THE ROLE OF KNOWLEDGE ABOUT GENERATIVE AI ON DECISION-MAKING AMONG LEADERS IN PUBLIC UNIVERSITIES

[1]Safiah Masbaka
[2]Jamsari Hashim
[3]Farous Izwan Abdul Aziz
[4]Syahrul Nizam Salam
[1,2,3&4]Centre for the Promotion of Knowledge and Language Learning
Universiti Malaysia Sabah Labuan International Campus
[1]safiahmasbaka@yahoo.com
Dihantar/Received: 25 Mei 2024 | *Penambahbaikan*/Revised: 20 Julai 2024
Diterima/Accepted: 25 Julai 2024 | Terbit/Published: 30 Jun 2024

Abstract: This conceptual paper discusses the roles of knowledge about generative artificial intelligence (GAI) on decision-making among leaders in public universities. This paper uses literature review technique. The result of this discussion is the roles of GAI knowledge on decision-making from the perspective of leaders in public universities among members of the senate and top management. GAI helps to automate the creation of digital content that transforms teaching and learning, research, and academic publishing paradigms in public universities. Leaders in public universities equipped with knowledge of GAI's transformative potentials as well as its disruptive risks can leverage their strategic positions to plan and manage university governance frameworks for the ethical use of AI in higher learning institutions. They can involve stakeholders from the government, academia, industry, and society, to harness the benefits of GAI technology ethically to enhance research, publication, as well as teaching and learning while managing its inherent risks. Their decisions steer the ethical integration and adoption of technology into the academic functions in higher learning institutions in the University 4.0 era. This paper suggests the need for an empirical case study on the successful implementation of GAI regulations in academia from the perspective of educational leaders.
Keywords: Generative Artificial Intelligence, Knowledge, Educational Leaders, Public Universities

INTRODUCTION

Educational leaders in the context of public universities are responsible for leading the institutions to achieve their objectives and to spearhead the advancement in teaching, learning, research, publication, and the activities related to the expansion of knowledge in general. According to Chkheidze (2023), educational leaders set the vision, mission, and ensure a conducive learning environment for students and teachers, while also developing values and promoting change in teaching and learning. The recent ongoing advancement of generative artificial intelligence (GAI) technology that can automatically generate digital content including text, images, codes, and other digital media has greatly disrupted these domains by enabling the rapid production of realistic content for users (Fezari et al., 2023; Goldstein et al., 2023). For leaders in public universities, their decisions shape the strategies for developing and sharing innovations in public universities that align with current development. They have the bird-eye view from their strategic position to allocate the funds and resources in facing the current of education 4.0 and university 4.0 where emerging technology like GAI are used to enhance teaching and learning outcomes as well as transform every aspect of university operations.

In the context of higher learning institutions, GAI tools help students to generate digital content that is almost similar to human creations for educational purposes. For example, GAI tools that converse with users through chat interface and generate text for users like ChatGPT, Jenni.AI, and Claude.AI have transformed the conventional way of education processes by allowing students to easily generate essay drafts, answer questions, solve arithmetic problems, generate citations, and generate codes. More and more GAI tools are available to help users generate digital content cheaper and faster. As these GAI tools transform the teaching and learning processes and academic publishing, university leaders must account for its implications in the university policies and strategic planning by integrating technology and transformative approaches to education. Their oversight in leadership and governance is vital to steer universities in the digital age to harness GAI's potential for academic effectiveness and efficiency. As Rashid et al. study in 2016 implied, leadership decision-making is the most significant factor in strategic planning at public universities, followed by leadership style and change flexibility.

This means that public university leaders need to equip themselves with the knowledge about GAI for judicious adoption in academic functions while maintaining academic integrity. This paper conceptualizes knowledge based on the definition proposed by Hauke (2019), which characterizes knowledge as an active engagement with ideas, arguments, and the world around us. Knowledge is viewed as a complex, integrative, and reciprocal process that unites the knower with the subject to be known. Specifically, in the context of this research, it refers to the educational leaders engagement and decisions towards GAI technology in public universities. Effective decision-making in higher education requires thoughtful and precise leadership, focusing on systematic planning and swift response to unanticipated situations (Ololube et al., 2021) like rapid technological development and utilization of GAI tools in universities. As university leaders chart their institutions' trajectories, the knowledge of GAI forms the baseline for the application of GAI in their decisions for institutional policy making. The knowledge dimension allows university leaders to progress from concrete to more abstract thinking in a construct defined by factual, conceptual, procedural, and metacognitive knowledge, making use of Bloom's Taxonomy action verbs (BTAV) in the cognitive process in any area of the knowledge dimension (Waite et al., 2020). For instance, C. Wu et al. (2023) taxonomy of decision-making for strategic decision-making used Bloom's Taxonomy top-

down classification approach in cognitive domains as the foundation. Overall, public university leadership steer appropriate GAI adoption despite its disruptive impact on education.

Statement of the problem and research question

The inherent flaw of the AI language model and the risk of misuse of GAI tools in academics poses threats to the academic integrity which has been safeguarded by all levels of educational institutions (Glendinning, 2022). Without interventions, the high accessibility and rapidly improving capabilities provided by these freely available tools create risks of misuse for cheating, plagiarism, and hindering the development of critical thinking skills (Hewett, 2023) among students and faculty alike. Several studies discussed the limited effectiveness of institutional detection processes (Chaka, 2023; Heilweil, 2022, Miller, 2023; Perkins et al., 2024), deterrence policies, and technical solutions to this AI-generated digital content, undercutting foundational values of merit and honesty in education. As an example, the ability of the GPT-3 language model to generate several paragraphs of synthetic content that people find difficult to distinguish from human-written text represents a concerning milestone in this regard (Brown et al., 2020). Therefore, better insight by university leaders is urgently required to guide university governance strategies for the ethical use of AI to minimize the risks of cheating and plagiarism in academic cultures. This paper hence conceptualizes the knowledge of university leaders around GAI across higher learning institution's contexts in their decision-making amidst the emerging threats to academic integrity.

To do that, this paper will discuss the knowledge of GAI among university leaders based on BTAV, from identifying GAI applications in lessons and assessments to discerning proper safeguards while simultaneously avoiding the stifling of technology development and minimizing its risks. Effectively fostering cultures of ethics around AI amidst techno-social change requires insight and judgment from university leaders for ethical integration and adoption into education contexts. By conceptualizing leadership knowledge, this paper aims to identify the roles of knowledge about GAI on decision-making among leaders in public universities.

Research question: What are the roles of knowledge about GAI in decision-making among leaders in public universities in the literature?

To answer the research question, the objective of this paper is stated below:

Research objective: To identify the roles of knowledge about GAI in decision-making among leaders in public universities from the literature review.

To achieve the research objective, this paper explores conceptual frameworks and generates new ideas for the roles of university leaders' knowledge about GAI on their decision-making. The concepts will be developed from the thematic analysis of the literature. This paper also discusses university leadership and concludes the informed decisions in university governance, which contribute to the ethical use of GAI tools at the institutional level.

LITERATURE REVIEW

Public universities typically follow a hierarchical structure where major decisions flow from the top management down through the ranks of administration, operation, and students. University leaders comprised of the chancellor, vice-chancellors and senate determine the strategic directions that shape policies, investments, and initiatives adopted across all schools,

institutes or academies, centres, and departments. While advisory bodies representing the university stakeholders provide input, ultimate authority over consequential choices around issues like technological integration and adoption rests with leaders at the senior administrative and top management roles. This top-down decision-making model enables institution-wide alignment and coordinated implementation of the whole university operation. Their leadership insight, mission, and judgment in areas like identifying and assessing emergent technologies in education determine the implementation of institutional policies for teaching and learning, research and operational aspects affecting administrative and academic staff and students. Hence the discernment of public university leaders takes on elevated importance for navigating shifts in technology for education.

Since the release of the AI chatbot ChatGPT by OpenAI in November 2022, many GAI applications capable of autonomously generating text, images, code and other digital content have rapidly emerged and proliferated online. Students can easily and frequently use these applications since most university students own a smartphone (Okonkwo & Ade-Ibijola, 2021). Smartphone devices have become indispensable educational aids since the pandemic era with the need for distance learning and instant access to communication and information. With tools and applications downloadable as mobile apps or accessible through web interfaces, university students can leverage these tools for various academic tasks and other purposes anytime whenever they are connected to the internet. Therefore, university leaders must proactively examine the implications of these transformative yet disruptive AI-powered tools becoming readily available in the hands of tech-savvy students.

Recent literature discusses a mixture of excitement and apprehension (Lim et al., 2023), because of the capacity of GAI tools to comprehend and generate text like humans (Floridi, 2023; Lim et al., 2023; Teubner et al., 2023). Most GAI tools are released to the public as consumer applications, hence there are cases of misuse of the technology in education (Mannuru et al., 2023). Educational leaders at the managerial level of decision-making can include GAI in the complex and diverse psychological processes of planning, organization, motivation, control, regulation, and analysis (Horban, 2021) related to GAI adoption in their institutions.

In the context of GAI technology integration and adoption in public universities, the leaders' decisions should align between national higher education strategy, objectives, and values with the academic goals across the classroom, schools, and discipline. In Malaysia for example, the Malaysian Qualification Agency (MQA) issued Advisory Note No. 2/2023 in March 2023 as a reference for higher learning institutions including public universities and students. The advisory note addressed the rise of GAI applications, its potential and risks, and the need for universities including academic staff and students to adopt the technology ethically as well as uphold academic integrity.

University leader's decisions shape the institution's direction, including investments in technology and educational tools. Knowledge of GAI allows them to make informed decisions about its integration into academic functions and operations. By proactively equipping their communities with substantive GAI knowledge, universities position themselves to judiciously integrate GAI tools and applications to augment research, teaching and learning in the current education 4.0 and university 4.0 era. For example, the fundamental knowledge of the taxonomy and typology of GAI tools advances our practical understanding, strengthens the distinguishability, as well as adds clarity to the discourse of GAI potential (Strobel & Möller, 2024). As Shao-Wei's (2011) study suggested, university leaders can improve their decisiveness and promote competition and development by understanding decision processes, optimizing decision-making gravity, enhancing analytical judgments, exercising decisive quality, developing strategic thinking, and stressing democratic participation. This means that university leaders can include stakeholders and experts from academics, industries, and

governments to contribute in improving the policy and governance best practices for education. These efforts cultivate informed and calibrated perspectives and understanding that consider GAI potential and its disruptive nature.

Knowing GAI's abilities to automate digital content creation like lesson planning, materials, and initial draft submissions enables informed decisions among university leaders to craft guidelines and mechanisms that balance the efficiency and academic integrity concerns. In liberal arts studies, for example, student's assessments are mostly done through essay writing. Therefore, the prohibition of GAI application assistance in students' writing assessments might not always be plausible. The use of GAI tools in writing potentially helps students to learn at their own pace like a personalized tutor, overcoming the constraints of lecturers' face-to-face interaction within limited lecture periods. In such cases, AI-assisted learning expands students' theoretical knowledge, writing skills, and understanding of fundamental concepts in their discipline that fulfil course learning outcomes. On the other hand, opting to implement authentic assessments such as project-based learning to avoid AI-assisted or AI-generated content in assessments altogether might not be practical for all disciplines and also risk stifling the development of students' writing skills, which is important for the expansion of knowledge.

Autonomy for teachers allows them to exercise their own judgment to set and monitor the boundaries for acceptable and not acceptable use of GAI tools in lectures accordingly. Through direct interaction with students, teachers are better positioned to detect potential cheating behaviours by identifying inconsistencies in written work, without necessarily relying on AI detection tools on every single submission. For instance, ChatGPT is not always capable of fluently generating output in Malay the Malaysian way because of its training data. It often generates responses in Malay that sound more Indonesian than Malaysian, which is noticeable by native speakers. The free version of ChatGPT also cannot access real-time information. In such cases, teachers can apply problem-based learning and allow students to use ChatGPT to help them answer questions based on current events in Malay. In this specific scenario, students can use GAI tools ethically, learn new information, and develop critical thinking with minimal risk of claiming AI-generated content as their own.

Moreover, based on a systematic literature review by Labadze et al. (2023), they concluded that incorporating AI chatbots in education brings personalized learning for students and time efficiency for educators. By embracing the advancement of GAI in universities, university leadership can promote technology adoption and resilience among academics and students. Some universities also use their funds to subscribe to AI detection tools to detect the risk of misuse of GAI tools that threaten academic integrity. However, these tools also incorrectly differentiate between human-written and AI-generated texts. As Chaka's study in 2023 concluded, AI content detectors like GPTZero, OpenAI Text Classifier, Writer.com's AI Content Detector, Copyleaks AI Content Detector, and Giant Language model Test Room seem not yet fully ready to accurately and convincingly detect AI-generated content from machine-generated texts in different contexts (Chaka, 2023b). The limitations of current AI detection applications only add to the lecturers' workloads when assessing students' learning outcomes because despite its goal to automatically identify AI-generated content submissions, the imperfect performance of these tools needs manual verification processes by teachers. This additional burden falls on teachers who must turn on the power of their computers, connect to the internet, log in or set up their account, select students' submissions and upload each submission, waiting for the machine algorithm to detect potential AI assistance or AI-generated content, and finalize students' marks. AI detection tools are designed to scrutinize submissions and identify potential AI-generated content, their results may not always be accurate or conclusive. Teachers or examiners still need to double-check the tool's findings and cross-verify the results. This additional layer of verification can place an unnecessary burden on

educators, creating an extra workload that detracts from their primary responsibility of conducting fair and meaningful evaluations. Students and GAI tools developers might as well come up with deceit mechanisms or AI-powered tools to bypass detection processes which might further threaten academic integrity and learning process.

Using technological solutions to flag AI misuse in students' writing only makes the assessments become an even more laborious endeavour that requires time, money, energy, and resources. It also creates an impression that teachers are sceptics and students are incapable of learning and prone to cheating. This situation hinders the university's goal to nurture a conducive education environment for students' authentic growth and learning process. Therefore, university leaders must include other deterrence mechanisms to avoid compromise in academic integrity. Whether through advances in machine learning forensics and computational linguistics, prohibiting students from taking digital devices on certain assessments, self-regulatory trainings, compliance to GAI adoption ethical framework, modifying certain writing assignments to involve additional in-class work, peer review, and peer editing altogether, proactive solutions are needed. After all, AI writing tools use machine learning (ML) techniques on language model algorithms to learn from vast datasets and learn patterns from statistical relationships and contextual nuances in training data. Language models allow these tools to generate sequences of text. From one perspective, using AI tools is comparable to using search engines or dictionaries or calculators to help achieve learning outcomes, answer questions, and solve a problem.

The use of GAI tools among students also becomes a motivation in learning because they are engaged by interactive systems such as chatbots, which allow them to study in an exciting and comfortable environment (Chen et al., 2020; Pham et al., 2018; Rooein, 2019; Troussas et al., 2017). Consequently, the use of chatbots in education helps to increase student engagement (Moln'ar & Szuts, 2018; Lam et al., 2018, pp. 18–19; Adamopoulou & Moussiades, 2020). When using GAI tools in learning, students can develop their critical thinking especially when they use the tools to generate information on topics that students are already familiar with, which they learn from lectures. This way students can evaluate and question the accuracy of AI-generated information, not blindly accept every AI-generated information or compromise academic integrity.

For students, researchers, scholars, and academicians, the academic writing mechanism of citations and references helps preserve integrity and protect them from plagiarism by explicitly acknowledging and crediting the original sources from which information is derived. Citations not only recognize the contributions of others but also foster a culture of transparency and accountability in the expansion of knowledge. However, the information generated by GAI tools does not always provide references and cite the source accurately. AI chatbots like ChatGPT are designed for conversation, not academic writing. AI text generators like Claude can provide made-up citations and references, and Perplexity AI can use unreliable sources to generate information. Therefore, users still need to verify the information to avoid misinformation and misconception. For academic writing, they need to trace and cite the source of information to avoid plagiarism.

University leaders should consider assigning compulsory training and academic discourse on ethical ways to conduct AI-assisted academic writing in universities. The guidelines of ethical AI-assisted writing should be as clear as student manuals or university policy documents. Documentation of the code of ethics for GAI adoption writing should include ethical principles such as what is right, wrong, good, bad, and balance everything in between, which reflect university's normative ethics. Furze et al. (2024) proposed AI Assessment Scale (AIAS), a flexible framework for incorporating GAI into educational assessments as shown in Table 1 below.

	LEVEL OF AI USAGE	DESCRIPTION
1	NO AI	The assessment is completed entirely without AI assistance. This level ensures that students rely solely on their knowledge, understanding, and skills. **AI must not be used at any point during the assessment.**
2	AI-ASSISTED IDEA GENERATION AND STRUCTURING	AI can be used in the assessment for brainstorming, creating structures, and generating ideas for improving work. **No AI content is allowed in the final submission.**
3	AI-ASSISTED EDITING	AI can be used to make improvements to the clarity or quality of student created work to improve the final output, but no new content can be created using AI. **AI can be used, but your original work with no AI content must be provided in an appendix.**
4	AI TASK COMPLETION, HUMAN EVALUATION	AI is used to complete certain elements of the task, with students providing discussion or commentary on the AI-generated content. This level requires critical engagement with AI generated content and evaluating its output. **You will use AI to complete specified tasks in your assessment. Any AI created content must be cited.**
5	FULL AI	AI should be used as a "co-pilot" in order to meet the requirements of the assessment, allowing for a collaborative approach with AI and enhancing creativity. **You may use AI throughout your assessment to support your own work and do not have to specify which content is AI generated.**

Table 1 The AI Assessment Scale (AIAS) adapted from Furze et al. (2024)

The AIAS consists of five levels, ranging from 'No AI' to 'Full AI', enabling educators to design assessments that focus on areas requiring human input and critical thinking. This scale exemplifies a clear framework of the use of AI tools for students, lecturers, and policy-makers in higher learning institutions. With clear written guidelines and policies for academic writing, universities can embrace the potential benefits of GAI and safeguard academic integrity. Through their governance, university leaders can encourage the judicious integration of these tools, promoting their use as tools to enhance creativity, efficiency, and intellectual exploration while simultaneously instilling ethical engagement with GAI technology at institutional level.

Therefore, using AI detection tools is an option but not a solution to maintain academic integrity. Institutional subscription to such tools means spending resources to scrutinize individual student submissions. Alternatively, institutions could evaluate if the budget is better invested in cultivating ethical foundations and educational processes that position students' growth and nurture values. It is aligned with one of the United Nations Educational, Scientific and Cultural Organization's (UNESCO) five principal functions which is to perform the advancement, transfer and sharing of knowledge through research, training and teaching activities (Law et al., 2018). Malaysia for instance, has emphasized the aspect of education in the Shared Prosperity Vision 2030 (WKB 2030) document and the Twelfth Malaysia Plan (RMKe-12) in the Malaysian Higher Education Action Plan 2022-2025 (PTPTM) because

educating students to develop their individual potentials goes hand in hand with efforts to enhance the quality of the national education system.

Theoretical and practical GAI training programs, hands-on workshops, conferences, colloquiums, forums, lectures, and value-driven academic discourse should be available and convenient for students, academicians, researchers, and experts to participate, publish, and share. These platforms allow the exchange of new and novel ideas on GAI so that the pursuit of knowledge can dynamically coexist with technological progress. In this era of university 4.0, the transformational leadership approach focuses not just on policing potential violations better, but on fostering intrinsic motivations for education aligned with the ideals of intellectual enlightenment through transformation. As suggested by Prestiadi et al. in their qualitative study in 2020, transformational leadership is done through building commitment and awareness among all stakeholders of educational institutions to actualize themselves and use technological advances, information and communication in the education process.

DISCUSSION

By equipping themselves with knowledge of GAI, university leaders will be able to apply Bloom's Taxonomy cognitive domain and the action verbs towards higher-ordered critical thinking which will result in complex innovative opportunities. The knowledge they acquire will benefit them in making informed decisions about the university's investments, infrastructure, partnerships and the improvement of pedagogical practices. These decisions will hopefully ensure that AI technology can be recognised and ethically integrated into academic work.

While the use of GAI tools can help teachers and students during lectures assignments and assessments will help foster technological adaptation and resilience, there are, however, risks where the tools can be misused. These risks warrant the use of AI detection measures to ensure academic integrity. Leaders are critical in such scenarios as they need to adjust their decision-making style based on the situation and modify their approaches based on their subordinates' participation (Vroom & Jago, 2018). For instance, the universities may set ground rules and state that AI tools may be used to proofread dissertation submissions and help generate plagiarism reports. Considering the students will eventually grow into future experts in their respective fields, they need to uphold the standards of intellectual honesty and ethical conduct. In such scenarios, the university leaders may set guidelines for AI-assisted writing to help maintain academic integrity. Implementing such measures can foster transparency and ethical conduct whilst harnessing GAI.

The university's research and publication domain can also be improved via the integration of GAI tools which are designed to accelerate research. Tools such as Elicit and Scite utilise language models and information retrieval to streamline a multi-disciplinary literature review process. These AI can rapidly synthesize and surface relevant insights by ingesting data inputs like research questions and literature, resulting in an accelerated literature review process that would traditionally require a great deal of manual effort and time. This makes GAI tools invaluable and time-saving for expanding research and publications as they can manage and arrange extracted information from many sources both coherently and efficiently. University leaders can arrange for training for researchers, academics and students to use these tools ethically, encouraging more high-impact research and innovations. This could lead to an expansion and create new, significant knowledge, make discoveries, or suggest solutions that benefit the fields of knowledge, industry, governments and society. It is the role public universities must adopt since they are mostly funded by state governments as well as by tuition fees, research grants and other sources to provide education.

Regardless of how digitalized the education landscape is, people should be the priority. Technological advancement should not cause harm to people or allow them to harm each other. Therefore, when adopting technology, human values should be embraced. University leaders can help regulate the ethical integration of GAI through governance and informed decisions. Individual compliance with university regulations will allow students, academics, researchers and scholars to comprehend the benefits and deficits of using GAI. Their compliance reflects their descriptive ethics that will help them to make the best of using GAI while avoiding any of the shortcomings at individual level. Regulations on GAI tools are utilitarian because the risks of misuse of AI-generated content can compromise academic integrity, cause misinformation and misconception, and hinder the development of critical thinking skills. GAI tools also possess inherent flaws like biases and inaccurate output.

Knowledge about the mechanism, capabilities, limitations, implications, and risks of GAI technologies is existential for university leaders in developing a well-rounded understanding and evaluations to formulate policies governing its adoption in education. Learning objectives can be updated to better prepare students to adapt, adopt, and become adept with AI in the future. Educational leaders face numerous challenges in regulating and integrating GAI technologies in academic settings which can potentially hinder the success of policies, programs, and activities related to the responsible use of GAI in education. For example, Ahmad et al. (2021) study implied that there are situations that are not ideal as expected by all parties because of constraints and challenges that encompass technological aspects among others; that may have a slightly negative impact on the success of the relevant teaching, learning, and supervision activities in universities.

GAI tools are used to generate digital content more efficiently and at a lower price in professional and business settings such as copywriting, coding, translation, marketing, relationship building, and many more. Hence, university leaders should be well-informed to describe, analyse, evaluate, and ultimately take a balanced stance in technology adoption that embed ethical values like transparency, honesty, and accountability among students. These values still apply in their future careers after they graduate. With insights into current technological limits as well as development trajectories, balanced policies can provide clear guidelines distinguishing acceptable applications from violations of academic integrity. Moreover, knowledge about data biases, privacy and intellectual property surrounding GAI tools enables provisions that address such pitfalls in drafting policies that align with the institution's strategic objectives and values.

Overall, by knowing of GAI's evolving functions and limitations in the decision-making frameworks, university leadership can responsibly steer adoption in academic and research missions. Their knowledge is the base of their decisions on university governance, which determines GAI adoption to amplify education processes. The ecosystem of university leadership, especially public universities, requires inter-layer and inter-cluster interaction of all educational environment members to embrace the digital transformation of the educational environment (Gruzina et al., 2019). This means that students, stakeholders, societies, industries, and ministries are interrelated with academia in creating, using, governing, and solving issues in GAI technological adoption. Based on this conclusion, this paper proposes a conceptual framework for the roles of GAI knowledge among university leaders in their decision-making that consists of four steps as follows:

1. Knowledge – University leaders equipped with knowledge of GAI tools as well as their nature, potential, and risks to academics.
2. Informed decision – University leaders make decisions accordingly to maximize benefit and minimize harm while safeguarding academic integrity.

3. Regulation – University leaders collaborate with relevant stakeholders and experts to formulate and implement policies and governance.
4. Ethical use of GAI– University leaders lead the top-down ethical use of GAI tools in university 4.0.

This paper identifies the roles of knowledge about GAI in decision-making among leaders in public universities from the literature review, specifically from 22 sources ranging from the year 2011 to 2024. The themes are analyzed and the concepts are developed by making clear linkages between the emerging themes (Lochmiller, 2021). The tabulation of the sources and the conceptual definitions are included in Table 2

Sources	Literature Review Theme	Category	Concept
Hauke, 2019; Waite et al., 2020; Strobel & Möller, 2024	Knowledge as an active engagement with ideas, arguments, and the surroundings. The knowledge dimension allows university leaders to progress from concrete to more abstract thinking in a construct defined by factual, conceptual, procedural, and metacognitive knowledge. The fundamental knowledge of the taxonomy and typology of GAI tools advances our practical understanding, strengthens the distinguishability, as well as adds clarity to the discourse of GAI potential.	**Knowledge**	University leaders equipped with knowledge of GAI tools as well as their nature, potential, and risks to academics.
Chaka, 2023; Chaka, 2023b Heilweil, 2022, Miller, 2023; Perkins et al., 2024	Institutional detection processes have limitations.		
Moln'ar & Szuts, 2018; Lam et al., 2018, pp. 18–19; Adamopoulou & Moussiades, 2020	AI tools have immense potential in education like increasing student engagement.		
Fezari et al., 2023; Goldstein et al., 2023	GAI enable the rapid production of realistic content for users.		

Ololube et al., 2021; Horban, 2011	Effective decision-making in higher education requires thoughtful and precise leadership, focusing on systematic planning and swift response to unanticipated situations, in this context the situation is GAI technology adoption.	**Informed Decisions**	University leaders make decisions accordingly to maximize benefit and minimize harm while safeguarding academic integrity.
Shao-Wei, 2011	University leaders can improve their decisiveness and promote competition and development by understanding decision processes, optimizing decision-making gravity, enhancing analytical judgments, exercising decisive quality, developing strategic thinking, and stressing democratic participation. Cost-benefit analysis might be required in this context.		
Rashid et al., 2016	Leadership decision-making is the most significant factor in strategic planning at public universities.	**Regulation**	University leaders collaborate with relevant stakeholders and experts to formulate and implement policies and governance.
Prestiadi et al., 2020	Transformational leadership is done through building commitment and awareness among all stakeholders of educational institutions to actualize themselves and use technological advances, information and communication in the education process.		
Gruzina et al., 2019	The ecosystem of university leadership, especially public universities, requires inter-layer and inter-cluster interaction of all educational environment members to embrace the digital transformation of the educational environment.		

Labadze et al., 2023; Vroom & Jago, 2018	Incorporating AI chatbots in education brings personalized learning for students and time efficiency for educators. Therefore, leaders need to adjust their decision-making style based on the situation and modify their approaches based on their subordinates' participation.	**Ethical use of GAI**	University leaders lead the top-down ethical use of GAI tools in university 4.0.
Furze et al., 2024	AI Assessment Scale (AIAS), a flexible framework for incorporating GAI into educational assessments, can be considered to be implemented among public universities based on leaders' insights.		

Table 2 Literature review table for the roles of knowledge about generative artificial intelligence (GAI) on decision-making among leaders in public universities.

This framework posits the role of knowledge as the foundation to the ethical use of GAI in higher learning institutions. In short, this framework establishes knowledge as the basis for leaders' decision-making, which contributes to regulations of GAI technology, and facilitates the ethical adoption of GAI technology in higher education.

LIMITATIONS

As a conceptual paper, this study does not provide empirical data or analysis to support its claims. The arguments and insights presented are primarily based on conceptual considerations and literature reviews, lacking direct observational or experimental evidence. While conceptual papers are valuable for exploring theoretical frameworks and generating new ideas, they may lack the practical implications and real-world applicability that empirical studies can offer. This limitation of study therefore limits the generalizability of its findings and recommendations to specific contexts or situations within public universities and higher education institutions. Since this paper can be influenced by the authors' personal interpretations, biases, and perspectives, which may introduce subjectivity in the analysis and conclusions drawn, future studies can fill this gap to support or challenge with empirical analysis. Moreover, this paper discusses the roles of GAI knowledge on decision-making from the perspectives of leaders in public universities, potentially overlooking the viewpoints and experiences of other stakeholders, such as faculty members, students, industry partners, and societal groups, who may have valuable insights on the integration of GAI in academia. Given the rapid pace of technological advancements, particularly in the field of artificial intelligence, the conceptual framework and recommendations presented in the paper may become outdated or require revisions as new developments and challenges emerge. Therefore, to address these limitations, the authors acknowledge the need for rigorous empirical case studies that can

provide real-world insights into the successful leadership that steers the ethical use of GAI in educational institutions through the era of university 4.0.

Opportunities for Future Research

This paper achieves its objective to identify the roles of GAI knowledge in university leadership decision-making that leads to the ethical use of GAI in education. Based on the literature review, there are emerging themes that are categorized into (1) knowledge, (2) informed decisions, (3) regulation, and (4) ethical use of GAI. The concepts are then developed from the linked themes. In future works, the impact of knowledge needs to be empirically examined to determine the extent to which GAI adoption and implementation in education through policy and technological interventions.

A detailed case study investigating a successful implementation of university governance measures in detecting and deterring misuse of GAI writing tools could provide valuable insight. By tracing the processes, strategies, and solutions deployed to uphold academic integrity against this new form of cheating, other universities can learn from targeted responses found to be most impactful. Additional examination is warranted to understand the structures and best practices enabling one institution to shape norms around responsible AI adoption and integration that uphold academic integrity - outcomes vital for preserving trust in emerging technologies' contributions rather than merely their disruptions across institutes of teaching, research and innovation.

By the time this paper is written, this paper identifies the lacking of GAI tools directory curated specifically for academic purposes. Educational leaders might also consider the necessity of providing a comprehensive directory of GAI tools and websites deemed appropriate and sustainable for academic utilization. Such directory would enable students and academics to access relevant resources, fostering an equitable and inclusive learning environment. This directory could categorize the available tools and websites based on their pricing models, including free, freemium (offering basic features for free with premium paid options), free trial periods, and paid subscriptions. Some of these tools might already being used in universities such as Scopus AI, Grammarly, Canva, Zoom, et cetera. Moreover, implementing a search functionality that allows students to filter resources by specific categories or academic disciplines would streamline their ability to identify the most suitable tools for their respective educational endeavours. By providing a centralized repository of vetted AI resources, educational institutions can empower students with access to GAI technologies while ensuring alignment with academic integrity standards, ethical adoption, and responsible AI practices.

Universities also can consider to appoint academic officer or consultant in human form to be in charge of the AI and GAI adoption at institutional level. The primary responsibilities of this officer include providing guidance and recommendations to the university management regarding the appropriate scope, applications, and governance frameworks for AI and GAI adoption. Moreover, they would play a crucial role in addressing inquiries and concerns from students, faculty, and other stakeholders regarding how much, how, and why AI and GAI are integrated within various academic and operational processes. This officer would be responsible for keeping up the latest discoveries, developments, best practices, and ethical considerations in the field, thereby enabling the institution to navigate the complexities and potential challenges associated with AI. This initiative would not only promote technological literacy but also encourage the ethical and effective integration of AI in various academic pursuits, ultimately enhancing the overall quality of education. Therefore, university leaders can engage student representatives, AI experts from academia and industry, as well as

government ministries to collaboratively develop comprehensive policies for ethical use of GAI in higher learning institutions.

ACKNOWLEDGEMENT

We thank our colleagues from the Centre for the Promotion of Knowledge and Language Learning (PPIB) of University Malaysia Sabah (UMS) who provided thoughtful insights and proficiency that critically helped this study although they might not agree with all of the interpretation and conclusion of this paper. We would also like to thank all anonymous reviewers for their insights. We also extend our appreciation to the commentators for their comments on the earlier version of the manuscript. Any errors that remain are solely our responsibility and should not diminish the esteemed reputation of those mentioned.

REFERENCES

Adamopoulou, E., & Moussiades, L. (2020). Chatbots: History, technology, and applications. *Machine Learning With Applications*, *2*, 100006. https://doi.org/10.1016/j.mlwa.2020.100006

Ahmad, S. H. A., Yusof, S., Meri, A., & Modili, C. (2021). ISU DAN PENDEFINISIAN SEMULA DIGITAL POVERTY DALAM PENGAJARAN, PEMBELAJARAN DAN PENYELIAAN (PPDP) SECARA ATAS TALIAN. *Jurnal Komunikasi Borneo*, 104–113. https://doi.org/10.51200/jkob.vi.3289

Brown, T. B., Krueger, G., Mann, B., Askell, A., Herbert-voss, A., Winter, C., Ziegler, D. M., Radford, A., & Mccandlish, S. (2020). Language Models are Few-Shot Learners. *NeurIPS*.

Chaka, C. (2023). Stylised-facts view of fourth industrial revolution technologies impacting digital learning and workplace environments: ChatGPT and critical reflections. *Frontiers in Education*, *8*. https://doi.org/10.3389/ feduc.2023.1150499

Chaka, C. (2023b). Detecting AI content in responses generated by ChatGPT, YouChat, and Chatsonic: The case of five AI content detection tools. *Journal of Applied Learning and Teaching*, *6*(2), 94–104. https://doi.org/10.37074/jalt.2023.6.2.12

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. *Ieee Access*, *8*, 75264–75278.

Chkheidze, S. (2023). ROLE OF LEADER IN EDUCATIONAL MANAGEMENT. *PUPIL: International Journal of Teaching, Education and Learning*, *7*(2), 171–179. https://doi.org/10.20319/pijtel.2023.72.171179

Fezari, M., Dahoud, A. A., & Al-Dahoud, A. (2023). Augmanting Reality : The power of Generative AI. *ResearchGate*. https://www.researchgate.net/publication/370821758

Floridi, L. (2023). AI as Agency without Intelligence: On ChatGPT, large language models, and other generative models. *Philosophy & Technology*, *36*(1), 1-7. https://doi.org/10.1007/s13347-023-00621-y

Furze, L., Perkins, M., Roe, J., & MacVaugh, J. (2024, March 15). *The AI Assessment Scale (AIAS) in action: A pilot implementation of GenAI supported assessment*. arXiv.org. https://arxiv.org/abs/2403.14692

Goldstein, J. A., Sastry, G., Musser, M., DiResta, R., Gentzel, M., & Sedova, K. (2023, January 10). *Generative language models and automated influence operations: emerging threats and potential mitigations*. arXiv.org. http://arxiv.org/abs/2301.04246

Glendinning, I. (2022). Aligning Academic Quality and Standards with Academic Integrity. In *Springer eBooks* (pp. 199–218). https://doi.org/10.1007/978-3-031-12680-2_14

Gruzina Y. M., Mel'Nichuk M. V., Belogash M. A. (2019). Leadership ideas shaped by digital insights in higher education. *Управленческие науки*. №4. URL: https://cyberleninka.ru/article/n/leadership-ideas-shaped-by-digital-insights-in-higher-education (дата обращения: 09.03.2024).

Hauke, E. (2019). Understanding the world today: the roles of knowledge and knowing in higher education. *Teaching in Higher Education*, *24*(3), 378–393. https://doi.org/10.1080/13562517.2018.1544122

Heilweil, R. (2022, December 7). ChatGPT, artificial intelligence, and the future of education. *Vox*. https://www.vox.com/recode/2022/12/7/23498694/ai-%20artificial-intelligence-chat-gpt-openai

Hewett, J. (2023). *Why white-collar workers fear ChatGPT*. Afr.

Horban, H. O. (2021). DECISION MAKING AS PSYCHOLOGICAL PROBLEM. *Scientific Bulletin of Uzhhorod National University. Series: Psychology.*, *1*, 9–11. https://doi.org/10.32782/psy-visnyk/2021.1.2

Labadze, L., Grigolia, M., & Machaidze, L. (2023). Role of AI chatbots in education: systematic literature review. *International Journal of Educational Technology in Higher Education*, *20*(1), 1–17. https://doi.org/10.1186/s41239-023-00426-1

Lam, C., Chan, L., & See, C. (2018). Converse, Connect and Consolidate – The Development of an Artificial Intelligence Chatbot for Health Sciences Education. *Frontiers in Medical and Health Sciences Education Conference*. http://hub.hku.hk/handle/10722/266425

Law, N., Woo, D., de la Torre, J., & Wong, G. (2018). *A Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2*. Information Paper No51, 51, 146. http://uis.unesco.org/sites/default/files/documents/ip51-global-framework-reference-digital-literacy-skills-2018-en.pdf. Consultado em 05fev2023, 17:45

Lim, W. M., Gunasekara, A., Pallant, J. L., Pallant, J. I., & Pechenkina, E. (2023). Generative AI and the future of education: Ragnarök or reformation? A paradoxical perspective from management educators. *The International Journal of Management Education, 21*(2), 100790. https://doi.org/10.1016/j.ijme.2023.100790

Lochmiller, C. (2021). Conducting Thematic Analysis with Qualitative Data. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2021.5008

Mannuru, N. R., Shahriar, S., Teel, Z. A., Wang, T., Lund, B. D., Tijani, S., Pohboon, C. O., Agbaji, D., Alhassan, J., Galley, J., Kousari, R., Ogbadu-Oladapo, L., Saurav, S. K., Srivastava, A., Tummuru, S. P., Uppala, S., & Vaidya, P. (2023). Artificial intelligence in developing countries: The impact of generative artificial intelligence (AI) technologies for development. *Information Development*, *September*. https://doi.org/10.1177/02666669231200628

Miller, M. (2023, July 27). *ChatGPT, Chatbots and artificial intelligence in education*. Ditch That Textbook. https://ditchthattextbook.com/ai/

Molnar, G., & Szuts, Z. (2018). The Role of Chatbots in Formal Education. *2018 IEEE 16th International Symposium on Intelligent Systems and Infor- Matics (SISY)*. https://doi.org/10.1109/sisy.2018.8524609

Okonkwo, C. W., & Ade-Ibijola, A. (2021). Chatbots applications in education: A systematic review. *Computers and Education: Artificial Intelligence*, *2*, 100033. https://doi.org/10.1016/j.caeai.2021.100033

Ololube, N. P., Ingiabuna, E. T., & Dudafa, U. J. (2021). Effective decision making for knowledge development in higher education. In *IGI Global eBooks* (pp. 546–563). https://doi.org/10.4018/978-1-7998-3438-0.ch025

Perkins, M., Roe, J., Vu, B. H., Postma, D., Hickerson, D., McGaughran, J., & Khuat, H. Q. (2024, March 28). *GenAI Detection Tools, Adversarial Techniques and Implications for Inclusivity in Higher Education*. arXiv.org. https://arxiv.org/abs/2403.19148

Pham, X. L., Pham, T., Nguyen, Q. M., Nguyen, T. H., & Cao, T. T. H. (2018). In Chatbot as an intelligent personal assistant for mobile language learning in Proceedings of the 2018 2nd International Conference on Education and E-Learning, pages 16–21.

Prestiadi, D., Gunawan, I., & Sumarsono, R. B. (2020). Role of Transformational Leadership in Education 4.0. *6th International Conference on Education and Technology (ICET 2020)*. https://doi.org/10.2991/assehr.k.201204.020

Rashid, I. M. A., Samah, I. H. A., Razali, R., Sham, M. F., Karim, N. A., Basri, H. H., Radzi, W. N. W. M., Abashah, A. N., & Zahari, M. K. (2016). The importance of perceived leadership elements in strategic planning at Public University. *Procedia Economics and Finance*, *39*, 422–426. https://doi.org/10.1016/s2212-5671(16)30343-4

Rooein, D. (2019). Data-driven edu chatbots. In companion proceedings of the 2019 world wide web conference, pages 46–49.

Shao-Wei, F. (2011). Analyses on University Leader' s Decisiveness. *Journal of Fujian Commercial College*. https://en.cnki.com.cn/Article_en/CJFDTOTAL-FJSY201106004.htm

Strobel, G., Banh, L., Möller, F., & Schoormann, T. (Eds.). (2024). *Exploring Generative Artificial Intelligence: A Taxonomy and Types*. Hawaii International Conference on System Sciences (HICSS) At: Honolulu, Hawaii. https://www.researchgate.net/publication/373927156_Exploring_Generative_Artificial_Intelligence_A_Taxonomy_and_Types

Teubner, T., Flath, C. M., Weinhardt, C., van der Aalst, W., & Hinz, O. (2023). Welcome to the Era of ChatGPT et al: The Prospects of Large Language Models. *Business & Information Systems Engineering*, *65*(2), 95-101. https://doi.org/10.1007/s12599-023-00795-x

Troussas, C., Krouska, A., & Virvou, M. (2017). Integrating an adjusted conversational agent into a mobile-assisted language learning application. In 2017 IEEE 29th international conference on tools with artificial intelligence (ICTAI), pages 1153–1157. IEEE.

Vroom, V., & Jago, A. (2018). Leadership and decision making. *Leadership*. https://doi.org/10.1017/9781108617666.015.

Waite, L. H., Zupec, J., Quinn, D. H., & Poon, C. Y. (2020). Revised Bloom's taxonomy as a mentoring framework for successful promotion. *Currents in Pharmacy Teaching and Learning*, *12*(11), 1379–1382. https://doi.org/10.1016/j.cptl.2020.06.009

Wu, C., Ramamohanarao, K., Zhang, R., & Bouvry, P. (2023). Strategic Decisions: Survey, Taxonomy, and Future Directions from Artificial Intelligence Perspective. *ACM Computing Surveys*, *55*(12), 1–30. https://doi.org/10.1145/3571807