

# AI-Powered Education: Exploring the Potential of Personalised Learning for Students' Needs in Indonesia Education

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**Abstract.** Artificial intelligence (AI) stands out as a relatively new yet rapidly expanding technological tool that is transforming the field of education. This paper examines the potential of Artificial Intelligence to assist students and teachers in personalised learning. The research methodology employed for this study is a literature review, providing an overview of the current knowledge on practical AI applications for personalised learning and insights into methodological developments in this research field. Based on the literature, the results of this research demonstrate that personalised learning effectively accommodates students' learning preferences and enhances academic performance. Therefore, it could significantly benefit students by accommodating their learning pace and style. In the Indonesian education system context, the integration of AI for personalised learning is already included in the Indonesia Artificial Intelligence National Plan framework. To support this plan, the authors employed a Personalized Learning Plan (PLP) to integrate AI into educational settings practically. However, a challenge in integrating AI into education for personalised learning is that course or class designers often pay insufficient attention to creating content that develops practical skills. This neglect of pedagogical and technical aspects has led students and teachers to perceive these systems as unresponsive to their learning preferences, fostering a sense of pessimism.

**Keywords:** Personalised learning; Artificial Intelligent; Adaptive learning; Indonesia education.

## INTRODUCTION

*Turning Point of AI in Education.* The global impact of technological advancement, notably in education and training, including Indonesia's education sector, has been substantial [2]. Over the past two decades, emerging technologies have disrupted conventional teaching and learning methods. Artificial intelligence (AI) stands out as a relatively new yet rapidly expanding technological tool that is transforming the field of education [12, 67]. Initially a catalyst for change, AI is progressively integrated into the "new normal" [1], and its remarkable development shows no signs of slowing down, playing an essential role in daily information, communication, and technology domains.

A study [68] observed that many teachers actively embrace AI tools as they become accessible to the public. This widespread adoption has fueled

significant growth in the AI market within the education sector. Between 2008 and 2017, approximately 104.7 billion US dollars were invested in AI-based education [15]. In higher education, investments in AI in education (AIEd) are rising due to their cost-effectiveness, the benefits they offer students, and their ability to enhance operational efficiency and market competitiveness [54].

*General Use of AI in Indonesian Education.* Implementing AI in the Indonesian education system has yielded positive outcomes for students and teachers in their learning and teaching processes. In this section, we will discuss the general application of AI in Indonesian education.

### 1. For Teachers

*a) Administrative Task Management.* AI offers a solution to alleviate educators' burnout by tack-

ling their burdensome administrative tasks, a significant contributor to exhaustion [70]. Automation simplifies educators' processes, allowing them to dedicate more time to meaningful student interaction and improving the learning experience [70]. Moreover, educators can utilise AI-powered intelligent assistants to handle routine administrative responsibilities like monitoring student attendance, developing lesson plans, and organising classroom activities, further enhancing their time management [4, 63].

b) *Teaching plan recommendations.* Teachers increasingly rely on AI to support lesson materials, specifically theme development and lesson enhancement [16, 22]. AI tools can suggest, choose, and modify lesson materials. Microsoft Tay, a chatbot equipped with natural language processing (NLP) and artificial neural networks, is a notable example [69].

c) *Learner's support.* Through diverse techniques like machine learning and advanced deep learning, AI offers a broader spectrum of "intelligent services" that emulate human actions. Educators progressively acknowledge the value of AI-driven capabilities, such as speech recognition, for assisting learners with disabilities, multilingual students, and individuals desiring more adaptable and personalised digital learning tools [41]. Consequently, the adoption of AI in education has surged, becoming widely integrated into educational approaches, enhancing student management, learning processes, and assessment.

## 2. For students

AI can tailor learning experiences to meet each student's unique needs. Research [54] shows that students are open to AI's role in providing knowledge-based educational support, including personalised course recommendations, module selection, registration guidance, and individualised tutoring or coaching sessions. An example is the ASSISTments platform, which combines intelligent tutoring capabilities with real-time student feedback during assignments and provides data-driven reports for teachers on each assignment [18].

Providing real-time feedback to students is instrumental in improving their academic performance. Studies [35] show that AI can optimise students' academic progress and achievements. Similarly, research [32, 33] demonstrates that AI-assisted learning can enhance academic achievement. Personalising learning aligns edu-

cation with the specific requirements of each student, improving adaptability to their strengths and needs [41]. This has the potential to promote accessibility and inclusivity.

*AI Adoption Potential in Indonesia Education.* The adoption of AI in Indonesia is driven by its potential to enhance educational outcomes. Resource [3] states that generative AI can revolutionise learning and improve academic results. Resource [19] reports that 75% of AI adoption is motivated by the desire to boost student learning outcomes. This is because AI tools offer various avenues for enhancing learning outcomes, including innovative assessment and feedback, data-driven insights, and personalised and interactive learning [3]. Simultaneously, educators can utilise AI to elevate their teaching methods and professional development [70].

Promoting AI in the education sector, also known as AIED, has opened new opportunities for designing practical learning tasks and improving technology-enhanced learning environments [26]. Educators traditionally monitor student academic performance, manage daily assignments, and plan lessons and activities [12]. As a result, the increasing sophistication of emerging technologies may be steering us towards a transformative shift in teaching and learning, contributing to the disruption of education as we currently understand it.

Furthermore, AI technology is poised to revolutionise the education sector by transforming teaching and learning tools, learning modes, access to knowledge, and teacher training. Microsoft [43] stated that this modernisation could integrate AI with learning analytics to accelerate students' comprehension and personalise education. Experts believe that AI's role in education is to aid in planning, facilitating, and personalising learning [12].

## METHOD

The writer conducted a systematic literature review of effect studies. This provided an overview of current knowledge of practical Artificial intelligence (AI) to assist teachers and students in personalised learning and insight into the methodological developments in this field of research. A systematic review has the advantage that it surpasses the methodological limitations of single studies, thus providing more robust information for future research, as well as evidence-

informed policy and practices [46]. A systematic literature review is a research method for locating, evaluating, and interpreting significant research findings connected to research questions, specific topics, or phenomena [34, 52, 61].

Writers use selection criteria to determine which research studies to include in their review. These criteria establish guidelines for the review process, ensuring transparency and consistency. Systematic reviews emphasise making these restrictions transparent across studies. The review question and conceptual framework shape the selection criteria, specifying factors such as participants, country, and language. Overall, selection criteria ensure a systematic and objective approach to reviewing research studies [46]. The stages of this research apply the scheme [7] presented in Figure 1.

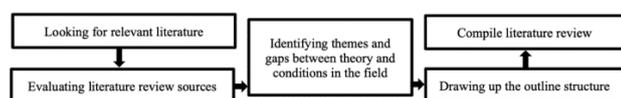


Figure 1- Bettany-Saltikov's literature review step

## RESULTS AND DISCUSSION

The emergence of AI in the education sector has rapidly impacted learning and teaching conditions in Indonesia's education sector. One of the crucial aims of AI in education is the provision of learning personalisation. It helps students based on their learning styles and preferences. This essay will examine AI used for personalised learning and its opportunities and risks in Indonesia's knowledge and teaching context. The theoretical approach and framework also will be discussed to investigate the AI implementation in Indonesian education.

### Concept of personalised learning and its importance in education

Personalised learning is a pivotal component of contemporary education, profoundly shaping students' motivation and engagement. Authors [51] highlight that customised learning has the potential to elevate student engagement, ignite inspiration, and deepen comprehension, with far-reaching effects that positively impact overall satisfaction, learning efficiency, and effectiveness, as emphasised by [14].

To grasp the essence of personalised learning, it's essential to explore its foundation, which revolves around a student-centric approach. Authors [35] reveal the intricate connection between personalised learning and learner-centred instruction, forming a cohesive educational paradigm. A central element of this approach is the Personalized Learning Plan (PLP), a tailored instructional framework meticulously crafted to assess individual learners' unique attributes, interests, and academic competencies, as underscored. Miliband's visionary concept, as cited in [35], posits personalised learning as the quintessential solution to unlock each learner's potential by adapting instruction to their specific needs and prior experiences, aligning with the views of [20, 37].

A common theme throughout scholarly discussions underscores personalised learning's ability to empower students by giving them control over their learning journey. Authors [6, 28, 62] collectively endorse personalised learning Tailors instruction to individual students, creating a real-time feedback loop for educators and learners, a sentiment reaffirmed by [45].

The synergy between personalised learning and technology is undeniable, with technology playing a pivotal role in this educational evolution. Authors [57] emphasise this symbiotic relationship, showcasing how technology strengthens and enhances the benefits of personalised learning. In this evolving landscape, artificial intelligence (AI) technology takes centre stage, ushering in a new era of educational customisation in line with students' unique needs. Given the growing influence of technologies like big data and learning analytics, authors [24] assert that personalised learning is imperative. Integrating AI and learning analytics allows for a personalised approach that identifies and adapts to student learning behaviours and patterns, as elucidated by [53].

### The AI-driven Personalized Learning

The rationale for employing AI-powered education to tailor learning experiences is its remarkable ability to enhance the learner's journey. AI achieves this by providing personalised tools, enabling adaptive learning functions and models [40], and supporting decision-making, resulting in adaptive and individualised educational experiences [49]. Authors [47] also advocate for inte-

grating AI into education to establish a dynamic learning environment, enabling early identification of struggling learners and delivering customised interventions. Furthermore, AI facilitates the customisation of local curricula [41].

AI streamlines administrative tasks, analyses student competencies, and offers tailored learning content and feedback [12]. It tailors support to individual students based on their learning status, preferences, and personal traits [25]. Educators use AI to assess student performance in real-time, enhancing learning [30]. AI-based personalised learning empowers students to shape their learning experiences and improves assessment and feedback mechanisms [23].

AI in personalised learning also provides content recommendations and evaluates student performance [65]. It customises learning to meet individual student requirements, emphasising preventive and intervention practices [1, 26]. This approach offers adaptive pedagogical content, tutoring, and assistance as needed [12]. AI systems generate comprehensive reports for educators, offering insights into class and individual student performance [27].

### Ways of AI in Personalized Learning

Concerning the benefit of AI in personalised learning, it has been applied to a specific technology application. AI will focus on and analyse students' learning styles and then assist them in progressing through their learning. Therefore, this section will explore the opportunities for AI to be used in learning personalisation.

1. **Tutoring Intelligent System.** Intelligent tutoring systems (ITS) harness the power of artificial intelligence to elevate the learning experience through personalised support [17]. Authors [61] define ITS as innovative technological solutions that leverage AI to provide one-on-one instructional guidance. Compelling evidence reinforces this approach, illustrating that AI-driven ITS delivers superior direction and instruction to learners [66], enhancing student performance and cost savings for educational institutions [61]. For instance, success stories like Carnegie Speech and Duolingo, which employ automatic speech recognition for language instruction [1], exemplify the potential of integrating ITS, enabling students to customise their learning pace.

Integrating conversational agents and AI-generated characters with tutoring systems takes personalisation and trust to a new level [48]. This innovative approach fosters increased engagement and motivation in learning, rendering ITS a growing trend in education [61]. Akyuz's study also underscores the manifold benefits of ITS, including the enhancement of ICT skills, cost savings, flexibility in learning, and improved time management. Significantly, authors [61] report that 90% of students and educators utilise ITS for personalised learning, with 27% making considerable progress through personalised instruction. Additionally, 97% of teachers express satisfaction with the materials provided by ITS [13]. Infographics are often incorporated to facilitate comprehension and convey information effectively, a pivotal element in personalised learning that ensures efficient and impactful information delivery [61].

2. **Adaptive learning system.** AI can also personalise learning through Adaptive Learning systems, which create individualised learning paths based on each student's conditions. Authors [21] emphasise that this adaptive approach tailors learning paths to a student's background and pedagogical objectives set by educators. Authors [50, 71] explain that these systems personalise learning by considering factors like learning style, task difficulty, feedback timing, and student preferences, adjusting their behaviour for each learner or learner group [27].

Enhanced adaptive learning capabilities provided by intelligent assistants enable students to study at their own pace and schedule [1]. Kidaptive, for instance, is a service that supports educational institutions in collecting data and increasing student engagement through adaptive learning [1]. AI-adaptive systems support educators and students when integrated with learning management platforms and human teaching [27]. These systems help students discover their strengths, areas for improvement, interests, learning preferences, and personality types, offering personalised content recommendations to address specific needs.

3. **Learning Analytics.** Authors [47] recommend using AI and learning analytics to create dynamic learning environments that identify learner obstacles early and offer adaptive interventions. Learning analytics systems employ data analytics to track and assess students' engagement, progress, and ongoing assessments, which, in turn,

helps teachers design learning environments that cater to student preferences [39].

Educational institutions often employ dashboards to monitor student progress and performance, visualising data from learning analytics, such as pie charts illustrating skill mastery percentages over time [65]. This tracking can aid in identifying student difficulties, monitoring their progress, and uncovering intellectual challenges [55].

Learning analytics is critical in enhancing student engagement by providing feedback for improvement. The study [30] shows that integrating AI and learning analytics fosters student engagement through personalised metacognitive feedback. Furthermore, including learning analytics in learning design provides insights to enhance student engagement and self-regulation. Authors [40] also found that applying Course Learning Analytics (CLA) and nudging can improve student engagement and retention in online course design and delivery.

## How to Integrate AI for Personalized Learning in Indonesian Education

*1. Personalised Learning (PL) conceptual framework.* Specifically, the PL conceptual framework can be used to integrate Ai-personalised learning into the Indonesian education system. Lee (2014) proposed five elements in the PL conceptual framework as follows:

*1.1. Personalised Learning Plan (PLP) elements:* By focusing on instructional customisation that considers students' needs, these elements involve adjusting the pace to suit individual students, adapting the instructional approach to their preferences, and tailoring different learning styles to their interests.

*1.2. Competency-based student progress (CBSP):* This element focuses on students' progress and performance based on individual mastery rather than time-based progress.

*1.3. Criterion-referenced assessment (CRA):* This element evaluates whether students have acquired specific skills or competencies. Through ongoing formative assessment, it tracks students' learning needs and progress toward achieving learning goals and selects suitable instructional materials based on their needs.

*1.4. Project or problem-based learning (PBL):* PBL is a recommended method for personalised instruction, enabling students to select their preferred topics, learning methods, and paces.

*1.5. Multi-year mentoring (MYM):* Teachers better understand students over the years, creating personalised learning plans and effective strategies. MYM allows for a more organic implementation of CBSP, eliminating the need for summative decision-making.

*2. IDEE Framework.* Personalised learning includes tutoring intelligent systems, adaptive learning, and learning analytics, which are feedback and recommendations. Real-time feedback systems through generative AI give suggestions that align with students' needs and preferences. Authors [60] suggested that Generative AI, ChatGPT, can benefit students with personalised learning to be more efficient and give teachers easier and faster feedback. Authors [60] introduce the IDEE (Identify, Determine, Ensure, Evaluate) framework to integrate generative AI to provide feedback within personalised learning.

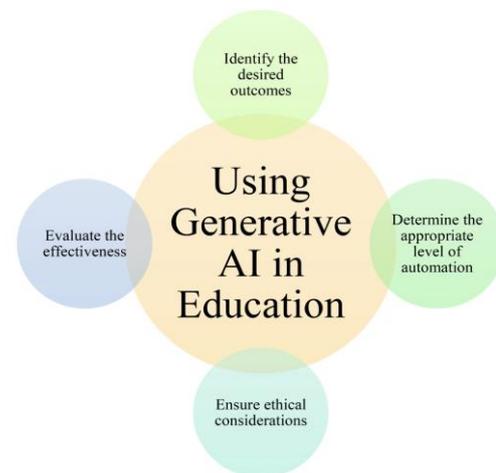


Figure 2 – IDEE Framework Source [60]

This framework can be used as a guide to utilise generative AI in education. Authors [60] proposed that this framework's four aspects be:

*Identify:* identify the goals of the application to ensure that the utilisation of technology corresponds to the intended results.

*Determine:* The decision to completely automate the educational process with AI or enhance conventional teaching techniques depends on the set goals.

Ensure that the *ethical issues* of educational AI, including potential biases and their impact on teachers and students, are carefully explored.

*Evaluate:* It is critical to assess the efficacy of educational AI in reaching the desired results.

### **The challenges and pitfalls to utilising AI in learning personalisation**

In May, UNESCO surveyed over 450 schools and universities globally, revealing that fewer than 10% have established institutional policies or formal guidance for generative AI applications [64]. This highlights a significant challenge in the education sector regarding personalising learning through AI. Globally, the adoption of AI in education still lags in industries such as medicine, business, and finance [8, 38].

*1. Tutoring Intelligent System (TIS).* Implementing tutoring intelligent systems (TIS) faces various obstacles, including social issues, communication limitations, cost concerns, and knowledge gaps. Authors [61] warn that the widespread use of technological solutions might isolate students from their social environment and hinder communication, which is crucial for improving social skills. As [61] notes, the cost is another significant hurdle that can pose challenges for smaller educational institutions, potentially creating disparities in access to TIS due to ICT infrastructure limitations.

Understanding the new systems is a fundamental challenge in TIS implementation, as highlighted by [58]. When students lack the minimum knowledge about these systems, the reliability of TIS diminishes. This complexity is echoed by [11], who state that existing TIS models can be overly complicated, making it difficult for students to obtain a highly tailored learning experience.

Additionally, data accuracy in providing relevant learning materials is a concern. Authors [9] point out that current TIS models rely on generic data that may not be relevant to individual learners. This risk increases when excessive simulations are used for teaching, potentially leaving students without practical, real-world applications of their knowledge and skills [65].

*2. Adaptive Learning System.* Despite their advantages, many learning systems primarily prioritise technical goals, often neglecting the requirements of learning objectives and pedagogical

aspects that encompass the entire learning-teaching process [31, 44]. Furthermore, designers of AI-enabled adaptive learning systems often pay insufficient attention to creating courses that develop practical skills [71]. This neglect of both pedagogical and technical aspects has led to students and teachers perceiving these systems as non-responsive to their learning preferences, fostering a sense of pessimism [29].

Managing complex information poses another challenge for adaptive learning systems. The breakdown of process-oriented adaptation and the difficulty in organising intricate information are recognised limitations [29]. Additionally, the inexplicability of data to users is a concern, particularly when AI is connected to an adaptive learning system. Authors [65] argue that using such systems is unethical when the underlying algorithms are unexplainable.

*3. Learning Analytics (LA).* Implementing personalised learning using AI-integrated learning analytics in education carries various risks, as highlighted by [36]. These risks include inconsistencies in AI pedagogy, misallocating AI resources, accountability concerns, privacy issues, transparency issues, misunderstandings of human-centred AI models, and biases. The primary problem, particularly with bias and accountability, may arise from AI's utilisation of data from inaccurate dimensions [36]. Data bias is also a substantial worry, as [65] noted, due to biases in available data, especially historical data, which may contain biases related to ethnicity and gender.

On the other hand, authors [54] found that learners may be uncomfortable with AI's role in assessing their competency and performance. This discomfort arises from the need for an elevated level of trust in technology's accuracy and performance within AI in education [54]. Additionally, issues related to data collection ethics, particularly when obtaining information about learners' emotional lives, can raise normative concerns, especially when it doesn't align with students' preferences [42].

As authors [65] suggested, privacy and self-determination also present challenges in learning analytics. Using data to create student models without safeguards or data usage limitations can be considered a violation.

## CONCLUSIONS

The emergence of AI technology has significantly impacted Indonesian education, primarily due to its effectiveness in teaching and learning. This essay will explore the potential use of AI in personalised learning within Indonesia's education system. AIED (Artificial Intelligence in Education) in Indonesia has demonstrated positive results in assisting teachers to enhance their teaching methods and, more importantly, in enabling students to personalise their learning experiences, improving their learning outcomes. While learning personalisation offers students numerous benefits by enhancing their learning experiences and aligning with their preferences, there are challenges and risks associated with implementing AIED in Indonesia's education system.

However, it is crucial to note that the potential benefits of AI in personalised learning within Indonesia's education system are supported by fundamental frameworks established by the Indonesian government. One such framework is the AI National Strategy Framework (ANSF),

which outlines a roadmap and priority areas for education development, mainly focusing on personalised learning for students. In its implementation, the ANSF will be bolstered by a conceptual network for personalised learning (PL) that drives AI-driven personalised learning. Lastly, the integration of real-time feedback and recommendations will be facilitated through the IDEE framework in the context of the Indonesian education system. This comprehensive approach aims to harness the full potential of AI in personalised learning, mitigating the associated challenges and advancing the quality of education in Indonesia. Consequently, AI-based learning personalisation holds the potential to be seamlessly integrated into Indonesia's education system.

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