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Artificial Intelligence (AI) Adoption in Pesantren: Challenges and Readiness

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Abstract: The presence of Artificial Intelligence (AI) has impacted various sectors of life, including education, in which there are *pesantren* entities. This article aims to discuss how the readiness of *pesantren* in adopting AI in learning at the same time as the challenge of maintaining the values and traditions of *pesantren* as the driving force of Islamic religious education in Indonesia. This research was conducted using the literature method with data collection techniques in the form of literature reviews from scientific articles and various relevant sources of information. The data obtained is then analyzed and compiled to obtain coherent information and good conclusions. As a result, there are at least three attitudes of *pesantren* in dealing with the development of information technology: open, closed, and partially open. There are several opportunities for AI utilization to be applied by *pesantren* along with its challenges. As an unstoppable phenomenon, the development of AI needs to be adopted by *pesantren*, both actively and passively, while maintaining the values and culture of *pesantren*.

Keywords: challenges, Pesantren, readiness.

Introduction

Artificial intelligence, also known as AI, is a rapidly growing field of technology. AI refers to the ability of computers or machines to perform tasks that require human thought, such as decision-making, data processing, and self-learning (Zhang, Zhu, and Su, 2023). AI technology allows computers to recognize patterns, learn from data, and improve their performance over time. Artificial intelligence is used in a variety of fields, including natural language processing, facial recognition, autonomous cars, and data analysis.

AI has opened up a wide range of opportunities in various sectors of life. In the healthcare sector, AI is used to analyze medical data, predict diseases, and even assist in diagnosis (Kumar, Chauhan, and Awasthi, 2023). In the automotive industry, AI technology is used to develop autonomous cars that can reduce traffic accidents and improve transportation efficiency (Khaleel, Ahmed, and Alsharif, 2023). In the financial sector, AI is used to detect fraud, manage investment portfolios, and process financial transactions quickly and accurately (Pallathadka *et al.*, 2023). Education has also benefited from AI, with intelligent learning systems that can be customized to individual needs (Udvaros and Forman, 2023). Even in agriculture, AI is being used to monitor crops, predict weather, and improve agricultural productivity (Sharma, Verma, and Hardaha, 2022). In addition, AI is also used in the entertainment industry, such as personalized digital content search, gaming, and movie making (Shalender, 2023). Overall, the utilization of artificial intelligence has transformed many aspects of life, improving efficiency, accuracy, and quality of service in various sectors.

The aspect that this paper will focus on is education. The use of AI in education has brought significant innovation into the learning process. AI is used to create intelligent learning systems that can respond to students' individual needs. For example, an e-learning platform that utilizes AI can develop learning plans that are tailored to each

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student's level of understanding (Cardona, Rodríguez dan Ishmael, 2023). In addition, AI is used to develop interactive learning content, ranging from virtual lecturers who can provide further explanations to simulations that allow students to experience the concepts being taught. One of them is developed by Universitas Teknokrat Indonesia, which on April 25, 2023 launched the virtual lecturer "Alpha" made with AI as its backbound technology (Azzahra, 2023). In addition, AI can help teachers with administration and classroom management (Ng *et al.*, 2023). Automating routine tasks, such as managing student attendance and grading, allows teachers to focus more on the teaching process. AI can also be used to support research in education, assist curriculum development, and identify educational trends and needs (Diantama, 2023).

Related to education in Indonesia, there are Islamic education providers "*pesantren*" that have unique characteristics when compared to conventional schools (Aroka *et al.*, 2023). *Pesantren* have long had a value-rich culture based on religious traditions and life values that prioritize religious teachings, ethics/morals, and obedience (Haris, 2023). In *pesantren*, Islamic education is not only about understanding religious texts, but also the formation of strong character and morals (Huda, Duwila dan Rohmadi, 2023). *Pesantren* is a place where santri (*pesantren* students) learn not only from reading sources, but also from the behavior of teachers and the surrounding environment (Latifah dan Awad, 2023). In addition, *pesantren* also have a strong social culture, with a tradition of deliberation and mutual cooperation that prioritizes togetherness and concern for others (Asad, 2023). The *pesantren* culture creates close bonds among members of the *pesantren* community and plays an important role in maintaining the sustainability of *pesantren* as important educational and spiritual institutions in Indonesia (Mawardi, 2023).

With such culture and characteristics, it then becomes interesting to know the readiness of *pesantren* in facing the AI era which is currently starting to penetrate the education sector. Will *pesantren* be open to technological developments, especially AI, and adopt them? Or will they choose to remain independent without implementing AI? This paper will discuss how the adoption of AI in the *pesantren* environment, including the challenges, threats, and strategies that can be applied. The application of AI in *pesantren* will bring a number of benefits and challenges. Some of the benefits have been mentioned in the previous sentences. The challenge is in the readiness and response of pesantren towards the presence of AI, because each pesantren has policies that cannot be interfered with by outsiders regarding the use of technological devices. Some pesantren even prohibit the use of technological devices altogether to strive for maximum learning and education results.

Materials and Methods

This research applies literature study as an essential method in exploring an in-depth understanding of *pesantren* and their readiness to implement AI. With regard to the literature study, researchers collected and analyzed data for review from various sources, such as scientific articles, books, papers, and pre-existing documentation. This method allows researchers to develop a strong theoretical framework, identify important trends and findings, and identify knowledge gaps that are still worth exploring.

The sequence of research steps carried out are: topic identification, literature review collection, literature selection, literature analysis, and writing the analysis results. The analysis conducted is a critical evaluation that also looks at the logical flow of the method, the validity of the data, and the relevance of the literature sources used, to ensure that the literature used is quality data. From the above process, it is expected that the analyzed data will be objective, and provide useful insights.

Results and Discussion

The dynamics of *pesantren* in responding to the development of information technology

Pesantren, as the oldest educational institution in Indonesia with a focus on religious and moral

education, respond to technological developments with a variety of approaches. The response of *pesantren* to technological developments may vary, but there are at least three general trends in how *pesantren* deal with these changes:

1. **Open to Technology**: Many *pesantren* have adopted technology in the education process. They use digital learning software, e-learning platforms, and educational apps to facilitate learning. This allows santri to access religious resources more easily and efficiently. Moreover, *pesantren* also provide training on the use of technology to teachers and santri. This can help them better cope with technological developments and integrate technology with their education. The characteristics of *pesantren* that apply this approach are that they allow santri to use gadgets and technological devices, such as laptops and smartphones, as a medium for learning. Although there are still rules regarding operating hours, this approach opens up ample opportunities for santri and teachers to utilize information technology.
2. **Restrictions on Technology**: *Pesantren* are more careful in controlling and monitoring the digital content accessed by santri. *Pesantren* that apply this approach allow santri to use technological devices with more rigid restrictions, such as only being able to access the internet during certain hours. This rule is made to ensure that the material accessed by students remains in accordance with the religious and ethical values taught.
3. **Closed to Technology**: Some *pesantren* retain their traditional approach to education, where the main axis of teaching is done by the teacher to the santri. In addition, learning still focuses on textbooks as study materials. This trend is reflected in the rules that prohibit students from bringing and using gadgets and technological devices in *pesantren*.

It is important to note that *pesantren* approaches to technology may vary and depend on the culture, experience, and leadership of each *pesantren*, so there is no right or wrong. Most *pesantren* recognize that technology can be a useful tool in enhancing religious and moral education as well as giving santri a broader insight into the modern world (Putri, 2023). Regardless of the three attitudes of *pesantren* towards information technology as written above, *pesantren* still emphasize ethics in the educational learning process. Therefore, they teach santri to use technology wisely and not violate religious principles. In fact, at a higher level, some *pesantren* also integrate the development of science and technology in the context of Islam, such as research on ethics in artificial intelligence or the use of technology in da'wah (Marwantika, 2023).

Opportunities for AI utilization in *pesantren*

The utilization of artificial intelligence (AI) in *pesantren* can provide valuable opportunities to improve the quality of education, operational efficiency, and resource management (Grassini, 2023). Here are some opportunities for AI utilization in *pesantren*:

1. **Interactive Learning**: AI can be used to create an interactive digital learning platform. AI systems can monitor the learning progress of each student, adapt learning materials to individual levels of understanding, and provide personalized feedback. This will enable *pesantren* to provide more effective and engaging education.
2. **Virtual Assistant for Teachers**: AI can be used as a virtual assistant for teachers in lesson preparation, assessment, and curriculum planning. This can save teachers' time and allow them to focus more on interacting with students.
3. ***Pesantren* Administrative Management**: AI can be used for administrative management of *pesantren*, including financial management, student attendance, and asset management. This will help optimize *pesantren* operations and reduce administrative burden.
4. **Education Quality Analysis**: AI can be used to analyze educational data, such as exam results and student evaluations, to understand performance trends and improvements that may be needed in the curriculum or teaching methods.
5. **Counseling and Psychological Support**: AI systems can be used to provide psychological

counseling and support to students. They can provide information and advice in terms of personal problems experienced.

6. **Boarding School Security**: AI can be used to monitor boarding school security, such as surveillance through cameras and facial recognition to ensure the physical security of the boarding school.
7. **Customer Service and Communication**: A chatbot or AI system can be used to provide better and more efficient customer service, as well as for communication between *pesantren* and parents.
8. **Supporting the socialization and promotion of *pesantren***: *pesantren* can utilize AI to create a website as a medium for *pesantren* information. In addition, AI can also be used in preparing digital content in the form of copywriting and graphic design as a promotion of *pesantren* services.

With the wise utilization of AI, *pesantren* can improve the efficiency, effectiveness, and quality of the religious education they provide, while still upholding the religious values and ethics that are the main foundation of *pesantren*. However, these opportunities are not easily implemented. Cross-sectoral cooperation, facility support, and the readiness of human resources to implement it need to be prepared from the beginning for the implementation of *ai* in *pesantren*. Thus, the implementation of AI is not a short path, it requires careful planning of the various needs, risks, and consequences that will arise later on.

AI threats and challenges for *pesantren*

The significant development of AI and its massive use in education has its own threats and challenges for *pesantren*. Some of them are:

1. **Shifting the source of authority for the truth of religious teachings**: Muslims should make religious texts and scholars the source of knowledge and teachings in carrying out religious guidance. The presence of AI has the potential to be used as a shortcut for some people to find answers to religious problems quickly. In fact, AI was developed by taking various training data, not all of which are relevant to Islamic teachings.
2. **Replacing Human Interaction**: Another concern is that the use of AI could replace human interaction in the context of religious education. This concern could lead to the diminishment of the teacher-santri relationship, which is an important component of *pesantren* education.
3. **Ethics and Religious Values**: The use of AI in *pesantren* should be carefully monitored to ensure that the technology complies with ethics and religious values. There is a potential that AI may display or generate content that contradicts the religious values or ethical norms of *pesantren*.
4. **Dependence on External Technology**: *Pesantren* may become overly dependent on external technology, and if there are technical issues or vulnerabilities, this may disrupt the educational process and operations of the *pesantren*.
5. **Technology Gap**: The use of AI may create a technology gap between *pesantren* that have the access and ability to adopt technology and those that do not. This may lead to inequality in religious education.
6. **Loss of *Pesantren* Integrity**: Excessive use of AI or without good planning may cause *pesantren* to lose their identity as educational institutions based on religious and cultural values.

To address this concern, it is important for *pesantren* to take a wise approach in adopting AI technologies, by ensuring that they are used as tools that support and complement the religious and moral education that *pesantren* excel in. In addition, proper regulations, training, and ethical policies should be implemented to maintain the safe and beneficial use of AI in *pesantren*. *Pesantren* requires careful planning, full involvement of various stakeholders, and an approach that takes into account the characteristics and purpose of the pesantren.

***Pesantren* involvement in dealing with AI**

Sunan Kalijaga's saying "*Anglaras ilining banyu, angeli ananging ora keli*" seems relevant to the attitude of *pesantren* in facing AI. AI, which is currently a flow that is difficult to avoid, makes

pesantren have to go with the flow, but at the same time, they must stick to the basic principles of *pesantren*. This means that *pesantren* must continue to preserve substantial practices whose role cannot be replaced by AI, such as teacher guidance, empathy, and teacher behavior as a role model.

Responding to the challenges and threats that arise with the development of AI, *pesantren* can be involved either actively as contributors or passively as users. An active step that can be taken by *pesantren* is to participate in developing their own AI based on *pesantren*. For example, developing a chatbot about the rules and laws of prayer, where the training data is taken from relevant sources and can be accounted for in religious and *pesantren* science (Naufa, 2023), The data can be taken from the *pesantren* website or books studied in *pesantren*. Thus, the AI developed will be closer to the truth. In addition, active steps can also be taken by adding AI to the curriculum studied, or building a pilot *pesantren* that makes AI the core and vision of the *pesantren*. So, when the pilot runs and finds its foundation, the students who study there can act as mentors in dissemination either through workshops or incubation. The end result is that more and more students are equipped with soft skills with religious knowledge and hard skills with knowledge that is relevant to the demands of the times.

The passive involvement of *pesantren* is to encourage *pesantren* to utilize Ai technology that has been widely developed into *pesantren* management. One of them is by implementing a chatbot in answering incoming questions automatically. With intense interaction, it is expected to increase expertise in operating the application of AI, thus increasing the efficiency of *pesantren* management.

Conclusions

It has been explained above that each *pesantren* has a different policy in responding to the development of technology and AI. Some are open, closed, and partially open. For those who choose to close themselves, they may be protected from various AI threats. However, there are consequences faced that in the aspect of information technology adoption, it will be left behind compared to *pesantren* that are welcoming to the development of AI. Nevertheless, the policy chosen by the *pesantren* must still be respected considering that the conditions, environment, resources, and leadership in each *pesantren* are not the same.

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