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Leadership, Challenges and Strategies in Artificial Intelligence (AI) Integration: Perspectives from Principals of Malaysian Junior Science Colleges

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Abstract

This study investigates the factors influencing the integration of Artificial Intelligence (AI) in Malaysian secondary schools, focusing on the perspectives and strategies employed by principals in Junior Science Colleges. Employing a qualitative phenomenological approach, semi-structured interviews were conducted with principals to capture their insights on AI adoption. The findings reveal that while principals generally hold a positive outlook on AI and recognize its transformative potential in education, significant challenges persist. These include limited practical understanding of AI, insufficient technological infrastructure, and

varying levels of teacher readiness. Notably, younger teachers exhibit greater openness to AI adoption, whereas senior teachers express reluctance due to a lack of technical proficiency. Additional barriers include financial constraints, the absence of clear AI-related policies, and concerns regarding the misuse of AI by students. To address these challenges, the study proposes several recommendations: the implementation of structured professional development programs to enhance AI literacy among educators, the upgrading of digital infrastructure to support AI tools, the formulation of comprehensive AI policies, and the initiation of pilot projects to evaluate AI's impact on teaching and learning processes. The study espouses the critical role of leadership in driving AI adoption and ensuring its alignment with broader educational goals. These findings provide valuable insights for policymakers and educational leaders in designing strategic approaches to optimize AI integration in schools. By doing so, AI can serve as a transformative tool, enhancing teaching effectiveness and improving student learning outcomes. This research contributes to the growing discourse on AI in education, offering practical implications for cultivating innovation and equity in educational practices.

Keywords: artificial intelligence, school governance, educational leadership, school digitalisation

1. Introduction

1.1 Artificial Intelligence (AI) in

Integrating Artificial Intelligence (AI) into education is a revolutionary development that has the capacity to greatly enhance teaching and learning experiences. AI applications in education encompass personalised learning systems (Christudas et al., 2018), intelligent tutoring, automated grading, and advanced data analytics such as diagnosing students' strength and weakness (Liu et al., 2017), aiming to improve efficiency and respond to specific student requirements. Successful integration of AI technologies in educational environments relies heavily on effective leadership.

While the potential benefits of AI in education are substantial, the road to successful integration is not without its challenges. School leaders play a pivotal role in navigating this transition and ensuring that the integration of AI technologies meaningfully improves teaching and learning outcomes. A lack of leadership support can create significant obstacles to the adoption and implementation of AI technologies, leading to the wastage of the potential to enhance the educational experience (Mello et al., 2023). Effective transformational leadership is crucial in guiding teachers and staff through the transition, nurturing a culture of innovation, and maximising the benefits of AI-driven solutions in the classroom (Mello et al., 2023). Leaders that support and encourage for the use of AI can help teachers transition smoothly and increase their adoption of these technologies, thereby maximising the benefits they serve.

Artificial intelligence technology could transform the learning process for students and teaching methods for teachers in Malaysia. Even though AI has many potential applications in education, different institutions have varied levels of adoption. Many factors, such as the

availability of technology, the resistance towards changes of teachers (De Oliveira Lima et al., 2024), and support from institutions could be responsible for this variability. According to Mercader and Gair ń (2020), despite AI-enabled learning supports have significant promise, the widespread use of technology in education does not automatically mean that teachers will be able to effectively employ technology in classrooms or that the quality of teaching will be ensured. Many teachers still hold a negative perspective towards integrating technology in the classroom and are hesitant to utilise it (Istenic et al., 2021).

Some researchers suggest that, for digital transformation to occur, changes and support need to happen across various organizational levels, such as organizational, cultural, and administrative change (Saputra et al., 2023; Popenici & Kerr, 2017). However, according to the literature, the lack of such holistic support often results in the underutilisation of AI-powered learning solutions (Idroes et al., 2023). One of the primaries focuses and key players in the integration of AI in schools is the school leader. School leaders have emerged into the focus of research on technology integration in schools (Chiu, 2022; Dexter & Richardson, 2020). School leaders play a critical role in this process, as they are responsible for leading the integration of AI and other technologies into the educational system (Idroes et al., 2023).

Every leader must establish specific plans to move towards the vision. A transformational leader depends on vision and strategic planning as critical instruments for promoting progress (Kim & Kim, 2022). School leaders who are effective can inspire teachers by providing opportunities and access to information concerning artificial intelligence (Bin Bakr et al., 2022). Recognizing the importance of leaders understanding the capabilities of AI and their crucial role in effectively integrating it into educational environments is very essential. If a more comprehensive understanding of this phenomenon can be achieved, effective strategic plan for integrating AI into the organization's setting can be accomplished.

Hence, the subject to be explored in this study is to discover the factors that lead to the optimisation of AI integration in school by principals and what strategies can be employed to assist AI integration in school. Specifically, this study attempts to address several critical subject matters. First, it will look at the existing level of AI understanding and awareness among principals, evaluating how this awareness effects their ability to encourage the use of AI technology among teachers. Additionally, the study will analyse the availability and sufficiency of technology infrastructure in schools and how this influences AI adoption in schools.

1.2 Artificial Intelligence (AI) in Teaching

The application of artificial intelligence (AI) and digitalisation in education is a prevalent phenomenon. The integration of AI and digital technology in education has been rapidly progressing, fundamentally transforming traditional approaches to teaching, learning and administration (Al-Omari, 2024). Over the past five years, AI has made significant advancements in both its theoretical understanding and practical application, resulting in a profound influence on several aspects of educational institutions (Shao et al., 2022).

Recent research has highlighted the ability of AI to address persistent challenges in the field of education. Zawacki-Richter et al. (2019) conducted a thorough examination of the utilisation of AI in the context of higher education. The researchers highlighted four primary areas: profiling and forecasting, assessment and appraisal, adaptive systems and customisation, and intelligent teaching systems. According to their research, AI could improve learning outcomes, increase retention rates, and provide personalized educational experiences. Luckin and Cukurova (2019) presented a thorough framework for incorporating AI into education, emphasizing the importance of cooperative interaction between humans and AI. They argue that AI should be seen as a tool to improve human intelligence rather than replace it, highlighting the need for educators to develop new skills to work effectively with AI systems.

Chen et al. (2020) completed a comprehensive examination of the application of AI in K-12 education. They have discovered numerous areas that exhibit potential, such as intelligent tutoring systems, automated essay scoring, and early warning systems for children at danger. Their work showcases the capability of AI to address educational disparities by providing personalized support to students who may otherwise fall behind.

However, the incorporation of AI in education has also sparked significant controversy. AI-driven tools offer promising opportunities as well as notable challenges including bias, equity and confidentiality (Holmes et al., 2023). Selwyn (2019) provides a meticulous examination advising against the uncritical use of AI in the field of education. The author argues that AI possesses the capacity to worsen pre-existing inequalities and undermine the fundamental aspects of teaching and learning that are specific to human beings. Expanding on these concerns, Reich and Ito (2023) undertook a thorough investigation into the ethical implications of artificial intelligence in the education sector. The worries are around data privacy, algorithmic unfairness, and the potential for AI to perpetuate socioeconomic gaps in educational accomplishments. Their study emphasizes the importance of robust ethical frameworks and governance structures to direct the incorporation of AI in educational settings.

In addition, Sarwar et al. (2024) emphasise the need to take a more nuanced approach when considering the role of AI in education. They highlight the importance of considering ethical implications, concerns about data privacy, and the possibility for AI to reinforce systemic biases. They promote a more nuanced understanding of AI's role in education, one that recognises both its potential benefits and limitations. Arion et al. (2024) investigated the challenges related to the incorporation of digitalisation into educational systems in rural regions. They underlined the limitations caused by inadequate technology expertise and digital literacy. Access to trainings, courses, programs, and other activities aimed at enhancing digital literacy is limited in these regions. The Internet is predominantly utilised for entertainment, pleasure, and communication due to the limited digital literacy, as well as the development of rural people, education, perspectives, and attitudes. Their work emphasizes the importance of considering the unique conditions and capabilities of a specific

region when deploying AI solutions in the realm of education.

The importance of this literature in the research on the incorporation of AI among junior science college principals in Malaysia is complex and has multiple aspects. Firstly, it provides a comprehensive analysis of the current state of AI in education globally, helping to situate the study within the broader context of educational technology and the integration of AI (Zawacki-Richter et al., 2019). Having a comprehensive awareness of the context allows for making comparisons and gaining significant insights that are special to the college.

Moreover, the research highlights important issues such as ethical considerations, privacy concerns, and potential biases in AI systems (Holmes et al., 2022; Reich & Ito, 2023). College principals should have this foresight when considering the incorporation of AI in their schools, to accurately anticipate and address any possible challenges. While there is an abundance of literature on AI in education globally, there is a noticeable dearth of study that specifically examines the Malaysian context, particularly in relation to college.

The literature on AI in education covers several ideas and topics that can offer significant insights for formulating policy recommendations for junior science college. Implementing AI in a cautious and accountable way will be facilitated by this approach (Selwyn, 2019). The literature emphasizes the critical significance of school leaders in successfully integrating AI. The study explicitly examines the element of principals, providing potentially valuable insights for leadership in the application of AI (Chen et al., 2020). Studies on the incorporation of artificial intelligence (AI) in underdeveloped countries highlight the importance of reflecting the circumstances and conditions of the local setting (Arion et al., 2024). The study has the capacity to provide useful insights into how the unique cultural and educational setting of junior college influences the integration of AI.

1.3 AI, Principals and Leaders in School

The integration of AI in educational settings has become a critical focus, with school administrators and educational leaders playing a significant role in its successful implementation. School leaders have received considerable focus in research examining the incorporation of technology in classrooms (Chiu, 2022; Dexter, 2018; Dexter & Richardson, 2019). Recent academic publications have shed light on various aspects of this complex process. Schmitz et al. (2023) conducted a comprehensive and systematic investigation on technology leadership in schools, specifically emphasizing the crucial role of administrators in promoting an innovative culture. Their research has identified key competencies such as digital literacy, strategic planning, and flexible leadership as essential for effectively incorporating AI.

In their publication, Dexter and Richardson (2019) identified five essential domains of technology leadership practices that are crucial for school administrators. The primary domain involves the act of developing and effectively communicating a vision. The second domain focuses on facilitating the application of educational technology by students. The third domain is dedicated to improving the professional competencies of staff members. The fourth domain focuses on creating a favourable organizational climate. Ultimately, the fifth

domain emphasizes the need of cultivating connections with external partners. This entails conducting requirements assessments to pinpoint areas where AI can yield advantages, setting clear objectives and benchmarks for AI's accomplishments, and devising a systematic strategy for adopting AI. It was found that effective leaders demonstrated a combination of technical proficiency, change management capabilities, and ethical decision-making abilities.

The Global Education Monitoring Report 2023, Southeast Asia: Technology in Education: A Tool on Whose Terms? (2023), conducted comparative research on AI integration in schools across Southeast Asia, focusing on cultural considerations. It was found that while there were common challenges, such as resource constraints and technical limitations, the approaches to tackling these problems varied significantly based on national education policy and cultural norms.

1.4 AI and Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), proposed by Davis (1989), has been extensively employed to comprehend the assimilation of novel technologies, such as AI across diverse contexts. Based on the TAM, an individual's likelihood to utilise technology is mainly determined by two factors: the perceived usefulness and the perceived ease of use of the technology (Venkatesh & Davis, 2000). In recent times, scholars have made alterations and enhancements to the TAM to tackle the distinct difficulties and prospects linked to artificial intelligence (AI) in educational settings.

A meta-analysis conducted by Scherer and Teo (2019) on TAM in education found that educators' intentions to adopt AI were strongly influenced by their assessments of AI's utility and user-friendliness. Nevertheless, they noted that these elements alone were inadequate to account for the intricacy of AI adoption in educational institutions. The adoption of technology by teachers is a complex issue, which is influenced not only by the resources and assistance offered by schools, but also by motivational traits, self-perceptions and attitudes towards technology.

This literature review offers a comprehensive examination of the complex and diverse aspects of integrating AI in educational institutions, particularly emphasising the involvement of principals and educational leaders. However, it also exposes notable deficiencies, especially in context-specific research that considers the distinct attributes of educational systems. Most of the cited research has been conducted in settings other than Malaysia, specifically, outside of junior science college. Therefore, the specific challenges and opportunities faced by principals in science colleges have not been adequately examined.

2. Method

This study employed a qualitative, phenomenological approach to examine the growth in AI integration in junior science college by principals. This method aligns with the phenomenological design, enabling a comprehensive examination of participants' experiences and perspectives. A comprehensive interview procedure was created, specifically targeting the exact informants, with special emphasis on the elements that enable the integration of AI, strategies for promoting its integration, and challenges related to its adoption. The research

seeks to determine the elements that lead to the successful incorporation of AI in educational environments, as well as the strategies that facilitate this process. Furthermore, the study examines concerns pertaining to the implementation of AI in the field of education. This research underpinned by two following research objectives: (a) to explore factors, contribute to the optimisation of AI integration by junior science college principals and (b) to identify the strategies can be used by principals to facilitate AI integration.

The semi-structured interview protocol for this study was carefully developed guided by the research questions. The procedure comprised of open-ended inquiries specifically crafted to extract comprehensive and intricate feedback from four informants regarding their encounters with the integration of artificial intelligence in colleges. Interviews were performed through either in-person meetings or video conferencing, based on the participant's choice and logistical factors. Each interview was anticipated to have a duration of roughly 60-90 minutes and recorded in audio format with the participant's permission. Field notes was taken during the interviews to document non-verbal cues and contextual information. The development and execution of this interview procedure is vital in collecting comprehensive, qualitative data required to comprehend the experiences of junior science college principals in incorporating AI into their schools. A preliminary data collection was conducted with a chosen informants of principals who possess similarities to the target subject but was excluded from the actual study. This study employed triangulation, audit trails, and stringent verification processes to achieve a high degree of trustworthiness, hence improving the depth and dependability of the research findings.

A thematic analysis was employed for qualitative data analysis. Data was gathered in audio recordings format, video footage, and written records. This task entails converting audio and video recordings into written text, ensuring that all information is precisely recorded. Then, coding was conducted using an inductive approach. This approach allows for the emergence of themes from the data (inductive). The main objective of the inductive approach is to facilitate the emergence of research findings based on the common, dominant, or significant themes present in raw data, without being limited by formal techniques. To facilitate this process, ATLAS.ti was used to efficiently organize and manage coding. These software offers tools for organizing, coding, and visualizing data, which can enhance the efficiency and rigor of the analysis.

3. Results

The results are organised according to the research questions as a structural framework. Each theme is detailed, accompanied by illustrated quotations that support the discussion. This framework facilitates the systematic presentation of the study's results, ensuring that each research question is comprehensively addressed and supported by the data.

Theme 1: Principals Perspectives and Acceptance of AI

The attitudes and acceptance of school principals are essential for the incorporation of AI in education. Their perspectives have an impact on policy implementation, decision-making, and the general effectiveness of AI adoption. The awareness, attitudes, and perceived

significance of AI among principals are examined in this theme.

Subtheme 1.1: Principals Awareness of AI

The examination of interview data indicated that principals exhibit differing levels of understanding of AI's potential in education. A considerable number of principals exhibited a fundamental comprehension of AI's essential functions and its significance to modern educational practices.

"AI is a new technology that simplifies human tasks." (Informant 2)

"AI collects and processes the received data into useful information to complete the assigned tasks." (Informant 3)

"...AI is a medium used to facilitate tasks or a machine or supercomputer capable of obtaining data from computers and existing servers." (Informant 4)

This perspective indicated the need of having a basic knowledge of AI, as it provides a key foundation for empowering principals to adopt AI and other developing technologies more effectively. This is the preliminary phase of comprehension and acceptance, essential for nurturing readiness and confidence in the incorporation of innovative solutions within educational administration and teaching methods. Subsequent investigation indicated that principals' awareness beyond the simple acknowledgment of AI as a technological instrument. One of the informants exhibited comprehension of AI's capacity to revolutionize conventional educational frameworks.

"...including learning, language comprehension, pattern recognition, and decision-making. Among the well-known AI software widely used in the field of education today is ChatGPT." (Informant 2)

"...we have seen how we use AI to create questions and build lesson plans using AI, right...quizzes and all that have already shown potential to be created using AI." (Informant 4)

The response acknowledged that AI may act as a catalyst for creating more individualised learning experiences and improving student engagement through innovative educational methods. Their perception on AI not alone as an instrument but as a transformative agent in education. The differing perspective among principals indicates a progressive improvement in recognizing AI's function in education, establishing a basis for focused professional development and effective AI integration in colleges.

Subtheme 1.2: Perception of AI

From the interview, principals continuously highlighted the necessity of adopting AI to sustain institutional competitiveness and relevance in the swiftly changing educational environment. This indicates a favourable and progressive viewpoint among principals, who

saw AI not solely as a technology trend but as a revolutionary technology capable of redefining educational instruction and administration. Informants conveyed optimism regarding AI's potential, illustrating their willingness to investigate its integration.

"AI can be used to create personalized learning plans for each student based on their individual strengths and weaknesses... Furthermore, by autonomously performing routine tasks such as grading, attendance management, and report generation, teachers can save time and focus more on teaching and interacting with students... To my knowledge, AI can analyse student performance data to identify trends and patterns, assisting teachers in making data-driven decisions about effective teaching strategies and interventions." (Informant 2)

This progressive perspective corresponds with global trends, wherein AI is progressively acknowledged as a driver for personalised learning and enhanced efficiency.

"Certainly, I do not want to be left behind in keeping up with the mainstream. I am confident that one day, the use of AI will be widely implemented in institutions….." (Informant 1)

"Like it or not, we will indeed try to assimilate with the current situation." (Informant 4)

"I am confident that, whether we like it or not, one day we will all be using AI in our daily lives. …….Certainly, we do not want to be left behind by these current developments." (Informant 4)

By embracing this forward-thinking strategy, principals want to enhance their institution's standing in the competitive educational landscape, ensuring it remains flexible and innovative in addressing future demands. It provides a strong basis for advocating AI integration, but this optimism must be matched with structured plans to address practical challenges.

Subtheme 1.3: Challenges in Understanding

Although AI is generally viewed positively, the finding revealed significant barriers in principals' comprehension of its practical uses. This highlights a notable gap between theoretical understanding and practical application knowledge.

"Speaking directly about applications or devices claimed to be AI, in my opinion, they are still not available yet." (Informant 4)

The lack of connection is manifest in various areas, such as insufficient knowledge with certain AI tools. This is demonstrated by the fact that Informants were unable to provide more specific information or instances of AI's wider uses, instead citing just well-known examples as ChatGPT.

"Among the well-known software currently widely used in the field of education is ChatGPT." (Informant 2)

This constraint depicts shallow understanding of AI tools, wherein familiarity with current tools does not necessarily equivalent to an extensive understanding of its potential capabilities or integration methodologies inside the educational framework.

"I learned about AI mostly from my surroundings, especially from younger teachers who are more advanced, as well as through other dissemination mediums such as circulars, education blueprints, and informally through social media." (Informant 1)

"I will like Facebook or other applications such as Instagram and TikTok related to AI so that the latest information about AI can be obtained." (Informant 2)

Interestingly, this reveals that principals' knowledge of AI does not stem from formal sources but rather from staying updated with current trends, often through platforms like Facebook or other social media channels. Another compelling indication that their awareness of AI is derived from informal sources is their acknowledgment of learning about AI from younger, more technologically adept teachers. This reliance on non-formal avenues for information highlights the principals' adaptability and willingness to engage with AI.

However, it also highlights a critical opportunity for improvement, suggesting the need for more formal and structured approaches to enhance their understanding of AI. By implementing targeted training programs and providing access to reliable educational resources, principals can develop a deeper and more practical comprehension of AI, empowering them to lead its integration more effectively.

Theme 2: Availability of School Facilities for AI

A key factor in the implementation of AI in education is the accessibility of resources and infrastructure. To properly integrate AI, schools require adequate technology infrastructure, funding, and well-defined policies. This theme looks at the financial support, infrastructure, and difficulties schools currently face in getting prepared for AI integration.

Subtheme 2.1: Infrastructure availability and inadequacy

The condition of infrastructure availability varies significantly among junior science colleges. Proactive collaborations, especially with technology suppliers such as Chromebook and Microsoft 365, have produced favourable outcomes in improving device accessibility and internet connectivity in directly.

"Actually, we are currently collaborating with Chromebook. An indirect advantage we gain from this collaboration is the upgrading of internet access as well as the use of Chromebooks." (Informant 1)

"...and now the college also has a joint venture with Microsoft 365." (Informant 4)

These collaborations signify a vital progression in establishing the essential groundwork for AI integration, illustrating college's dedication to technical innovation. However, the research indicates that these enhancements, although significant have failed to align with the swiftly advancing requirements of AI-driven educational technology. A significant discovery revealed the insufficiency of current facilities in relation to technological progress and this reflects a widespread issue among colleges.

"Honestly, I would say it might not be sufficient. Compared to the speed of current technology, there are still many other technological needs that need to be considered." (Informant 1)

"Technological facilities are still limited in this college. Students can only use computers in the ICT lab. This is because the college does not allow the use of smartphones. The use of iPads is on a borrowing basis and is utilized at specific times, such as for assignments by the Student Representative Body. So, I feel it is still insufficient if we want to keep up with the current situation. We can see that the 'pace' of AI seems quite fast." (Informant 2)

"...perhaps we still do not have adequate facilities for that purpose, with basic internet access and a limited number of computers." (Informant 4)

The research indicates that these limitations create significant barriers to implementing sophisticated AI tools and platforms effectively within the educational environment. This represents an opportunity for enhancement and offers valuable ideas for college administration to make improvements to its current facilities. Such initiatives would enhance college's readiness to leverage AI, guaranteeing that educational institutions are adequately equipped to address the requirements of contemporary educational progress efficiently.

Subtheme 2.2: Institutional support

Institutional support is a vital element in infrastructure development. The findings espouse the beneficial effects and constraints of existing support mechanisms. The study observed that college's measures to supply Chromebooks and financial support for device acquisition have been positively welcomed by principals. Nonetheless, the research indicates that these initiatives, although beneficial, reflect only preliminary measures toward extensive infrastructure advancement.

"...The college administration offered a Chromebook package to the college under my supervision in 2022. Unlike the offerings at other colleges, our college accepted the Chromebook offer to experiment with it. We were provided with Chromebooks for both teachers and students. Through this program, indirectly, the school received assistance from the headquarters in improving internet access to facilitate the use of Chromebooks at that time. To date, internet access has improved, and there has been an increase in gadgets provided by Chromebook to us." (Informant 1)

The findings indicated that college has designated a specific funds for teachers to purchase their own laptop or electronic gadgets, intended to motivate them to remain updated of current digitalisation trends through programmes called Bring Your Own Device (BYOD). This endeavour represents a significant benefit, establishing a strong basis and a catalyst for further integration of AI.

"...College offered a BYOD program, where each teacher was provided with financial assistance of RM3000.00 per person to purchase devices such as laptops or tablets. Indirectly, this is to encourage teachers to use technology in the classroom." (Informant 1)

"...one of the supports from college is the BYOD (Bring Your Own Device) program..." (Informant 3)

Regardless of the support that was offered, principals articulated concerns. Challenges such as limited computer access, insufficient internet connectivity in specific institutions, and slow infrastructure upgrades were regularly identified as barriers to efficient adoption. To address these challenges, college should adopt a structured approach that entails a comprehensive evaluation of existing facilities to pinpoint deficiencies, prioritizing investments in inadequately resourced schools, and ensuring consistent funding for technological advancements. Enhancing collaborations with technology providers such as Chromebook and Microsoft may yield scalable solutions to address changing requirements. Moreover, forming specialized teams for routine maintenance and technical assistance will guarantee ongoing infrastructure effectiveness.

Theme 3: Teacher Readiness for AI

Teachers play a critical role in integrating AI into classrooms as their readiness and competency affect the efficacy of AI-based teaching strategies. This theme explores on teachers' comprehension, readiness to accept AI, and the training and assistance they receive to improve their AI proficiency.

Subtheme 3.1: Principals perspectives on teacher readiness

Principals suggest that teachers exhibit a continual willingness to integrate and utilise AI in their instructional methods. This readiness shows an encouraging trend, indicating teachers' acknowledgment of AI's capacity to revolutionise and improve the teaching and learning experience.

"I am confident that my teachers and staff are always ready for any innovations. They are always prepared to use AI technology in their teaching. In fact, they are ahead in keeping up with current AI developments. I observe that they have started experimenting with this technology during teaching and learning sessions. They are also seen to be able to explore this technology on their own, even without pressure or enforcement from the administration." (Informant 1)

"Among the teachers, I believe there is no issue. They are always up to date with these developments. I am pleased that they have taken a step forward, even though there is no formal circular or directive yet regarding the use of AI." (Informant 4)

The principals believe this adaptability indicates a willingness to innovate, as teachers progressively adopt technology to develop more engaging, individualised, and efficient learning experiences for students.

Subtheme 3.2: Generational gaps

The research revealed a significant relationship between teacher age and the propensity to use AI technologies. Younger teachers exhibited heightened initiative and interest in the experimentation of AI tools within their classes.

"However, the acceptance from the baby boomer generation of teachers seems relatively slow due to the generational gap. They appear somewhat resistant to embracing innovations and are more comfortable with traditional teaching methods." (Informant 1)

"What I observe is that almost all teachers, especially the younger generation of teachers, are ready and have started using current AI technology." (Informant 2)

This natural tendency among younger teachers constitutes a significant advantage for promoting AI integration within junior science colleges. The stronger the willingness of teachers to adopt AI technology, the easier and faster the integration of AI in school will be. This readiness to embracing new technology not only accelerates the integration process but also cultivates an encouraging environment.

Nonetheless, the investigation also uncovered more intricate relationships among senior teachers. According to the principals, although senior teachers voiced concerns regarding AI integration, their objections frequently originated from practical factors rather than outright resistance.

"Perhaps they feel that new things need to be thoroughly understood in terms of their effects and consequences before they are comfortable using them." (Informant 1)

"These senior teachers are sometimes sceptical about changes." (Informant 3)

The study suggests that senior teachers' opposition is not primarily due to a resistance to new technology, but rather to a lack in understanding AI. The gap in understanding can be remedied by focused exposure and customized training programs aimed at enabling them to comprehend and utilize AI safely and efficiently. By providing essential support and resources, schools can enable senior teachers to build confidence in embracing AI, so promoting a more inclusive and collaborative method of technological integration.

Subtheme 3.3: Principals Support and Encouragement

Leadership is essential in cultivating teacher readiness for AI. Principals aggressively promote collaboration between educators and technology specialists, facilitating chances for professional development.

"...I always encourage such collaboration. Many activities and training sessions with technology or digital experts have been planned and will be implemented. In addition, college is also undoubtedly planning to provide related training in the near future." (Informant 1)

"We encourage and support teachers' applications to attend courses related to AI, in addition to those offered by the college." (Informant 2)

Support for participation in appropriate training, seminars, or competitions further illustrates leadership's dedication to empowering teachers with essential skills and confidence. Leaders facilitate access to opportunities, so playing a crucial role in cultivating a culture of professional development and creativity. This commitment guarantees that teachers acquire technical proficiency while also feeling supported and appreciated in their attempts to effectively include AI into their teaching methods.

Theme 4: Strategies for AI Integration

To effectively integrate AI into education, school administrators must establish strategies that encourage its adoption. These tactics include teacher training, external collaborations, and the formulation of policies and strategic plans. This theme explores how college principals promote AI integration in their schools.

Subtheme 4.1: Training and skill development

The data analysis indicates that all informants unanimously agreed on the importance of training and skill development in educational institutions to enable the rapid and smooth integration of AI. They believe the necessity of providing teachers and staff with the information and skills essential for the comprehensive integration of AI into their administrative or teaching strategies. Thorough training programs customized for schools may close the gap between awareness and practical application, ensuring that they not only comprehend AI's promise but also have the confidence and proficiency to use it effectively.

"...hands-on and continuous training related to digitalisation and AI would greatly help in becoming prepared and proficient with AI." (Informant 1)

"The Integration of AI Technology in Education course is the most suitable course for teachers to face this AI era." (Informant 3)

This discovery indicates a potential enhancement inside college through the implementation of highly qualified, focused training programs. Interestingly, the study finds that introductory AI programs are equally crucial as a first step in familiarizing teachers with AI ideas and applications. These introductory training establish the foundation for more advanced training, including the integration of AI into curriculum design and teaching.

"...as a starting point, perhaps training or an introductory course on AI to familiarize teachers and staff with this new technology." (Informant 4)

Additionally, principals recognises task-specific training as an additional element. Programs designed for specific domains like data analysis empower teachers to implement AI in focused, practical manners. Utilizing AI techniques to forecast student success or creating individualized learning plans can markedly improve classroom efficiency.

"Training on the specific use of AI, such as analysing data, forecasting student information, and so on." (Informant 1)

These findings emphasise the necessity of a systematic and incremental training

strategy that begins with fundamental knowledge and advances to more specialized,

application-oriented skills. The idea empowers teachers and facilitates the smooth

transition to AI-integrated school.

Subtheme 4.2: AI-supportive environment

Establishing a conducive climate is crucial for effective AI integration in educational

institutions. Strategies encompass the creation of online communities for teachers to

exchange experiences and acquire knowledge from each other. These networks promote collaboration, allowing teachers to share techniques, address issues and learn from one another's gains.

"By creating an online community for teachers to share experiences and learn from one another." (Informant 2)

"The other day, we already conducted a course to introduce AI to the teachers and staff. After that, I was informed that they have a Telegram group where they share resources." (Informant 4)

This setting indicates that educators are prepared to collaborate and equip themselves for the incorporation of AI in colleges. This transparency and preparedness establish a good foundation, generating opportunities and favourable prospects for the effective execution of AI efforts in schools. This optimistic perspective renders the incorporation of AI not only possible but also capable of effecting significant changes in education.

Interestingly, majority of informants agree that recognizing and honouring teachers'

contributions are vital for nurturing a culture of innovation and ongoing enhancement. This sort of recognition not only honours the time, effort, and creativity teachers dedicate to integrating new technologies but also encourages them to modify their teaching methodologies, cultivating a good atmosphere for growth and development.

"...so far, we encourage the integration of AI in the classroom by recognizing the involvement and use of AI." (Informant 1)

"Providing appreciation and recognition to teachers who demonstrate exceptional efforts in integrating AI." (Informant 2)

"As I mentioned earlier, we encourage and provide recognition to those who wish to participate in training or related competitions." (Informant 4)

Despite their apparent simplicity, these gestures have a significant motivational impact. They enhance a sense of accomplishment among teachers and motivate others to imitate their actions, producing a chain reaction of passion and engagement. These activities not only elevate individual morale but also promote a collective culture of technological advancement within the institution.

Furthermore, as a crucial component of success, the research findings highlight the essential role that strong infrastructure plays in enabling the integration of AI. Essential facilities such as internet access, LCD projectors, and computer labs are requisite; however, infrastructure demands further encompass high-speed internet connectivity, sophisticated presentation technologies, fully outfitted computer laboratories, dependable technical support systems, and adaptable learning environments for technology-enhanced teaching strategies.

"Providing facilities to support technology such as the Internet, LCD projectors, and at least

one tablet per classroom, in addition to upgrading the computer labs in college." (Informant 3)

"We always ensure that the internet access in our college is of good quality." (Informant 4)

These elements collectively nurture a climate that facilitates effective AI integration, allowing teachers to innovate and apply AI-driven solutions effortlessly. Without such extensive infrastructure, AI's potential advantages in education would go unused, highlighting the critical need for thoughtful funding and advancement in this field. These results point to the need for a well-balanced strategy that incorporates digital collaboration platforms, physical infrastructure, and recognition systems for successful AI integration.

Subtheme 4.3: Policies Development

Observations indicate that nearly all informants reported the absence of clear guidelines or standard operating procedures concerning the utilisation of AI in college. The lack of such criteria has led to inconsistent and unstructured AI application, hence obstructing its full potential inside the school system.

"What I can say is that, so far, there are no concrete guidelines for the implementation of AI usage in the college. The permission granted is more focused on the use of digital devices to access learning materials through online platforms." (Informant 1)

"College has also not issued any SOPs on how to handle matters related to AI." (Informant 2)

"Moreover, college has not issued proper guidelines for device usage." (Informant 4)

Despite the lack of formal guidelines, principals have taken proactive steps at the individual college level to encourage the exploration and utilisation of AI. Some principals have established device usage policies to enable pupils to interact with technology. These regulations permit students to utilize devices during specified periods, such as weekends, to access educational resources, communicate, and do assignments or engage in contests.

"The permission granted is more focused on the use of digital devices for accessing learning materials through online platforms and facilitating communication. Beyond that, they are used only for assignments and competitions." (Informant 1)

"...the restriction on device usage is that it is only allowed during weekends." (Informant 4)

Considering the outstanding nature of these measures, the lack of clear usage instructions remains a significant concern. These policies must be supported by structured and ethical usage frameworks to guarantee responsible application, particularly in educational settings where misuse could compromise learning outcomes.

Theme 5: Concern and Resistance in AI Integration

AI integration in education encounters difficulties despite its potential advantages. The challenges include financial limitations, ethical issues, and opposition to change. The main challenges college face while implementing AI are highlighted in this theme, along with the implications for future AI plans and regulations.

Subtheme 5.1: Financial challenges

On the other hand, in establishing optimal strategies for AI integration in college, principals have articulated worries about financial limitations. The mentioned constraints intensify the difficulties of AI integration, since the significant costs related to infrastructure enhancement and the procurement of essential technology equipment considerably limit colleges' capacity to provide advanced resources for students and teachers.

"So far, students have not fully utilized this technology due to limitations in technological equipment such as smartphones, tablets or laptops. The high cost is also a factor, as not everyone can afford to provide their own gadgets." (Informant 2)

"The high costs of supporting AI infrastructure have led the college to strive to secure funding to maximize the existing facilities." (Informant 3)

Consequently, sustainable solutions, encompassing the gathering of additional funds and the establishment of partnerships with other organizations such as non- governmental bodies or technological organizations, are essential for addressing these challenges. These solutions not only resolve financial issues but also facilitate the acceleration of educational change in college through the incorporation of advanced technology.

Subtheme 5.2: Misuse of AI

The study data indicates that informants concur there are no problems regarding acceptance from teachers. They exhibit openness and acceptance towards AI integration with an optimistic perspective. However, the investigation revealed a more complex issue that beyond simple technical adoption. Teachers are more concerned about students abusing technology than the technology itself. This issue signifies an extensive awareness of AI's impact on educational integrity. While teachers welcome AI's potential to improve teaching and learning, they also face the possibility that it could facilitate academic dishonesty and learning shortcuts.

"Teachers are concerned that students might rely entirely on AI for their assignments, which could affect their performance in actual tests or exams."(Informant 2)

"I think teachers have no issue using AI, but in my opinion, their concern is the time needed to prepare or integrate AI due to a lack of ideas and resources. As for students, we are still uncertain about their level of readiness and whether we can effectively control the use of gadgets and AI." (Informant 3)

"For teachers, there’s no issue, but we are a bit concerned about the students as they are still young and require a lot of monitoring to ensure they do not misuse the facilities.” (Informant 4)

The findings emphasise the critical need for a balanced approach to AI integration that maximises educational benefits while protecting academic integrity. A comprehensive framework must include clear policies that define appropriate AI use in different educational contexts, from classroom activities to assessments. Effective monitoring systems, combining

technological solutions with traditional oversight, are essential for detecting and preventing misuse.

Subtheme 3: Monitoring

The research findings indicate the vital necessity of implementing comprehensive monitoring mechanisms to oversee AI utilisation inside college. Participants constantly highlighted that robust monitoring measures are crucial for guaranteeing appropriate AI inclusion in educational environments. This necessity for oversight demonstrates a profound comprehension of both AI's potential advantages and its prospective exploitation in academic settings.

"...guidelines and control from the higher authorities are needed to ensure the smooth implementation of the technology." (Informant 1)

"Moreover, for now, there are no clear guidelines or control methods regarding this issue." (Informant 3)

"What I am concerned about is how we control gadget usage. For teachers, there's no issue, but for students, we are a bit worried as they are still young and require significant monitoring to ensure they do not misuse the facilities." (Informant 4)

Robust monitoring methods guarantee that AI is utilized appropriately and for its designated educational objectives. This encompasses AI-integrated analytics for usage monitoring, controls to mitigate misuse, and teacher-led supervision for ethical application. These strategies protect educational integrity, link AI utilisation with learning objectives, and promote trust in AI as a supporting pedagogical tool.

4. Discussion

After A study on the integration of AI by principals at junior science college formed the following conclusions, implications, and recommendations. The study analysed the perspectives of principals regarding AI integration, technological infrastructure, and the challenges and opportunities associated with AI adoption. The study showed approaches to enhance AI for the advancement of teaching and learning, while also tackling infrastructural, teachers' readiness, and policy framework challenges.

This study applied the Technology Acceptance Model (TAM) proposed by Davis (1989) to investigate the viewpoints of principals toward the incorporation of AI in education. The model's two main dimensions, perceived usefulness (PU) and perceived ease of use (PEOU), were recognized to be key determinants affecting technology acceptability and adoption.

On perceived usefulness (PU), principals exhibited a positive attitude towards AI integration, acknowledging its capacity to enhance administrative efficiency, personalize learning experiences, and improve teaching strategies. These findings align with Yahşi and Hopcan (2021), who indicated that technological leadership has a statistically significant positive impact on technology acceptance, highlighting the importance of leadership support in effective technology adoption. Ahmad et al. (2023) stressed that, despite the predicted

benefits of AI, practical implementation frequently faces challenges including inadequate infrastructure, insufficient training programs, and financial constraints.

Significant differences are indicated on perceived ease of use (PEOU) were noted among teachers, mostly caused by demographic factors and access to technology resources. This corresponds with Guner and Acarturk (2018), who discovered that age and experience significantly influence technology adoption. Junior teachers had superior technological proficiency, while their older colleagues encountered more significant adaptation difficulties. These findings highlight the need for targeted training courses designed for different degrees of technological proficiency among teachers.

Aside from personal attitudes, external variables were recognized as significant barriers to the effective use of AI in junior science college. Despite partnerships with technology providers, several institutions faced challenges due to inadequate technological infrastructure and limited access to essential resources. The results support the research conducted by Rane et al. (2024), which recognized infrastructure and resource availability as essential factors for effective AI integration. The lack of comprehensive standards for AI implementation and governance has slowed down adoption efforts, emphasizing the critical requirement for formal policy frameworks (Mahusin et al., 2024; Rane et al., 2024).

To tackle these issues, many approaches were suggested. One main recommendation is the establishment of targeted professional development programs aligned with teacher technology competencies. This matches with Rane et al. (2024), who highlighted the significance of systematic training approaches in technological adoption. Furthermore, cultivating a favourable disposition towards AI via ongoing professional development and collaborative learning environments was recognized as essential for establishing a culture of acceptance.

Lastly, prospects for further study that might broaden the theoretical framework beyond TAM were noted. Integrating models like the Diffusion of Innovation (Rogers, 2003) and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003) might provide a more thorough comprehension of the complexities of AI adoption in education. Moreover, longitudinal research investigating the progression of teachers' attitudes and competencies over time could provide significant data into the enduring effectiveness of multiple implementation strategies.

The results of this study have significant implications for numerous stakeholders within the junior science college educational system, especially during a post normal time of swift technological advancement. The incorporation of AI in education requires schools incorporate more adaptable and flexible strategies that capable of responding to evolving challenges. AI possesses the capacity to improve instructional effectiveness and boost educational results; nonetheless, its effective deployment relies on careful planning and organized execution. Educational institutions must guarantee that the integration of AI match with pedagogical goals while preserving the fundamental principles of learning and teaching.

From a policy viewpoint, thorough standards are crucial for regulating the application of AI

in education. Clear operational policies must be developed to assure the ethical and successful integration of AI, limiting concerns associated with data privacy, student dependency, and academic integrity. Policies must be flexible to align with advancements in AI technology and changing educational needs. Prior research illustrates the need of policy adaptability in overseeing technological shifts, guaranteeing that AI improves rather than threatens the educational setting (Funa & Gabay, 2024). Frequent policy evaluations are essential for ensuring relevance and resolving new difficulties in AI adoption.

Leadership is essential in cultivating an environment that contributes to AI adoption. Educational leaders have to evolve from conventional management methods to more flexible approaches that incorporate technological improvements. Skill in managing uncertainty, building strong institutional frameworks, and promoting innovation is necessary for the incorporation of AI. Strong leadership support can significantly impact teacher readiness and promote AI experimentation in educational settings. Studies indicate that organizations with proactive leadership are prone to undergo smooth AI adoption, as leaders establish the vision and establish a culture that welcomes change (Yahşi & Hopcan, 2021).

Teachers' readiness is an important variable in the effective implementation of AI in education system. Although numerous teachers acknowledge AI's capacity to improve individualized learning and optimize administrative functions, absences in technical proficiency may hinder its adoption. Targeted professional development programs designed for varying levels of teacher proficiency are essential to address this gap. Ongoing educational opportunities, cooperative knowledge-sharing platforms, and practical training can assist teachers in effectively incorporating AI into their educational approaches. Research suggests that continuous professional development is essential for enabling teachers to effectively utilize AI to improve student learning outcomes (Ayeni et al., 2024).

Technology providers carry a duty for ensuring the smooth integration of AI in education. Providers must adapt their approaches to meet the requirements of educational institutions, as stated in Making Technology Work for Education: A Transformational Goals and Partnership Approach (2024). Collaboration with corporate sectors, NGOs, academic institutions, and other governmental agencies is essential to develop scalable and cost-effective solutions. The results show that providers must provide comprehensive training and technical assistance to teachers, guaranteeing they obtain the necessary resources and expertise to employ AI effectively. Clear communication regarding AI capabilities and limitations is critical for managing expectations and facilitating effective adoption.

The study suggests that conventional problem-solving approaches are insufficient for tackling the issues of AI integration in education system. The complex nature of AI adoption arises from the interdependent technological, pedagogical, and social factors affecting its implementation. The rapid advancement of technology generates uncertainty, reducing the capacity of teachers to predict future advancements and their impacts on education. Moreover, conflicts emerge between conventional educational approaches and contemporary AI-driven approaches, demanding a careful balancing between tradition and innovation. Institutions must adopt a flexible and strategic planning to address these challenges while ensuring that

AI improves rather than destroys educational practices.

5. Conclusion

The study identifies the essential aspects affecting AI integration in junior science college by principals and offers a structured approach for addressing the challenges related to its adoption. The Technology Acceptance Model (TAM) suggests that AI acceptance is substantially affected by perceived usefulness (PU) and perceived ease of use (PEOU). Despite principals acknowledge AI's capacity to improve administrative efficiency and teaching efficacy, actual application is restricted by infrastructural limitations, varied teacher readiness, and the lack of comprehensive policies. The study highlights the necessity of organized professional development customized to various competency levels to tackle these difficulties. Junior teachers demonstrate greater rates of AI adoption, but senior teachers demand further assistance and training to bridge the technology gap. The study emphasizes that practical, application-oriented training is essential for cultivating a culture of AI acceptance among teachers. Infrastructure improvement is seen as essential requirement for AI integration. Although partnerships with technology providers have enhanced digital accessibility, the survey reveals that numerous schools still lack sufficient resources for comprehensive AI adoption. Investments in technology infrastructure, such as fully equipped computer labs and AI-enhanced learning tools, are crucial for successful AI adoption. The study emphasizes the necessity for clear policies and governance frameworks. The lack of clear guidelines generates uncertainty concerning AI utilisation, raising issues about ethical application and potential misuse by students. Policymakers must implement legal restrictions to guarantee the responsible use of AI while preserving academic integrity. Regular reviews of policies are essential to adapt to the changing technology environment. From a leadership standpoint, principals play an important role in facilitating AI adoption. The study emphasizes that leadership support significantly impacts teachers' readiness to incorporate AI into their teaching approaches. Principals must exemplify the use of AI in their administrative responsibilities and cultivate an atmosphere that promotes AI-driven educational advancements. Furthermore, educational institutions ought to establish official mentorship frameworks that enable senior teachers to gain perspectives from their younger, technologically proficient colleagues.

This study emphasizes that effective AI integration in education institution requires a collaborative strategy encompassing policy growth, infrastructure investment, professional development, and leadership initiatives. By systematically tackling these concerns, education institution may establish a sustainable, AI-augmented educational ecosystem that is responsive to future technology advancements. The results and suggestions establish a systematic framework that guarantees AI implementation is both efficient and adaptable to the changing requirements of education.

A study on the integration of AI by principals at junior science college formed the following conclusions, implications, and recommendations. The study analysed the perspectives of principals regarding AI integration, technological infrastructure, and the challenges and opportunities associated with AI adoption. The study showed approaches to enhance AI for

the advancement of teaching and learning, while also tackling infrastructural, teachers' readiness, and policy framework challenges.

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