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Exploring AI Integration in the Philippine Educational System: A Literature Review on the Opportunities and Challenges

Samper G. Abad

College of Home Economics and Technology - Benguet State University

Abstract— Advanced technologies transform education in all parts of the world, including in the Philippines. AI transforms the instructional method by making learning personalized and engaging for students. The intelligent systems analyzing performance and predicting needs improve teaching and supportive environments for educators. This development calls for a reorientation of education delivery to ensure maximum impact. Challenges facing the integration of AI in education include limited opportunities to access necessary infrastructure given the digital divide afflicting most schools. More serious concerns include educators facing an insufficient amount of education and resources for deploying it. Ethical matters concern issues such as access being equal and informed. Closing the tech gaps between the developed and developing worlds requires an important strategic approach in a country like the Philippines for the empowerment of educators and students. It is not just about collaboration among the policymakers, educators, and stakeholders but an inclusive shift by tackling these challenges and working with AI towards a better future for education.

Keywords— artificial intelligence, digital divide, integration, strategic approach.

I. INTRODUCTION

Artificial intelligence integration in teaching institutions is revolutionizing classrooms, introducing opportunities for transformative teaching and learning. In the Philippines itself, where the educational setting seems to be constantly changing from the advances of technology, AI presents a promising area in the solution of many long-standing problems, ranging from personalized instruction to teaching support and access to high quality education. This integration brings to the fore critical issues of accessibility, teacher readiness, and ethical use of AI tools that call for a well-informed and balanced approach.

One of the most apparent advantages of introducing AI into the classroom is teaching efficiency. In this regard, Wang et al., argue that technology has led to substantial enhancement towards teaching approaches used by a teacher in that it allows for students' engagement as well as learning conditions (Wang et al., 2021). The concept brought forth here is that AI modeling can enhance situations with regards to how students learn and, in that, improve educational outcomes.

Fahimirad and Kotamjani put the same idea, emphasizing that AI can modify pedagogical models to present an opportunity for the individualization of learning, unique to each student's need (Fahimirad & Kotamjani, 2018). On this account, AI is capable of analyzing data in a way that gives insight on student performance, which would help the educator tailor his instruction for better educational experiences.

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Moreover, AI in education is an incentive to attract students and engage them in the learning process. According to Saimon, "The 6E learning by design model effectively trains teachers to integrate AI applications into their classrooms to support student learning" (Saimon, 2024). This model is experiential learning, which pushes teachers to use AI tools to create interactive learning experiences. The findings suggested that when teachers are properly equipped and trained, they are able to integrate AI in their teaching practices very effectively, thus improving student outcomes.

Another current research focus is the application of AI and deep learning in enhancing the learning process. For example, as Kotsis illustrates, AI can help elementary school teachers prepare as well as execute classroom experiments for better quality in school learning (Kotsis, 2024). This makes it interesting to know whether AI can provide real-time feedback on the performance of students, which would make it easier for the teacher to identify which points to troubled students and adjust her teaching accordingly (Tartuk, 2023). This capability supports a more general goal of ensuring that learning experiences are highly personalized for students, widely recognized as critical for their educational outcomes.

However, the adoption of AI in education is not without its challenges. Woodruff points out that there are significant barriers to the widespread adoption of AI technologies in K-12 education, including issues related to equitable access to technology and the need for targeted strategies to support educators (Woodruff, 2023).

Apart from access, teachers need complete professional development. Lee and Perret argue that the professional development workshops should be focused and targeted to assist high school teachers in preparing to present AI methods in the STEM classroom (Lee & Perret, 2022). In this study, it was realized that teachers needed support and resources for some time to effectively implement AI in teaching. This aligns with the assertion of Kim et al., arguing that the beliefs and attitudes of teachers are essential factors for AI integration in learning (Kim et al., 2022). A teacher needs not only technical knowledge to use AI tools but also pedagogical knowledge to use these appropriately in their practice.

Furthermore, the ethical issues of AI in education should not be overlooked. As AI tools are increasingly used in class, educators need to critically ponder the impact that these tools have on students' learning and development. Toncic calls for a critical approach to the integration of AI in schooling by stressing the social and ethical aspects of AI technologies (Toncic, 2021). This is an important step to ensure responsible and fair use of AI in educational settings. There have been studies that demonstrated most teachers are concerned about the ethics of AI, technology infrastructures, and even teacher training (Aghaziarati, 2023).

Additionally, the need for a strategic approach to AI integration is underscored by the findings of Otero et al., who call for a competency framework to guide the development of AI literacy in K-12 education (Otero et al., 2023). This framework should therefore co design itself with teachers such that the outcome supports not only student-specific requirements but also contributes to their goals in line with curriculum provisions. This would create room for developing AI literacy so that it could further provide educators the capacity of transforming students for a future-dominated challenge.

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A yet more important reason to regard AI as potentially revolutionizing the practice of education are findings from bibliometric analyses such as by Triansyah, where a quantitative indicator of increasing numbers of articles on the application of AI in education is noticed, especially among high schools (Triansyah, 2023). Thus, this points out growing attention to and consideration for how AI impacts future models for education curricula, thereby instructional models.

As educational institutions in the Philippines pursue further integration with AI, it is high time for the update on the latest research and best practices surrounding AI. This study matters because it addresses a topic of ever-growing global concern within the Philippine context as related to the interface between AI technology and education. By adding to the ongoing efforts of education modernization, promoting equity, and enhancing teaching effectiveness among students, this study adds to that knowledge by understanding opportunities and limitations for AI integration into classrooms.

It further attempts to elucidate implications of AI in teacher training, policy formulation, and holistic welfare for students. The main aim of the study is to find out how AI can be integrated effectively into Philippine classrooms, keeping in mind the local barriers and enablers. Besides this, the study focuses on good practices regarding the use of AI, inclusive, engaging, and efficient learning environments. Lastly, the study digs into the ethical and social dimensions of AI in education, ensuring that its introduction supports equitable and responsible practice. Addressing these objectives, this research provides a basis for policymakers, educators, and technology developers to jointly design strategies that take the best from AI while addressing its challenges toward the improvement of Philippine education.

II. METHODOLOGY

This systematic review adhered to the PRISMA 2020 guidelines for transparent reporting. A comprehensive literature search was conducted across major electronic databases, including Google Scholar (n = 152), ERIC (n = 34), Scopus (n = 87), and Philippine E-Journals (n = 28), yielding 301 records. Additional sources were systematically explored, including government reports (n = 16), institutional repositories (n = 22), and conference proceedings (n = 28), contributing a further 66 records. Duplicate entries were removed prior to screening, resulting in the exclusion of 82 records from database searches and 16 from other sources.

Following deduplication, 219 records underwent title and abstract screening. Of these, 103 were excluded due to lack of relevance to artificial intelligence in education, non-academic format, or absence of accessible abstracts or full texts. A total of 166 full-text reports were subsequently assessed for eligibility, comprising 116 records from databases and 50 from supplementary sources. During full-text evaluation, 57 studies were excluded for the following reasons: publication outside the specified date range (2018–2024), lack of focus on the Philippine context, absence of empirical data, or methodological limitations.

In total, 116 studies met the inclusion criteria and were retained for qualitative synthesis. Among these, 26 reports were identified as core studies and formed the primary basis for in-depth analysis. Given the heterogeneity in study designs, data sources, and outcome measures, a meta-analysis was not undertaken. Instead, findings were

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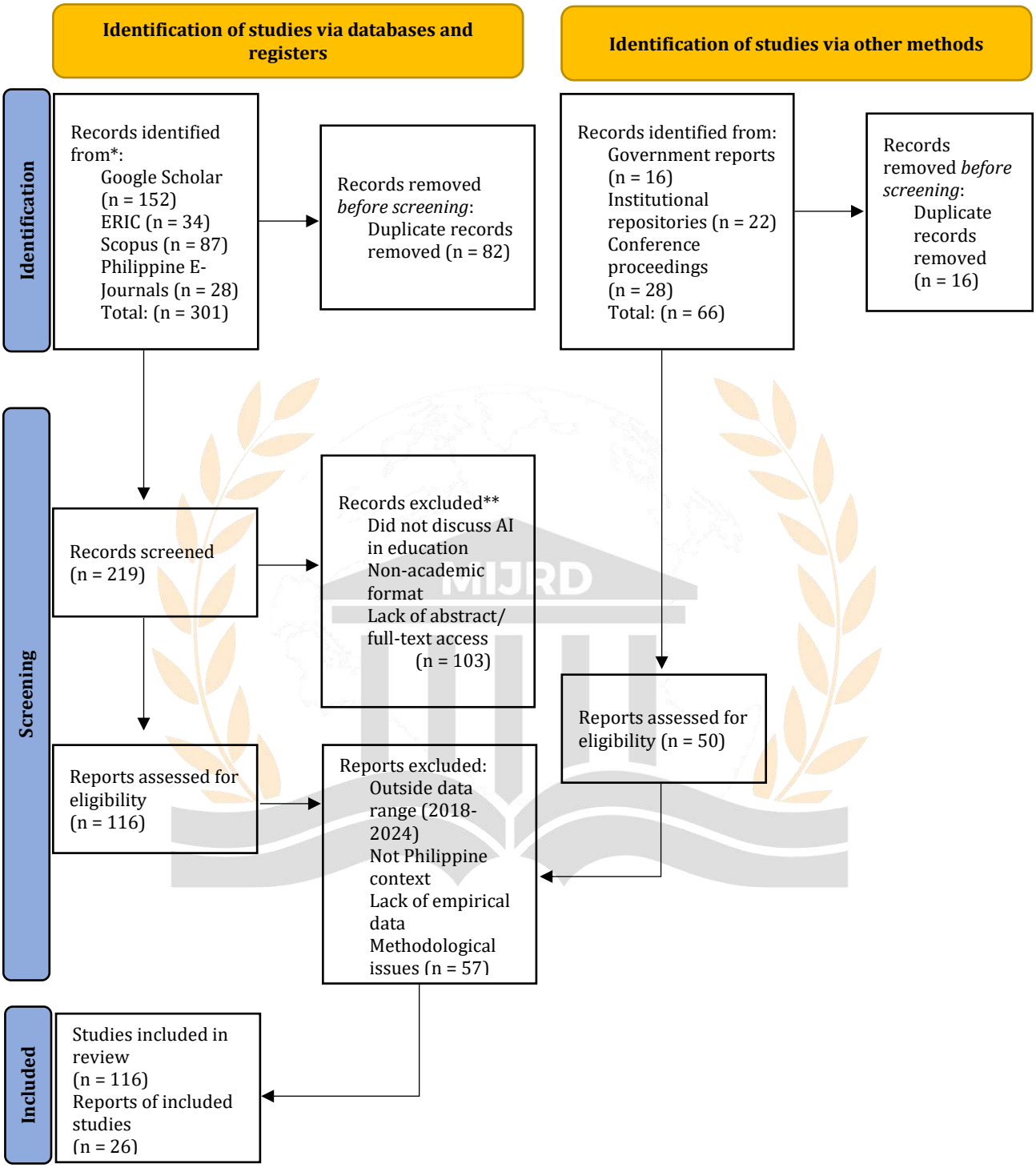
synthesized narratively, with emphasis on identifying recurring themes, methodological trends, and patterns in the application of artificial intelligence in education within the Philippine context.



Source: Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71.

Figure 01: PRISMA 2020 flow diagram

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III. RESULTS

A. Local barriers

Limited Hardware and Internet Access

The other barrier to the integration of AI into Philippine life is the diffusion of necessary hardware and internet access. Even with the concerted efforts of both the government and the private sector, hardware availability in schools is not at a critical mass 8 level, and internet access for the poorest sectors is almost nil. Lack of infrastructure, especially the technological and physical, renders implementing AI technologies very difficult, even more challenging in the context of learning when adaptive instructional systems (AISs) are most promisingly applied (Rodrigo, 2021).

Curriculum and Teacher Preparedness

The current educational curriculum in the Philippines tends to focus on basic computer literacy skills rather than integrating information and communication technologies (ICT) to support specific subjects. Additionally, teachers often lack the preparation and confidence to use technology in innovative ways. This gap in teacher preparedness further complicates the integration of AI in educational settings, as effective use of AI technologies requires a certain level of technological proficiency and confidence among educators (Rodrigo, 2021).

Weak Legal Frameworks and Data Privacy Issues

Other major barriers to AI adoption in the Philippines include the lack of comprehensive legal frameworks and concerns about data privacy and security. Such concerns require robust policy-making to establish clear legal guidelines ensuring the safe and effective use of AI technologies (Hernandez et al.,2023).

Government and Industry Readiness

The Philippines is still at the stage of learning to deal with AI adoption, and there is a need for a mental shift on the part of government and industry leaders to embrace this technology. Strengthening technology governance and strictly implementing policies, such 9 as those outlined in the Philippine Development Plan (PDP) 2017-2022 and the Harmonized National Research and Development Agenda (HNRDA), are important steps toward improving AI integration in the country (Conception et al.,2019).

B. Good Practices of AI Integration in Education in the Philippines

The adoption of artificial intelligence (AI) in the education system of the Philippines is gradually picking up, as many educational institutions embrace innovative practices that will create inclusive, engaging, and efficient learning environments. These highlights specific practices that are currently being implemented in the Philippines, focusing on how they enhance educational experiences.

Personalized Learning

AI-driven platforms are being used to personalize education content based on the needs of each student. This will enable every student to receive personalized learning and assessment, thus engaging the students and improving learning results. For example, Quizlet and AI-based virtual tutors provide customized learning experiences that

can be learned by different students in varying ways and at different paces, making education accessible for all students, including the disabled (Ligot, 2023).

Teacher Empowerment through AI Tools

Educational institutions are capitalizing on AI to diminish administrative burdens on teachers. In this regard, with AI automating tasks, grading, and lesson plans, educators can spend more time interacting with students and provide more personalized instruction. University of the Philippines Open University has been a forerunner in this area in its 10 guidelines on the effective and ethical use of AI in teaching and learning. This empowerment enables the teachers to build stronger relations with students and enhance the general effectiveness of their teaching (Estrellado, 2023).

Data-Informed Decision

AI-based technologies are utilized to scan student performance records so that educators can be alerted on the at-risk students for timely interventions. The Basic Education Development Program, 2030 of the Department of Education aims at employing AI to do predictive models toward making decisions on resource utilization and curriculum development (Estrellado, 2023). In such a data-driven methodology, all educational strategies employed will address the needs of the learners.

Campus Innovation

Many universities in the Philippines are embracing the concept of a "smart campus," which incorporates next-generation digital technologies, including IoT, big data, and machine learning, in their operations. Mariano Marcos State University is one of them, with funding to strengthen its IT infrastructure, enabling a more connected and efficient learning environment (PNA, 2021). It is an operational efficiency-enhancing activity that also benefits students by providing better access to resources.

Collaborative Learning Environments

The UPOU has started numerous forums and workshops that share knowledge in the implementation of AI in education. It involves multi-stakeholders in collaboration, among them, educators from diverse regions who share a sense of community of practice 11 with regard to the integration of AI into teaching (Superadmin, 2024). Such environments foster innovation and shared learning in the educator fraternity.

IV. DISCUSSION

Discussions The integration of AI in Philippine education presents both opportunities and challenges, echoing the broader global discourse. The local barriers and good practices discussed earlier, when correlated with the global research and frameworks cited in the latter section, provide a nuanced understanding of AI's potential and its hurdles in the Philippine context. Accessibility Challenges and Solutions The lack of necessary hardware and internet accessibility in the Philippines (Rodrigo, 2021) aligns with Woodruff's view that it is a fundamental hindrance to AI implementation in K-12 education (Woodruff, 2023). Both state that necessary infrastructural development must come into place before AI shall be generally adopted. While promising globally, real-time classroom AI tools (Tartuk, 2023) and deep learning models (Kotsis, 2024) will only succeed in the Philippines if

foundational access issues are addressed. Local steps toward bridging this gap include IT infrastructure upgrades just like at Mariano Marcos State University (PNA, 2021). Teacher Readiness and Empowerment Rodrigo (2021) emphasizes the readiness gap among teachers in the Philippines. Lee and Perret's findings, in 2022, on the role of professional development for AI integrating educators support this concern. Training models like 6E learning by design 12 (Saimon, 2024) and frameworks for AI literacy by Otero et al., 2023, might inspire similar initiatives in a localized manner across the world. The University of the Philippines Open University's (UPOU) workshops on AI integration (Superadmin, 2024) represent good practice, underscoring how targeted training can empower educators and foster innovation. Curriculum Gaps The Philippine educational curriculum's focus on basic ICT skills (Rodrigo, 2021) contrasts with the individualized learning opportunities enabled by AI, as discussed by Fahimirad and Kotamjani (2018). AI tools, such as those used for personalized learning (Ligot, 2023), could revolutionize Philippine classrooms if integrated into curricula. The Basic Education Development Program, 2030's emphasis on data-driven decision-making (Estrellado, 2023) aligns with calls for competency frameworks (Otero et al., 2023), suggesting a strategic roadmap for curriculum enhancement. Ethical and Legal Issues Data privacy concerns and a relatively weak legal framework in the Philippines (Hernandez et al., 2023) are consistent with Toncic's (2021) call for ethics to be considered in AI implementation in education. Developing clear policies, as envisioned in the Philippine Development Plan (Conception et al., 2019), resonates with international best practices that emphasize ethical AI integration. This calls for governance that balances innovation with accountability. 13 Best Practices and Future Directions Local initiatives such as smart campuses and AI-driven platforms, for example, are manifestations of scalable models (PNA, 2021; Ligot, 2023). These local practices mirror global trends in the use of AI, such as in personalized learning (Fahimirad & Kotamjani, 2018) and student performance analytics (Tartuk, 2023). The increasing interest in AI in education around the world, as reported by Triansyah (2023), means that the Philippines should not lag behind by continuously researching and investing.

V. CONCLUSION

AI has the potential to revolutionize education in the Philippines by solving long standing issues like access, teacher preparedness, and curriculum relevance. However, this would require a multi-stakeholder approach involving government policies, infrastructure investment, teacher training, and ethical considerations. The interplay between local practices and global insights demonstrates that while challenges are substantial, the opportunities for transformative impact are equally significant. The Philippines can become a global leader in AI-driven education innovation by learning from the global models and adapting them to local contexts.

VI. RECOMMENDATION

To maximize the integration of AI in the Philippine educational system, a comprehensive strategy is required among policymakers and stakeholders. First, a national AI education strategy should be established, clear goals, standards, and guidelines that will align AI with the country's educational objectives with its safe and ethical application. 14 Upskilling programs for the education providers concerning AI tools should also be employed to enhance digital proficiency, and bolster AI literacy to guide students effectively. Improving digital infrastructure requires availability in underserved areas. Internet connectivity should be made reliable, hardware sufficient and appropriate, and cloud-based systems safe to be available across schools in the country. Simultaneously, AI must

be integrated into curricula-this not only as a subject to teach students AI literacy, but as a tool to support learning through practical, project-based applications as well. Public-private partnerships could be done to increase AI integration significantly, as there could be collaborations with tech firms and local startups that provide the tools, expertise, and funding. Localized AI educational tools are going to be developed based on incentives that ensure such technologies address the needs of learners in the Philippines. Another requirement is that AI must support equity and inclusion: by designing AI systems for local languages, cultural contexts, and the needs of children and youth with disabilities while making it affordable for poor communities. Ethical use of AI is needed. Policies should be made to ensure data privacy, address biases in AI systems, and ensure that there is transparency in decision-making processes. Pilot programs should be used to test AI initiatives, with regular assessments of how effective they are and refinements based on student, teacher, and parent feedback since artificial intelligence is evolving every now and then. Community engagement and AI literacy campaigns should be implemented to raise awareness about the positive impacts and risks of AI in education and build trust. 15 Lastly, AI integration must reach not just conventional education but also adult education and vocational training that would promote lifelong learning in preparation for the job market of the future, AI-driven. This would create an inclusive, efficient, and future ready educational system as the Philippines transforms its schools into centers of learning into the future.

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