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Transformation of Education and Human Resource Development in The Era of AI: Global Challenges and Indonesia's Readiness

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Abstract:

This study analyses the transformation of education and human resource (HR) development in the era of artificial intelligence (AI), placing Indonesia in the context of global change. The research uses a qualitative-descriptive approach through literature review of UNESCO, the World Economic Forum (WEF), the Central Statistics Agency (BPS), and academic literature related to education, technology, skills, and human resource policies. The results of the study show that AI is not only changing learning tools, but also objectives, processes, assessments, teacher competencies, data governance, and the relationship between education and the job market. The WEF estimates that 39% of workers' core skills will change or become obsolete by 2025–2030, while AI and big data are the skill groups with the fastest growth in demand. UNESCO emphasizes the importance of human-centered approaches, ethics, security, privacy, and AI competencies. In the Indonesian context, readiness is still uneven due to differences in digital access, teacher and lecturer capacity, learning quality, data literacy, and the connection between education and industry needs. The research recommends a national strategy that integrates AI literacy, strengthening educator competencies, project-based learning, lifelong reskilling and upskilling, equitable distribution of digital infrastructure, responsible AI governance, and government-education-industry partnerships. Educational transformation must be directed not to replace humans, but to strengthen human abilities to be productive, critical, creative, ethical, adaptive, and able to create new value.

Keywords: Artificial Intelligence; Educational Transformation; Human Resources; AI Literacy; Indonesia; Future Skills

Introduction

The development of artificial intelligence (AI) has entered a phase that affects almost all sectors of life. In education, AI is present through adaptive learning systems, learning analytics, translation, digital tutors, generative AI, administrative automation, and various devices that help the production and processing of knowledge. These changes make education no longer sufficiently oriented to the mastery of factual knowledge. Educational institutions need to prepare students to be able to use technology while understanding its limitations, risks, ethics, and social impacts.

UNESCO places AI as part of the transformation of the education system that must remain human-centered. The Guidance for Generative AI in Education and Research emphasizes privacy protection, safe and fair use, pedagogical validation, and human capacity building. UNESCO also developed the AI Competency Framework for Students with four main dimensions: human-centred mindset, ethics of AI, AI techniques and applications, and AI system design, which are developed through the understand, apply, and create levels. UNESCO further asserts that generative AI is evolving faster than regulatory adaptations in many countries, so educational institutions need to prepare policies that include data protection, age-appropriate use, ethical validation, and pedagogical design.

On the employment side, the WEF in its Future of Jobs Report 2025 shows that technological transformation, green transition, demographic changes, geoeconomic fragmentation, and economic uncertainty will shape the job market until 2030. About 39% of workers' core skills are estimated to change or become obsolete, while AI and big data are among the fastest-growing skills. The WEF also identifies networking and cybersecurity and technology literacy as fast-growing skill groups, although human skills remain important. Consequently, human resource development in the AI era must move from a momentary training model to lifelong learning, in which technology competencies are combined with analytical thinking, creative thinking, resilience, flexibility, leadership, collaboration, and the ability to learn continuously.

Within this context, educational transformation should be understood as a systematic change to goals, curriculum, pedagogy, assessment, organization, educator competencies, technology, and governance. Digitalization is one of the instruments of transformation, while the broader transformation concerns the way educational institutions create learning experiences and prepare students to face societal changes. AI can help personalize learning, provide quick feedback, support information search and processing, help teachers prepare materials, and analyze learning patterns. However, AI's ability to generate text or answers does not automatically guarantee truth. Therefore, source verification, critical reasoning, academic integrity, and human supervision are still necessary.

Indonesia faces both opportunities and challenges in this transformation. The number of people of productive age and the growth of the digital economy open up space for increased productivity. However, this transformation requires education that is able to connect basic literacy, digital literacy, technology skills, social skills, character, and lifelong learning. BPS data through Education Statistics 2024 provides a national and provincial overview of education, schools, classrooms, sanitation, and teacher indicators based on the March 2024 Susenas and school registration for the 2023/2024 school year. At the same time, the digital divide is not only about device ownership and internet connections. It also includes the ability to use technology meaningfully, the ability to evaluate information, access to training, content quality, and the ability of institutions to integrate technology into the learning process. Therefore, education AI policies must pay

attention to regional equality, socio-economic, gender, and the condition of educational units.

Based on these conditions, this research addresses four questions: how AI is changing educational paradigms and practices; what the main challenges of human resource development in the AI era are globally; how ready Indonesian education and human resources are to deal with these changes; and what strategies can strengthen Indonesia's readiness. Accordingly, the research aims to analyze educational changes due to AI, identify global challenges in human resource development, map aspects of Indonesia's readiness, and formulate strategies to strengthen education and future-oriented human resources.

Academically, the research enriches discussions about the relationship between AI, education, and human resources. Practically, the results can be considered for governments, schools, universities, educators, the business world, and professional organizations in designing competency transformation programs.

Methods

The research uses a qualitative-descriptive approach with a literature review method. The focus of the analysis is the relationship between the development of AI, educational transformation, skill needs, and readiness of Indonesian human resources. The main sources include UNESCO documents on AI and education, the Future of Jobs Report 2025 from the World Economic Forum, Education Statistics 2024 from BPS, as well as relevant academic and policy literature. BPS states that Education Statistics 2024 uses the results of Susenas March 2024 and school registration data for the 2023/2024 school year.

The analysis was carried out through four stages: (1) identification of key issues and concepts; (2) grouping findings into the dimensions of technology, pedagogy, human resources, governance, and equity; (3) comparison of global challenges with the Indonesian context; and (4) formulation of policy strategies. The analysis is interpretive and is not intended as a new national survey.

The research framework places AI as a change factor that affects educational inputs (infrastructure and human resources), processes (curriculum, learning and assessment), outputs (student competencies), and outcomes (productivity, innovation, job quality and competitiveness). Governance, ethics, data security, and inclusion factors are cross-dimensional controls.

Results and Discussion

Findings

Paradigm Shift in Education

Literature findings show a shift from a knowledge-centred paradigm towards capability-centred education. Knowledge remains important, but learners need to be able to search, assess, connect, apply, and create knowledge. In the context of AI, the educational question is not just 'what learners know', but also 'how learners use AI to think, solve problems, create, and make decisions responsibly'.

Changes in the Role of Teachers and Lecturers

AI can take on some administrative tasks and routine tasks, but the role of educators remains central in building relationships, guiding thought processes, providing context, developing character, and assessing learners' processes and work. Educators

need to evolve from primary sources of information to designers of learning experiences, facilitators, mentors, evaluators, and leaders of the use of technology.

Assessment Changes

Generative AI challenges assessment models that only ask for final answers. Assessments need to test processes more: arguments, reflections, presentations, demonstrations, projects, portfolios, local case studies, and the ability to account for resources. The use of AI should be transparently stated according to the institution's policies.

Enhanced Skills

The WEF reports that AI and big data are among the fastest-growing skills, followed by networking and cybersecurity and technology literacy. At the same time, creative thinking, resilience, flexibility and agility, curiosity and lifelong learning, leadership, and analytical thinking are also increasing in importance.

Job Market Outlook

The WEF estimates that by 2030 there will be 170 million new jobs and 92 million jobs affected by displacement due to various macrotrends, resulting in a net change of 78 million jobs. This figure is a projection based on employer surveys, not a definitive prediction.

Discussion

Global challenges

The first challenge is the skills gap. Technology is evolving faster than the ability of some organizations to prepare workers. The WEF noted 63% of employers surveyed identified skills gaps as a major obstacle to business transformation.

The second challenge is governance. Institutions must determine limits on the use of AI, data protection, intellectual property rights, transparency, security, and accountability. The third challenge is access inequality. AI has the potential to improve the quality of learning, but its benefits can be concentrated in groups that have better devices, connections, capabilities, and support.

Indonesia's readiness

Indonesia's readiness can be analyzed through five dimensions: digital infrastructure; educator competence; digital literacy and AI of students; curriculum suitability with work needs; and AI governance. BPS education statistics show the importance of looking at the condition of education at the national and provincial levels because the characteristics of schools, teachers, facilities, and educational outcomes are not uniform between regions.

Structural Strengths and Weaknesses

Indonesia's strengths include a large population base, the growth of the digital ecosystem, the existence of universities and training institutions, and increasing attention to digital transformation. The weaknesses include inequality in the quality of education, variations in educators' abilities, non-uniform access to technology, and the lack of optimal relationships between education, research, and industrial needs.

Risks of AI in Education

Risks that need to be managed include over-reliance on AI, misinformation, bias, privacy violations, plagiarism, reduced self-thinking exercises, and access gaps. Therefore, the use of AI must be accompanied by AI literacy, verification, academic policy, and human supervision.

National Strategy for AI Literacy

AI literacy needs to be a cross-level competency. In primary and secondary education, the focus can be given to understanding basic concepts, ethics, security, information verification, and creative use of AI. In higher education, literacy needs to develop into

data literacy, prompt literacy, model evaluation, AI-assisted research, and the application of AI according to disciplines. The UNESCO framework provides competency references that can be adapted to national contexts.

Strengthening the Competence of Teachers and Lecturers

Professional development programs need to move from discrete application training to digital pedagogical and AI competencies. Educators need to be able to choose tools, design learning, supervise the use of AI, assess AI output, and develop tasks that demand reasoning.

Competency-Based Curriculum

The curriculum needs to balance technical and human competencies. Relevant models include analytical thinking, creative thinking, problem solving, communication, collaboration, leadership, digital literacy, AI literacy, entrepreneurship, sustainability, and ethics.

Reskilling dan Upskilling

Colleges, vocational schools, training institutions, local governments, and industry need to build a lifelong learning ecosystem. Micro-credentials, competency certifications, bootcamps, internships, industrial projects, and modular learning can be used to accelerate the transition.

Education-Industry Partnerships

The gap between the curriculum and the world of work can be reduced through industry advisory boards, joint curriculum development, practitioner lecturers, real projects, internships, joint laboratories, and tracer studies. Education should get regular feedback on the skills that are really needed.

Equitable Infrastructure

Policies should not just build devices. Infrastructure needs to include connectivity, power, devices, platforms, technical support, security, and user capacity building. Disadvantaged areas and educational units with limited resources need to receive affirmative support.

Conclusion

AI is fundamentally transforming human resource education and development. Changes are happening in the way knowledge is produced, learning is designed, assessments are conducted, jobs are defined, and competencies are developed. Global evidence suggests that skills change will last significantly until 2030 and the combination of technological skills with human skills is becoming increasingly important.

Indonesia has the opportunity to utilize AI to improve the quality and productivity of human resources, but readiness must be built systemically. The challenge lies not only in technology, but also in the quality of educators, curriculum, equal access, learning culture, governance, and the relationship between education and the world of work.

Recommendations

- 1) Develop a national AI competency framework that is adaptive and can be applied across education levels.
- 2) Making the development of AI competencies of teachers and lecturers part of continuous professional development.
- 3) Develop assessments that assess thought processes, creativity, problem-solving, projects, and reflections, not just the final product.
- 4) Expanding reskilling and upskilling programs based on industry and regional needs.
- 5) Strengthen data protection, AI ethics, academic integrity, and transparency of AI use.

- 6) Directing digital investment in areas and educational units that have access and capacity gaps.
- 7) Building partnerships with governments, universities, schools, businesses, communities, and technology providers.
- 8) Conduct periodic evaluations of the impact of AI on learning quality, productivity, equity, and job readiness.

Research Implications

Follow-up research can use surveys of teachers, lecturers, students, students, and companies in Indonesia; build an educational AI readiness index; compare provinces; and measure the relationship between AI literacy, learning quality, and workforce productivity. For the context of West Sulawesi, research can focus on school and college readiness, workforce digital competence, and AI needs in the agriculture, MSMEs, government, education, and industry sectors.

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