matos *et al.*, 2025; John Jr, G. A., 2025). Inadequate infrastructure, lack of AI tools, unreliable internet connectivity, insufficient equipment, and financial limitations shows that AI application faces with Infrastructure, Resource, and Financial Constraints (John Jr, G. A., 2025; Ahmed *et al.*, 2022).

Another challenge among teachers is technological issues between AI technologies and existing teaching strategies or systems that prevents them from integrating AI into their teaching practices (Ahmed *et al.*, 2022). The absence of clear curriculum guidelines, institutional standards, and policy frameworks creates uncertainty and discourages teachers from fully integrating AI into classroom instruction (Yedjou *et al.*, 2024; Cheng, E. C. K., & Wang, T., 2023). Awareness and work engagement issues influence teacher's engagement, acceptance, and actual use of AI in education (Rahiman, H. U., & Kodikal, R., 2024).

Teachers also express concerns on algorithmic bias, ethical implications, and the risk of reinforcing existing inequalities, which may lead to unfair or inaccurate educational outcomes (John Jr, G. A., 2025; Matos *et al.*, 2025; Fernández-Miranda *et al.* 2024). Data Privacy, Security, and Legal Risks is seen as well as a challenge as AI applications collect and process large volumes of sensitive student data, raising serious concerns related to privacy, consent, data ownership, security, and potential misuse (Abdelal, N. M., & Al Sawi, I., 2024; Yedjou *et al.*, 2024; Asy'ari, M., & Sharov, S., 2024; Dimitriadou, E., & Lanitis, A., 2023). AI systems often lack transparency and may generate biased, outdated, or inaccurate information, which undermines trust and poses risks in academic contexts that require accuracy and accountability (John Jr, G. A., 2025; Matos *et al.*, 2025; Asy'ari, M., & Sharov, S., 2024).

Benefits of Artificial Intelligence Application among Learners

Several studies demonstrated the potential benefits of artificial intelligence (AI) application among learners (see Table 4). Increasing student's engagement and motivation is the most important benefits that AI can provide. AI not only engage students during the classroom activities but also motivate them to continue learning even outside the school premises (Filiz, O., Kaya, M. H., & Adiguzel, T., 2025). For instance, students exhibit increased engagement and interest in science courses when AI tools are integrated into learning environments (Almasri, F., 2024). These studies support the suggestion that the usage of AI for study purposes influences students' engagement and academic performance (Ma'amor *et al.*, 2024).

Personalized and Adaptive Learning Experiences is another benefit that AI can give. AI showcased its ability to cater student needs, offering tailored curricula, and adaptive assessment by supporting personalized learning experiences (Ifenthaler *et al.*, 2024). Moreover, AI supports allow learners to progress at their own pace, promotes deeper understanding, and improve learning outcomes (Santandreu Calonge, D., & Gurrib, I., 2023). Emotional support is another significant benefit, with AI applications reducing anxiety through their constant availability and increasing motivation with gamified elements and positive reinforcement (Chanpetch, N., & Songserm, U., 2023).

Finally, AI helps the development of cognitive skills and innovation. AI applications introduce new ideas and enhance problem-solving skills, fostering innovative approaches to learning (Chanpetch, N., & Songserm, U., 2023). Equally significant, AI helps in developing self-reflection, answering deep questions, resolving conflict statements, generating creative questions, and choice-making skills (Malik, G., Tayal, D.K., Vij, S., 2019).

Table 4: Benefits of Artificial Intelligence Application among Learners

Theme	Description	Source(s)
Engagement and Motivation	Integration of AI tools makes learning environment enjoyable, increasing students' engagement and motivation	Filiz, O., Kaya, M. H., & Adiguzel, T. (2025); Almasri, F. (2024); Ma'amor, H., Achim, N. A., Ahmad, N. L., Roszaman, N. S., Anuar, N. N. K., Azwa, N. C. A. K., ... & Hamjah, N. A. A. (2024); Chanpetch, N., & Songserm, U. (2023); Pandita, A., & Kiran, R. (2023); Kamalov, F., Santandreu Calonge, D., & Gurrib, I. (2023);
Personalized and Adaptive Learning Experiences	By supporting personalized learning experiences, AI showcased its ability to cater student needs, offering tailored curricula and adaptive assessment. AI supports allow learners to progress at their own pace, promotes deeper understanding, and improve learning outcomes	Ifenthaler, D., Majumdar, R., Gorissen, P. et al (2024); Kamalov, F., Santandreu Calonge, D., & Gurrib, I. (2023)

Development of Cognitive Skills and innovation	AI applications introduce new ideas and enhance problem-solving skills, fostering innovative approaches to learning. AI helps in developing self-reflection, answering deep questions, resolving conflict statements, generating creative questions, and choice-making skills.	Chanpetch, N., & Songserm, U. (2023); Malik, G., Tayal, D.K., Vij, S. (2019)
Emotional Support and Reduced Learning Anxiety	Emotional support is another significant benefit, with AI applications reducing anxiety through their constant availability and increasing motivation with gamified elements and positive reinforcement.	Chanpetch, N., & Songserm, U. (2023)

Challenges among Learners

If the teachers encountered several concerns and challenges in AI application, so does the learners. AI application challenges among learners include Data Privacy and Security; Ethical Concerns and Academic Integrity; Over-reliance on AI Tools; Reduced Learner Autonomy; Accuracy, Bias, and Reliability Issues; and Critical Thinking and Cognitive Engagement (Table 5). Primarily, the learners express their concern over the potential exposure, misuse, and unauthorized sharing of personal data when using AI tools (Sok, S., Heng, K., & Pum, M., 2025; Hesham *et al.*, 2023; Zhai *et al.*, 2021). Moreover, AI use raises ethical issues such as cheating, dishonesty, manipulation, misinformation, lack of transparency, and uncertainty about the trustworthiness of AI-generated outputs (Chan, C. K. Y., & Hu, W., 2023); Tlili *et al.*, 2023; Zhai *et al.*, 2021). Since that AI application is inevitable in education, there is increasing concern on excessive dependence on AI-assisted tools, which

undermines independent thinking and negatively affect academic performance and learning outcomes (Sok *et al.*, 2025; Fullan *et al.*, 2024; Asy'ari, M., & Sharov, S., 2024; Akgun, S., & Greenhow, C., 2022). Finally, AI application exposes the learners to potentially inaccurate, biased, or misleading AI-generated information, which may affect judgment, learning quality, and critical evaluation skills (Daskalaki *et al.*, 2024; Chan, C. K. Y., & Hu, W., 2023; Tlili *et al.*, 2023).

The literature on AI governance highlights that the development and implementation of regulatory frameworks are accompanied by significant, multi-level constraints spanning governance, institutional, and capacity dimensions. However, these challenges are largely discussed from a general perspective, underscoring the need for context-specific research. In particular, there is a need to examine how these constraints manifest in basic education settings within resource-constrained regions

Table 5: AI Application Challenges among Learners

Theme	Description	Source
Data Privacy and Security	Students express concern over the potential exposure, misuse, and unauthorized sharing of personal data when using AI-assisted educational tools, particularly due to excessive disclosure of personal information on digital platforms.	Sok, S., Heng, K., & Pum, M. (2025); Hesham, A., Dempere, J., Akre, V., & Flores, P. (2023); Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., ... & Li, Y. (2021)
Ethical Concerns and Academic Integrity	AI use raises ethical issues such as cheating, dishonesty, manipulation, misinformation, lack of transparency, and uncertainty about the trustworthiness of AI-generated outputs.	Chan, C. K. Y., & Hu, W. (2023); Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023); Zhai, X., Chu, X., Chai, C. S., Jong, M. S. Y., Istenic, A., Spector, M., & Li, Y. (2021)
Over-reliance on AI Tools	Excessive dependence on AI-assisted tools may foster learner passivity, reduce independent thinking, and negatively affect academic performance and learning outcomes.	Sok, S., Heng, K., & Pum, M. (2025); Fullan, M., Azorin, C., Harris, A., & Jones, M. (2024); Asy'ari, M., & Sharov, S. (2024)
Reduced Learner Autonomy	Heavy reliance on AI may undermine students' ability to act independently, make decisions based on personal values, and engage in self-directed learning.	Akgun, S., & Greenhow, C. (2022)

Accuracy, Bias, and Reliability Issues	Students are exposed to potentially inaccurate, biased, or misleading AI-generated information, which may affect judgment, learning quality, and critical evaluation skills.	Daskalaki, E., Psaroudaki, K., & Fragopoulou, P. (2024); Chan, C. K. Y., & Hu, W. (2023); Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023)
Critical Thinking and Cognitive Engagement	The use of AI tools may limit students' deep cognitive engagement and critical thinking when tasks are completed without genuine understanding or reflection.	Asy'ari, M., & Sharov, S. (2024); Fullan, M., Azorín, C., Harris, A., & Jones, M. (2024)

to inform more responsive and equitable AI governance strategies.

Legal and Governance Frameworks of Artificial Intelligence Across Regions

Artificial Intelligence requires the creation of specific governance mechanisms to manage its potential risks (Taeiagh A., 2021). Significantly, there are existing legal and policy frameworks governing artificial intelligence (AI) across selected regions, highlighting the number of AI policies, AI policies, types of policies and their focus (Table 6). Primarily, AI governance globally is characterized by a combination of mandatory law and regulations, guiding frameworks, and international standards, reflecting different level of institutional maturity and policy orientation. Moreover, it can be

seen that European Union and United States have the most number of AI policies. In addition, the focus area of these legal and policy frameworks are categorized into Data Management Governance, Risk Management, Risk and Auditing Management, and Human-Centric Management.

The analysis of AI policies across regions indicates that their development is largely shaped by regional contexts and institutional capacities, as reflected in the variation in both the number and types of policies adopted. Regions with more advanced governance systems, such as the European Union and the United States, tend to implement a greater number of AI policies, including a combination of mandatory regulations and structured frameworks, demonstrating a more institutionalized and regulatory-

Table 6: Global Legal and Policy Frameworks Governing Artificial Intelligence Across Selected Regions

Region	Number of AI Policies	AI Policies	Type of AI Policy	Focus
Canada	2	Canada's Consumer Privacy Protection Act (BILL C-27)	Mandatory law and regulations	Data Management Governance Area
		Algorithmic Impact Assessment	Framework	Risk Management Governance Area
Hiroshima	1	Shaping Global AI Governance	Framework	Risk Management Governance Area
OECD	1	OECD Framework for Classification of AI Systems	Framework	Risk Management Governance Area
Singapore	2	Model Artificial Intelligence Governance Framework	Framework	Human-Centric Management Area
		Model AI Governance Framework for Generative AI	Framework	Risk Management Governance Area
United states	4	Artificial Intelligence Risk Management Framework (AI RMF 1.0)	Framework	Risk Management Governance Area
		Artificial Intelligence Risk Management Framework: Generative Artificial Intelligence Profile	Framework	Risk Management Governance Area
		Blueprint for an AI Bill of Rights Making Automated Systems Work for the American People	Mandatory law	Data Management Governance Area
		Nist Assessing Risks and Impacts of AI (ARIA) Pilot Evaluation	Framework	Risk Management Governance Area

EU	5	Plan	Framework	Risk Management Governance Area
		EU AI act	Mandatory law	Risk and Auditing Management Area
		EU Assessment List for Trust worthy AI: ALTAI	Framework	Risk and Auditing Management Area
		EU General Data Protection Regulation (GDPR)	Mandatory law	Data Management Governance Area
		A Pro-Innovation Approach to AI Regulation	Framework	Human-Centric Management Area
		Governance of Artificial Intelligence (AI)—Third Report of Session 2023–24	Framework	Risk and Auditing Management Area
ISO	1	ISO/IEC 42001:2023: Information Technology Artificial Intelligence Management System	Standard	Risk and Auditing Management Area
Australia	1	NSW Artificial Intelligence Assurance Framework	Framework	Risk and Auditing Management Area

Source: Batool A., Lee S., & Dong L. (2025)

driven approach. In contrast, other regions rely on fewer but more flexible and adaptive policy instruments. While AI is already subject to multiple legal and policy frameworks across regions and institutions, these remain fragmented and generalized. This call the idea the need for a comprehensive, education-specific regulatory policy that directly addresses the implications of AI in teaching, learning, and academic governance. This gap underscore the necessity for a more coherent and context-sensitive policy framework for AI governance in education.

Artificial Intelligence (AI) Governance Frameworks in Education

Responsible Artificial Intelligence Framework (Batool, A., Lee, S., Lin, Y., & Dong, L., 2026)

This framework categorized key elements to consider while designing Responsible Artificial Intelligence (RAI) into three components: 1) Qualities, 2) Dimensions, and 3) Governance Practices (see Figure 2). Primarily, RAI can be understood as a structural, systematic

approach that integrates governance structure, ethical principles, stakeholder engagement, risk management, and operational practices to ensure that AI is developed, deployed, and maintained in an ethical, transparent, accountable, and scalable manner. Qualities as key considerations emphasize that RAI must be implemented by organizations of any size (Scalable); easily modifiable to meet an organization's legal requirements (Extensible); able to accommodate compliance requirements (Adaptive); and time-saving in implementation and operation (Efficient).

As to dimensions as key components, RAI should include AI development stages, RAI principles, and roles including both governors and subjects, which should be explicitly stated in the RAI framework (Scope); it should encompasses region agnostic/specificity, technology agnostic/specificity, and targeted audiences to help organizations (Context); and it should include implementation tools or guides available to assist organizations in effectively implementing the

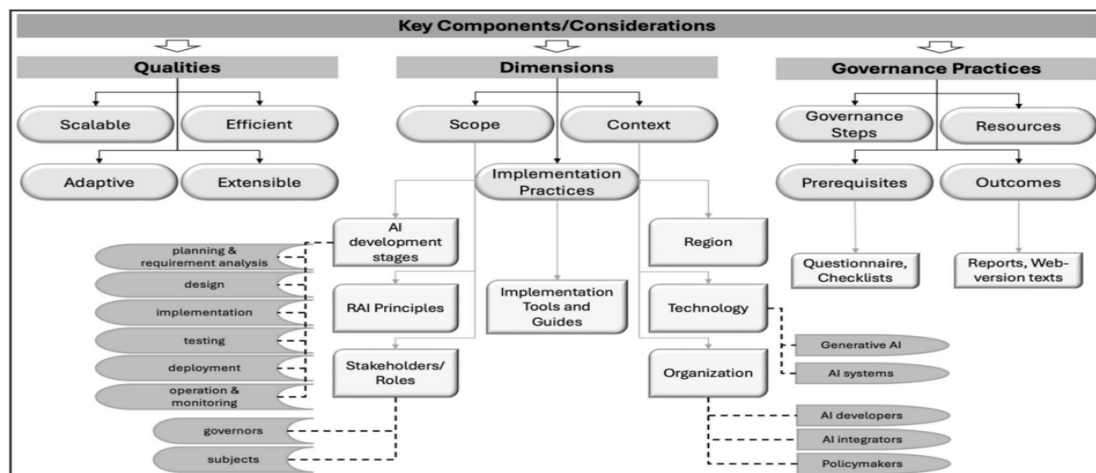


Figure 2: Key elements to consider while designing RAI framework

RAI framework (Implementation practices). Finally, for governance practices, RAI must have a clear input/output requirements, necessary requirements, and detailed steps to guide the governance practices.

AI ecological education policy framework (Chan, C. K. Y., 2023)

This framework presented three dimensions to turn policy recommendations into action plan, as follows: 1) Pedagogical, 2) Governance, and 3) Operational (see Figure 3). Pedagogical dimensions focuses on the teaching and learning aspects of AI integration. It includes the following areas: a) Rethinking assessments and examinations, b) Developing student holistic competencies/generic skills, c) Preparing students for the AI-driven workplace, and d) Encouraging a balanced approach to AI adoption. This dimension emphasizes that the teachers are the initiator as they are the one who design and implement lesson plans, activities, and assessments that utilize AI technologies. As such, they need to possessed the necessary awareness and knowledge to educate students on the potential risks associated with the use of generative AI in learning.

The governance dimensions encompasses the following key areas: a) Understanding, identifying, and preventing academic misconduct and ethical dilemmas, b) Addressing governance of AI: data privacy, transparency, accountability, and security, c) Attributing AI technologies, and d) Ensuring equity in access to AI technologies. This dimension highlights senior management as the initiator of governance as they hold decision-making authority and are tasked with developing and enforcing policies, guidelines, and procedures that address the ethical concerns surrounding AI use in education. These include academic integrity, data privacy, transparency, accountability, and security.

The operational dimension of the framework concentrates on the practical implementation of AI with the following areas: a) Monitoring and evaluating AI implementation and b) Providing training and support for teachers, staff, and students in AI literacy. This dimension highlights the importance role of the teaching and learning and IT staff as they are task in managing and maintaining the AI

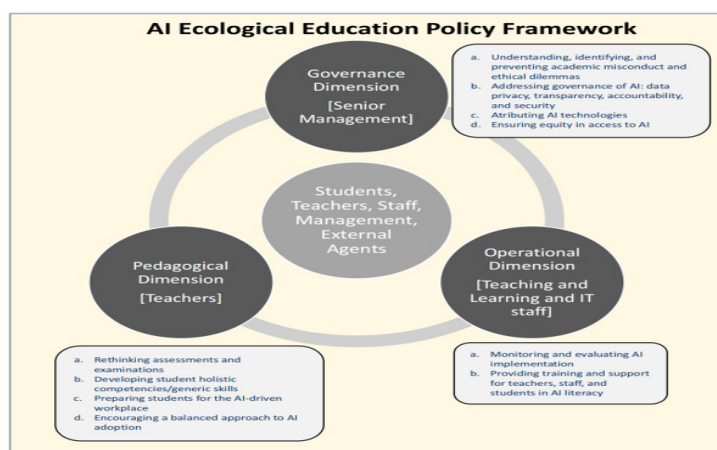


Figure 3: AI ecological education policy framework

technologies used in the educational setting. Their tasks include providing training and support for both students and staff to ensure proper functioning of AI tools and to address any technical issues that may arise.

Philippine Guiding Framework for Artificial Intelligence (AI) in Education

Through Department of Education Order No. 003, Series of 2026 (DepEd Order No. 003, s. 2026), the Philippine government released its foundational guidelines on AI in basic education. This department order is guided by European Union (EU) Act and ASEAN 2025 Expanded AI Guide. This reflects a progressive and globally aligned policy framework that balances innovation with ethical safeguards through human-centered and risk-based governance approach.

The EU AI Act was published as regulation 2024/1689 of 13 June 2024 (and in the official Journal on 12 July) (Quintais J.P., 2025). Accordingly, the act is an extremely long and complex legislative text with 180 recitals, 113

articles, and 13 annexes. It has 13 chapters that includes: General Provisions (I), Prohibited AI Practices (II), High-Risk AI Systems (III), Transparency Obligations for Providers and Deployers of Certain AI Systems (IV), General-purpose AI Models (V), Measures in Support of Innovation (VI), Governance (VII), EU Database for High-Risk AI Systems (VIII), Post-Market Monitoring, Information Sharing and Market Surveillance (IX), Codes of Conduct and Guidelines (X), Delegation of Power and Committee Procedure (XI), Penalties (XII), and Final Provisions (XIII).

The act, as proposed by European Union, is considered as the first legal framework for AI in the world (Cabrera B.M., Luiz L.E., & Teixeira J.P., 2025). This act aims to ensure the safety and rights of citizens within the framework of advances and innovations in AI systems. Nevertheless, this act deserves recognition given its influence on other countries' regulations, including the Philippines.

Significantly, the order provides the basic education

AI framework establishing the scope and foundational parameters for the adoption and use of AI in the Philippine basic education (see Figure 2). This framework covers AI application in teaching and learning, learner assessment, teacher professional development, and education governance and operations. Moreover, the framework is anchored on three interrelated areas: 1) AI in education, which governs the use of AI tools to support

instruction, learning personalization, and assessment; 2) Education on AI, which focuses on developing AI literacy, ethical awareness, and critical use of AI among learners, teachers, and education personnel; and 3) AI for education system, which covers the use of AI to enhance education governance, planning, monitoring, and school operations. Consequently, this framework shall serve as the primary

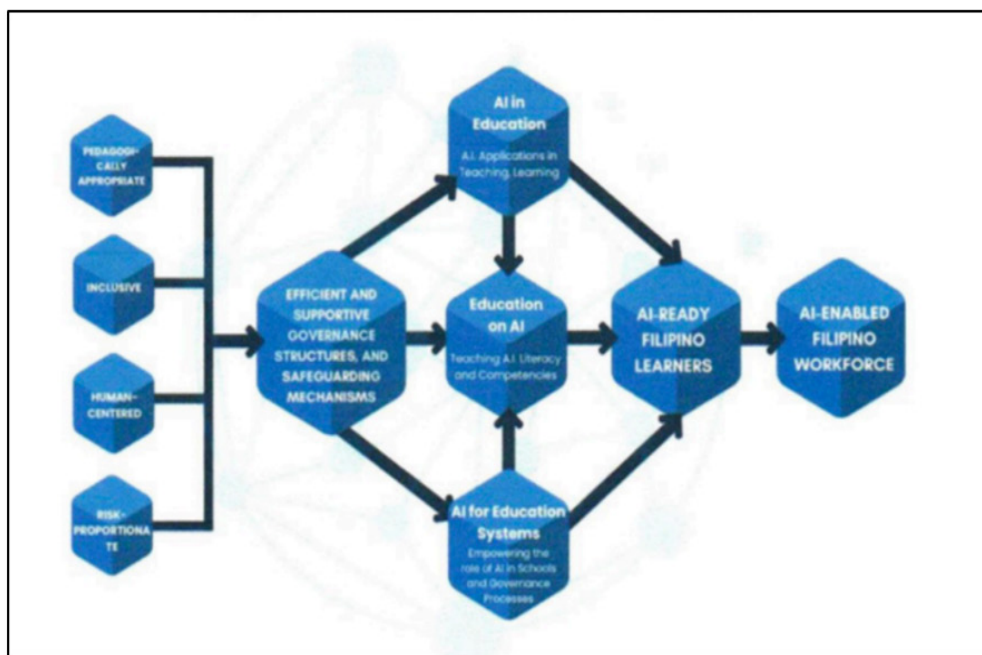


Figure 4: Basic Education AI Framework in the Philippine

reference for all DepEd policies, programs, issuance, and partnerships related to the ethical and responsible use of AI in basic education. The private schools, offering basic education, may adopt the provisions of this framework in accordance with existing laws, rules, and regulations. The issuance of DepEd Order No. 003, s. 2026 reflects the Philippine government's recognition of both the transformative potential and associated risks of artificial intelligence in basic education. However, the policy explicitly acknowledges that its implementation is contingent upon contextual factors, including resource availability, technological capacity, and institutional readiness. This conditionality highlights a critical policy gap, particularly in geographically and economically constrained regions. As such, there is a need for empirical investigation into AI readiness and application in resource-limited contexts, such as Lanao del Sur, to inform more context-responsive and equitable policy implementation.

Governance and Institutional Challenges of Artificial Intelligence

Artificial Intelligence presents significant challenges for government in designing and implementing effective policies to regulate its development and use (Taeihagh

A., 2021). These challenges stem from the complex nature of AI systems, which are often characterized as unpredictable, intractable, and nonlinear, thereby making it difficult for governments to establish clear and concrete policy objectives. Existing literature identifies a broad range of challenges associated with the use of AI in public governance. These challenges can be categorized into eight areas: 1) data challenges, 2) organizational and managerial challenges, 3) skills challenges, 4) interpretation challenges, 5) ethical and legitimacy challenges, 6) political, legal, and policy challenges, 7) social and societal challenges, and 8) economic challenges (Zuiderwijk, A., Chen, Y.-C., & Salem, F., 2021).

Beyond these categories, scholars have also emphasized critical legal and human rights concerns associated with AI (Rodrigues R., 2020). These include lack of algorithmic transparency; cyber security vulnerabilities; unfairness, bias, and discrimination; lack of contestability; legal personhood issues; intellectual property issues, adverse effects on workers; privacy and data protection issues; liability damage; and lack of accountability for harms. Furthermore, recent studies have highlighted emerging security concerns in AI systems, including data security, model security, and network security (Ofosu-

Ampong K., 2024). Despite differences in socio-political contexts and governance structures, countries are not immune to these challenges in the implementation of digital and AI initiatives (see Table 7). This suggests that the complexities associated with AI governance are pervasive and cut across varying institutional and political

environments.

In public policy parlance, implementing AI policies is challenges due to several factors (Batool, A., Lee, S., Liu, Y., & Dong, L., 2026). First, many AI policies lack clarity on resource requirements, making them difficult to be implemented by smaller organization. Second, AI

Table 7: Socio-political contexts and governance structures

Country	Political System	Governance Structure	Digital/AI Initiatives	Key Challenges
Brazil	Federal presidential constitutional republic	Multi-tiered system with federal government, 26 states, and 5000+ municipalities	“Marco Civil da Internet” framework; General Data Protection Law (LGPD)	Digital divide between urban and rural populations; socio-economic disparities
Russia	Authoritarian political system	Centralized governance with strong executive branch	National Strategy for the Development of AI (2019)	Limited political competition; state control of media; restrictions on civil society
India	Federal parliamentary democracy	Divided responsibilities between central and state governments	Digital India; National Strategy for AI (NSAI) by NITI Aayog	Regional, linguistic, and socio-economic disparities; digital inequality
China	One-party system (Communist Party)	Highly centralized state authority	“New Generation AI Development Plan”; goal to be global AI leader by 2030	Concerns about civil liberties, privacy, and information control
South Africa	Constitutional democracy	Three-tier system(national, provincial, local)	Fourth Industrial Revolution (4IR) Commission	High socio-economic inequality; digital exclusion; limited infrastructure
Egypt	Semi-presidential system	Centralized governance structure	Egypt Vision 2030; National AI Strategy (2019)	Limited political pluralism; restricted civic freedoms; urban–rural disparities
Ethiopia	Federal parliamentary republic	Ethnically defined regional states with central federal government	“Digital Ethiopia 2025” strategy	Political instability; ethnic tensions; limited digital infrastructure
Iran	Islamic Republic (theocratic and democratic elements)	Dual governance structure with Supreme Leader and elected officials	National focus on AI for self-sufficiency	International sanctions; censorship; surveillance concerns
UAE	Federation of seven emirates (monarchy)	Centralized governance structure	UAE AI Strategy 2031	Limited democratic institutions; controlled public discourse

Source: Sharma A.K. & Sharma R. (2025)

policies are complex and lack practical implementation tools. Third, many of these AI policies do not specify targeted audiences. And finally, recent AI policies are only focusing on Generative AI technology, which could lead to the neglect of other significant AI systems. This review of key challenges on AI governance and policy suggests that the development of AI policies is inherently complex and challenging due to the dynamic and evolving nature of AI systems. These

challenges are multidimensional, encompassing technical, organizational, ethical, legal, and socioeconomic domains. In light of these complexities, there is a critical need to investigate how such challenges manifest in specific-context, particularly in educational setting. This is especially important to schools located in resource-constraint regions, where limitations in infrastructure, technical capacity, and institutional support may further affect the implementation of AI initiatives.

CONCLUSION

Primarily, the review highlights that Artificial Intelligence offers both significant opportunities and substantial challenges in the field of education. It has the potential to transform education through improving instructional delivery, assisting personalized learning experiences, and improving assessment practices. Despite these potential benefits, AI in education also raises challenges and risks related to data privacy and security, technological capacity and skills limitations, ethical issues, algorithmic bias, and equity. These challenges necessitate appropriate actions through effective governance, regulatory frameworks, and institutional policies to ensure the responsible use of AI in educational settings.

Furthermore, the review reveals that, although several international and national legal and policy frameworks have been developed to regulate AI, these initiatives remain fragmented and largely general in scope. Consequently, there is a need for a comprehensive, education-specific AI policy framework that directly addresses the unique implications of AI for teaching, learning, assessment, and academic governance. Such a framework should promote the transparent, accountable, ethical, equitable, and sustainable integration of AI within educational institutions.

Hence, policymakers and relevant stakeholders should collaborate in formulating context-responsive AI governance policies, especially for Philippine basic education. These policies should support investment in digital infrastructure, capacity-building programs, ethical guidelines for AI use, data privacy, and equitable access to AI technologies. Further studies are recommended to examine the effectiveness of AI governance and policies across different educational contexts.

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