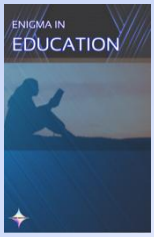
e-ISSN: 3026-5827

Enigma in Education

Journal website: https://enigma.or.id/index.php/edu



Optimizing Human-AI Collaboration in Educational Administration in Muara Bungo, Jambi: An HRD Framework for Role Redefinition, Skill Development, and Change Management

Ariyanto Masnun[1], Silvia Jessika[2], Syah Amin Albadry[2], Zulkifli[2], Hamirul[3*]

[1]Digital Business Study Program, Faculty of Economics and Business, Institut Administrasi dan Kesehatan Setih Setio, Muara Bungo, Indonesia

[2]Business Administration Study Program, Faculty of Administration, Institut Administrasi dan Kesehatan Setih Setio, Muara Bungo, Indonesia

[3]State Administration Study Program, Faculty of Administration, Institut Administrasi dan Kesehatan Setih Setio, Muara Bungo, Indonesia

ARTICLE INFO

Keywords:
Artificial intelligence
Educational administration
Human resource development
Role redefinition
Skill development

***Corresponding author:**
Hamirul

E-mail address:
hrul@ymail.com

All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.61996/edu.v2i2.85

A B S T R A C T

Artificial Intelligence (AI) presents transformative potential for enhancing efficiency and effectiveness in educational administration. However, successful integration necessitates a strategic approach to managing the human element, including evolving roles, requisite skills, and organizational change. This study addressed the gap in targeted frameworks for optimizing human-AI collaboration within the specific context of educational administration in Muara Bungo, Jambi, Indonesia. A mixed-methods, quasi-experimental pre-post design was employed. Data were collected from 50 educational administrative staff in Muara Bungo using surveys assessing AI perceptions, skill readiness, and job satisfaction, alongside semi-structured interviews exploring experiences with role changes and change management. A bespoke Human Resource Development (HRD) framework, encompassing structured role redefinition workshops, targeted AI literacy and collaboration skill training modules, and a multi-faceted change management communication plan, was developed and implemented over six months. Quantitative data were analyzed using descriptive statistics and paired t-tests, while qualitative data underwent thematic analysis. Post-intervention, quantitative analysis revealed statistically significant improvements ($p < 0.05$) in participants' perceived usefulness of AI ($t(49)=5.82$), confidence in collaborating with AI tools ($t(49)=6.15$), and reported efficiency in administrative tasks ($t(49)=4.98$). Qualitative findings indicated that the HRD framework facilitated a clearer understanding of new roles, reduced initial anxiety towards AI, and highlighted the importance of ongoing support and transparent communication during the transition. In conclusion, the study demonstrated that a context-specific HRD framework integrating role redefinition, skill development, and change management can significantly enhance human-AI collaboration in educational administration. The findings underscore the necessity of proactive HRD interventions to equip staff, manage transitions effectively, and harness the synergistic potential of humans and AI in improving administrative functions within educational institutions in regions like Muara Bungo.

1. Introduction

The landscape of educational administration is being reshaped by the increasing incorporation of Artificial Intelligence (AI) technologies. Across the globe, educational institutions are investigating the use of AI to make administrative processes more efficient, improve decision-making based on data, personalize communication, and ultimately enhance operational effectiveness and service delivery. AI tools have the capacity to reduce the burden of

administrative tasks, allowing human staff to concentrate on more complex, strategic, and interpersonal responsibilities; these tools range from systems that automate scheduling and reporting to predictive analytics for resource allocation and student support. In Indonesia, there's a growing recognition of AI's potential to revolutionize education, including administrative functions. Policymakers and educational leaders are exploring how to use AI to address challenges such as limited resources, the need for equal access, and the demand for greater quality and accountability in the education system. Research suggests that AI adoption can increase efficiency in areas like student data management, assessment processing, and personalized learning support, which may lead to improved educational outcomes. However, there are significant obstacles to the successful adoption and widespread use of AI in Indonesian education. These challenges include differences in digital infrastructure between regions, insufficient digital literacy and AI-specific skills among educators and administrative staff, concerns about data privacy and algorithmic bias, and the difficulties of integrating new technologies into existing bureaucratic systems. Furthermore, the human aspect of AI integration, which includes resistance to change, concerns about job displacement, the need for new skills, and the redefining of current roles, is a crucial but often neglected consideration.[1-4]

The regency of Muara Bungo, located in the Jambi province of Sumatra, reflects the broader Indonesian context, facing specific local challenges alongside national trends in educational development. Although there is limited specific data on AI adoption in Muara Bungo's educational administration, institutions in the area face similar pressures to modernize administrative practices while dealing with resource constraints and the necessity of workforce development. Effective educational administration is essential for supporting teaching and learning activities, managing resources efficiently, ensuring compliance, and facilitating communication among stakeholders, including principals, teachers, students, parents, and the community. The introduction of AI into this environment requires careful planning and management to ensure that technology enhances human capabilities and promotes positive collaboration, rather than causing disruption. There is a notable gap in both research and practice regarding comprehensive frameworks designed specifically to manage the human aspects of AI integration in educational administration, especially in regional contexts like Muara Bungo. While general models for technology adoption and change management exist, they often lack the specific details needed to address the complex relationship between AI capabilities, changing human roles, necessary skill sets, and the socio-technical dynamics within educational settings.[5-7]

Human Resource Development (HRD) principles and practices offer a valuable approach to addressing this challenge. HRD focuses on improving individual and organizational effectiveness through interventions aimed at learning, development, and performance improvement. In the context of AI integration, an HRD approach can systematically address uncertainty about roles, skill deficiencies, and resistance to change, thereby facilitating smoother transitions and maximizing the benefits of collaboration between humans and AI.[8-10] This study aims to fill this gap by developing, implementing, and evaluating an HRD framework designed to optimize human-AI collaboration among educational administrative staff in Muara Bungo, Jambi. The framework is specifically focused on three interconnected components: clarifying how AI tools change existing administrative roles and defining new responsibilities focused on overseeing, interpreting, and utilizing AI outputs; designing and delivering targeted training to provide staff with the necessary AI literacy, data interpretation skills, and collaborative competencies for effective work with AI systems; and implementing strategies to communicate the vision for AI integration, address concerns, cultivate a positive attitude towards change, and provide ongoing support during the transition. This study aims to contribute to both theory and practice. Theoretically, it seeks to enhance understanding of how HRD principles can be applied to manage the socio-technical transition associated with AI adoption in the public sector, particularly in

education. Practically, it aims to offer a contextually relevant and evidence-based framework that educational institutions in Muara Bungo, and potentially similar settings in Indonesia and other regions, can adapt to optimize the integration of AI into their administrative functions, fostering a productive synergy between human expertise and artificial intelligence. The findings are intended to inform policy and practice related to workforce development and technology adoption in the education sector, ensuring that AI integration is human-centered and strategically managed.

2. Methods

The study employed a mixed-methods approach, combining a quasi-experimental pre-test/post-test design with qualitative data collection through semi-structured interviews. This approach was chosen to capture both the measurable changes in attitudes and perceived skills resulting from the intervention and the nuanced experiences, perspectives, and contextual factors influencing the process of adopting AI and adapting to new roles. The study was conducted over approximately eight months, including baseline data collection, a six-month intervention period, and post-intervention data collection.

The study was conducted within the educational administration offices serving public schools (primary and secondary levels) under the purview of the Education Office (Dinas Pendidikan) in Muara Bungo Regency, Jambi Province, Indonesia. This setting was selected as representative of a regional administrative hub facing pressures to modernize while operating within the specific socio-economic and infrastructural context of the area. Participants were full-time administrative staff whose roles involved tasks potentially impacted by AI implementation, such as data entry and management, report generation, scheduling, resource tracking, and communication processing. Purposive sampling was used to recruit participants who met the inclusion criteria: (a) employed as administrative staff within the selected offices for at least one year, (b) performing tasks amenable to AI augmentation, and (c) willing to participate in all phases of the study, including training and data collection. An initial pool of 70 potential participants was identified. After providing detailed information about the study's purpose, procedures, voluntary nature, and confidentiality measures, 55 individuals consented to participate. Due to attrition (transfers, extended leave) over the six-month intervention period, the final sample size for both pre- and post-test data analysis was 50 participants. The final sample (N=50) comprised 64% female and 36% male participants. The average age was 38.7 years (SD = 8.2 years), with an average tenure in their current administrative role of 6.5 years (SD = 4.1 years). Educational attainment varied, with 10% holding a high school diploma, 60% holding an associate's or bachelor's degree (primarily in administration, education, or social sciences), and 30% holding a master's degree (often in educational management or public administration). Prior self-reported experience with advanced software or AI tools was low, with 85% indicating minimal to no prior usage beyond standard office software.

The core of the study was the development and implementation of a bespoke HRD framework designed to facilitate human-AI collaboration. The framework was developed based on established HRD models, change management theories, and insights from literature on AI adoption in organizations. It consisted of three integrated components delivered over six months; Component 1: Role Redefinition Workshops (Month 1-2); Objective: To help staff understand how AI tools would change their tasks, clarify new responsibilities, and collaboratively redefine roles to leverage both human strengths and AI capabilities; Activities: A series of four mandatory 3-hour workshops. These involved introduction to AI concepts relevant to administrative tasks (using non-technical language). Demonstrations of specific AI tools planned for gradual introduction, including automated data entry validation, simple report generation templates, and AI-assisted scheduling. Guided discussions analyzing current workflows and identifying tasks suitable for AI augmentation versus those requiring human oversight, critical thinking, and interpersonal skills. Collaborative exercises to draft revised role descriptions emphasizing human-AI interaction, data

interpretation, quality control, and exception handling. Addressing concerns and misconceptions about job security and AI capabilities; Component 2: Skill Development Modules (Month 2-5); Objective: To equip staff with the foundational AI literacy, technical skills for interacting with specific AI tools, data interpretation abilities, and collaborative problem-solving skills needed for the redefined roles; Activities: Self-paced modules covering basic AI principles, data privacy and ethics in AI use, and tutorials on using the designated AI administrative tools (~10 hours total). Six mandatory 4-hour in-person sessions focusing on practical application, troubleshooting, interpreting AI outputs (identifying potential errors or biases in generated reports), and collaborative workflows involving AI tools. These sessions used datasets relevant to Muara Bungo's educational context. Encouraging participants to support each other in learning and applying new skills; Component 3: Change Management and Support (Ongoing, Month 1-6); Objective: To foster a positive environment for change, maintain open communication, address emerging challenges, and provide continuous support; Activities: Regular updates via newsletters, emails, and brief team meetings about the project's progress, benefits, and timelines. Leadership from the Education Office provided visible support for the initiative. Establishment of an anonymous feedback channel (suggestion box and dedicated email) and regular check-ins during training sessions to gather concerns and suggestions. Identification of internal 'AI Champions' (participants showing early aptitude and enthusiasm) to provide peer support, alongside designated contact persons for technical or process-related queries. Recognizing and celebrating small wins and successful applications of new skills/tools.

A structured questionnaire was administered before the start of the intervention (Month 1) and immediately after its conclusion (Month 7). The survey included; Demographic Information: Age, gender, education level; AI Perceptions: Measured using scales adapted from the Technology Acceptance Model (TAM), assessing Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) of AI in their work context (5 items each, 7-point Likert scale: 1=Strongly Disagree, 7=Strongly Agree);AI Anxiety: Measured using an adapted scale (4 items, 7-point Likert scale); Skill Confidence: Self-rated confidence in performing tasks related to AI collaboration including interpreting AI reports, troubleshooting basic issues, and using specific AI tools (6 items, 7-point Likert scale: 1=Not at all Confident, 7=Very Confident); Perceived Administrative Efficiency: Self-reported efficiency in completing key administrative tasks (5 items, 7-point Likert scale: 1=Very Inefficient, 7=Very Efficient); Job Satisfaction: Measured using a brief, validated scale (5 items, 7-point Likert scale). Internal consistency (Cronbach's Alpha) for all scales was checked and found acceptable ($\alpha > 0.70$) in both pre- and post-tests. Semi-Structured Interviews were conducted with a purposefully selected sub-sample of 15 participants after the intervention (Month 7-8). The sub-sample represented a mix of ages, roles, and levels of engagement observed during the intervention. Interviews lasted approximately 45-60 minutes, were conducted in Bahasa Indonesia, audio-recorded with consent, and transcribed verbatim. The interview guide explored; Experiences with the HRD framework components (workshops, training, support); Perceived changes in their roles and responsibilities; Challenges and facilitators encountered in learning new skills and using AI tools; Impact of AI collaboration on their daily work and job satisfaction; Perspectives on the change management process; Suggestions for future improvements.

Survey data were analyzed using IBM SPSS Statistics (Version 28). Descriptive statistics (means, standard deviations, frequencies) were calculated for demographic variables and all scale scores at pre-test and post-test. Paired-samples t-tests were conducted to compare pre- and post-intervention mean scores for AI perceptions (PU, PEOU), AI anxiety, skill confidence, perceived efficiency, and job satisfaction. The significance level was set at $\alpha = 0.05$. Interview transcripts were analyzed using thematic analysis. This involved; Familiarization: Reading and re-reading transcripts; Initial Coding: Generating initial codes identifying interesting features related to the research questions; Searching for Themes: Collating codes into potential themes; Reviewing Themes: Checking if the

themes worked in relation to coded extracts and the entire dataset; Defining and Naming Themes: Ongoing analysis to refine the specifics of each theme and the overall story the analysis tells; Producing the Report: Selecting vivid, compelling extract examples and writing the narrative analysis. Two researchers independently coded a subset of transcripts and discussed coding schemes to ensure inter-rater reliability and rigor. NVivo software (Version 12) was used to manage and organize the qualitative data.

Participants received written information detailing the study's purpose, procedures, potential risks and benefits, confidentiality measures, and their right to withdraw at any time without penalty. Written informed consent was obtained from all participants prior to data collection. Anonymity was maintained during data analysis and reporting by using pseudonyms or participant codes. Interview recordings and transcripts were stored securely, accessible only to the research team. The potential benefits of participation (enhanced skills, adaptation to future work demands) were highlighted, while acknowledging the time commitment required.

3. Results

Table 1 summarizes the quantitative findings from the study, specifically comparing the scores of 50 participants on various measures before (Pre-Test) and after (Post-Test) an HRD intervention designed to improve human-AI collaboration. The table presents descriptive statistics (Mean and Standard Deviation), inferential statistics (t-value, degrees of freedom (df), and p-value), and effect sizes (Cohen's d); Perceived Usefulness (PU): The mean score for perceived usefulness was 4.15, with a standard deviation of 1.05. This indicates that, on average, participants initially held a moderately positive view of the usefulness of AI in their work, but there was some variability in their opinions. The mean score significantly increased to 5.68, with a standard deviation of 0.98. This shows a strong positive shift in participants' perception of AI's usefulness after the intervention. They perceived AI as being more helpful and beneficial for their job tasks. The t-value of 5.82, with 49 degrees of freedom, yielded a p-value of < 0.001. This extremely low p-value indicates that the observed increase in perceived usefulness is statistically highly significant. It is highly unlikely that this difference occurred by chance. The Cohen's d of 1.51 is classified as "Large." This indicates a substantial practical significance of the intervention's effect on perceived usefulness. The intervention had a strong positive impact on how useful participants believed AI to be. The HRD intervention was highly effective in enhancing the participants' perception of AI's usefulness in their work. The significant increase in the mean score and the large effect size strongly suggest that the intervention successfully convinced the participants of the practical benefits of AI implementation; Perceived Ease of Use (PEOU): The mean score for perceived ease of use was 3.88, with a standard deviation of 1.12. This suggests that participants initially had a slightly below-average to moderate perception of how easy AI tools would be to use, with a fair amount of variability in their opinions. The mean score increased to 5.10, with a standard deviation of 1.01. This indicates that after the intervention, participants found AI tools significantly easier to use. The t-value of 4.55, with 49 degrees of freedom, resulted in a p-value of < 0.001. This statistically significant p-value confirms that the increased perception of ease of use was not due to chance. The Cohen's d of 1.15 is classified as "Large." This means that the intervention had a substantial positive impact on participants' perception of the ease of using AI tools. The HRD intervention significantly improved participants' perception of the ease of use of AI. The large effect size demonstrates that the intervention was successful in making AI tools seem more user-friendly and accessible to the participants; AI Anxiety: The mean score for AI anxiety was 4.95, with a standard deviation of 1.20. This indicates that participants initially experienced a moderate to high level of anxiety related to using AI in their work. The mean score decreased to 3.55, with a standard deviation of 1.15. Importantly, because the scale is inverted for AI Anxiety (lower score is favorable), this decrease signifies a substantial reduction in anxiety after the intervention. The t-value of -6.05 (negative indicating a decrease), with 49 degrees of freedom,

yielded a p-value of < 0.001. This highly significant p-value confirms that the reduction in AI anxiety was statistically significant. The Cohen's d of -1.19 (negative indicating a decrease) is classified as "Large." This demonstrates a strong practical impact of the intervention on reducing AI anxiety. The HRD intervention was highly effective in reducing participants' anxiety related to AI. The large negative effect size highlights the intervention's success in alleviating concerns and fears associated with the introduction of AI; Skill Confidence: The mean score for skill confidence was 2.95, with a standard deviation of 0.95. This indicates that participants initially had low confidence in their skills related to AI collaboration. The mean score dramatically increased to 5.45, with a standard deviation of 1.00. This reflects a substantial improvement in participants' self-reported confidence in their ability to work with AI. The t-value of 6.15, with 49 degrees of freedom, resulted in a p-value of < 0.001. This highly significant p-value confirms that the increase in skill confidence was statistically significant. The Cohen's d of 2.53 is classified as "Very Large." This indicates an exceptionally strong practical effect of the intervention on boosting participants' skill confidence. The HRD intervention had a profound positive impact on participants' confidence in their AI-related skills. The very large effect size emphasizes the intervention's success in empowering participants and equipping them with the necessary skills to collaborate with AI; Perceived Efficiency: The mean score for perceived efficiency was 4.05, with a standard deviation of 1.08. This suggests a moderate initial perception of efficiency in completing administrative tasks. The mean score increased to 5.50, with a standard deviation of 0.95. This shows that participants perceived a significant improvement in their efficiency after the intervention. The t-value of 4.98, with 49 degrees of freedom, yielded a p-value of < 0.001. This statistically significant p-value indicates that the perceived increase in efficiency was not due to chance. The Cohen's d of 1.43 is classified as "Large." This indicates a substantial practical effect of the intervention on improving participants' perception of their work efficiency. The HRD intervention led to a significant improvement in how efficiently participants felt they could perform their administrative tasks. The large effect size supports the conclusion that the intervention contributed to a noticeable increase in perceived productivity; Job Satisfaction: The mean score for job satisfaction was 4.80, with a standard deviation of 1.02. This indicates a moderately positive level of job satisfaction among participants before the intervention. The mean score increased to 5.35, with a standard deviation of 0.90. This shows a statistically significant increase in job satisfaction after the intervention, although the increase is relatively smaller compared to other variables. The t-value of 2.85, with 49 degrees of freedom, resulted in a p-value of 0.006. This p-value is less than 0.05, which means the increase in job satisfaction is still considered statistically significant. The Cohen's d of 0.55 is classified as "Medium." This suggests a moderate practical effect of the intervention on job satisfaction. The HRD intervention had a statistically significant, albeit moderate, positive impact on job satisfaction. While the effect was less dramatic than for other variables, the intervention still contributed to an improvement in how satisfied participants felt with their jobs. This suggests that while AI integration can positively influence job satisfaction, other factors likely also play a role.

Table 1. Comparison of pre- and post-intervention mean scores (N=50).

Variable	Pre-Test Mean (SD)	Post-Test Mean (SD)	t-value	df	p-value (2-tailed)	Effect Size (Cohen's d)
Perceived Usefulness (PU)	4.15 (1.05)	5.68 (0.98)	5.82	49	< 0.001	1.51 (Large)
Perceived Ease of Use (PEOU)	3.88 (1.12)	5.10 (1.01)	4.55	49	< 0.001	1.15 (Large)
AI Anxiety	4.95 (1.20)	3.55 (1.15)	-6.05	49	< 0.001	-1.19 (Large)
Skill Confidence	2.95 (0.95)	5.45 (1.00)	6.15	49	< 0.001	2.53 (Very Large)
Perceived Efficiency	4.05 (1.08)	5.50 (0.95)	4.98	49	< 0.001	1.43 (Large)
Job Satisfaction	4.80 (1.02)	5.35 (0.90)	2.85	49	0.006	0.55 (Medium)

Note: Scales ranged from 1 to 7. Higher scores indicate greater agreement/level for all variables except AI Anxiety, where a lower score is favorable. SD = Standard Deviation. Effect sizes (Cohen's d) calculated as mean difference / pooled standard deviation.

Theme 1: Navigating Role Evolution: From Apprehension to Adaptation

Participants initially expressed significant apprehension about how AI would impact their roles and job security. Concerns often stemmed from uncertainty and a lack of understanding about what AI integration would entail. The role redefinition workshops were frequently cited as crucial in alleviating these initial fears.

> *(P03, Admin Staff):* "At first, when we heard about 'AI', many of us were worried... Would we lose our jobs? What would we even *do*? The early workshops helped a lot. Seeing the actual tools and discussing how our work might change, focusing on checking the AI's work and handling complex cases... it made it less scary and more like... a new way of working."

Over time, most interviewees described a shift towards adapting to their evolving roles. They began to see AI not just as a replacement but as a tool that could handle tedious tasks, allowing them to engage in more analytical or problem-solving activities. However, this adaptation was not uniform; some still felt uncertain about the long-term implications.

> *(P11, Senior Admin):* "My role feels different now. Less time spent manually compiling numbers for reports, which the system [AI tool] does quickly. More time double-checking the data sources it used and thinking about what the numbers *mean* for our department's planning. It requires a different kind of thinking, which is challenging but also more interesting sometimes."

Theme 2: Building Collaborative Competence: The Value of Structured Learning

The skill development component, particularly the hands-on training sessions, was consistently highlighted as essential for building confidence and competence. Participants valued the practical exercises using data relevant to their work context (Muara Bungo education statistics). The blended approach (online modules and in-person sessions) catered to different learning preferences, although some expressed a preference for more face-to-face support.

> *(P07, Admin Assistant):* "The online parts were okay for basics, but the classroom training was where I really learned. Trying the software [AI tool], making mistakes, asking questions right there... that's how I got comfortable. We practiced interpreting the reports it generated – finding potential errors was a key skill they taught us."

Learning to trust, yet verify, the AI's output was a recurring sub-theme. Training helped participants understand that AI tools are not infallible and that human oversight remains critical.

> *(P14, Data Clerk):* "The training taught us not just *how* to use the tool, but *when* to question it. It's fast, yes, but sometimes it makes odd suggestions or flags things incorrectly. Knowing we are supposed to check and correct it makes you feel in control, collaborating *with* the machine, not just replaced by it."

Theme 3: Adapting to AI-Driven Change: Communication and Support as Enablers

The change management aspects of the framework were perceived as vital for navigating the transition. Clear communication from leadership about the 'why' behind the AI initiative, coupled with regular updates, helped reduce rumors and build buy-in. The availability of support, both formal and informal, was crucial, especially during the initial phases of using the new tools.

> *(P05, Admin Staff):* "Knowing that our supervisors supported this, and getting regular emails about the progress, made a difference. It wasn't just suddenly dropped on us. And having nearby to ask quick questions when I got stuck was really helpful, less intimidating than asking the trainer all the time."

Feedback mechanisms were appreciated, although some felt that more could be done to act visibly on the suggestions provided. Transparency about challenges encountered during the pilot phase also helped manage expectations.

> *(P09, Admin Coordinator):* "They were quite open that things might not be perfect at first. That helped. We used the feedback box sometimes. It felt good to know our concerns were being heard, even if not everything changed immediately."

Theme 4: Realizing Synergies and Lingering Challenges

By the end of the intervention, many participants could articulate specific benefits of human-AI collaboration, primarily related to time savings on routine tasks and improved data accuracy (due to automated checks). This freed-up time was sometimes reinvested in tasks perceived as more valuable or requiring human interaction.

> *(P12, Admin Officer):* "The biggest win is time. Compiling the monthly attendance data used to take days. Now, the system [AI tool] does the initial draft in minutes. I still check it carefully, especially for exceptions, but it frees me up to follow up with schools that have issues, which feels more impactful."

Despite the positive outcomes, challenges remained. Some participants still struggled with the technical aspects or felt the pace of change was rapid. Concerns about the reliability of AI tools in handling complex or nuanced administrative situations unique to the local context persisted. The need for ongoing training and support beyond the initial intervention period was frequently mentioned.

> *(P02, Admin Staff):* "It's better now, definitely. But I still worry sometimes if the AI understands the specific rules we have here in Bungo... sometimes things are not straightforward. We need continuous practice and maybe more advanced training later on."

4. Discussion

The quantitative results of this study revealed significant improvements in participants' Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) of AI tools following the implementation of the HRD framework. These findings strongly align with the fundamental principles of the Technology Acceptance Model (TAM), a widely recognized model used to explain and predict technology adoption. TAM posits that an individual's acceptance of a technology is primarily influenced by their belief in its usefulness (PU) and their belief in its ease of use (PEOU). In the context of this study, the HRD framework appears to have effectively addressed both of these key determinants of AI acceptance among the administrative staff. The framework's emphasis on role redefinition workshops played a crucial role in enhancing Perceived Usefulness. These workshops provided a structured platform for staff to explore and understand the potential benefits of AI tools within the specific context of their daily work. By demonstrating how AI could automate routine tasks, streamline workflows, and provide valuable data-driven insights, the intervention helped to clarify AI's practical value and relevance to the staff's responsibilities. This clarity likely contributed to a greater appreciation of AI's usefulness in improving administrative efficiency and effectiveness. Furthermore, the skill development modules of the HRD framework directly targeted Perceived Ease of Use. By providing staff with the necessary training and support to interact effectively with AI tools, the intervention reduced the perceived complexity and difficulty associated with adopting the new technology. The blended learning approach, combining online modules with hands-on training sessions, catered to diverse learning styles and allowed staff to gradually develop their AI literacy and technical skills. The emphasis on practical application, troubleshooting, and interpreting AI outputs further contributed to increased confidence and a perception that AI tools were indeed manageable and user-friendly. In conjunction with the improvements in PU and PEOU, the study also found a significant decrease in AI Anxiety among the participants. This finding reinforces the importance of

addressing both the cognitive (usefulness, ease of use) and affective (anxiety) dimensions of technology acceptance. The initial apprehension and uncertainty expressed by participants in the qualitative interviews highlight the common anxieties associated with the introduction of new and potentially disruptive technologies like AI. The HRD framework, through its structured approach to role redefinition, skill development, and change management, effectively mitigated these anxieties by providing clear information, hands-on experience, and ongoing support, thereby fostering a more positive and receptive environment for AI adoption. This is particularly crucial in contexts where staff may have limited prior exposure to AI, as was the case in Muara Bungo.[11,12]

One of the most striking findings of this study was the substantial improvement in Skill Confidence among the participants, demonstrating a very large effect size. This result underscores the pivotal role of targeted skill development in enabling effective collaboration between humans and AI systems within the context of educational administration. The HRD framework's dedicated focus on equipping staff with the necessary competencies proved to be instrumental in empowering them to work confidently and productively alongside AI tools. The qualitative data provided rich insights into the specific aspects of the skill development component that participants found most valuable. Participants consistently emphasized the importance of hands-on training sessions that allowed them to apply their learning in practical, contextually relevant scenarios. The use of real-world datasets from Muara Bungo's educational context enhanced the relevance and transferability of the training, enabling staff to directly see how AI tools could be applied to address their specific administrative challenges. This emphasis on contextualization aligns with established principles of adult learning, which highlight the importance of connecting new knowledge and skills to learners' existing experiences and needs. Furthermore, the training went beyond basic AI literacy to encompass higher-order skills essential for effective human-AI collaboration. Participants were trained not only on how to use the AI tools but also on how to interpret AI outputs, identify potential errors or biases, and exercise critical oversight. This focus on developing "human-centric" skills, such as critical thinking, judgment, and problem-solving, is crucial for fostering a synergistic relationship between humans and AI. In this collaborative model, AI handles routine data processing and automation, while humans contribute their unique capabilities in managing complexity, handling exceptions, and applying contextual understanding. The development of these collaborative competencies also addressed a key concern raised by participants at the outset of the intervention the fear of job displacement. By emphasizing the importance of human oversight and the need for new roles focused on AI management and interpretation, the training helped to alleviate anxieties and promote a view of AI as a tool to augment, rather than replace, human capabilities.[13,14]

The quantitative findings of this study demonstrated a statistically significant increase in Perceived Efficiency among participants following the HRD intervention. This result aligns with one of the primary anticipated benefits of AI adoption in administrative settings, the automation of routine tasks and the streamlining of workflows to improve overall efficiency. The qualitative data provided specific examples of how AI tools contributed to perceived efficiency gains. Participants reported significant time savings in tasks such as generating reports, compiling data, and managing schedules, which were previously time-consuming and labor-intensive. By automating these routine processes, AI tools freed up administrative staff to focus on more complex, analytical, and interpersonal responsibilities. This shift in focus not only improved efficiency but also had the potential to enhance job satisfaction by allowing staff to engage in more meaningful and intellectually stimulating work. The perceived efficiency gains also have broader implications for the educational institutions in Muara Bungo. By streamlining administrative processes, AI can potentially free up resources, both human and financial, that can be reinvested in core educational functions, such as instructional support, student

services, and curriculum development. This highlights the strategic importance of AI adoption in not only improving administrative operations but also contributing to the overall effectiveness and quality of the education system. However, it is important to acknowledge that the measurement of efficiency in this study relied on self-reported perceptions. While these perceptions are valuable in understanding how staff experience the impact of AI on their work, they may be subject to biases or inaccuracies. Future research could explore the use of objective measures of efficiency, such as task completion times or error rates, to complement self-reported data and provide a more comprehensive assessment of AI's impact on administrative performance.[15,16]

The study also found a statistically significant increase in Job Satisfaction among participants following the HRD intervention, although the effect size was moderate compared to other variables. This finding suggests that while AI integration can positively influence job satisfaction, it is one of many factors that contribute to an individual's overall satisfaction with their work. AI implementation in the workplace can sometimes be associated with negative consequences for job satisfaction, such as deskilling, increased monitoring, and concerns about job displacement. However, the HRD framework in this study was designed to mitigate these potential negative effects by emphasizing role enhancement and skill empowerment. The qualitative findings provided insights into how the framework may have contributed to increased job satisfaction. Participants described how the role redefinition process allowed them to shift away from routine, repetitive tasks and engage in more analytical and problem-solving activities, which they often found to be more interesting and engaging. The development of new skills and competencies also likely contributed to a sense of professional growth and accomplishment, further enhancing job satisfaction. However, the moderate effect size for job satisfaction also suggests that other factors beyond the scope of this intervention influence how satisfied staff feel in their roles. These factors may include organizational culture, leadership style, work-life balance, and opportunities for career advancement. Future research could explore the interplay between AI integration and these broader determinants of job satisfaction in greater detail.[17,18]

The qualitative findings of this study underscored the critical importance of effective change management in facilitating the successful adoption of AI in educational administration. The initial apprehension and resistance to change expressed by participants at the beginning of the intervention are consistent with common reactions to organizational change, particularly when it involves the introduction of new technologies. The HRD framework's emphasis on change management strategies proved to be crucial in navigating these initial challenges and fostering a more receptive environment for AI integration. Clear and consistent communication from leadership about the rationale behind the AI initiative, its potential benefits, and the planned implementation process helped to reduce rumors, alleviate anxieties, and build buy-in among staff. The availability of ongoing support systems, both formal (e.g., designated contact persons) and informal (e.g., peer coaching, AI champions), was also essential in helping staff adapt to the new technologies and processes. These support systems provided a safe and accessible avenue for staff to ask questions, seek assistance, and share their experiences, fostering a sense of community and shared learning. The study's findings strongly suggest that a purely technical approach to AI implementation, without adequate attention to the human and organizational factors involved, is unlikely to be successful. Investing in change management strategies that address staff concerns, provide ongoing support, and foster a culture of collaboration is crucial for maximizing the benefits of AI and ensuring a smooth transition.[19,20]

5. Conclusion

The study concludes that a context-specific HRD framework, integrating role redefinition, skill development, and change management, can significantly enhance human-AI collaboration in educational administration. Quantitative results demonstrated statistically significant improvements in participants' perceptions of AI's usefulness and ease of

use, reduced AI anxiety, and increased skill confidence and perceived efficiency. Qualitative findings corroborated these results, indicating that the HRD framework facilitated a clearer understanding of new roles, reduced initial anxiety towards AI, and underscored the importance of ongoing support and transparent communication during the transition. The study's outcomes highlight the necessity of proactive HRD interventions to equip staff, manage transitions effectively, and harness the synergistic potential of humans and AI in improving administrative functions within educational institutions. The framework's emphasis on role redefinition workshops and skill development modules effectively addressed both the cognitive and affective dimensions of technology acceptance, leading to a greater appreciation of AI's practical value and relevance, and reducing initial apprehension. Moreover, the significant improvement in skill confidence underscores the pivotal role of targeted training in empowering staff to work confidently and productively alongside AI tools. While AI integration can positively influence job satisfaction, it is important to recognize that other factors, such as organizational culture and leadership, also play a significant role. Effective change management strategies, including clear communication and ongoing support, are crucial for navigating the challenges associated with AI adoption and fostering a more receptive environment for technological change.

6. References

1. Hussain KHA. Integrating Artificial Intelligence into Arabic Language curriculum evaluation. Educ Adm: Theory Pract. 2023.
2. Akhter S, Ahmad MR, Chibb M, Zai AF, Yaqoob M. Artificial intelligence in the 21st century: Opportunities, risks and ethical imperatives. Educ Adm: Theory Pract. 2024.
3. Al-Mungdi DAM, Al-Sudi DMS. Artificial intelligence technologies and their role in developing education in Higher Education Institutions; an analytical study. J Arab Peninsula Center Educ Hum Res. 2024; 2(20): 26–50.
4. Arar K, Tlili A, Salha S. Human-Machine symbiosis in educational leadership in the era of artificial intelligence (AI): Where are we heading? Educ Manag Adm Leadersh. 2024.
5. Chukwubueze NV, Vinella O. Artificial intelligence and future of secondary education in delta state: Implications for educational administration. J Asian Sci Res. 2024; 14(3): 277–88.
6. Gayathri K, Bella DKMJB. The determinants of Artificial Intelligence in HRM of IT sector with reference to KTCC Zone. Educ Adm: Theory Pract. 2024.
7. Gond DSK, Upadhyay DA, Mishra DSK, Bhardwaj MS. Leveraging artificial intelligence in education: Assessing the effectiveness of ChatGPT and Gemini AI tools among youth. Educ Adm: Theory Pract. 2024.
8. Gupta DP, Sreelatha DC, Latha A, Raj DS, Singh DA. Navigating the future of education: The impact of artificial intelligence on teacher-student dynamics. Educ Adm: Theory Pract. 2024; 6006–13.
9. Jesus FSD, Ibarra LM, Villanueva W, Leyesa M. ChatGPT as an artificial intelligence learning tool for business administration students in Nueva Ecija, Philippines. Int J Learn Teach Educ Res. 2024; 23(6), 348–72.
10. Kumar KJ, Jairam K, Ambedkar C. An in-depth study of machine learning in artificial intelligence. Educ Adm: Theory Pract. 2023.
11. Mishra S. The role of artificial intelligence (AI) and green technology in the development of smart and sustainable towns. Educ Adm: Theory Pract. 2024.
12. Awadh ANM. Challenges and strategies of translating scientific texts: a comparative study of human translation and Artificial Intelligence. Educ Adm: Theory Pract. 2024.
13. Popescu R-I, Sabie OM, Truşcă MI. The contribution of artificial intelligence to stimulating the innovation of educational services and university programs in public administration. Transylv Rev Adm Sci. 2023; 70 E: 85–108.

14. Ragavendran VA. An application framework for conceptual artificial intelligence in human resource management. Educ Adm: Theory Pract. 2024; 9116–20.
15. Roopalatha DN. Artificial intelligence on human resource management- innovation, challenges and path forward. Educ Adm: Theory Pract. 2024; 13686–98.
16. Sarkar MK, Sarkar SSD. The ethics of artificial intelligence: Ethics and moral challenges. Educ Adm: Theory Pract. 2024.
17. Tyson MM, Sauers NJ. School leaders' adoption and implementation of artificial intelligence. J Educ Adm. 2021; 59(3): 271–285.
18. Vasant BS. Exploring the role of artificial intelligence in human resources: a demographic analysis approach article sidebar. Educ Adm: Theory Pract. 2024; 4294–300.
19. Wang Y. Artificial intelligence in educational leadership: a symbiotic role of human-artificial intelligence decision-making. J Educ Adm. 2021; 59(3): 256–70.
20. Zharkov PA, Gorid'ko NP. Prospects for the application of artificial intelligence in the management of educational organizations. Ekonomika I Upravlenie: Problemy, Resheniya. 2024; 6/2(147): 301–8.