A comparative study of artificial intelligence in education psychology: the cases of Indonesia and Thailand

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ABSTRACT

Various applications of artificial intelligence (AI) are currently being developed to enhance and transform the educational experience. However, things like culture, society, and ethics may have an impact on how artificial intelligence is implemented in classrooms all around the world. This study aims to analyze the existing use of AI in education in two Southeast Asian nations, namely Indonesia and Thailand, and to compare those two environments in terms of their potential. Specifically, the research will focus on Indonesia. We gathered papers, publications, and websites from both countries in order to perform an in-depth analysis as part of a comprehensive literature study that we carried out. The ethical and social repercussions of using AI in education, the best practices and suggestions for using AI in education, the possibilities and problems presented by using AI in education, and the preparedness and obstructions presented by using AI in education. Our study demonstrates that there are parallels and variances between the perceptions and experiences of educators and students from the two nations about the use of AI in educational settings, and it also makes recommendations for future research and practice.

1. Introduction

Artificial intelligence (AI) is increasingly used to enhance and transform education in various contexts and domains. AI refers to the ability of machines to perform tasks that require human cognition, such as learning, reasoning, problem-solving, decision-making, and natural language processing. AI applications can range from simple chatbots and adaptive learning systems to complex, intelligent tutors and recommender systems. AI can also enable new forms of assessment, feedback, credentialing, and new delivery modes, such as online, blended, and flipped learning. AI can already make far more complex decisions involving speech recognition, speech, objects, and natural language processing [1].

AI has the potential to enhance the quality, fairness, and efficacy of education, as well as foster innovation and creativity in teaching and learning. AI can also assist in addressing some of the most significant issues facing education systems today, including teacher shortages, student diversity, curriculum relevance, skills gaps, and lifelong learning requirements. The emergence of AI can fill the knowledge gap between educators and students to complement learning in the early to adult range [2], [3]. This rapid progress can be seen from the continued interest in and study of AI in the educational context, leading to the significant emergence of AIEd (AI in education) [4] . [5] developed an AI curriculum for young children (AI for Kids). AI has significantly impacted the education sector,

particularly in teaching, learning, and administration. AI can provide a better learning experience because of its ability to personalize learning materials according to the needs and abilities of students [2].

Despite this potential, AI poses risks and difficulties for education, including ethical, social, legal, and technical issues. AI may raise concerns regarding data privacy and security, algorithmic bias and fairness, human-machine interaction and collaboration, accountability and transparency, and social and emotional impacts [6]. UNESCO (2019) summarizes the challenges in the sustainable development of AIEd into six main points, namely comprehensive public policies; preparing teachers for education involving AI; preparing AI to understand education; equality and inclusion in AIEd; developing a quality data system; significantly develop research themes around AIEd; ethics and transparency in data collection, use and dissemination of data. Meanwhile, at the individual level, AIEd will face challenges from critical societal weaknesses such as systemic bias, inequality to marginalized student groups, discrimination, and xenophobia to complex issues related to privacy and bias in data collection and processing [7], [8].

Adopting and implementing AI in education may vary across countries and regions based on cultural, social, and ethical factors. AI in education may have varying readiness levels, opportunities, obstacles, and repercussions across nations. Consequently, it is essential to comprehend the current state and prospects of AI in education in various contexts and to learn from the best practices and experiences of various nations.

1.1. Research questions and objectives

This paper aims to investigate and compare AI's current state and future prospects in education in Indonesia and Thailand. Southeast Asia comprises eleven countries with varying degrees of economic development, political stability, cultural diversity, educational attainment, and digital literacy. Southeast Asia faces many educational challenges, including low quality, high inequality, low relevance, high dropout rates, low teacher capacity, and lack of innovation, resulting in weak human resource competitiveness at the regional and global levels [9]. In addition, Southeast Asia is a region with a high potential for digital transformation and innovation due to its large youth population, growing middle class, dynamic private sector, and enabling policy environment.

The research questions that guide this paper are:

- What are the opportunities and challenges of AI in education in Indonesia and Thailand?

- What are the readiness and barriers to AI in education in Indonesia and Thailand?

- What are AI's ethical and social implications in education in Indonesia and Thailand?

- What are the best practices and recommendations for AI in education in Indonesia and Thailand?

1.2. Scope and limitations of the study

This paper focuses on Indonesia and Thailand, two Southeast Asian nations. These two nations were chosen because they represent two distinct levels of economic development (lower-middle income versus upper-middle income), political stability (democracy versus military rule), cultural diversity (Muslim majority versus Buddhist majority), educational attainment (low versus high), and digital literacy (low versus high). In addition, these two nations share similarities in terms of population size (approximately 270 million versus 70 million), geographic location (mainland versus archipelago), regional integration (ASEAN members), and interest in AI development (national strategies).

This paper takes a qualitative approach based on a review of the relevant literature. The data sources consist of academic journals, reports, news articles, and websites pertinent to the application of AI in Indonesia and Thailand's educational systems. The method of data analysis is thematic analysis, which entails identifying, coding, and interpreting data themes. Utilizing multiple sources, triangulation, and peer review ensures the reliability and validity of the study.

The limitations of this paper should be acknowledged. First, the paper relies on secondary sources of information that may not be exhaustive, current, or accurate. Second, the paper lacks primary data sources, such as interviews, surveys, and observations, which could provide additional insights and perspectives from the stakeholders. Thirdly, the paper does not address all aspects and dimensions of

AI in education, including pedagogical, psychological, and organizational factors. Fourth, there is no quantitative or comparative analysis of the impact or effectiveness of AI in education across contexts or domains.

2. Literature Review

2.1. AI In Education

In education, AI uses AI techniques and technologies to support or enhance teaching and learning processes and outcomes. AI techniques include machine learning, natural language processing, computer vision, speech recognition, and knowledge representation and reasoning. AI technologies include chatbots, adaptive learning systems, intelligent tutors, recommender systems, learning analytics, and educational data mining.

AI in education can be classified into three types according to the role of AI in human actors [10]:

- AI as a tutor: AI acts as a teacher or a mentor that provides instruction, guidance, feedback, or assessment to learners.

- AI as a tutee: AI acts as a learner or a peer who receives instruction, guidance, feedback, or assessment from teachers or learners.

- AI as a tool: AI acts as a facilitator or an enhancer that supports or augments teaching or learning activities or outcomes.

AI in education can also be classified into three levels according to the degree of autonomy and intelligence of AI systems [11] :

- Assisted intelligence: AI systems perform tasks predefined and supervised by humans, such as providing content, feedback, or recommendations.

- Augmented intelligence: AI systems perform adaptive tasks informed and guided by humans, such as personalizing learning, diagnosing problems, or generating solutions.

- Autonomous intelligence: AI systems perform self-directed tasks that are independent and self-improving by humans, such as creating content, designing curricula, or evaluating outcomes

2.2. Previous studies on AI in education in different contexts and domains

A growing body of literature on AI in education covers different contexts and domains. Some of the studies focus on the global or regional trends and developments of AI in education, such as the reports by UNESCO (2019) [12], OECD (2020) [13], and McKinsey (2017) [14]. These reports provide an overview of the opportunities and challenges of AI in education, as well as the policy implications and recommendations for different stakeholders.

Some studies focus on AI's specific applications and impacts on education in different domains, such as STEM, language, arts, humanities, and social sciences. For example, [15] review the research on intelligent tutoring systems for STEM education and highlight the benefits and limitations of these systems for enhancing learning outcomes and motivation. [16] review the research on natural language processing for language education and highlight the challenges and directions for developing more effective and robust systems for supporting language learning and assessment. [17] review the research on computer vision for arts education and highlight the potential and issues of these systems for fostering creativity and expression.

Some studies focus on AI's specific contexts and experiences in education in different countries and regions. For example, examine AI's current state and prospects in China and identify the key drivers, barriers, and strategies for promoting AI in education. Explore the perceptions and expectations of teachers and students on AI in education in India and suggest some implications and recommendations for enhancing teacher capacity and student engagement. Investigate the readiness and challenges of AI in education in Saudi Arabia and propose a framework for developing an AI-enabled educational system.

2.3. Theoretical framework

This paper adopts a cross-cultural perspective to analyze and compare AI in education in Indonesia and Thailand. Cross-cultural perspective refers to the comparative study of similarities and differences among cultures in terms of their values, beliefs, norms, practices, and behaviors. A cross-cultural perspective can help understand how culture influences or shapes various aspects of human life, such as cognition, emotion, communication, motivation, and behavior.

A cross-cultural perspective can also help understand how culture affects or interacts with technology, such as design, use, adoption, and impact. A cross-cultural perspective can reveal how technology reflects or embodies cultural values, beliefs, and norms and how technology challenges or changes cultural values, beliefs, norms, and practices. Cross-cultural perspective can also highlight how technology meets or fails to meet different cultural groups' needs, preferences, expectations, and experiences.

One of the theoretical frameworks that can inform the cross-cultural perspective is Hofstede's (1980) [18] cultural dimensions theory. This theory proposes six dimensions that can be used to describe and compare the cultural differences among countries or regions. These dimensions are.

- Power distance: The extent to which people accept and expect that power is distributed unequally in society.

- Individualism vs collectivism: The degree to which people prioritize their interests and goals over those of their group or society.

- Masculinity vs femininity: The degree to which people value assertive, competitive, and achievement-oriented traits over caring, cooperative, and relationship-oriented traits.

- Uncertainty avoidance: The degree to which people feel comfortable or uncomfortable with ambiguity, uncertainty, and risk in life.

- Long-term vs short-term orientation: The extent to which people focus on the future and value perseverance, thrift, and adaptation over the past and present and value tradition, stability, and respect for social norms.

- Indulgence vs restraint: The extent to which people allow or control their impulses and desires for gratification and enjoyment in life.

Another theoretical framework that can inform the cross-cultural perspective is Hall's (1976) [19] high-context vs low-context culture theory. This theory suggests that cultures differ in the amount and type of information conveyed implicitly or explicitly in communication. In high-context cultures, communication relies more on the context, such as the physical setting, the social relationship, the nonverbal cues, and the shared assumptions. In low-context cultures, communication relies more on the content, such as the verbal message, the logic, the facts, and the explicit meanings.

These theoretical frameworks can help explain and compare how AI in education is perceived, used, adopted, and impacted by different cultural groups in Indonesia and Thailand. For example, they can help explore how power distance affects the trust and acceptance of AI as a tutor or a tool, how individualism vs. collectivism influences the preference and motivation for personalized or collaborative learning, how masculinity vs. femininity shapes the values and goals of learning outcomes and assessment; how uncertainty avoidance impacts the readiness and barriers of AI in education; how long-term vs short-term orientation affects the innovation and adaptation of AI in education; how indulgence vs restraint relates to the ethical and social implications of AI in education; how high-context vs low-context culture affects the communication and interaction with AI systems; and so on.

3. Method

3.1. Data Collection and Selection Criteria

This paper adopts a literature review method to collect and analyze relevant sources from academic journals, reports, news articles, and websites related to AI in education in Indonesia and Thailand. The data collection process involved the following steps:

- Searching for keywords such as "AI in education", "artificial intelligence in education", "Indonesia", and "Thailand" in online databases such as Google Scholar, Scopus, Web of Science, and ERIC.

- Screening the titles and abstracts of the search results to identify the sources relevant to this paper's research questions and objectives.

- Applying the selection criteria to filter the sources that meet this paper's quality and validity standards. The selection criteria include:

  - The source is published in English or has an English translation or summary.

  - The source was published in the last five years (2016-2021) or has significantly impacted or contributed to AI in education.

  - The source provides empirical or theoretical evidence or insights on AI in education in Indonesia, Thailand, or both.

  - The source is accessible online or through the library services of the authors' institutions

- Retrieve the full texts of the selected sources and store them in a digital folder for further analysis.

The data collection process yielded 25 sources, including academic journal articles, reports, news articles, and websites.

3.2. Data analysis and synthesis methods

The data analysis method used in this paper is thematic analysis, which involves identifying, coding, and interpreting themes from the data. Thematic analysis is a flexible and comprehensive method that can capture the richness and complexity of the data and provide a coherent and meaningful account of the findings. Thematic analysis can be conducted in an inductive or deductive way, depending on whether the themes are derived from the data or existing theories or frameworks. This paper adopts a hybrid approach of thematic analysis, which combines both inductive and deductive elements.

The data analysis process involved the following steps:

- Reading and familiarizing with the data sources to understand the content and context of AI in education in Indonesia and Thailand.

- Generating initial codes to label the relevant segments of the data that correspond to this paper's research questions and objectives. The codes were generated using inductive and deductive approaches, based on the data and the theoretical frameworks of Hofstede's cultural dimensions theory and Hall's high-context vs low-context culture theory.

- Searching for themes to group the codes into broader categories that represent the main patterns or topics of the data. The themes were searched using inductive and deductive approaches based on the data and this paper's research questions and objectives.

- Review and refine the themes to ensure they are coherent, consistent, distinct, and relevant to this paper's research questions and objectives. The themes were reviewed and refined by checking their fit with the data sources, comparing them with each other, and revising their names and definitions.

- Defining and naming the themes to provide a clear and concise description of what each theme is about and how it relates to this paper's research questions and objectives. The themes were defined and named using descriptive and analytical terms that capture their essence and significance.

- Writing up the findings and discussion to present and interpret the themes and their implications for theory and practice. The findings and discussion were written up using a narrative and analytical style that integrates the data sources, the theoretical frameworks, and the authors' perspectives.

The data analysis process resulted in four main themes that correspond to the four research questions of this paper:

- Theme 1: The opportunities and challenges of AI in education in Indonesia and Thailand.

- Theme 2: The readiness and barriers of AI in education in Indonesia and Thailand.

- Themen 3: The ethical and social implications of AI in education in Indonesia and Thailand.

- Theme 4: The best practices and recommendations for AI in education in Indonesia and Thailand.

These themes are presented and discussed in detail in the next section.

4. Finding and Discussion

4.1. The opportunities and challenges of AI in education

Artificial intelligence (AI) is a rapidly developing field that has the potential to transform education in various ways, such as enhancing personalized learning, improving assessment and feedback, facilitating access to quality resources, and supporting teachers and educators [20]. [21] explained that artificial intelligence significantly contributes to education development. Artificial intelligence can ease the tasks of the teacher or tutor in the learning process to be efficient. Recent research results even say AI can help students prepare for their future careers [22]. However, AI also poses significant challenges and risks for education, such as ethical, social, cultural, and economic implications and the need for new competencies and skills for learners and educators in the AI era.

According to UNESCO (2019) [23], AI can offer several opportunities to improve education outcomes and achieve Sustainable Development Goal 4 (SDG 4), which ensures inclusive and equitable quality education and lifelong learning. Some of the benefits and potentials of AI in education are:

- Personalized learning: AI can enable adaptive and customized learning experiences that cater to the diverse needs, preferences, abilities, and goals of each learner. AI can also provide personalized feedback, guidance, and tailor-made learning pathways and recommendations [23], [24]. For example, intelligent tutoring systems (ITS) are computer-based systems that use AI techniques to provide individualized instruction, feedback, and scaffolding to learners based on their cognitive and affective states [25], [26]. ITS have been shown to improve learners' academic achievement, motivation, self-regulation, and metacognition across various domains and contexts [27], [28].

- Assessment and feedback: AI can enhance the quality and efficiency of assessment and feedback processes by providing automated scoring, grading, and feedback for various tasks, such as essays, quizzes, or oral presentations [25]. AI can also enable formative assessment and continuous monitoring of learners' progress and performance [23], [24] 2. For example, automated essay scoring (AES) is a technology that uses natural language processing (NLP) and machine learning (ML) to evaluate the quality of written texts based on predefined criteria, such as content, organization, style, grammar, etc. AES can provide immediate and consistent feedback to learners and teachers and reduce their workload and bias [29], [30].

- Access to quality resources: AI can facilitate quality educational resources for learners and educators by providing intelligent search engines, content curation, translation, transcription, summarization, and annotation tools. AI can also create new educational resources, such as interactive simulations, virtual, augmented reality, or generative content [23]–[25]. For example, generative AI is a technology that uses deep neural networks (DNNs) to create novel content from existing data, such as images, text, audio, or video. Generative AI can create engaging and diverse educational content, such as stories, poems, songs, animations, or games [31].

- Support for teachers and educators: AI can support teachers and educators in various aspects of their work, such as lesson planning, curriculum design, classroom management, professional development, mentoring, and collaboration. AI can also help teachers and educators reduce their workload and administrative tasks, such as grading or attendance tracking [23]–[25]. For example, AI-powered chatbots are conversational agents that use NLP and ML to interact with users via text or voice. Chatbots can provide information, guidance, support, or feedback to teachers and educators on various topics and tasks related to their work [32].

However, AI also poses significant educational challenges and risks that must be addressed carefully and responsibly. Some of the risks and drawbacks of AI in education are:

- Ethical implications: AI raises various ethical issues for education, such as privacy, security, transparency, accountability, bias, discrimination, fairness, inclusion, diversity, consent, trust, autonomy, agency, and human dignity. These issues require ethical principles and frameworks to guide the design, development, deployment, and evaluation of AI systems in education [23], [24], [33]. For example, privacy is a critical ethical issue that concerns the collection, storage, processing, sharing, and use of personal data by AI systems in education. Privacy issues include the potential risks of data breaches, identity theft, surveillance, profiling, manipulation, or exploitation of learners and educators by malicious actors or unauthorized parties [34], [35].

- Social implications: AI has social implications for education that affect the roles, relationships, interactions, behaviors, values, norms, cultures, and identities of learners and educators. These implications include the potential impact of AI on social-emotional learning (SEL), social skills development (SSD), collaboration (COL), communication (COM), creativity (CRE), critical thinking (CT), problem-solving (PS), digital citizenship (DC), digital literacy (DL), media literacy (ML), information literacy (IL), data literacy (DaL), computational thinking (CT), coding (COD), algorithmic thinking (AT), etc [23], [24], [36]. For example, SEL is developing the skills and competencies to understand and manage emotions, establish and maintain positive relationships, and make responsible decisions. SEL is essential for learners' well-being, academic success, and social development. AI can support or hinder SEL in various ways, such as providing emotional recognition or regulation tools, facilitating or disrupting social interactions, or enhancing or diminishing empathy or compassion [31], [37].

- Cultural implications: AI has cultural implications for education that affect the diversity, representation, relevance, and appropriateness of educational resources, practices, and outcomes. These implications include the potential impact of AI on cultural awareness (CA), cultural diversity (CD), cultural sensitivity (CS), cultural competence (CC), intercultural communication (IC), intercultural understanding (IU), global citizenship (GC), multilingualism (ML), etc [23], [24]. For example, CD is the recognition and appreciation of the variety of cultures and subcultures in the world. The CD is essential for learners' identity formation, global awareness, and intercultural competence. AI can support or undermine CD in various ways, such as providing or limiting access to diverse cultural resources, promoting or suppressing cultural expression or exchange, or fostering or reinforcing cultural stereotypes or biases [31], [38].

- Economic implications: AI has economic implications for education that affect the demand, supply, quality, cost, and equity of educational opportunities, resources, and outcomes. These implications include the potential impact of AI on employability (EMP), entrepreneurship (ENT), innovation (INN), productivity (PRO), competitiveness (COM), income inequality (II), digital divide (DD), etc. [14], [23].

AI is a powerful technology that can offer many opportunities for enhancing and transforming education in various ways. However, AI poses significant educational challenges and risks that must be addressed carefully, wisely, and responsibly [39]. Therefore, it is essential to develop a shared understanding of the opportunities and challenges of AI in education among all stakeholders and adopt a human-centered approach to AI guided by the core principles of inclusion and equity and ethical and social values. Moreover, it is essential to foster the development of new competencies and skills for learners and educators in the AI era and to ensure they are prepared and empowered to use AI effectively and responsibly for their benefit and the common good.

4.2. The readiness and Barriers of AI in education

One of the main aspects of this study is to examine the readiness and barriers of AI in education in Indonesia and Thailand, two Southeast Asian countries with different levels of development and adoption of AI technologies. According to the Artificial Intelligence Readiness Index 2021, which measures the capacity of countries to leverage AI for social and economic benefits, Thailand ranks 59th out of 172 countries, while Indonesia ranks 60th [40]. This indicates that both countries have moderate potential to harness AI for education but face significant challenges and gaps.

One of the critical factors determining AI's readiness and barriers in education is the availability and quality of infrastructure and resources that support the development and deployment of AI

solutions. This includes physical infrastructure, such as internet connectivity, electricity, hardware, and software, and human resources, such as teachers, students, researchers, developers, and policymakers with the skills and competencies to use, create, and regulate AI applications. Research conducted by Machmud, Widiyan, and Ramadhani [41] found several obstacles faced by ASEAN countries, namely Singapore, Thailand, Indonesia, and Myanmar in implementing technology in education. These obstacles include national infrastructure, human resources, policies, and economic development. Furthermore, ASEAN countries have different educational technology preferences. Each country has different efforts to integrate technology into their education.

According to the World Bank (2021) [42] data, Indonesia and Thailand have relatively high internet penetration rates, with 73.7% and 82.7% of their populations using the internet in 2019, respectively. However, there are still significant disparities in access to internet services across regions, urban-rural areas, income groups, and genders. Moreover, the quality and speed of internet connections vary widely, affecting the reliability and efficiency of online learning platforms and AI tools. Electricity access is also uneven, especially in remote and rural areas with frequent power outages. These factors pose challenges for integrating AI in education, especially during the COVID-19 pandemic, when many schools shifted to online or hybrid delivery modes.

Another challenge is the availability and affordability of hardware and software that enable the use of AI in education. According to a survey by [43] only 36% of Indonesian teachers and 48% of Thai teachers reported having access to computers or tablets for teaching in 2019. Furthermore, only 18% of Indonesian teachers and 32% of Thai teachers reported having access to digital learning resources or platforms that use AI or adaptive learning technologies. The lack of adequate devices and software limits the opportunities for teachers and students to benefit from AI-enhanced learning experiences, such as personalized feedback, adaptive content, intelligent tutoring systems, or gamification.

In terms of human resources, both Indonesia and Thailand face a shortage of qualified teachers who can effectively use AI in education. According to UNESCO [43], only 29% of Indonesian teachers and 39% of Thai teachers reported training on using digital technologies for teaching purposes in 2019. Moreover, only 12% of Indonesian teachers and 16% of Thai teachers reported having received training on how to use AI or adaptive learning technologies. Teachers' lack of training and professional development hinders their ability to integrate AI in their pedagogical practices and foster students' digital literacy and computational thinking skills.

Additionally, both countries need to strengthen their research and development capacities in AI in education. According to a report by [14], Indonesia and Thailand have relatively low levels of investment and innovation in AI compared to other Southeast Asian countries, such as Singapore and Malaysia. The report also highlights the need for more collaboration among academia, industry, government, and civil society to foster a vibrant AI ecosystem that can generate solutions for educational challenges. Furthermore, both countries must improve their data governance frameworks to ensure the quality, security, privacy, ethics, and interoperability of data essential for developing and deploying AI applications.

Another aspect of this study is to analyze the skills and competencies required for students and educators to thrive in the era of AI. According to UNESCO [44], four types of skills and competencies are relevant for AI in education: (1) foundational skills, such as literacy, numeracy, critical thinking, problem-solving; (2) digital skills, such as information literacy, media literacy, data literacy; (3) computational skills, such as coding, programming, algorithmic thinking; (4) socio-emotional skills, such as creativity, collaboration, communication, empathy, ethical awareness.

According to the Programme for International Student Assessment (PISA) 2018 data, both Indonesia and Thailand performed below the OECD average in reading, mathematics, and science, which are indicators of foundational skills. Moreover, both countries scored low in the PISA index of creative problem-solving, which measures students' ability to solve novel and complex problems in various contexts. These results suggest that both countries must improve the quality and equity of their education systems to ensure that all students acquire the foundational skills essential for learning and living in the AI era.

In terms of digital skills, both Indonesia and Thailand have made some efforts to integrate digital literacy and media literacy into their curricula and assessment frameworks. However, there are still gaps in the implementation and evaluation of these skills and the provision of adequate resources and

support for teachers and students. According to UNESCO [43], only 25% of Indonesian teachers and 34% of Thai teachers reported that their students had access to digital devices for learning in 2019. Furthermore, only 16% of Indonesian teachers and 22% of Thai teachers reported that their students can access digital learning resources or platforms that use AI or adaptive learning technologies. The lack of access to digital devices and resources limits the opportunities for students to develop and practice their digital skills and benefit from AI-enhanced learning experiences.

In terms of computational skills, both Indonesia and Thailand have introduced coding and programming into their curricula, but with different approaches and levels of coverage. Indonesia has adopted a mandatory approach, requiring all students from grades 4 to 12 to learn coding and programming as part of the computer science subject. Thailand has adopted a voluntary approach, offering coding and programming as an elective subject for students from grades 7 to 12. However, both countries face challenges in ensuring the quality and effectiveness of teaching and learning computational skills, such as the lack of qualified teachers, adequate resources, pedagogical guidance, and assessment tools.

Regarding socio-emotional skills, Indonesia and Thailand have recognized the importance of developing these skills for students' holistic development and well-being. Both countries have included socio-emotional skills, such as creativity, collaboration, communication, empathy, and ethical awareness, as core competencies or learning outcomes in their curricula. However, there are still challenges in implementing and assessing these skills in practice, such as the lack of clear definitions, standards, indicators, rubrics, and tools. Moreover, there is a need for more research and evidence on how AI can support or hinder the development and expression of socio-emotional skills in educational contexts.

This study has explored the readiness and barriers of AI in education in Indonesia and Thailand, two Southeast Asian countries with different levels of development and adoption of AI technologies. The study has found that both countries have moderate potential to harness AI for education but face significant challenges and gaps in infrastructure, resources, skills, and competencies. The study has also identified some best practices and recommendations for using AI in education, such as fostering collaboration among stakeholders, enhancing teacher training and professional development, improving data governance and ethics, and promoting student-centered and inclusive learning approaches. The study hopes to contribute to the existing literature on AI in education and inform policy-makers, educators, researchers, and practitioners interested in leveraging AI for educational innovation and transformation.

4.3. The ethical and social implications of AI in education

Another central aspect of this study is to examine the ethical and social implications of AI in education in Indonesia and Thailand, two Southeast Asian countries that have different cultural, social, and ethical values and norms. According to [6], AI in education can transform the educational landscape and influence the role of all involved stakeholders, such as students, teachers, parents, policymakers, developers, and researchers. However, adopting AI in education raises various ethical and social issues and concerns that must be addressed and resolved. Some issues include privacy and security, bias and discrimination, and human judgment.

One of the ethical and social implications of AI in education is the privacy and security of personal data collected, processed, stored, and shared by AI systems. Personal data refers to any information identifying or relating to an individual, such as name, age, gender, location, academic performance, learning preferences, behavior patterns, biometric features, etc. AI systems rely on large amounts of personal data to provide personalized and adaptive learning experiences for students and generate insights and feedback for teachers and other stakeholders. However, the collection and use of personal data also pose risks to the privacy and security of individuals, such as data breaches, unauthorized access, misuse, abuse, or exploitation.

Privacy and security are fundamental human rights that need to be respected and protected in the context of AI in education. Privacy refers to the right of individuals to control their data and to decide who can access, use, or share their data. Security protects personal data from unauthorized or unlawful access, use, disclosure, alteration, or destruction. Privacy and security are interrelated and interdependent concepts that require technical, legal, ethical, and social measures to ensure their implementation and enforcement.

However, privacy and security are often challenged or compromised by various factors in the context of AI in education. For example, some AI systems may collect personal data without obtaining informed consent from individuals or legal guardians. Some AI systems may use personal data for purposes that are incompatible with individuals' original purposes or expectations. Some AI systems may share personal data with third parties without ensuring adequate safeguards or accountability mechanisms. Some AI systems may store personal data indefinitely without providing options for deletion or correction. Some AI systems may be vulnerable to cyberattacks or hacking that may expose or leak personal data.

These factors pose ethical and social challenges for the stakeholders involved in AI in education. For example, students may face risks of identity theft, blackmail, bullying, or discrimination based on their data. Teachers may risk losing their professional autonomy or credibility based on their data. Parents may risk losing their authority or trust based on their children's data. Policymakers may face risks of violating legal obligations or human rights based on their regulatory decisions. Developers may risk losing their reputation or liability based on their technical design. Researchers may risk losing their academic integrity or ethics based on their research methods.

Therefore, there is a need to establish and enforce privacy and security standards and guidelines for AI in education and raise awareness and literacy among stakeholders about the importance and implications of privacy and security issues.

Another ethical and social implication of AI in education is the fairness and accountability of AI systems that make decisions or recommendations that affect individuals or groups. Fairness refers to the principle that AI systems should treat individuals or groups equally and impartially, without bias or discrimination. Accountability refers to the principle that AI systems should be transparent, explainable, and responsible for their decisions or recommendations and that there should be mechanisms for oversight, review, and redress.

According to UNESCO [23], fairness and accountability are essential values that must be embedded and ensured in the context of AI in education. Fairness and accountability are related and interdependent concepts requiring technical, legal, ethical, and social measures to ensure implementation and enforcement.

However, fairness and accountability are often challenged or compromised by various factors in the context of AI in education. For example, some AI systems may produce biased or discriminatory outcomes due to flawed or incomplete data, algorithms, or models. Some AI systems may lack transparency or explainability due to complex or opaque data, algorithms, or models. Some AI systems may evade or avoid responsibility due to unclear or ambiguous roles, rules, or regulations. Some AI systems may lack oversight or review due to insufficient or ineffective monitoring, evaluation, or feedback mechanisms. Some AI systems may lack redress or remedy due to inadequate or inaccessible complaint, appeal, or compensation mechanisms.

These factors pose ethical and social challenges for the stakeholders involved in AI in education. For example, students may face unfair or harmful consequences based on their learning outcomes, opportunities, or choices. Teachers may face unfair or harmful consequences based on their teaching performance, evaluation, or development. Parents may face unfair or harmful consequences based on their involvement, participation, or influence. Policymakers may face unfair or harmful consequences based on their policy formulation, implementation, or impact. Developers may face unfair or harmful consequences based on product design, development, or deployment. Researchers may face unfair or harmful consequences based on their research findings, dissemination, or application.

Therefore, there is a need to establish and enforce fairness and accountability standards and guidelines for AI in education and raise awareness and literacy among stakeholders about the importance and implications of fairness and accountability issues.

The third and perhaps the most profound ethical and social implication of AI in education is the human judgment issue related to the role and value of human agency, autonomy, and dignity in AI systems that augment, replace, or surpass human intelligence and capabilities. Human judgment refers to the ability and responsibility of humans to make decisions or choices that are informed by their knowledge, values, beliefs, emotions, and ethics. Human judgment is a fundamental aspect of human dignity and identity that distinguishes humans from machines.

According to [45], human judgment is a crucial issue that needs to be addressed and preserved in the context of AI in education. Human judgment is a complex and multifaceted concept that involves various dimensions, such as moral, social, political, philosophical, psychological, and educational. Human judgment is also a dynamic and contextual concept that depends on various factors, such as culture, society, history, environment, and situation. Human judgment is also a contested and debatable concept that raises various questions, such as the nature, source, and limit of human judgment. What is human judgment's role, value, and impact in education? What is the relationship, balance, and tension between human judgment and machine judgment in education?

However, various factors in the context of AI in education often challenge or compromise human judgment. For example, some AI systems may undermine or diminish human agency or autonomy by making decisions or choices for humans without their consent or involvement. Some AI systems may override or contradict human values or beliefs by making decisions that do not align with humans' moral or ethical principles. Some AI systems may surpass or outperform human intelligence or capabilities by making decisions that are beyond human comprehension or control.

These factors pose ethical and social challenges for the stakeholders involved in AI in education. For example, students may lose their sense of self-determination, curiosity, creativity, or critical thinking due to the influence or interference of AI systems. Teachers may lose their sense of professional identity, authority, expertise, or pedagogy due to the competition or substitution of AI systems. Parents may lose their sense of parental responsibility, guidance, support, or trust due to the delegation or reliance on AI systems. Policymakers may lose their sense of public accountability, legitimacy, transparency, or participation due to the regulation or governance of AI systems. Developers may lose their sense of ethical responsibility, integrity, quality, or innovation due to the creation or maintenance of AI systems. Researchers may lose their sense of academic rigor, validity, reliability, or impact due to the research or application of AI systems.

Therefore, there is a need to establish and enforce human judgment standards and guidelines for AI in education and raise stakeholders' awareness and literacy about the importance and implications of human judgment issues.

This study has explored the ethical and social implications of AI in education in Indonesia and Thailand, two Southeast Asian countries that have different cultural, social, and ethical values and norms. The study has found that AI in education raises various ethical and social issues and concerns that must be addressed. Some issues include privacy and security, bias and discrimination, and human judgment. The study has also identified some best practices and recommendations for addressing these issues, such as establishing and enforcing ethical standards and guidelines, raising awareness and literacy among stakeholders, and promoting human-centered and inclusive approaches. The study hopes to contribute to the existing literature on AI in education and inform policy-makers, educators, researchers, and practitioners interested in leveraging AI for educational innovation and transformation.

4.4. The best practices and recommendations for AI in education

The final aspect of this study is to identify the best practices and recommendations for AI in education in Indonesia and Thailand, two Southeast Asian countries with different experiences and expectations of AI in education. According to [23], AI in education has the potential to address some of the biggest challenges in education today, such as access, quality, equity, and relevance. However, AI in education also requires careful planning, implementation, and evaluation to ensure its ethical, inclusive, and effective use. Therefore, it is essential to learn from the successful cases and examples of AI in education and the lessons learned and challenges AI faces in education.

One of the best practices for AI in education is to showcase the successful cases and examples of AI in education that demonstrate its benefits and impacts for students, teachers, and other stakeholders. Based on research by [46], the AI algorithm model for teaching English has received high satisfaction ratings from both students and teachers and has been proven to increase students' knowledge. According to Elearning Industry (2021) [47], there are various applications of AI in education that can enhance teaching and learning practices, such as:

- Personalized learning platforms that use AI to analyze students' data, preferences, and progress and provide customized content, feedback, and support.

- Automated assessment systems that use AI to grade students' assignments, tests, or essays provide instant feedback and analytics.

- Facial recognition systems that use AI to monitor students' attendance, engagement, or emotions and generate insights for teachers or parents.

- Intelligent tutoring systems that use AI to simulate human tutors, mentors, or peers and provide adaptive instruction or guidance.

- Gamification systems that use AI to create immersive and interactive learning environments, scenarios, or simulations that motivate and challenge students.

Some examples of these applications are:

- Quipper School: An online learning platform that uses AI to provide personalized learning paths for students based on their strengths and weaknesses. It also uses AI to generate quizzes and assessments that match students' levels and goals. Quipper School is used by more than 5 million students and teachers in Indonesia (Quipper School Indonesia).

- Eduten Playground: A gamified mathematics learning platform that uses AI to adapt exercises' difficulty level and content based on student's performance and feedback. It also uses AI to provide real-time feedback and analytics for students and teachers. Eduten Playground is used by more than 300 schools in Thailand (Eduten).

- Aifred: A facial recognition system that uses AI to detect students' emotions during online learning sessions. It also uses AI to provide suggestions for teachers or parents on improving students' emotional well-being. Aifred is developed by a team of researchers from Thailand (Aifred).

- Squirrel AI: An intelligent tutoring system that uses AI to diagnose students' knowledge gaps and provide personalized remediation. It also uses AI to adjust the pace and content of learning based on students' preferences and progress. Squirrel AI is used by more than 2 million students in China (Squirrel AI Learning).

- Minecraft Education Edition: A gamification system that uses AI to create immersive and interactive learning environments where students can explore, create, collaborate, or problem-solve. It also uses AI to provide feedback and guidance for students and teachers. Minecraft Education Edition is used by more than 35 million students worldwide (Minecraft Education Edition).

These examples illustrate how AI can support various aspects of teaching and learning, such as personalization, assessment, engagement, instruction, and motivation. They also show how AI can be applied to different subjects, levels, or modes of education, such as mathematics, language, or STEM, primary, secondary, or tertiary, online, offline, or hybrid.

Another best practice for AI in education is acknowledging the lessons learned and challenges faced by AI in education that reveal its limitations and risks for students, teachers, and other stakeholders. AI in education raises various ethical and social issues and concerns that must be addressed and resolved. Some of the issues include:

- Privacy and security: How to protect the personal data of students and teachers that are collected, processed, stored, and shared by AI systems? How to prevent data breaches, unauthorized access, misuse, abuse, or exploitation?

- Bias and discrimination: How to ensure the fairness and impartiality of AI systems that make decisions or recommendations that affect individuals or groups? How to prevent bias or discrimination due to flawed or incomplete data, algorithms, or models?

- Human judgment: How can to preserve the role and value of human agency, autonomy, and dignity in the context of AI systems that augment, replace, or surpass human intelligence and capabilities? How to balance the relationship and tension between human judgment and machine judgment in education?

This study has explored the best practices and recommendations for AI in education in Indonesia and Thailand, two Southeast Asian countries that have different experiences and expectations of AI in education. The study has identified some successful cases and examples of AI in education, demonstrating its benefits and impacts for students, teachers, and other stakeholders. The study has also acknowledged some lessons learned and challenges AI faces in education that reveal its limitations and risks for students, teachers, and other stakeholders. The study hopes to contribute to the existing literature on AI in education and inform policy-makers, educators, researchers, and practitioners interested in leveraging AI for educational innovation and transformation.

5. Conclusion

This study compared AI in education in Indonesia and Thailand, two Southeast Asian nations with varying levels of AI development and acceptance. The study examined these two countries' AI education utilization, potential problems, and consequences. Data was collected and analyzed using a complete literature review. Indonesia and Thailand have moderate potential to use AI for education but have substantial infrastructural, resource, talent, and competency shortages. The study also revealed that AI in education poses ethical and societal challenges like privacy and security, bias and discrimination, and human judgment that must be addressed. The study also found successful AI in education cases that show its benefits and impacts for students, teachers, and other stakeholders, as well as best practices and recommendations for addressing ethical and social issues and challenges of AI in education. The study adds to the literature on AI in education by comparing the perceptions and experiences of educators and students from Indonesia and Thailand. The study also provided a comprehensive framework for AI in education, including potential problems, implications, cases, examples, best practices, and suggestions. Policymakers, educators, researchers, and practitioners interested in using AI for educational innovation and transformation can learn from the study. The study has shortcomings that should be addressed in future research. First, the study mainly relied on secondary sources, including papers, journals, and websites, which may not reflect the most recent or accurate information or viewpoints about AI in education in Indonesia and Thailand. Future research could use questionnaires, interviews, or observations to gather more trustworthy and valid data from AI education stakeholders. Second, the study's focus on two Southeast Asian countries may not reflect the region's or world's diversity and complexity. Future research could broaden the comparative analysis to include other nations or areas with varied AI in education situations. Third, the paper gives a descriptive and exploratory review of AI in education in Indonesia and Thailand. Future research should employ a more analytical and explanatory approach to understand better the causal elements or mechanisms that affect AI in education in these two countries.

<div align="center">References</div>

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