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THE ROLE OF ARTIFICIAL INTELLIGENCE IN THE DEVELOPMENT OF EDUCATION MANAGEMENT INFORMATION SYSTEMS

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Abstract

The development of artificial intelligence (AI) challenges educational institutions to rethink how they manage data and make decisions. Education management information systems (EMIS) still tend to function as administrative record keepers rather than predictive decision-support tools. This article analyzes the role of AI in developing EMIS, identifies implementation problems, and formulates recommendations for institutional management, particularly in Islamic educational institutions. Using a library research method with descriptive-analytical content analysis, the study finds that AI contributes to five main functions: administrative automation, predictive analytics, decision support, service personalization, and resource management. Major obstacles include fragmented and low-quality data, limited human resource readiness, infrastructure constraints, privacy risks, and algorithmic bias. The article proposes a staged implementation framework and a governance model grounded in the values of trustworthiness (amanah), justice, and public benefit (maslahah). As the study is literature-based, its findings require empirical testing in specific institutions.

Keywords: *Artificial Intelligence, Education Management Information system, Data Governance*

INTRODUCTION

Educational institutions today manage a steadily growing volume of data, ranging from data on learners, educators and education staff, curricula, and finances to facilities and infrastructure. A management information system (MIS) is understood as a set of interrelated components for collecting, processing, storing, and distributing information to support decision-making and organizational control (Laudon & Laudon, 2020). In education, MIS takes the form of, among others, academic information systems, teacher and learner data systems, and quality reporting systems.

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The problem is that many education management information systems (EMIS) are still limited to recording and reporting functions. Data are stored but rarely processed into information that helps leaders anticipate problems or design policies. Data scattered across many unconnected applications, repeated manual entry, and delayed reports mean that decisions are often made on the basis of habit or intuition rather than evidence. This is also relevant to Islamic educational institutions such as *madrasah*, *pesantren*, and Islamic religious universities, which, besides meeting national reporting requirements, also have distinctive management needs, for example recording *santri* (*pesantren* student) data, religious guidance, and managing community funds.

At the same time, AI is developing rapidly. AI can be defined as a system's ability to interpret external data correctly, to learn from such data, and to use that learning to achieve specific goals through flexible adaptation (Kaplan & Haenlein, 2019). A systematic review of 146 articles on AI in higher education shows that AI applications are concentrated in four areas: profiling and prediction, assessment and evaluation, adaptive systems and personalization, and intelligent tutoring systems (Zawacki-Richter et al., 2019). The same review notes weak critical and ethical reflection and little involvement of educators in this research. In other words, enthusiasm for AI has not been matched by adequate study of its impact on institutional management.

Most of the literature on AI in education focuses on classroom learning, whereas studies of AI as part of an institution's management information system are relatively few, especially in the context of Islamic education management in Indonesia. This is the gap that this article seeks to fill. The article does not stop at definitions and theory; it analyzes implementation problems, provides illustrations of application, and offers recommendations that institutional managers can put into practice. The purpose of this article is to describe the role of AI in developing EMIS, analyze the problems of its implementation, and formulate solutions and recommendations for the management of educational institutions.

METHODS

This article uses a qualitative approach with the *library research* method, that is, research that uses library sources as the main data without collecting field data (Zed, 2004). This method was chosen because the aim of the article is to synthesize the concepts and findings of previous research rather than to measure the condition of a particular institution.

The data sources consist of academic books, scientific journal articles, and policy documents from reputable institutions that discuss AI in education, management information systems, learning analytics, data ethics, and personal data protection. Sources were selected purposively based on suitability to the topic, the credibility of the publisher or author, and relevance to the aims of the article. Data were collected by searching the literature and recording the important concepts, findings, and arguments of each source.

The analysis was carried out descriptively and analytically using *content analysis* in three steps: (1) reduction, namely sorting out relevant information; (2) grouping the findings into the themes of roles, problems, and solutions; and (3) synthesis to develop an implementation framework (Snyder, 2019). It should be noted that this study is not a systematic review with a standard search protocol, so its coverage of the literature is not intended to be

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exhaustive. The application examples in the discussion are illustrative and are the authors' own analysis, not empirical case data.

RESULTS AND DISCUSSION

The Concept of EMIS and the Position of AI Within It

EMIS essentially serve three managerial needs: operational (recording daily transactions), tactical (monitoring and control), and strategic (long-term planning). In conventional systems, data flow upward through periodic reports. The distinction proposed by Siemens and Long (2011) is useful here: *academic analytics* focuses on the institutional level, while *learning analytics* focuses on the learning process. An EMIS equipped with AI should ideally cover both, namely turning operational data into insight for leaders and turning learning data into feedback for educators.

AI does not replace EMIS but extends its capabilities. Databases and business processes remain the foundation, while AI, especially machine learning, natural language processing, and predictive analytics, processes these data to recognize patterns, predict trends, and generate recommendations (Russell & Norvig, 2021). The review by Chen et al. (2020) maps the influence of AI on education into administration, instruction, and learning; the administrative domain is the one closest to EMIS.

The Role of AI in Developing EMIS

Based on the literature synthesis, the role of AI in developing EMIS can be grouped into five functions.

1. Automation of administrative services and processes. AI can help with data validation, form filling, document classification, and information services through *chatbots*. The direct effect is a reduction in the repetitive workload of education staff, so that their time can be redirected to services that require human judgment (Chen et al., 2020).
2. Predictive analytics. In the area of profiling and prediction, models can estimate the risk of dropout, declining achievement, or repeated absence based on historical data (Zawacki-Richter et al., 2019). For institutional managers, the main value is early warning: interventions can be made before problems become more serious.
3. Decision support. Analytic *dashboards*, scenario simulations, and automatic summaries help leaders understand the condition of the institution more quickly. As a result, decisions such as setting class ratios, allocating budgets, or prioritizing teacher training can be based on evidence.
4. Service personalization. The system can tailor information, guidance service recommendations, or mentoring pathways to the needs of each learner, in line with the direction of adaptive system development mapped in the literature (Holmes et al., 2019; Luckin et al., 2016).
5. Resource management. AI can help with scheduling, mapping educators' workloads, detecting anomalies in financial transactions, and forecasting facility maintenance needs.

AI in academic and student administration. In academic and student administration, artificial intelligence (AI) can be used to automate data entry and validation, answer questions through chatbots, and recognize text in documents. Such use has the potential to reduce

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administrative workload and make information services faster and more consistent. Nevertheless, educational institutions need to anticipate the possibility of incorrect chatbot answers and leaks of personal data. Therefore, automatically provided information still needs verification mechanisms and referral to staff when necessary.

AI in learning quality and learner services. In the area of learning quality and learner services, predictive analytics can be used to give early warning of possible dropout, declining academic achievement, or attendance problems. This information enables educators to provide support before problems develop further. However, prediction results must not be used to put negative labels on learners or serve as the basis for automatic decisions. Model bias and data limitations must be taken into account, while follow-up decisions need to consider educators' professional knowledge and learners' individual circumstances.

AI in human resource management. In human resource management, AI can help map workloads, analyze training needs, and support scheduling. Such analysis has the potential to help institutions distribute tasks more fairly and on the basis of data. However, the performance appraisal of educators and education staff should not rely only on numbers or system outputs. The results of the analysis need to be understood together with the work context, responsibilities, and real conditions in the institution.

AI in finance and facilities. In finance and facilities, AI can be used to detect transaction anomalies and to forecast budget and facility maintenance needs. This use can strengthen accountability and help institutions prepare more focused plans. Nevertheless, detection and forecasting results can become less accurate if historical data are incomplete or inconsistent. Therefore, analysis results need to be checked by matching them against supporting documents and the judgment of authorized staff.

AI in planning and decision-making. At the planning and decision-making stage, analytic dashboards, scenario simulations, and automatic report summaries can help leaders understand the condition of the institution more quickly. This information can become the basis for setting program priorities, allocating budgets, and planning quality improvement. The risk that needs to be controlled is excessive dependence on system recommendations. Accordingly, AI should be positioned as a decision-support tool, not a substitute for professional judgment, institutional policy, and the responsibility of leaders.

Source: Authors' synthesis based on Chen et al. (2020), Holmes et al. (2019), Zawacki-Richter et al. (2019), and Bates et al. (2020).

Analysis of Implementation Problems

The roles above are potential ones. In practice, implementation faces several interrelated problems. Data quality and fragmentation. The performance of AI models depends heavily on the quality of the data used. If learner and educator data are stored in separate applications in different formats, or are entered inconsistently, the analytic results become unreliable. This problem is the most fundamental obstacle because it precedes all other technical problems of AI.

Human resource readiness. The review by Zawacki-Richter et al. (2019) notes the low involvement of educators in AI-in-education research and development. If managers and education staff act only as passive users, they find it hard to judge the reasonableness of system outputs and tend to accept them as they are. Infrastructure and funding. Institutions with limited networks and small technology budgets, which are common among small *madrasah* and *pesantren*, risk being left behind and widening quality gaps between institutions. UNESCO

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(2021) stresses that the use of AI must take inclusion and equity into account so as not to deepen existing inequalities.

Data privacy and security. EMIS store personal data of learners, including minors. Learning analytics raises ethical dilemmas concerning consent, data ownership, and the use of data beyond its original purpose (Slade & Prinsloo, 2013). In Indonesia, the management of personal data is subject to Law Number 27 of 2022 on Personal Data Protection, so institutions have a legal obligation, not merely a moral one.

Algorithmic bias and labeling. Predictive models are trained on historical data that may contain past inequalities. If not audited, the system can reproduce those inequalities, for example by continually flagging certain groups as at risk. Williamson and Eynon (2020) remind us that AI in education is not entirely neutral because it can reflect the assumptions and interests of its designers. Dependence and loss of professional judgment. Selwyn (2019) highlights that educational assessment involves value judgments that cannot be fully handed over to machines. For managers, the risk is turning system scores into decisions, when such scores are only one input.

Illustrations of Application in Islamic Educational Institutions

The following three illustrations are the authors' analysis to show how the role of AI can be operationalized. These illustrations are not the result of empirical case studies. **Madrasah aliyah (Islamic senior high school):** early warning for at-risk students. Attendance data, grades, and guidance records that were previously stored separately are integrated into a single database. A simple model flags students whose attendance and grades are declining. The list of flags does not immediately become a sanction; instead, it is passed on to homeroom teachers and guidance counselors to be followed up through conversations with the students and their parents. Here AI functions as a trigger for attention, while the decision remains with the educators.

Islamic religious universities: academic services. A chatbot answers students' repeated questions about schedules, letter-request procedures, and administrative deadlines, with referral to staff for questions beyond its scope. Analytics on academic information system data help study programs identify courses with high failure rates so that their learning patterns and assessment loads can be reviewed. **Pesantren**: *santri* and financial data governance. *Santri* data, permits, payments, and the use of funds are consolidated in a single system. Anomaly detection helps administrators identify recording discrepancies, thereby strengthening accountability in fund management. Because *santri* data are sensitive, access must be restricted according to the manager's role.

Solution: A Staged Implementation Framework

Based on the analysis of the problems, this article proposes a five-stage implementation framework. The framework is the authors' synthesis and needs further testing in real contexts.

1. Readiness assessment and data governance. Map existing systems and data, determine data owners, establish access and retention policies, and ensure compliance with personal data protection regulations. This stage should be carried out before the institution decides to procure or implement AI technology.
2. Data integration and quality improvement. Standardize formats, remove duplicates, and connect separate applications so that data can be analyzed as a whole.

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3. Limited pilot project. Start with one clear, measurable problem, for example early warning for attendance, before scaling up. Set success indicators from the outset.
4. Capacity building and the human-in-the-loop principle. Train managers and educators to understand how the system works and its limits, and ensure that every decision affecting individuals is reviewed by a human.
5. Periodic evaluation and audit. Test the system's accuracy, bias, and impact periodically, and provide an objection mechanism for those affected by system-based decisions.

Governance Based on Islamic Values

For Islamic educational institutions, AI governance can be formulated by referring to three values commonly regarded as the foundation of Islamic management. The value of *amanah* (trust) requires that learners' data be treated as a trust to be safeguarded, not as an asset to be freely exploited. The value of justice (*'adl*) requires that the system be audited so that it does not harm particular groups. The value of public benefit (*maslahah*) requires that every use of AI be measured by real benefits for learners and the institution, not merely by following technology trends. Using these values as an ethical framework is the authors' interpretation and is in line with the human-centered approach emphasized by UNESCO (2021), but translating them into operational standards requires further study.

CONCLUSION

Based on the literature review, it can be concluded that AI plays a role in developing EMIS through five functions, namely administrative automation, predictive analytics, decision support, service personalization, and resource management, which together enable EMIS to evolve from a recording and reporting system into one that supports decision-making; its implementation is hindered by data quality and fragmentation, human resource readiness, infrastructure and cost limitations, privacy risks, algorithmic bias, and dependence on system outputs; and these obstacles can be managed through staged implementation that starts from data governance rather than technology procurement, with human oversight and the values of *amanah*, justice, and *maslahah* as its foundation.

Recommendations for managers of educational institutions are as follows.

1. Fix and integrate data first before adopting AI, because data quality determines output quality.
2. Start with a small pilot project with a clear problem and clear indicators, then expand based on evaluation results.
3. Develop an internal data protection policy that is aligned with the Personal Data Protection Law, including access restrictions and consent for data use.
4. Stipulate that decisions affecting individuals are not made automatically by the system but are reviewed by educators or leaders.
5. Invest in improving data and AI literacy among managers, educators, and education staff.
6. Conduct bias audits and impact evaluations periodically, and provide an objection mechanism.

For future researchers, it is suggested to conduct case studies or field research at *madrasah*, *pesantren*, or Islamic religious universities to test the proposed implementation framework, since this article is limited to a literature review.

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