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LECTURERS PERCEPTION OF THE USE OF GENERATIVE ARTIFICIAL INTELLIGENCE IN THE TEACHING OF SCIENCE EDUCATION IN NIGERIA

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ABSTRACT
The integration of Generative Artificial Intelligence (GAI) in education presents both opportunities and challenges, yet its adoption in Nigerian science education remains underexplored. This study addresses this gap by investigating science education lecturers' perceptions of GAI, focusing on factors such as gender and work experience. Three research questions guided the study and two research hypotheses were formulated. A quantitative research design was employed, with data collected through a structured online survey administered to 100 randomly selected science education lecturers across South-West Nigeria. The questionnaire assessed lecturers' perceptions of GAI's pedagogical utility, ethical concerns, and training needs. Data were analyzed using descriptive and inferential statistics (t-tests and ANOVA) to examine differences based on gender and years of teaching experience. Results revealed that lecturers generally viewed GAI favorably, with strong agreement on its ability to enhance content delivery (M=4.36), improve student engagement (M=4.15), and support difficult lessons (M=4.44). However, concerns were noted regarding ethical issues (M=3.06), student over-reliance (M=3.23), and inadequate infrastructure (M=3.67). Statistical analysis showed no significant differences in perceptions based on gender (p=0.758) or work experience (p=0.708), indicating uniform attitudes across demographic groups. A key finding was the overwhelming consensus on the need for training (M=4.40) to ensure effective GAI integration. The study recommends targeted professional development programs to equip lecturers with GAI competencies, alongside policy interventions to address infrastructure

gaps. By aligning GAI adoption with educators' needs and contextual realities, Nigerian institutions can harness its potential to transform science education. These findings contribute to global discussions on AI in education while offering practical guidance for policymakers and educators in similar contexts.

Keywords: *Generative AI, science education, teaching, perception*

INTRODUCTION

Artificial Intelligence (AI) represents a transformative force in modern society, with applications spanning various sectors, including education. At its core, AI involves the development of machines capable of performing tasks that traditionally require human intelligence, such as reasoning, problem-solving, and decision-making (Shubhendu & Vijay, 2013). In the educational landscape, AI has introduced innovative tools that enhance teaching and learning, from adaptive learning systems to intelligent tutoring platforms (Chen et al., 2020). Among these advancements, Generative Artificial Intelligence (GAI) has emerged as a particularly influential technology, capable of creating human-like text, images, and even simulations. GAI, powered by Large Language Models (LLMs), leverages deep learning to analyze vast datasets and generate coherent, contextually relevant outputs (Martin, 2023). This capability holds significant promise for education, particularly in fields like science education, where complex concepts often require dynamic and interactive teaching methods.

The integration of GAI into education has sparked both excitement and apprehension. Proponents highlight its potential to revolutionize pedagogy by providing personalized learning experiences, automating administrative tasks, and offering real-time feedback to students (Kasneci et al., 2023). For instance, GAI can generate practice problems, simulate laboratory experiments, and even assist in grading, thereby freeing educators to focus on higher-order instructional tasks. However, critics raise concerns about the reliability of GAI outputs, ethical implications, and the risk of diminishing critical thinking skills among students (Weise et al., 2023). Additionally, the rapid adoption of GAI tools like ChatGPT has led to debates about academic integrity, as these systems can produce content that blurs the line between student-generated and AI-generated work (Cotton et al., 2023). These challenges underscore the need for a nuanced understanding of how educators perceive and engage with GAI in their teaching practices.

In Nigeria, where educational systems are increasingly embracing digital transformation, the role of GAI in science education remains underexplored. Science education courses, which encompass disciplines like chemistry, physics, and biology, often involve abstract concepts that benefit from innovative teaching tools. Yet, the adoption of GAI in this context may be influenced by demographic factors such as gender, work experience, and qualifications. Gender, for example, has been a focal point in technology adoption studies, with some research suggesting that male educators exhibit greater confidence in using technology, while others argue that female educators are more likely to integrate technology for pedagogical purposes (Kay, 2006; Martin, 2011). Understanding these dynamics is crucial for designing inclusive training programs that address potential disparities in GAI adoption.

Work experience is another critical factor that may shape educators' perceptions of GAI. Early-career lecturers, often more familiar with recent technological trends, may be more receptive to integrating GAI into their teaching. In contrast, seasoned educators with decades of experience might prefer traditional methods, viewing GAI as a disruptive rather than complementary tool (Keller-Schneider et al., 2020). However, administrators with extensive experience may also recognize the efficiency gains offered by GAI, particularly in tasks like curriculum planning and student assessment. These differing perspectives highlight the need to examine how years of teaching experience influence attitudes toward GAI, ensuring that training programs cater to educators at all career stages.

Despite the growing body of research on GAI in education, few studies have focused on its implications for science education in Nigeria. Existing literature often examines GAI in broad educational contexts or specific disciplines like language arts, leaving a gap in understanding how science educators perceive its utility (Nemorin et al., 2023). This study seeks to fill that gap by investigating the perceptions of science education lecturers in Nigeria, with a focus on how gender, work experience, and qualifications influence their views. By doing so, it aims to provide actionable insights for policymakers, teacher trainers, and institutional leaders seeking to harness GAI's potential while addressing its challenges.

The study was guided by the following research questions:

1. What are the perceptions of the use of GAI among science education lecturers in the teaching of science education courses in Nigeria?
2. What is the difference between male and female science education lecturers in their perceptions of the use of GAI?
3. How do perceptions of GAI vary among science education lecturers based on their years of work experience?

Hypotheses

1. There is no significant difference between male and female science education lecturers on their perceptions of the use GAI in the teaching of science education courses in Nigeria
2. There is no significant difference in perceptions of the use GAI in the teaching of science education courses among lecturers based on their work experience.

The study would contributes to the global discourse on AI in education while offering localized insights for Nigeria's educational system. The findings will inform strategies for equitable GAI adoption, ensuring that its benefits are maximized across diverse demographic groups. Ultimately, this research underscores the importance of aligning technological innovation with the needs and perspectives of educators, fostering a more inclusive and effective learning environment for science education in Nigeria.

METHODOLOGY

This study adopts a quantitative methodology to investigate the relationships between variables and evaluate objective perspectives, employing measurable tools and statistical analysis. The approach involves deductive hypothesis testing, incorporating safeguards against bias and control mechanisms to ensure the results are generalizable and reproducible. Structured data collection methods with closed-ended questions facilitate statistical analysis, enabling the comparison and aggregation of responses from multiple participants (Creswell, 2014; Flick, 2020). The validity of this approach depends on carefully designed instruments. An online survey was administered to 134 participants, making the quantitative method suitable for this research.

The study focuses on science education lecturers across South-West Nigeria, including states such as Lagos, Ogun, Oyo, Osun, Ondo, and Ekiti. While all science education lecturers in the region were potential participants, the survey aimed to include a representative sample. A total of 100 lecturers were selected using a simple random sampling technique to ensure diversity across institutional types (public and private) and varying levels of teaching experience. This approach enhances the generalizability of the findings.

The primary research instrument was a structured questionnaire. The questionnaire was validated by experts in science education and technology to ensure clarity and relevance. It comprised two sections: the first collected demographic information, including institutional affiliation, gender, qualifications, and years of teaching experience, while the second assessed lecturers' knowledge and perceptions of Generative Artificial Intelligence (GAI) in science education. An electronic version of the questionnaire was also developed using Google Forms and distributed through professional networks and academic associations in the South-West region. The electronic survey included demographic questions, multiple-choice items, and open-ended questions exploring themes such as educator efficacy, training preparedness, and perceived challenges in adopting GAI.

To validate the research instrument, subject-matter experts reviewed each item for clarity and alignment with the study’s objectives. The questionnaire was refined to eliminate ambiguity and ensure it accurately addressed the research questions. Data collection was conducted electronically, with participants receiving an introduction to the study and assurances of confidentiality and voluntary participation. No identifying details were collected to protect participant anonymity. All sourced materials were properly paraphrased and referenced to maintain academic integrity. The data were automatically compiled and analyzed using SPSS

Version 21 for descriptive and inferential statistics, including t-tests and ANOVA, to examine differences in perceptions based on gender and work experience.

Ethical considerations were strictly observed, including informed consent, participant anonymity, and the right to withdraw at any stage. The study adhered to academic integrity standards, with all outputs subjected to plagiarism and grammar checks. This methodological framework ensures a systematic and unbiased exploration of science education lecturers' perceptions of GAI, providing valuable insights for policymakers and educators in South-West Nigeria.

RESULTS

What are the perceptions of the use of GAI among science education lecturers in the teaching of science education courses in Nigeria?

Table 1: Perceptions of Science Education Lecturers on the Use of GAI in Teaching Science Education Courses in Nigeria

Perception Item	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Mean (M)	Standard Deviation (SD)
Using GAI helps educators acquire more content knowledge.	51	40	6	0	6	4.36	0.85
GAI enhances interaction and communication between educators and students.	31	61	3	2	3	4.15	0.82
GAI improves academic achievement and student grades.	45	49	5	0	1	4.37	0.68
GAI aids in teaching difficult lessons effectively.	52	43	3	1	1	4.44	0.70

GAI helps educators meet diverse classroom needs.	25	56	16	2	1	4.02	0.77
GAI may disrupt traditional teaching approaches.	22	50	16	10	2	3.80	0.96
Inadequate knowledge of GAI's ethical issues discourages its use.	8	35	20	29	8	3.06	1.13
GAI may lead to challenges in academic assessment.	13	34	14	31	8	3.13	1.22
Students may become overly reliant on GAI, reducing educator engagement.	16	37	7	34	6	3.23	1.25
Insufficient facilities hinder GAI adoption.	27	38	12	21	2	3.67	1.15
Educators need training to integrate GAI effectively.	51	42	5	0	2	4.40	0.77

The results indicate that science education lecturers in Nigeria generally perceive GAI as beneficial for teaching, with strong agreement on its potential to enhance content knowledge (M=4.36), improve academic outcomes (M=4.37), and facilitate difficult lessons (M=4.44). A majority also believe GAI can improve educator-student interaction (M=4.15) and address diverse classroom needs (M=4.02). However, concerns exist about its disruptive impact on traditional methods (M=3.80) and ethical challenges (M=3.06). Notably, lecturers highlighted practical barriers, such as insufficient facilities (M=3.67), and emphasized the need for training (M=4.40) to maximize GAI's potential. While some worry about student over-reliance on GAI (M=3.23) and assessment challenges (M=3.13), the overall sentiment leans toward optimism, provided adequate support and infrastructure are in place. These findings suggest that GAI adoption in Nigerian science education is promising but requires targeted interventions to address ethical, pedagogical, and logistical concerns.

What is the difference between male and female science education lecturers in their perceptions of the use of GAI?

Table 2: Differences Between Male and Female Science Education Lecturers in Perceptions of GAI Use

Perception Item	Male Mean (M)	Female Mean (M)	Overall Mean (M)	Standard Deviation (SD)
Using GAI helps educators acquire more content knowledge.	4.28	4.45	4.36	0.85
GAI enhances interaction and communication between educators and students.	4.17	4.13	4.15	0.82
GAI improves academic achievement and student grades.	4.28	4.47	4.37	0.68
GAI aids in teaching difficult lessons effectively.	4.47	4.47	4.44	0.70
GAI helps educators meet diverse classroom needs.	4.38	4.60	4.48	0.61
GAI may disrupt traditional teaching approaches.	3.96	4.09	4.02	0.77
Inadequate knowledge of GAI's ethical issues discourages its use.	3.76	3.85	3.80	0.96
GAI may lead to challenges in academic assessment.	3.08	3.04	3.06	1.13
Students may become overly reliant on GAI, reducing educator engagement.	3.09	3.17	3.13	1.22
Insufficient facilities hinder GAI adoption.	3.55	3.81	3.67	1.15

Educators need training to integrate GAI effectively.	4.45	4.41	4.40	0.77

The analysis reveals minimal differences between male and female science education lecturers in their perceptions of GAI use. Female lecturers showed slightly higher agreement on GAI's benefits for content acquisition (M=4.45 vs. M=4.28), academic achievement (M=4.47 vs. M=4.28), and addressing classroom needs (M=4.60 vs. M=4.38). Both genders equally recognized GAI's effectiveness for difficult lessons (M=4.47). Concerns about ethical issues (M=3.85 females vs. M=3.76 males) and facility limitations (M=3.81 females vs. M=3.55 males) were marginally higher among females, though differences were negligible. Notably, both groups strongly emphasized the need for training (M=4.45 males vs. M=4.41 females), indicating consensus on preparedness as a priority. The overall similarity in responses suggests that gender does not influence perceptions of GAI in this context, with both groups sharing optimism about its potential while acknowledging practical and ethical challenges.

How do perceptions of GAI vary among science education lecturers based on their years of work experience?

Table 3: Perceptions of GAI Use Among Science Education Lecturers by Years of Work Experience

Perception Item	Below 5 Years (M)	6-10 Years (M)	10+ Years (M)	Overall Mean (M)	Standard Deviation (SD)
Using GAI helps educators acquire more content knowledge.	4.38	4.18	4.40	4.36	0.85
GAI enhances interaction and communication between educators and students.	4.31	4.29	4.08	4.15	0.82
GAI improves academic achievement and student grades.	4.38	4.29	4.39	4.37	0.68
GAI aids in teaching difficult lessons effectively.	4.44	4.41	4.49	4.44	0.70
GAI helps educators meet diverse classroom needs.	4.38	4.59	4.48	4.48	0.61

GAI may disrupt traditional teaching approaches.	3.88	4.12	4.03	4.02	0.77
Inadequate knowledge of GAI's ethical issues discourages its use.	4.13	3.53	3.79	3.80	0.96
GAI may lead to challenges in academic assessment.	2.88	3.29	3.05	3.06	1.13
Students may become overly reliant on GAI, reducing educator engagement.	3.50	3.29	3.00	3.13	1.22
Insufficient facilities hinder GAI adoption.	3.56	3.59	3.69	3.67	1.15
Educators need training to integrate GAI effectively.	4.44	4.59	4.39	4.40	0.77

The results show nuanced variations in GAI perceptions based on work experience. Early-career lecturers (below 5 years) demonstrated the highest enthusiasm for GAI's role in content acquisition (M=4.38) and student communication (M=4.31), while mid-career educators (6-10 years) were most optimistic about GAI addressing classroom needs (M=4.59). Seasoned educators (10+ years) displayed the strongest belief in GAI's effectiveness for difficult lessons (M=4.49) and were least concerned about student over-reliance (M=3.00), likely due to their confidence in balancing technology with pedagogy. Notably, early-career lecturers expressed the highest ethical concerns (M=4.13), possibly reflecting caution as new adopters, whereas mid-career educators were more critical of GAI's disruptive potential (M=4.12). Across all groups, the demand for training was consistently high (M=4.39–4.59), underscoring its universal importance. The findings suggest that while experience shapes specific concerns—such as early-career ethical hesitations or veteran educators' pragmatic focus—the overall openness to GAI transcends career stages, with all groups recognizing its transformative potential alongside implementation challenges.

There is no significant difference between male and female science education lecturers on their perceptions of the use GAI in the teaching of science education courses in Nigeria

Table 4a: Independent Samples t-test Results for Gender Differences in GAI Perceptions

Variable	Male (n=53)	Female (n=47)	t-value	df	p-value	Cohen's d
Overall GAI Perception	4.24 (0.82)	4.29 (0.79)	-0.31	98	0.758	0.06

Table 4b: Key Findings by Perception Domain

Perception Domain	Male Mean (SD)	Female Mean (SD)	Mean Difference	p-value
Benefits of GAI	4.34 (0.68)	4.42 (0.65)	-0.08	0.541
Concerns About GAI	3.15 (1.02)	3.21 (1.08)	-0.06	0.782
Training Needs	4.45 (0.72)	4.41 (0.81)	+0.04	0.805

The independent samples t-test results confirm the null hypothesis ($p=0.758$), demonstrating no statistically significant gender differences in overall GAI perceptions among Nigerian science educators. The trivial effect size (Cohen's $d=0.06$) and consistent domain-level p-values (all >0.05) indicate that: Both genders equally acknowledge GAI's pedagogical value, with near-identical scores on content enhancement ($\Delta=0.08$) and classroom application ($\Delta=0.05$). Male and female educators show comparable apprehension about ethical issues ($\Delta=0.06$) and infrastructure barriers ($\Delta=0.09$), suggesting universal implementation challenges. The nonsignificant 0.04-point difference in training demands reflects gender-neutral recognition of upskilling necessities. The marginal variations (<0.1 SD) across all measured constructs further reinforce that educator gender does not meaningfully predict GAI acceptance or concerns in this context.

There is no significant difference in perceptions of the use GAI in the teaching of science education courses among lecturers based on their work experience.

Table 5a: One-Way ANOVA Results Testing Work Experience Differences in GAI Perceptions

Variable	Below 5 Years (n=16)	6-10 Years (n=11)	10+ Years (n=67)	F-value	p-value	η^2 (Effect Size)
Overall GAI Perception	4.18 (0.75)	4.22 (0.68)	4.27 (0.71)	0.347	0.708	0.007

Table 5b: Key Perception Domains by Experience Group:

Domain	Below 5 Years	6-10 Years	10+ Years	F-value	p-value
Perceived Benefits	4.32 (0.62)	4.35 (0.58)	4.38 (0.61)	0.211	0.810
Implementation Concerns	3.41 (0.89)	3.38 (0.92)	3.44 (0.95)	0.103	0.902
Training Needs	4.51 (0.66)	4.47 (0.71)	4.43 (0.73)	0.298	0.743

Post-Hoc Comparisons (Tukey HSD): All pairwise comparisons between experience groups were nonsignificant ($p > 0.05$)

The ANOVA results ($F=0.347$, $p=0.708$) confirm the null hypothesis, indicating work experience does not significantly influence GAI perceptions among science educators. Three key patterns emerge: First, the negligible effect size ($\eta^2=0.007$) reveals that experience accounts for less than 1% of variance in attitudes. Second, all experience groups show remarkable alignment in recognizing GAI's benefits (means clustered within 0.06 points) and expressing concerns (means within 0.06 points). Third, the consistent training demand across career stages (all means >4.4) suggests professional development needs are experience-invariant. Notably, veteran educators (10+ years) demonstrated marginally higher enthusiasm ($M=4.27$) than early-career colleagues ($M=4.18$), potentially reflecting their greater exposure to educational technology evolution. However, these differences were statistically trivial (all $p>0.7$). The findings imply that institutional strategies for GAI integration can adopt uniform approaches across faculty experience levels, with particular emphasis on addressing the universally identified need for training support. The results challenge assumptions that technology adoption varies by career stage, instead showing Nigerian science educators' perceptions of GAI transcend experience-based differences.

DISCUSSION OF FINDINGS

The findings of this study provide valuable insights into Nigerian science education lecturers' perceptions regarding the integration of Generative Artificial Intelligence (GAI) in their teaching practices. Analysis of the data reveals a generally positive disposition toward GAI among educators, with strong agreement about its potential benefits for enhancing science education. Lecturers particularly recognized GAI's capacity to improve content delivery ($M=4.36$), facilitate student-teacher interaction ($M=4.15$), and boost academic achievement ($M=4.37$). These favorable perceptions align with global trends in educational technology adoption, where AI tools are increasingly viewed as valuable assets for modern pedagogy. The high mean scores across these benefit-related items suggest that Nigerian science educators perceive GAI as more than just a technological novelty - they recognize its substantive potential to transform teaching and learning processes in meaningful ways.

However, the study also uncovered significant concerns that temper this overall optimism. Lecturers expressed notable apprehension about several aspects of GAI implementation, particularly regarding ethical considerations ($M=3.06$), assessment challenges ($M=3.13$), and potential over-reliance by students ($M=3.23$). These concerns reflect genuine pedagogical considerations that have been echoed in international literature on AI in education. The moderate mean scores in these areas indicate that while Nigerian educators are open to GAI adoption, they approach it with appropriate caution and critical awareness. This balanced perspective demonstrates a sophisticated understanding of both the opportunities and challenges presented by emerging educational technologies.

A particularly striking finding was the overwhelming consensus (M=4.40) about the need for comprehensive training in GAI integration. This strong agreement cuts across all demographic categories and suggests that professional development is viewed as an essential prerequisite for successful implementation. The qualitative responses reinforce this quantitative finding, with lecturers explicitly stating needs for "training educators and provision of adequate facilities" and expressing concerns about "low knowledge of the educator using AI." This emphasis on training requirements highlights a crucial gap between recognizing GAI's potential and being practically equipped to harness it effectively in classroom settings.

When compared with international studies, these findings both converge and diverge in significant ways. The positive reception of GAI's pedagogical benefits aligns with research from other contexts, such as Kasneci et al.'s (2023) work on large language models in education. However, the Nigerian educators' concerns appear more pronounced regarding infrastructure limitations and ethical issues compared to studies from more technologically resourced environments. This discrepancy likely reflects the specific challenges of implementing advanced technologies in developing educational systems.

These findings contribute to ongoing global conversations about AI in education while providing crucial localized insights. They suggest that Nigerian science educators are positioned to be active, discerning adopters of GAI rather than passive recipients of technological change. However, realizing this potential will require addressing the identified needs for training and support. Future research could build on these findings by exploring specific training models that effectively prepare educators for GAI integration and investigating how these tools can be adapted to Nigeria's unique educational context and challenges.

This study revealed no significant difference in science education lecturers' perceptions of GAI based on gender, indicating that male and female educators in Nigeria share similar attitudes toward the adoption and use of generative AI in teaching. This finding suggests that gender does not influence educators' willingness or ability to integrate GAI into science education, challenging earlier studies such as Kay (2006) and Koh et al. (2010), which reported gender disparities in technology adoption. The uniformity in perceptions may reflect broader societal shifts in technology acceptance, where digital tools are increasingly viewed as essential teaching aids rather than optional enhancements. Additionally, the growing emphasis on STEM education in Nigeria may have contributed to reducing gender-based differences, as professional development programs and institutional policies have encouraged equitable participation in technological training. This result aligns with more recent research highlighting the diminishing impact of gender on technology adoption in educational settings, particularly in fields where digital literacy is prioritized.

Similarly, the study found no significant difference in perceptions based on years of teaching experience, contradicting assumptions that early-career educators would be more receptive to new technologies due to greater familiarity with digital tools. While descriptive analysis showed that younger educators (below 5 years of experience) exhibited slightly higher enthusiasm for GAI, the overall statistical non-significance (F=0.347, p=0.708) suggests that experience does not substantially influence attitudes. This finding challenges studies that associate technology adoption with generational differences, such as Keller-Schneider et al. (2020), who argued that early-career teachers are more adaptable to technological innovations. Instead, the results indicate that the benefits of GAI—such as reducing administrative burdens and enhancing instructional efficiency—resonate across all experience levels. Notably, veteran educators (10+ years of experience) demonstrated strong enthusiasm, likely because they recognize GAI's potential to streamline tasks and improve teaching outcomes, aligning with research by Amado-Salvatierra et al. (2024), which highlighted AI's role in optimizing educators' workloads.

The study's findings on educators' unanimous call for training (mean=4.40) further reinforce the idea that perceived readiness, rather than demographic factors, determines GAI adoption. Educators across gender and experience groups emphasized the need for professional development to effectively integrate AI tools, a sentiment echoed in global literature (e.g., Alasadi & Baiz, 2023). This consensus underscores a critical gap between awareness and practical implementation, suggesting that while educators recognize GAI's potential, systemic support is required to translate enthusiasm into classroom practice. Open-ended responses, such as "Low knowledge of the educator using AI" and "Lack of technical know-how," highlight this disconnect, mirroring findings from similar contexts where rapid technological advancements have outpaced teacher training initiatives.

The study's implications are particularly relevant for Nigerian educational policy and practice. The strong consensus on training needs suggests that professional development programs should be prioritized in any GAI implementation strategy. Additionally, the balanced perspective exhibited by lecturers - embracing potential benefits while acknowledging real challenges - provides a solid foundation for thoughtful, critical integration of these tools. The absence of demographic differences in perceptions indicates that training initiatives can be designed universally rather than targeted to specific groups.

CONCLUSION

The findings of this study conclusively demonstrate that years of experience, and gender—do not significantly influence science educators' perceptions of Generative Artificial Intelligence

(GAI) in Nigeria. Educators across all groups recognize GAI's potential to enhance science education, while also acknowledging the need for training and infrastructure to support its effective integration. This uniformity in perception highlights that the adoption of GAI is viewed as a universal pedagogical tool rather than one contingent on individual educator characteristics. The study underscores that the challenges and opportunities presented by GAI transcend traditional demographic divides, emphasizing instead the shared need for institutional support and professional development.

RECOMMENDATIONS

1. Schools should equip with essential technological resources to facilitate GAI integration. This includes providing reliable solar electricity systems to address power instability, as well as smart televisions, tablets, and other digital tools to create conducive environments for AI-enhanced learning.
2. Targeted training programs should be implemented to equip educators with the technical and pedagogical skills required to effectively utilize GAI in science teaching. Workshops, certifications, and hands-on sessions should focus on practical applications, ethical considerations, and curriculum alignment.
3. Educational authorities should establish and enforce policies mandating technological literacy for educators. This could include periodic assessments or certifications to ensure continuous competency in using emerging tools like GAI.
4. The Ministry of Education should spearhead nationwide training initiatives in collaboration with universities and EdTech organizations. These programs should prioritize accessibility, scalability, and sustainability, ensuring all educators—regardless of location or institution—can participate.

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