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Integration of Artificial Intelligence in Education: Opportunities, Challenges, Threats and Obstacles. A Literature Review.

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Abstract

The research background is the rapid development of AI which affects various aspects of education. The purpose of this study is to analyze in depth about the opportunities, challenges, threats and obstacles to the implementation of AI in education. The research method used in this study is semi-systematic literature review. The analysis technique used is a meta-narrative approach that includes the process of identifying, analyzing, recognizing patterns and topic-related themes. The results describe that AI opportunities in education are related to the delivery of learning materials, evaluation, management systems, and educational policy making. Meanwhile, the challenges are related to pedagogy, educational frameworks, and literacy. Threats that arise are related to the security of personal data, character building and educational ethics. Finally, obstacles that arise include the high costs required, limited teacher and professional training schemes in preparing AI competencies, and slow changes in curriculum structure and structural level of education.

A. Introduction

Artificial Intelligence (AI) provides new patterns and colors to all aspects of the world. The benefits offered by AI certainly seem so broad, but AI also provides threats and challenges. The integration of AI in various aspects of life has a complex impact related to use to ethics in its use [1]. If briefly defined, AI is a combination of applications of machine learning, deep learning, algorithm productions, and natural language processing [2], [3]. But if analyzed more deeply, AI is the result of the development of devices that have a level of intelligence like humans. Some of the uniqueness of AI that can resemble human abilities include cognitive abilities, the ability to learn, the ability to make decisions to the ability to adapt to the environment [4]. For example, in general aspects of life, AI is able to create smart buildings with the ability to regulate the quality and air temperature in the room, as well as adjust music playlists according to the mood of the day of the person in the room [4].

If AI can provide all the conveniences in aspects of general life, then of course AI can also be used in achieving good quality education. For example, AI which has several advantages can open up new opportunities, maximize potential and provide its own challenges in the world of education. The implementation of AI in education is usually known as Artificial intelligence in education (AIEd) [5]. The development of AI in education is closely related to one of the disciplines, namely computer science. Then the development is increasingly widespread and fully integrated in the field of education [6]. One indicator of the process of integrating AI in education is AIEd which functions as an education management system that includes the process of facilitating teaching, learning and decision making, being a reference in determining educational policies and as virtual assistants for personalized education [7], [8].

Furthermore, AI is also able to contribute in achieving learning goals that include facilitating the learning needs of each student. AI supported by technological developments in the form of mobile internet, cloud computing, big data technologies opens up AI opportunities to take a role in delivering learning content that really suits the learning needs of each individual [9]. Other forms of convenience that can be utilized from AI in learning include enabling assisted learning by humanoid robots which can certainly make it easier for students to achieve learning goals. On the other hand, web-based chatbots can also facilitate students in developing ideas in the process of independent learning and structured learning [4].

The importance of the role of AI in improving the quality of education has not received special attention from the general public, education practitioners and even education policy makers. The attention and interest of investment in AIEd cannot exceed the development of AI investment in the economic, health, cyber or military fields [10]. Therefore, the general public, education practitioners and education policy makers should begin to explore in depth the potential of AI in order to improve the quality of education.

The purpose of this study is to analyze in depth related to opportunities, challenges, threats and obstacles in the process of integrating AI in education. The results of this analysis are expected to be able to provide references for educators who are still dominant in using conventional learning methods, models and media.

With the reference to the results of this analysis, educators can assume the role of change in order to achieve learning goals effectively through the process of integration in education.

B. Research Method

The research method used in this study is semy-systematic literature review. This study is designed to analyze a number of research results that are in accordance with the topic being analyzed. This study analyzes the development of a topic over time from various aspects. This research also analyzes the relevant potential and has implications for the topic being studied. The analysis used in this study tends to be similar to qualitative research in general, which uses a meta-narrative approach that includes the process of identifying, analyzing, recognizing patterns and themes from various research results relevant to the topic [11], [12]. The data analyzed in this study is a type of secondary data in the form of research results that have been published and detected on the Google Scholar web. The keyword used in the search process is "challenges and opportunities of AI in education". The research data that has been collected is then selected based on several criteria such as theme, title, content, and quality of research. The technical stages of selection of this study can be observed as follows:

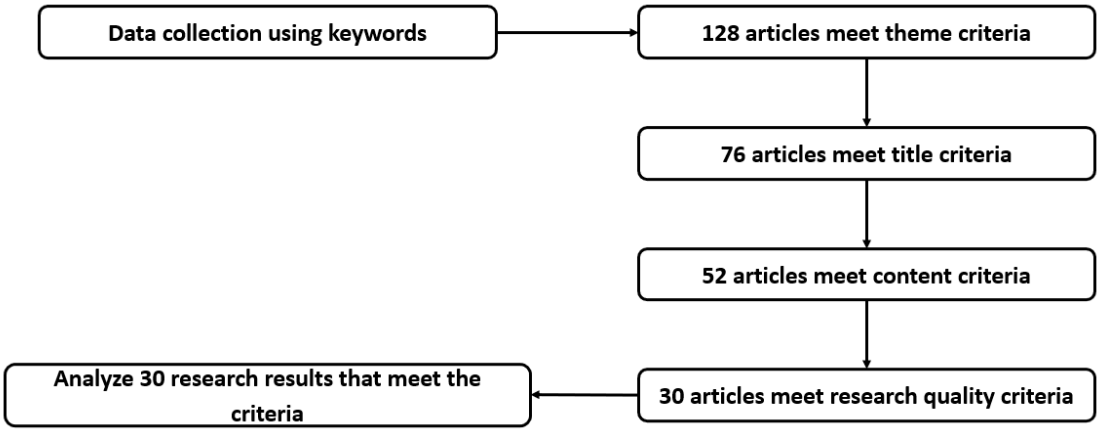

Figure1. The technical stages of article selection

C. Result and Discussion

1. Opportunities

The opportunities offered by AI in education are vast, flexible and can be utilized practically. The opportunities provided by AI can be applied in various aspects of education both from technical teaching which includes the process of delivering learning materials, evaluating learning and managing learning systems, and other aspects of education. Some of the opportunities that AI provides to education are as follows:

a. Delivery of Learning Materials

The first opportunity that can be taken from the implementation of AI in education relates to the novelty of ways in delivering learning materials. AI implemented in learning provides new concepts and nuances that make it easier

for teachers to deliver material more effectively and make it easier for students to absorb learning material, increase student understanding, and strengthen students' confidence levels in adapting to the digital world [13], [14]. The implementation of AI is also not fixed on certain scientific fields, but can be implemented in all fields of learning such as science, psychology, health education, language, art, mathematics and others [14].

The strategy of applying AI in learning also opens up opportunities to improve the quality of personal learning. This can be achieved by several advantages of AI features that are able to create adaptive learning such as intelligent tutoring features that can provide assistance in the form of support and feedback in personal learning for students and intelligent tools features that make it easier for students to access all learning needs [2], [5], [8]. Furthermore, AI integrated with learning applications also provides support systems and scaffolding for students in carrying out personal learning [15].

On the other hand, teachers can also access the convenience offered by AI to maximize the learning process. For example, AI offers facial recognition systems and predictive analytics. This feature can be used by teachers as a tool to analyze student attitudes and behavior through analysis of student facial expression in the learning process. This makes it easier for teachers to take preventive and further actions so that students can achieve learning goals [2], [4].

Learning also cannot be separated from the process of applying the learning model. In this condition, AI also opens opportunities related to the integration of AI with widely used learning models such as project-based learning, collaborative learning, blended learning, problem-based learning, and mobile learning. The results of the integration are predicted to maximize several aspects of learning outcomes such as learning motivation, academic performance, achievement, behavior, creativity, problem-solving and others [16]. Furthermore, the most common example of implementation is learning robots. AI that is realized in the form of robots involved in learning will also provide meaningful impressions and experiences for students. Robots can act as teacher helpers in routine and patterned learning activities such as learning to spell, pronounce and learning activities that can be demonstrated [4].

b. Learning Evaluation

Effective learning evaluation can also be realized through the process of integrating AI in learning evaluation activities. Some AI features that support the evaluation stage include Automated assessment systems. This feature serves to automatically assess based on student answer patterns compared to the answer database that has been designed [2]. The next feature is image recognition, computer visions, prediction systems that can be used in assessment assignments in the form of papers, essays and working prototypes [4], [17]. Furthermore, AI also offers convenience in the academic performance assessment process through the feature of artificial neural networks that can provide an overview of student academic performance analysis [18].

A good assessment process must also be objective. AI features in the form of object-oriented assessment can realize assessments that focus on objects and do not involve elements of subjectivity such as interest factors, relationships, and the background of students and teachers involved in learning [19]. Through AI-based

assessment, the accuracy of assessment based on actual conditions and object achievements can be achieved well, so that student achievements and needs can be mapped well and appropriate actions can be determined based on student needs [20].

c. Learning Management System

The learning management system in the era of information technology must also be able to adapt to the latest learning needs. To achieve this goal, AI provides great opportunities in the creation of a modern learning management system. AI integrated with learning management systems can be packaged with smart school concepts that utilize AI features such as Face recognition, speech recognition, virtual labs, hearing and sensing technologies. A good learning management system is also able to facilitate online and mobile remote education with Edge computing features, virtual personalized assistants, real-time analysis [4].

The role of AI in the management of the education system is also able to realize modern management principles such as autonomy, adaptability, and interactivity [7]. This principle will be achieved well if it utilizes big data and AI techniques that are capable of collecting accurate and rich personal data [20]. In addition to these three principles, AI also offers several advantages for learning management systems that are illustrated by several characteristics, namely learning management systems that are calculability, measurability, and representability. These three characteristics can support the creation of an effective and efficient learning management system [19].

Furthermore, an effective education management system must also be able to map several aspects such as tracking student knowledge, engagement, academic performance, and detecting student opportunities to fail in a course. These data facilitate the taking of actions, policies and anticipatory steps of each existing condition [21]. Some efforts to improve the quality of the learning management system can open opportunities for the creation of a productive learning system [8].

d. Other Aspects of Education

The collaboration of AI and education in fact not only provides changes to the technical learning and management, but also has an impact on several other aspects related to education. Some other aspects are the process of determining education policy. In this case, education policymakers can consider several AI features that can act as Policy maker advisors. Some of the materials and information presented by AI can make appropriate and accurate education policies according to learning needs [8].

Other aspects that are also affected by the development of AI in education include the development of educational markets. The current state of educational markets is largely determined by the role of AI in education [22]. The next aspect that is also an important aspect of achieving the big goal of education is student literacy. In this information technology era, AI offers the concept of AI literacy which is designed to improve the quality of student literacy through three components, namely AI concepts, AI evaluation concepts, and AI understanding concepts [14].

The last aspect that also changes along with the development of AI is the educational research trend. This aspect also contributes greatly in supporting the

achievement of educational goals. Some educational research trends are related to educational data mining (EDM), intelligent tutoring for writing and reading, intelligent tutoring for K12 and special education, artificial neural networks (ANNs), and graphical representation and knowledge connection [23].

The description above provides a broad picture of the role of AI in achieving educational goals through four aspects, namely the delivery of learning materials, evaluation, learning management systems and other aspects related to education. The general descriptions related to AI implementation opportunities in education can be observed as follows:

Table 1. Opportunities of AI in education

No.	Educational Aspects	AI Opportunities
1	Delivery of learning materials	Multi-disciplinary Personal learning intelligent tutoring Support system and scaffolding Students' performance mapping
2	Learning Evaluation	Automated assessment Assessments of students' performance object-oriented assessment Accurate assessment
3	Learning management system	Calculability System Measurability System Representability System Automated System
4	Other aspects	Policy maker advisor Development of educational markets Research trend center

2. Challenges

The implementation of AI in education not only provides opportunities for education practitioners, but the development of AI also provides challenges that must be considered for education practitioners and policymakers. The first challenge that must be analyzed for solutions is the issue of AI ethics. The implementation of AI in education will intersect with elements of bias, automation, morality, privacy, fairness, transparency [24], [25]. In relation to these issues, practitioners and policy makers must be able to answer challenges related to how to create a comprehensive public policy on AI for sustainable development and pedagogical choices that are ethical, align with fundamental human principles and values, with our legal system, and align with the aspect of inclusion and equity in education [7], [25], [26].

Furthermore, the challenges in implementing AI in education are also related to how to design pedagogical concepts that are in line with epistemology and ethics, truth and the good, individual and collective responsibility [27]. In addition to pedagogical concepts, what must also be considered in the process of implementing AI in education is how to prepare educators who are able to adapt to

the development of AI and are also able to support the creation of ideal pedagogical concepts and integrated AI [26].

The next challenge that must be overcome by education practitioners and policy making is related to several aspects related to technical learning such as systems, frameworks, models, approaches, combinations of interventions and guidelines on how to implement the frameworks [9]. To realize this, there needs to be collaboration between educators, policy-makers, and professionals in achieving the AI revolution in ideal education [20].

The next challenge to consider is how to design the concept of embedding AI within student' everyday lives that support their cultures, goals and educational targets [28]. Finally, curriculum design must also be adjusted to the development and features of AI that support the achievement of curriculum goals. This curriculum design must also prioritize the achievement of AI literacy targets in students [29]. This is important to be designed properly because literacy is the main foundation for students to be able to master various competencies according to their fields. An overview of the challenges in implementing AI in education is as follows:

Table 2. Challenges of AI in education

No.	Educational Aspects	AI Implementation Challenges
1	Pedagogical Aspects	Ethics Bias Fairness Transparency
2	Educational Frameworks	Models Approaches Combinations of interventions Guidelines
3	literacy	Literacy-based curriculum AI Literacy

3. Threats

Some of the conveniences facilitated by AI for the benefit of the educational process are inseparable from several possible threats. The category of threats can be divided into two, namely threats that are directly related to the educational process and the people involved in it and indirect threats that also affect the education system and educational actors.

The first threat relates to the privacy aspect. This aspect can threaten the security of teacher privacy, student privacy, and the privacy of education policy makers. However, the most vulnerable to privacy threats are students. for example, Compromising students' privacy by exploitation of data face recognition and recommender systems [2], misuse of large volumes of data recorded from students related student competencies, personal data, inferred emotional states, strategies and misconceptions [7], [25]. These conditions are threats related to the depletion of ethical elements in education [1].

Furthermore, one of the most widely accessed types of AI by students and teachers is ChatGPT. This AI feature makes it easy to generate acceptable text such as essays. But on the other hand, this is a threat and potential risk associated with

instances of plagiarism. This condition makes it more difficult for teachers to identify and prevent plagiarism [30], [31].

The next threat that must also be watched out for is related to the depletion of the role of teachers. The change in the role of teachers from educators to facilitators further narrows the role of teachers in shaping character in students [28]. For example, automated processes implemented in the process of material delivery and evaluation will override affective elements. Automated assessment will focus on analyzing text and numbers without considering affective elements [32]. The general picture of the threats that arise in the implementation of AI in education is as follows:

Table 3. Threats of AI in education

No.	Educational Elements	AI Implementation Threats
1	Educators and Students	Privacy Exploitation of large personal data Exploitation of inferred emotional states data Exploitation of face recognition data
2	The role of the teacher	Narrowing down the role of teachers in shaping character
3	Educational ethics	Automated processes that override affective elements Plagiarism

4. Obstacles

The implementation of AI in education is inseparable from several obstacles that must be faced. These barriers are related to several fundamental aspects of education. Obstacles to implementing AI in education include the large costs required, limited teacher training schemes in preparing AI competencies for teachers and professionals, and slow changes in curriculum and structural levels of education in accordance with AI development [10].

D. Conclusions

The conclusions of the study include opportunities, challenges, threats and obstacles in the implementation of AI in education. AI opportunities in education are related to four aspects of education, namely the delivery of learning materials, learning evaluation, learning management systems and other aspects such as educational policy making and others. Meanwhile, the challenges of implementing AI in education are related to pedagogical aspects, educational frameworks, and literacy. Furthermore, threats that arise in the implementation of AI in education are related to the security of educators' and students' personal data, the narrowness of character building space and educational ethics. Finally, obstacles that arise in the implementation of AI include three aspects such as the high costs required, limited teacher and professional training schemes in preparing AI competencies, and slow changes in curriculum structure and structural level of education.

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