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Effective school leadership enactment of GAI: a 5C's framework for integration

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Introduction: The integration of Generative Artificial Intelligence (GAI) into educational settings is rapidly transforming teaching and learning processes. As this shift unfolds, school leadership plays a pivotal role in ensuring the effective and ethical adoption of GAI technologies. This study investigates the leadership traits and practices essential for guiding GAI implementation in schools within the Arab region.

Methods: A qualitative research design was employed, utilizing semi-structured interviews with 12 school principals from six Arab countries. All participants had led GAI integration initiatives in their schools over the past two years. Data were analyzed thematically to identify patterns in leadership behavior and strategy.

Results: Analysis revealed five core leadership roles, summarized in the 5 C's framework: *Catalysts for innovation, Curators of GAI technologies, Champions of its benefits, Cultivators of a culture of experimentation, and Connectors fostering collaboration*. These roles reflect the multifaceted responsibilities of school leaders in the context of GAI.

Discussion: The findings highlight that effective school leadership in the AI era requires more than technological literacy—it demands visionary, collaborative, and adaptive leadership. The proposed 5 C's framework provides a strategic model for guiding school leaders in fostering meaningful and sustainable GAI integration. These insights have broad implications for leadership development and policy in AI-informed education.

KEYWORDS

GAI, school leadership, digital leadership, leadership framework, Arab states

Introduction

Generative AI (GAI) denotes a sophisticated class of artificial intelligence systems designed to autonomously produce novel and creative outputs—ranging from text and imagery to music and video—by discerning intricate patterns within extensive datasets. Distinct from conventional AI, which primarily engages in data analysis and classification, generative AI synthesizes original content, employing complex architectures such as deep neural networks and leveraging advanced techniques like natural language processing (Feuerriegel et al., 2024).

GAI is no longer a futuristic concept but a present reality, rapidly reshaping various sectors, including education (Tuomi, 2024). In educational settings, GAI is being increasingly utilized by students to enhance their learning experiences, whether independently or within the classroom environment (Chen et al., 2023). GAI offers numerous opportunities to transform teaching and learning, from personalized learning paths to automated administrative tasks, but its integration also presents significant challenges, such as ethical concerns, equity issues, and the need for digital literacy among educators and students (Shal et al., 2018, 2024, 2025).

Amid these opportunities and challenges, the role of school leaders is paramount. School leadership is at the heart of any educational reform (Ghamrawi et al., 2024a,b), and as schools navigate the complexities of GAI integration, effective leadership becomes even more critical.

Leaders must balance the potential benefits of GAI with its potential risks, ensuring that its adoption enhances learning experiences without compromising student equity, wellbeing, and inclusivity (Ghamrawi et al., 2013, 2023).

The literature consistently highlights that effective school leadership drives change and innovation within educational institutions (Ghamrawi, 2013). School leaders not only envision the future direction of their schools but also inspire and mobilize stakeholders—teachers, students, and the broader community—toward common goals. They cultivate a culture of experimentation and collaboration, creating an environment where educators feel supported to adopt new methodologies and technologies (Ghamrawi et al., 2024a,b). Through clear objectives, robust support, and reflective practices, school leaders build frameworks that foster innovation and address evolving educational needs (Ghamrawi and Al-Thani, 2023). Additionally, they play a critical role in advocating for students, ensuring reforms align with values of equity and inclusivity (Ghamrawi and Al-Jammal, 2014; Ghamrawi and Al-Thani, 2023).

Despite extensive scholarship on school leadership and educational innovation, there remains a critical blind spot concerning how school leaders can strategically steer the integration of Generative AI (GAI) in ways that are both contextually grounded and ethically sound. This study directly addresses this void by introducing a novel, research-informed leadership framework tailored specifically for the GAI era. What distinguishes this framework is its dual innovation: it conceptualizes leadership not merely as administrative oversight, but as transformative engagement with emerging technologies, and it is empirically rooted in the lived experiences of school leaders across Arab contexts—an underrepresented yet increasingly vital region in global educational discourse. Unlike existing models, which often generalize leadership competencies in technology adoption, this framework articulates a nuanced constellation of knowledge, dispositions, and adaptive practices uniquely attuned to the pedagogical, ethical, and infrastructural demands of GAI. By doing so, it offers both theoretical advancement and practical utility, equipping school leaders to act not just as facilitators of change, but as strategic architects of AI-informed educational futures. Accordingly, the study is guided by the central question: *What are the key leadership traits and practices that enable school leaders to effectively serve as catalysts for GAI integration in educational settings?*

Literature review

Effective school leadership

School leadership is one of the highly addressed concepts in the literature, reflecting the significant interest in understanding its impact on educational outcomes (Freeman and Fields, 2023). The interest in school leadership relates to the fact that leadership predicts outcomes such as overall school performance and student achievement (Leithwood et al., 2020). Scholarly interest has long attended to the effects of specific principal leadership behaviors on teachers, particularly as mediators of student-level outcomes (Tan et al., 2024). These behaviors influence teachers' individual and collective self-efficacy, individual performance, organizational commitment, work engagement, and job satisfaction (Fullan and Quinn, 2015).

Effective school leadership is characterized by a combination of visionary thinking, instructional leadership, and organizational

management (Harris et al., 2023). Leaders in successful schools set clear goals and expectations, fostering a shared vision of academic excellence and continuous improvement among staff and students (Ghamrawi and Al-Jammal, 2014). They prioritize the professional development of teachers, encouraging collaborative practices and reflective teaching methods to enhance instructional quality (Shaked, 2024).

Moreover, effective school leaders also often rely on data-driven decision-making, using student performance data to inform instructional strategies and resource allocation (Massouti et al., 2024). Additionally, they cultivate a positive school culture by promoting inclusive practices, ensuring a safe and supportive learning environment, and engaging with the broader community to build strong partnerships (Ghamrawi et al., 2024a,b). These leaders demonstrate adaptive expertise, balancing the immediate needs of their schools with long-term strategic planning, and are adept at navigating the complexities of educational policy and reform (Massouti et al., 2024).

To further explore the significant impact of effective school leadership, the next section will explore the relationship between school leadership and school improvement and reform, highlighting how effective leadership practices drive educational advancements.

School leadership, school improvement and reform

A substantial body of literature underscores school leadership as a fundamental prerequisite for educational reform (Harris and Jones, 2015; Day et al., 2020; Castillo and Hallinger, 2018; Myran and Sutherland, 2019; Leithwood et al., 2020; Anderson, 2021; Evans, 2022). According to UNESCO (2016), school leadership is pivotal in achieving the United Nations' fourth Sustainable Development Goal (SDG 4), which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. UNESCO's Agenda 2030 emphasizes the importance of school leadership, recognizing it as crucial for supporting teachers' efforts to enhance educational quality.

This strategic shift from focusing on teachers to prioritizing school leaders is backed by extensive research evidence demonstrating the significant impact of effective school leadership on educational outcomes (Schleicher, 2015). The focus on school leadership aligns with the Organization for Economic Cooperation and Development (OECD), which has consistently championed effective school leadership as a cornerstone of educational reform (Guthrie et al., 2022; Jerrim and Sims, 2022).

Central to the focus on school leadership as a driver of change is its transformative potential (Burns, 1978) who describes it in terms of 'engag[ing] with others in such a way that leaders and followers raise one another to higher levels of motivation and morality' (Burns, 1978, p. 19). As such, transformational leadership serves as means for change leadership by facilitating a collaborative relationship that transforms both the leader and the follower (Ghamrawi et al., 2023), promoting mutual support (Harris et al., 2023) and heightened self-awareness toward achieving positive goals (Tan et al., 2024).

The role of school leadership in driving school improvement is illustrated by the functions identified by Day et al. (2020). They argue that effective school leaders articulate a holistic vision of success for the school community, cultivate collaborative cultures that encourage growth, develop leadership capacities among peers, and fulfill instructional leadership responsibilities to advance educational

outcomes. This emphasis on instructional leadership in promoting reform and enhancing school improvement is further emphasized by Leithwood (2021), who advocates for school leaders to actively engage in teaching and learning and establish clear expectations for educational practices within their schools. They also prioritize continuous professional development for themselves and their staff, cultivating a culture of empowered, self-directed learning and accountability (Doherty, 2021), while simultaneously driving innovation (De Jong et al., 2022; Díaz-Gibson et al., 2021).

With their instructional leadership roles, school leaders promote innovation and adaptability (Sudibjo and Prameswari, 2021), championing new initiatives within the school environment (Acton, 2021). They establish cultures that emphasize data-driven decision-making at all levels of the school, ensuring efficient operations and optimal learning outcomes for students (Leithwood, 2021). Lastly, school leaders bring change and nurture it by maintaining an ongoing engagement with the broader school community (Mayger and Provinzano, 2022) fostering collaborative partnerships.

On top of school reform agendas is the integration of technologies, particularly GAI, in a technology-driven global world. The role of school leaders in GAI enactment, despite being relatively less addressed in the literature (Shal et al., 2024, 2025), is crucial for ensuring successful integration and enhanced learning outcomes. This important aspect will be explored in the next section.

School leadership and GAI

GAI in education offers tremendous promises but also present potential risks, necessitating careful preparation for both (Chen et al., 2023; Tuomi, 2024). The transformative capabilities of GAI can revolutionize teaching and learning by providing personalized education, automating administrative tasks, and offering advanced analytics to inform instructional decisions (Ghamrawi and Al-Jammal, 2013; Yau et al., 2023). However, these advancements come with challenges such as ethical concerns, data privacy issues, and the potential for exacerbating educational inequalities (Yim and Su, 2024; Yuan, 2024).

The integration of GAI intensifies the strategic complexities faced by school leaders, demanding a recalibration of existing leadership models to align with data-driven, adaptive, and anticipatory practices. GAI tools not only generate vast amounts of real-time data but also automate decision-making processes traditionally reserved for human judgment, thereby challenging leaders to maintain a balance between algorithmic efficiency and professional discretion (Shal et al., 2025). This shift transforms the role of school leaders from mere facilitators of technological adoption to ethical gatekeepers who must critically assess the implications of GAI outputs, ensure transparency in data use, and uphold equity across all levels of the school community (Shal et al., 2024). As a result, the leadership task expands from guiding instructional improvement to orchestrating a responsible and context-sensitive integration of intelligent technologies into the fabric of school operations.

To harness the benefits of GAI in education while mitigating its risks, school leadership must play a crucial and pivotal role (Ghamrawi et al., 2024c). School leaders are entrusted with the task of cultivating environments that effectively prepare students for future challenges through innovative teaching and learning practices (Ng and Wong, 2020). As technology continues to sweep into school leadership, studies have shown that school leaders have increasingly incorporated technology into their daily operations (Tigre et al., 2023).

GAI, as a technological innovation, falls under the purview of digital leadership, albeit uniquely positioned as it can potentially revolutionize the educational landscape and usher in a new paradigm for schooling (Fullan et al., 2023). Although limited, the recent literature on school leadership and GAI strongly emphasizes the critical role of school leaders in effectively integrating GAI at all levels of education (Cheng and Wang, 2023; Yau et al., 2023). However, concerns persist regarding the preparedness of school leaders to assume leadership in this area (Cheng and Wang, 2023).

Moreover, the ambiguous and rapidly evolving nature of GAI presents a paradox for school leaders: while they are expected to be visionary drivers of innovation, they often lack access to targeted guidance, training, and support systems to meaningfully interpret and implement GAI strategies (Shal et al., 2024). This leadership vacuum risks reducing GAI integration to fragmented or superficial applications, thereby undermining its transformative potential. Addressing this requires a systemic rethinking of leadership preparation programs to include not only technical fluency with AI tools but also capacity-building in areas such as ethical foresight, change management, and cross-disciplinary collaboration (Shal et al., 2025). Without such recalibration, school leaders may struggle to move beyond reactive modes of implementation and fail to capitalize on GAI as a catalyst for deep, equity-focused reform.

Cheng and Wang (2023) contend that by offering professional development, technical resources, and pedagogical guidance, digital leadership can potentially empower teachers to effectively manage the complexities of integrating GAI. Addressing these challenges necessitates coordinated efforts to provide customized professional development for school leaders, enhance teachers' competencies across diverse subjects, and establish clear GAI frameworks and ethical guidelines (Cheng and Wang, 2023).

Although no universally established framework exists for the integration of Generative AI (GAI) tools within educational institutions, several prevailing models and guidelines can be adapted. The SAMR Model assists educators in evaluating how GAI can transform learning experiences (Hamilton et al., 2016), while the TPACK Framework ensures alignment between technology, pedagogy, and content knowledge (Maor, 2017). The ISTE Standards provide comprehensive guidelines for effective and ethical technology use (Trust, 2018), and the AI4K12 Guidelines offer a framework for AI integration in K-12 settings, emphasizing literacy and ethical considerations (Touretzky et al., 2023). Moreover, adoption frameworks such as the Technology Acceptance Model (TAM) (Marangunić and Granić, 2015) and the Concerns-Based Adoption Model (CBAM) (Kim and Lee, 2020) offer insights into the implementation of novel technologies.

Nevertheless, the authors have identified these existing frameworks as insufficient due to their general focus on pedagogical and instructional aspects of GAI, rather than addressing the specific challenges and opportunities associated with GAI tools in the realm of school leadership. This deficiency underscores the necessity for a bespoke framework that comprehensively addresses the distinct needs and responsibilities of educational leaders, ensuring that GAI tools are integrated effectively and ethically within schools, with a targeted focus on leadership dynamics and strategic implementation.

Building on this understanding, there is an urgent call for a robust framework that equips school leaders with the necessary skills and practices to navigate the complexities of GAI integration. Such a

framework must support leaders in every phase of implementation—from inception and planning to execution, evaluation, and optimization—ensuring that GAI tools are fully leveraged for educational success. Recognizing the absence of this leadership-oriented framework in existing literature, this study seeks to address the gap by developing and proposing a structured approach tailored specifically to the needs of school leaders in the GAI context.

Methods

Research design

This study was situated within the interpretive paradigm, aiming to explore and understand the perspectives and experiences of school principals recognized for their effective implementation of GAI in educational settings (Flick, 2009; Silverman and Patterson, 2021). A qualitative approach was adopted, employing semi-structured interviews as the primary method of data collection. Semi-structured interviews were chosen to allow for in-depth exploration of the participants' insights, strategies, challenges, and successes in integrating GAI technologies within their schools.

Semi-structured interviews were deemed appropriate for developing a research-based framework for GAI leadership due to several key reasons. Firstly, these interviews facilitate rich, detailed narratives from experienced school principals, offering deep insights into their leadership traits, practices, and decision-making processes concerning GAI integration (Magaldi and Berler, 2020). Secondly, the interpretive paradigm emphasizes understanding the subjective experiences and meanings attributed by participants, aligning with the study's goal to uncover nuanced perspectives on effective GAI leadership in education (Cuthbertson et al., 2020). Thirdly, by focusing on school principals recognized for their successful GAI implementation, the study ensures that the framework development is grounded in real-world expertise and practical insights, enhancing its relevance and applicability for educational leaders facing similar challenges (Tomaszewski et al., 2020).

Participants

To overcome the challenge of identifying schools effectively implementing GAI, the researchers recruited school principals nominated by a virtual community of practice (vCoP) serving the Arab States region for their GAI initiatives. These principals' applications were accepted by the vCoP, enabling their participation in a best practices forum where their schools were subsequently nominated for the Best School Award (BSA) in GAI implementation over the preceding 2 years. All 16 school leaders, whose schools were nominated for the BSA, were invited to participate in the study. Of these, 12 principals agreed to take part, forming the final study sample. Data saturation was reached by the time the eighth participant was interviewed, as no new themes or insights emerged after this point. However, the remaining four participants were included to ensure comprehensive coverage and reinforce the findings.

One of the researchers, serving anonymously as a committee member evaluating the BSA, worked with a panel of six internationally recognized educational technology experts to assess GAI

implementation in schools. The award was open to schools across all 22 Arab states; however, all the schools nominated for the BSA came from six countries only, and they were all K-12 private or international schools. The researchers did not make any deliberate choices regarding the selection of countries, but instead focused on recruiting participants based on their use of GAI, as recognized by an external quality assurance entity.

Following the announcement of awardees, the researcher formally requested access to the 16 nominated school principals through the vCoP board, which facilitated communication with the leaders. Consent letters and study concept notes were provided, with explicit assurances of anonymity and strict adherence to research ethical standards conveyed. The 12 principals who expressed interest constituted the final sample group, as outlined in Table 1.

Research instrument

A semi-structured interview schedule (see Table 2) was developed to effectively capture insights from school leaders. It covered key themes including leadership traits crucial for GAI integration, specific practices and strategies for implementation, challenges and solutions encountered, opportunities and support for effective GAI leadership, and recommendations for enhancing GAI efforts, concluding with a summary and gratitude for the participant's contribution.

Through iterative refinement, the schedule was optimized for relevance and methodological rigor, undergoing rigorous peer review by two external experts in the field to ensure its quality and alignment with research objectives. Prior to the main data collection phase, a pilot interview was conducted with a school principal not included in the study sample but sharing similarities in digital literacy and interest in GAI integration. This pilot aimed to validate the instrument and refine probing questions. Each interview session, averaging approximately 35 min, allowed for thorough exploration of participants' perspectives and experiences.

All interviews were conducted via Microsoft Teams due to the geographic dispersion of participants across Arab states. To respect privacy, cameras were closed, and only audio recordings were made, with participants' consent obtained beforehand. Each interview involved two researcher interviewers—one male and one female—both of whom brought over 20 years of experience in conducting interviews. The average duration of the interviews was 39 min and 45 s.

Data analysis

Data was analyzed using theme-based analysis, employing a comprehensive approach that encompassed open coding, axial coding, and selective coding as advocated by Williams and Moser (2019), based on pre-defined categories as per the guidelines of Braun et al. (2019). To ensure the robustness of our codes and themes, we implemented a peer debriefing approach. In this method, two researchers independently coded the data, followed by cross-referencing and harmonization, in accordance with the methodology recommended by Scharp and Sanders (2019).

During the open coding phase, interview transcripts were systematically segmented into smaller units, with each unit receiving

TABLE 1 Characteristics of the sample.

Characteristic		Number
Gender	Male	7
	Female	5
Age Mean = 41.25 years	25–35 years	2
	36–46 years	8
	47 years and above	2
Educational Degrees	Bachelor	9
	Masters	2
	PhD	1
Experience in teaching	5–7 years	9
	8–10 years	3
	11 years or more	0
Experience in leading a school	1–5 years	1
	6–10 years	8
	11 years or more	3
Countries	UAE	3
	Qatar	2
	Saudi Arabia	1
	Bahrain	1
	Jordan	2
	Lebanon	3
GAI Employed in Researched Schools	Text Generation and Assistance (ex. ChatGPT, Google Gemini, Jasper AI, Notion AI)	12
	Content and Assessment Tools (ex. Quizizz AI, Edpuzzle, Curipod)	12
	Writing and Editing Support (ex. Grammarly AI, Wordtune, Scribbr AI)	12
	Visual and Creative Tools (ex. Canva AI, DALL.E, Adobe Firefly)	12
	Audio and Video Applications (ex. Synthesia, Murf.ai, Lumen 5)	12
	School Administration & Communication (ex. Otter.ai, Tactiq, Trello, Humata.ai, Tome)	12

an appropriate code based on the pre-defined themes. These codes were consistently compared and contrasted to discern both commonalities and distinctions among them. Subsequently, we progressed to axial coding, wherein the codes were organized into categories, fostering the establishment of connections and relationships between these categories. Finally, in the selective coding stage, we elevated the central coding to a more abstract level, refining the narrative of the study, in line with [Flick \(2009\)](#) recommendations.

Following theme-based analysis across each category of the interview schedule, we conducted a cross-categorical synthesis following the guidelines outlined by [Miles et al. \(2014\)](#). Cross-categorical analysis is a sophisticated methodological approach used to synthesize and integrate findings across multiple thematic categories within qualitative research. It involves the systematic examination of data that has been categorized into distinct thematic

domains to identify patterns, relationships, and overarching themes that span across these domains ([Miles et al., 2014](#)). This analytical process enables researchers to move beyond the confines of individual categories, facilitating a comprehensive understanding of how different themes interact and contribute to a unified theoretical construct or framework. The usage of cross-categorical analysis, allows researchers to elucidate complex interdependencies and derive a more meaningful interpretation of data.

This rigorous synthesis integrated findings across all categories, culminating in the construction of a comprehensive framework for GAI school leadership. Through this cross-categorical approach, we gained a holistic understanding of the leadership traits and practices crucial for the successful implementation of GAI in educational settings. This methodological rigor ensured a clear and systematic delineation of the framework's development process.

TABLE 2 Interview schedule.

Introductions
<ul style="list-style-type: none">Welcoming, self-introductions, demographics, overview of the topic, informed consent, and ground rules.
Leadership traits
<ul style="list-style-type: none">What leadership traits do you believe are most important for effectively integrating GAI in educational settings?Can you provide examples of how these traits have influenced your approach to GAI integration?
Leadership practices/strategies
<ul style="list-style-type: none">What specific practices and/or strategies have you implemented to promote GAI integration in your school? <p>How do you prioritize GAI initiatives alongside other educational goals and challenges?</p>
Challenges
<ul style="list-style-type: none">What challenges have you encountered in integrating GAI into your educational environment? <p>How have you addressed these challenges? Can you share specific examples?</p>
Opportunities
<ul style="list-style-type: none">What opportunities potentially support school leaders in GAI integration?What types of support do you believe are necessary for school leaders to effectively lead GAI initiatives?
Recommendations
<ul style="list-style-type: none">What advice would you give to other school leaders looking to enhance their GAI integration efforts?
Closure
<ul style="list-style-type: none">Summarize key points discussed during the interview.Thank the participant for their contribution

Trustworthiness

Trustworthiness in qualitative research refers to the credibility, dependability, confirmability, and transferability of study findings, ensuring that the results are accurate, reliable, and applicable (Adler, 2022). The trustworthiness of our study was guarded and secured through several key strategies. First, credibility was reinforced by conducting in-depth interviews with school principals recognized for their effective GAI implementation by a well-recognized regional body, and by involving experienced interviewers with over 20 years of expertise. We employed member checking to validate preliminary findings with participants, which enhanced the accuracy of our interpretations. Second, dependability was achieved through a transparent and systematic approach to data collection and analysis, supported by detailed documentation and consistent interview protocols. Third, confirmability was ensured by maintaining an audit trail that documented all research decisions and processes, and by engaging in ongoing reflexivity to address potential researcher biases. To support transferability, we provided rich contextual descriptions of the research setting and participant demographics, enabling readers to assess the applicability of our findings to other contexts. These measures collectively ensured the credibility, dependability, and validity of our study, affirming its trustworthiness and its contributions to understanding GAI school leadership.

TABLE 3 Theme-based analysis of semi-structured interviews.

Categories	Themes	F	%
Leadership traits	<ul style="list-style-type: none">Visionary thinkingAdaptability and flexibilityTechnological proficiencyCollaboration and communication	9	75
		11	91.5
		12	100
		10	83
Leadership practices and strategies	<ul style="list-style-type: none">Participation in virtual communities of practicePilot-testing and small scale trialsFocus on core educational valuesStakeholder engagement and feedback mechanisms	8	66.6
		7	58
		8	66.6
		10	83
Challenges	<ul style="list-style-type: none">Resistance to changeLack of technical expertiseIntegration with existing systemsEthical concerns	12	100
		11	91.5
		7	58
		9	75
Opportunities	<ul style="list-style-type: none">Professional developmentMentorship and peer networksInstitutional support and policiesContinuous feedback	9	75
		9	75
		6	50
		8	66.6
Recommendations	<ul style="list-style-type: none">Starting Small and Scaling UpFostering a culture of innovationDifferentiating professional developmentEngaging stake holders earlyCommunicating success and celebrating it	11	91.5
		11	91.5
		10	83
		9	75
		8	66.6

Findings

The theme-based analysis of semi-structured interview data, conducted according to each category outlined in the interview schedule, is detailed in Table 3.

Leadership traits

Findings suggest that the leadership traits that predominantly contributed to the success of school leaders in enacting and using GAI in their school contexts were visionary thinking, adaptability and flexibility, technological proficiency, and collaboration and communication.

Visionary thinking

Visionary thinking emerged as a pivotal leadership trait among school leaders who successfully integrated GAI into their educational environments. Principals underscored the importance of setting ambitious yet practical goals for GAI adoption. One principal (P3) emphasized, ‘*Our vision was not just about incorporating GAI tools but fundamentally reshaping how we approach teaching and learning*’. This perspective highlights how visionary leaders envision GAI as a catalyst for transformative change rather than just a technological tool.

Another principal (P7) articulated, *‘Our vision for GAI centered on preparing students for future challenges by equipping them with critical thinking skills enhanced through GAI-driven personalized learning experiences’*. Such statements underscore how visionary thinking motivates leaders to align technological integration with broader educational objectives, fostering innovation and student-centered approaches.

Adaptability and flexibility

Adaptability and flexibility were identified as crucial traits enabling school leaders to navigate the complexities of GAI integration effectively. Principals highlighted the need to embrace uncertainty and adjust strategies in response to evolving technological landscapes. One principal (P2) remarked, *‘Flexibility allowed us to experiment with different GAI applications and adjust our approach based on what worked best for our students and teachers’*. This flexibility in approach enabled leaders to refine implementation strategies and address challenges proactively. Another principal (P10) noted, *‘Adaptability was key in overcoming resistance to GAI among staff, as we tailored professional development to meet diverse needs and concerns’*. These insights underscore how adaptable leadership fosters a culture of continuous improvement and responsiveness to the dynamic nature of GAI technologies in education.

Technological proficiency

Technological proficiency emerged as a foundational trait among successful school leaders leveraging GAI in educational settings. Principals emphasized the importance of not only understanding GAI technologies but also leveraging them strategically to enhance teaching and learning outcomes. One principal (P5) stated, *‘Technological proficiency empowered us to identify and implement GAI solutions that aligned with our educational goals, ensuring their meaningful integration into daily practices’*. This proficiency enabled leaders to make informed decisions regarding GAI investments and implementations, thereby maximizing their impact on student achievement. Another principal (P12) highlighted, *‘Our proficiency in GAI technologies allowed us to mentor and support teachers in effectively using GAI tools to personalize learning experiences for students’*. These perspectives illustrate how technological proficiency equips leaders with the knowledge and skills to lead successful GAI initiatives that benefit both educators and learners.

Collaboration and communication

Collaboration and communication skills were identified as essential traits enabling school leaders to foster a supportive environment for GAI adoption and implementation. Principals emphasized the importance of building partnerships and effectively communicating the benefits of GAI to various stakeholders. One principal (P4) noted, *‘Collaboration with teachers, parents, and community members was critical in gaining buy-in and ensuring a smooth transition to GAI-enhanced learning environments’*. This collaborative approach facilitated shared decision-making and collective ownership of GAI initiatives. Another principal (P9) remarked, *‘Clear and consistent communication about our GAI vision and goals helped alleviate concerns and build enthusiasm among staff and parents’*. These examples highlight how effective collaboration and communication enable leaders to create a culture

of trust and innovation, essential for successful GAI integration in schools.

Leadership practices and strategies

Themes surrounding leadership practices and strategies in GAI integration within education highlighted participation in virtual communities of practice, pilot-testing and small-scale trials, focus on core educational values, and stakeholder engagement and feedback mechanisms. School leaders employed various methods within these themes to successfully implement and utilize GAI technologies.

Participation in virtual communities of practice (vCoP)

Participation in virtual communities of practice emerged as a pivotal strategy for school leaders navigating GAI integration. *‘Engaging in virtual communities of practice allowed us to glean global insights on GAI in education, selecting strategies that resonated with our educational context’* remarked one principal (P6). Another principal highlighted, *‘Through these communities, we could stay informed about emerging trends and innovations in GAI, ensuring our strategies remained cutting-edge and effective’* (P9). This proactive engagement in virtual communities of practice facilitated ongoing professional development for school leaders by promoting continuous learning and adaptation of GAI technologies. As a result, school leaders are better equipped to effectively implement and leverage GAI tools to improve educational outcomes and meet the evolving needs of their schools.

Pilot-testing and small-scale trials

Pilot-testing and small-scale trials were foundational in the strategic implementation of GAI within schools. *‘Conducting pilot tests enabled us to assess the feasibility and impact of GAI applications in controlled environments’*, noted one principal (P11). Another principal emphasized, *‘Small-scale trials provided valuable insights into how GAI could enhance personalized learning experiences for students, guiding our broader implementation strategies. Always think big, but start small’* (P4). Such trials fostered confidence and buy-in among stakeholders, ensuring the effective integration of GAI technologies across educational practices.

Focus on core educational values

School leaders underscored the importance of maintaining a focus on core educational values while integrating GAI technologies. One principal stated, *‘We prioritize GAI initiatives by aligning them with our core educational goals. For example, our primary goal is improving student outcomes, so we focus on GAI tools that provide data-driven insights to tailor instruction and support. We also ensure that GAI initiatives complement rather than overshadow fundamental educational priorities’* (P3). This strategic alignment not only enriches student learning experiences but also cultivates a cohesive school community where all stakeholders are deeply engaged and supportive of our initiatives. By ensuring that GAI integration aligns closely with schools’ core educational values and priorities, principals were able to mitigate potential resistance and fostered a shared commitment to advancing educational outcomes through innovative technologies. This approach seemed to have encouraged collaboration and

transparency, enhancing trust and consensus among educators, students, parents, and the broader community in embracing GAI as a beneficial tool in student learning.

Stakeholder engagement and feedback mechanisms

Effective stakeholder engagement and feedback mechanisms were essential for the successful implementation of GAI initiatives in schools. *‘Actively involving teachers, students, and parents in the GAI integration process allowed us to address concerns and refine strategies collaboratively’*, noted one principal (P1). Another principal stated, *‘Regular feedback loops from all stakeholders were instrumental in adjusting our GAI implementations to better meet the needs and expectations of our school community’* (P7). That is to say, leaders ensured that GAI technologies were implemented in ways that aligned with and benefited all members of the educational ecosystem, prioritizing stakeholder input and engagement.

Challenges

Themes derived for challenges pertaining to GAI implementation were many and included resistance to change, lack of technical expertise, data privacy concerns, integration with existing systems, and ethical considerations.

Resistance to change

Resistance to change emerged as a significant challenge among stakeholders wary of GAI's impact on traditional educational practices. One principal noted, *‘Some teachers were hesitant to adopt GAI tools, fearing it would overshadow their role in the classroom’* (P2). Another highlighted, *‘Parents expressed concerns about GAI affecting their children's skills, fearing that it would their homework instead of them’* (P5). These apprehensions underscored the reluctance of some stakeholders to embrace GAI in education, reflecting broader concerns about its potential implications.

Lack of technical expertise

The lack of technical expertise posed a barrier to effective GAI implementation within schools. *‘Teachers faced challenges in understanding and utilizing GAI technologies due to limited training and support’*, suggested one principal (P8). Another principal elaborated, *‘Teachers and subject leaders struggled with identifying suitable GAI solutions that aligned with educational goals and their technical capabilities’* (P10). These observations underscored that implementing GAI in education, like any new initiative, comes with its share of hurdles that must be addressed through targeted support and training initiatives.

Integration with existing systems

Integrating GAI technologies with existing educational systems proved challenging due to compatibility issues and infrastructure limitations. According to P1, *‘Our school faced difficulties in aligning GAI tools with our current curriculum and instructional methods’*. Another principal stated, *‘Technical barriers hindered the seamless integration of GAI applications with our school's IT infrastructure and administrative processes’* (P6). Overcoming these challenges necessitated strategic planning, investment in infrastructure upgrades,

and collaboration with IT experts to ensure smooth integration and functionality of GAI systems.

Ethical considerations

Ethical considerations posed significant challenges in the deployment of GAI technologies in educational settings. According to P3, *‘We grappled with ethical dilemmas surrounding GAI's impact on student autonomy and fairness in educational opportunities’*. Another principal added, *‘Ensuring GAI systems are used responsibly and ethically aligned with educational values required clear guidelines and continuous ethical reviews. This is the basic challenge that gave me a real headache’* (P9). These perspectives highlight the complex ethical challenges embedded in GAI integration in education, emphasizing the need for strong ethical frameworks and ongoing oversight to promote responsible and beneficial deployment of GAI technologies.

Opportunities

Themes derived for opportunities related to GAI implementation in education encompassed professional development, mentorship and peer networks, institutional support and policies, as well as continuous feedback.

Professional development

Professional development emerged as a significant opportunity for teachers to enhance their skills in utilizing GAI effectively in classrooms. As P2 noted, *‘Training programs focused on GAI have empowered our teachers to integrate innovative teaching methods, they never thought they would be able to implement it’*. Another principal highlighted, *‘Workshops on GAI have been instrumental in building confidence among educators to explore new technologies and pedagogical approaches’* (P5). That is to say, investing in comprehensive professional development programs equips educators with the knowledge and skills needed to leverage GAI for personalized learning and improved student outcomes.

Mentorship and peer networks

Mentorship and peer networks provided valuable opportunities for collaboration and knowledge sharing among educators embarking on GAI integration journeys. P8 stated, *‘Peer mentorship has allowed us teachers to exchange ideas and troubleshoot challenges in implementing GAI in their classrooms’*. Another principal suggested, *‘Connecting with experienced mentors has provided guidance and insights on best practices for integrating GAI into curriculum planning and assessment strategies’* (P10). In other words, leveraging mentorship and peer networks fosters a supportive community of practice where educators can learn from each other's experiences and collectively drive innovation in education.

Institutional support and policies

Institutional support and policies were identified as crucial opportunities for facilitating sustainable GAI integration in educational settings. *‘Our school's commitment to supporting GAI initiatives through dedicated resources and leadership endorsement has been instrumental’*, acknowledged one principal (P4). Another

principal stated, *'Clear policies and guidelines on GAI use have provided a framework for ethical decision-making and responsible implementation across our institution'* (P7). That is to say, establishing robust institutional support and policies ensures consistency, transparency, and alignment with educational goals, thereby fostering a conducive environment for successful GAI adoption and innovation in schools.

Continuous feedback

Continuous feedback mechanisms offered valuable opportunities for stakeholders to contribute to and refine GAI implementations in educational settings. P1 stated, *'Regular feedback from teachers, students, and parents has enabled us to adapt GAI strategies to better meet the evolving needs of our school community'*. Another principal contended, *'Feedback mechanisms have supported GAI adoption, ensuring their relevance and effectiveness in improving learning outcomes are maintained'* (P6). In other words, implementing continuous feedback mechanisms fostered responsiveness in GAI integration efforts, thereby supporting the ongoing development and refinement of GAI adoption.

Recommendations offered by principals

Themes derived for recommendations regarding GAI implementation in education included starting small and scaling up, fostering a culture of innovation, differentiating professional development, engaging stakeholders early, and communicating success and celebrating it.

Starting small and scaling up

Starting small and scaling up was recommended as a strategic approach to effectively integrate GAI technologies in school contexts. According to P2, *'Piloting GAI initiatives in controlled environments allows for iterative testing and refinement before broader implementation'*. Another principal emphasized, *'Gradually expanding successful GAI implementations enabled us to manage risks and build capacity among teachers and students'* (P5). This phased approach ensured sustainable growth and maximized the impact of GAI.

Fostering a culture of innovation

Fostering a culture of innovation was identified as essential for nurturing creativity and embracing technological advancements in education. According to P8, *'Encouraging experimentation with GAI tools encouraged teachers to explore new teaching methodologies and student engagement strategies'*. Another principal highlighted, *'Creating opportunities for collaborative brainstorming and cross-disciplinary projects cultivated a culture where innovation thrived with less efforts'* (P10). Therefore, by fostering a culture of innovation, schools can harness the transformative potential of GAI to address educational challenges and enhance learning outcomes effectively.

Differentiating professional development

Differentiating professional development opportunities was recommended to cater to the diverse needs and readiness levels of educators in adopting GAI. As noted by P4, *'Tailoring professional development programs to teachers' roles and skill levels in GAI ensured relevance and engagement'*. Another principal emphasized, *'Offering choice in professional learning pathways empowered teachers to pursue*

personalized growth in GAI integration' (P7). Thus, it seems that providing differentiated professional development supports schools in acquiring the necessary knowledge, skills, and confidence to effectively implement GAI technologies in their teaching practices.

Engaging stakeholders early

Engaging stakeholders early in the GAI implementation process was crucial for building support and fostering a sense of ownership among educators, students, parents, and community members. P1 suggested, *'Involving stakeholders from the outset ensures that their perspectives and concerns are addressed proactively, minimizing potential larger issues along the way'*. Another principal added, *'Creating opportunities for dialogue and collaboration with stakeholders, as early as possible, fosters trust and alignment of goals in GAI integration efforts'* (P6). That is to say, early engagement of stakeholders enhanced transparency, promoted shared decision-making, and increased the likelihood of successful GAI adoption in educational settings.

Communicating success and celebrating it

Communicating success and celebrating achievements in GAI implementation were recommended to sustain momentum and motivate stakeholders. As P3 noted, *'Sharing success stories and showcasing the positive impact of GAI on student learning helped build enthusiasm and support among the school community'*. Another principal emphasized, *'Recognizing and celebrating milestones in GAI integration fosters a culture of achievement and encourages continued innovation in educational practices'* (P9). Therefore, effective communication and the deliberate celebration of successes were considered pivotal strategies to strengthen and sustain the implementation of GAI technologies. These practices bolstered morale and motivation among stakeholders and cultivated a positive culture of innovation and continuous improvement.

Synthesizing a school leadership framework for GAI enactment in schools

The authors synthesized the findings into a comprehensive 5C framework, which comprises five fundamental dimensions: Catalyst, Curator, Champion, Cultivator, and Connector. Each domain within this framework delineates specific roles and actions that effective school leaders undertake to promote successful GAI integration in educational settings. While the framework was designed with role names starting with the letter 'C' to facilitate memorability, it is important to recognize that these names were carefully developed to reflect the meanings derived from the research. The finalized role names—Initiator/Change Agent for Catalyst, Organizer/Resource Manager for Curator, Advocate/Supporter for Champion, Developer/Mentor for Cultivator, and Network Builder/Relationship Facilitator for Connector—accurately represent the insights gained and aim to clearly convey the nuanced roles identified in the study.

Thus, the cross-categorical synthesis of data resulted in the school leadership framework for the successful implementation of GAI, as depicted in [Figure 1](#). The mapping between themes identified in [Table 3](#), the framework domains, and their illustration is presented in [Table 4](#).

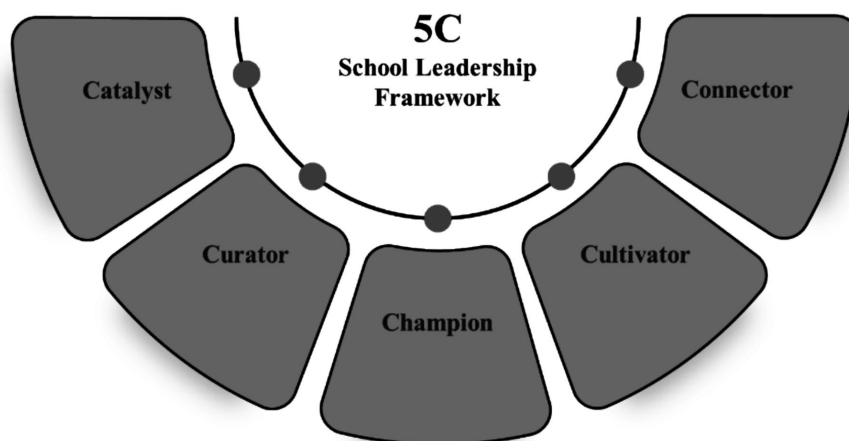


FIGURE 1
5C school leadership framework for successful GAI enactment.

The 5C School Leadership Framework embodies several roles, each of which is underpinned by contemporary leadership theories and digital integration models. The Catalyst role aligns with transformational leadership, wherein leaders inspire and motivate educators to embrace innovation and change, fostering a shared vision for the future of education (ex. [Kareem et al., 2023](#)). The Curator role reflects instructional leadership principles, emphasizing the strategic organization and allocation of resources to support effective teaching and learning practices ([Al Sharafat et al., 2024](#)). The Champion role is grounded in distributed leadership theory, promoting shared responsibility and collaborative decision-making among educators to enhance school improvement (ex. [Hsieh et al., 2024](#)). The Cultivator role draws from capacity-building leadership models, focusing on professional development and mentoring to build staff competencies in utilizing GAI tools effectively (ex. [Jha and Singh, 2025](#)). Finally, the Connector role resonates with relational leadership and social capital theories, emphasizing the importance of building networks and fostering relationships both within and beyond the school to facilitate knowledge exchange and sustain GAI initiatives (ex. [DeFlaminis et al., 2024](#)). By integrating these roles within established theoretical constructs, the 5C framework provides a promising model for guiding school leaders in fostering innovation, collaboration, and continuous improvement in the era of generative AI.

The next paragraphs illustrate how each domain within the 5C framework delineates specific roles and actions that effective school leaders undertake to promote successful GAI integration in educational settings.

Catalyst role

Effective school leaders play a pivotal role as catalysts for innovation within educational settings, driving transformative change through the strategic integration of GAI. They demonstrate visionary thinking by envisioning how GAI can significantly enhance educational practices and outcomes. With a strong emphasis on adaptability and flexibility, these leaders adeptly navigate complexities and tailor strategies to seamlessly integrate GAI initiatives into

existing frameworks. Moreover, they cultivate an environment that encourages experimentation with GAI technologies and methodologies by fostering a culture of innovation. Beginning with small-scale pilot projects and progressively scaling up successful initiatives, these leaders effectively manage risks while maximizing the benefits of GAI adoption. Furthermore, they prioritize ethical considerations, ensuring that GAI implementation aligns closely with educational values and upholds principles of student privacy and equity.

Curator role

School leaders in the role of curator meticulously select and customize GAI technologies and educational resources to precisely align with the unique needs of their school community. Possessing robust technological proficiency, these leaders possess a deep understanding of the capabilities and limitations of GAI tools. They prioritize seamless integration with existing systems, aiming to minimize disruptions and enhance operational efficiency. Emphasizing core educational values throughout the selection and implementation phases, they ensure that GAI solutions harmoniously align with educational objectives and principles. Through rigorous pilot-testing and small-scale trials, these leaders evaluate GAI applications in practical settings, enabling them to strategically manage resistance to change through effective communication and supportive measures.

Champion role

School leaders champion GAI in education by actively advocating for its transformative benefits and potential to revolutionize teaching and learning practices. They passionately promote the advantages of GAI, emphasizing its capacity to significantly enhance educational outcomes and prepare students for future challenges. These leaders prioritize investment in professional development opportunities for staff, ensuring educators possess the necessary skills and knowledge

TABLE 4 Mapping of framework domains to themes.

Framework domain	Role suggested by the domain	Mapped themes
Catalyst	School leaders serve as catalysts for innovation, igniting transformative change through the strategic integration of GAI in education.	Visionary thinking Adaptability and flexibility Fostering a culture of innovation Starting small and scaling up Ethical concerns
Curator	School leaders curate GAI technologies and educational resources, ensuring that the right tools and approaches are selected and tailored to meet the unique needs of their school community.	Technological proficiency Integration with existing systems Focus on core educational values Pilot-testing and small-scale trials Resistance to change
Champion	School leaders champion the cause of GAI in education, advocating for its benefits and potential to revolutionize teaching and learning practices.	Championing GAI benefits Professional development Mentorship and peer networks Communicating success and celebrating it Engaging stakeholders early
Cultivator	School leaders cultivate a culture of experimentation and exploration, empowering teachers and students to harness GAI technologies creatively to enhance learning outcomes.	Cultivating experimentation and exploration Differentiating professional development Continuous feedback Participation in virtual communities of practice Stakeholder engagement and feedback mechanisms
Connector	School leaders serve as connectors, facilitating meaningful collaborations and partnerships with various stakeholders to leverage GAI for educational excellence.	Collaboration and communication Facilitating partnerships Institutional support and policies Participation in virtual communities of practice Engaging stakeholders early

to effectively leverage GAI technologies. They foster robust mentorship and peer networks that facilitate ongoing learning and innovation in GAI integration within the educational context. By effectively communicating success stories and celebrating achievements, they cultivate a culture of positivity and achievement among stakeholders. Early and inclusive engagement with stakeholders ensures their enthusiastic buy-in and collaborative participation in GAI initiatives, thereby fostering a supportive environment conducive to sustained and impactful change.

Cultivator role

School leaders act as cultivators, nurturing a culture of experimentation and exploration with GAI technologies among teachers and students. They actively encourage and empower educators and students to innovate with GAI, fostering creativity and leveraging technology to enhance learning outcomes effectively. These leaders prioritize differentiated professional development opportunities, catering to diverse needs and interests related to GAI integration within educational practices. They establish robust mechanisms for continuous feedback, facilitating iterative improvements and refinements in GAI implementation strategies over time. Participation in virtual communities of practice enables educators to share valuable insights, resources, and best practices in GAI utilization, fostering a collaborative environment for

knowledge exchange. Through effective stakeholder engagement and feedback mechanisms, school leaders ensure that GAI initiatives are responsive to the evolving needs of the school community, thereby promoting inclusive learning and fostering sustainable growth.

Connector role

School leaders serve as connectors, playing a crucial role in establishing and nurturing collaborations and partnerships with diverse stakeholders to harness GAI for educational excellence. They facilitate open and effective communication among educators, administrators, industry experts, and researchers, fostering a cohesive vision for GAI integration in education. These leaders actively seek out and cultivate partnerships that strategically support the implementation of GAI initiatives within their educational contexts. They advocate for institutional support and the development of policies that promote innovation and ethical use of GAI technologies in education. Engaging in virtual communities of practice enables leaders to stay abreast of emerging trends and best practices in GAI, enhancing their knowledge base and leadership efficacy. Early and proactive engagement with stakeholders fosters trust and alignment, ensuring concerted efforts toward achieving educational goals through the thoughtful and collaborative application of GAI.

Discussion

This study explored the leadership qualities and strategies essential for the effective integration of Generative AI (GAI) in educational settings. Semi-structured interviews were conducted with 12 school principals from six Arab countries, all of whom had been actively involved in GAI initiatives over the past 2 years. The resulting framework comprises five interconnected dimensions: Catalyst, Curator, Champion, Cultivator, and Connector. What distinguishes this framework is its Arab/international duality—it is grounded in the lived experiences of school leaders in the Arab States, a region often underrepresented in GAI-related educational research, while simultaneously addressing leadership capacities that resonate across diverse global contexts. This dual orientation offers both culturally specific insights and broader relevance, enriching the international discourse on school leadership in the era of AI integration.

The role of school leaders as catalysts for innovation is well-documented in the broader literature on school leadership. [De Jong et al. \(2022\)](#) use the term ‘catalytic leadership’ to describe the role of school leaders in fostering collaborative innovation. This study aligns with that perspective, recognizing school leaders as pivotal figures who set visionary goals and actively catalyze the enactment of GAI for educational excellence. Similarly, it highlights the essential position leaders hold in driving educational transformation, as noted by scholars such as [Ghamrawi and Al-Jammal \(2013, 2014\)](#), [Harris et al. \(2023\)](#), and [Tan et al. \(2024\)](#).

However, this study contributes to the literature by detailing the specific ways in which school leaders act as catalysts, specifically in relation to GAI enactment. It suggests that they demonstrate visionary thinking and adaptability to enhance educational practices and outcomes. By fostering a culture of experimentation, managing risks through pilot projects, and prioritizing ethical considerations, they ensure that GAI implementation aligns with educational values and principles of student privacy and equity.

Furthermore, the study proposes a curator role for school leaders, emphasizing their responsibility to customize GAI technologies to meet the unique needs of their school community. This requires robust technological proficiency and a deep understanding of GAI capabilities and limitations, aligning with the literature on digital leadership ([Cheng and Wang, 2023](#); [Fullan et al., 2023](#); [Ghamrawi and Abu-Tineh, 2023](#); [Tigre et al., 2023](#); [Yau et al., 2023](#)). Similar to [Fullan et al. \(2023\)](#), the study underscores the importance of prioritizing core educational values. Leaders are expected to strategically manage resistance through effective communication, as highlighted by [Cheng and Wang \(2023\)](#), as well as [Yau et al. \(2023\)](#). Additionally, the study offers new insights into how school leaders can effectively undertake this curator role by suggesting incremental approaches that build trust and ensure the selection of appropriate tools and methods tailored to the specific needs of their school communities.

In addition, a champion role was attributed to school leaders, based on study findings, which come in line with the champion role suggested by [Ghamrawi et al. \(2024d\)](#). In fact, the study suggests that school leaders are expected to advocate for the transformative benefits of GAI in education, and are expected to emphasize GAI potential to revolutionize teaching and learning practices, echoing ([Cheng and Wang, 2023](#)), [Ghamrawi et al. \(2024d\)](#) and [Yau et al. \(2023\)](#). Parallel to [Cheng and Wang \(2023\)](#) leaders, according to this study, are meant

to prioritize professional development to lead successful GAI enactment. This study adds to this champion role by specifying the importance mentorship and the celebration of achievements to cultivate a positive culture and ensuring stakeholder buy-in.

Furthermore, the study posits a cultivator role for school leaders, suggesting that they encourage innovation with GAI technologies through differentiated professional development, echoing [Tigre et al. \(2023\)](#) and [Ghamrawi et al. \(2024d\)](#). This approach also involves establishing continuous feedback mechanisms, aligning with [Cheng and Wang \(2023\)](#). Additionally, the findings indicate that leaders leverage GAI enactment to a new level by promoting knowledge exchange through virtual communities of practice (vCoPs), a concept that partially resonates with [Shal et al. \(2018, 2024, 2025\)](#), who suggest that vCoPs are integral for school leadership development. It aligns with [Ghamrawi et al. \(2024e\)](#) who considers vCoPs as essential venues for supporting continuous learning, and collaboration. However, it goes a step further by suggesting the importance of vCoPs for school leaders in sharing best practices, thereby enhancing the overall effectiveness of GAI integration in educational settings.

Finally, the study suggests a connector role for school leaders, who establish and nurture collaborations with diverse stakeholders to harness GAI for educational excellence, echoing [Richardson et al. \(2020\)](#). According to this study, leaders achieve success with GAI enactment by advocating for supportive policies, parallel to [Asada et al. \(2020\)](#), and by engaging stakeholders early to ensure alignment and collaborative efforts toward educational goals, in line with [Yau et al. \(2023\)](#).

Conclusion

This study advances a theoretically grounded and empirically informed framework that collectively underscore the complex role of school leaders in steering the integration of GAI in education. Far from offering a static or prescriptive model, the 5C framework should be conceptualized as a generative heuristic—both responsive to context and anticipatory of emergent technological and pedagogical transformations. These roles are not discrete functions but overlapping spheres of leadership practice that converge in dynamic, iterative, and context-sensitive processes of educational change.

Critically, this study contributes a regionally layered perspective by focusing on Arab States, where scholarly engagement with GAI in school leadership remains nascent. By foregrounding the socio-cultural and policy-specific contingencies that shape GAI enactment in these contexts, the study challenges the prevailing universalist assumptions embedded in much of the global discourse on digital leadership. The findings thus call for a rethinking of leadership preparation and policy frameworks that are not only technologically informed but also culturally situated and ethically grounded.

Yet, the study acknowledges the inevitable limitations of its scope. The exclusive focus on Arab countries, while offering depth and contextual specificity, constrains the immediate transferability of its insights across global settings. Nevertheless, it opens fertile terrain for comparative inquiry, inviting scholars to interrogate how leadership roles articulated in this study translate, mutate, or

are rendered obsolete in differing sociopolitical and educational ecologies.

Future research must extend beyond validation to examine the performative enactment of the 5C roles in real-time decision-making, resistance management, and innovation diffusion across varied educational systems. Longitudinal and cross-regional investigations are particularly critical to assess the durability, adaptability, and transformative capacity of the proposed framework under shifting policy mandates and technological evolutions. Moreover, probing the ontological and epistemological assumptions underpinning the framework—such as the implicit prioritization of change agency, innovation logic, and technocratic rationality—could yield valuable critiques that further enrich its theoretical robustness. Additionally, future studies should explore how participants' demographic and professional profiles—such as their background, educational experiences, and leadership contexts—influence the emphasis placed on specific leadership themes, offering deeper insight into how such factors shape the framework's relevance and applicability across diverse settings.

Finally, this study speaks directly to policymakers, urging them to reconceptualize leadership development not merely as skill acquisition but as identity reformation—where leaders are continually supported to act as reflective, critical, and ethically attuned agents of change. Structural investments in capacity-building initiatives, adaptive policy infrastructures, and research-practice partnerships are essential for sustaining systemic transformation. Only through such multidimensional support can school leaders be positioned not only as implementers of innovation but as co-constructors of future-ready, equitable, and contextually responsive educational landscapes.

Data availability statement

The datasets presented in this article are not readily available for confidentiality reasons. Requests to access the datasets should be directed to Norma Ghamrawi, norma.g@qu.edu.qa.

Ethics statement

The studies involving humans were approved by Institutional Research Board at Qatar University. The studies were conducted in accordance with the local legislation and institutional requirements.

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Author contributions

NG: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft. TS: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Writing – review & editing. NARG: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Validation, Writing – review & editing.

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Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

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