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MINORITIES AND THE AI REVOLUTION: AN EXPANDED STUDY OF EQUITY, WORKFORCE PREPAREDNESS, AND THE DIGITAL DIVIDE IN STEM EDUCATION (2020–2024)

Cristo Leon

James Lipuma

INTRODUCTION

The current study extends prior research conducted six months ago to address equitable access to Artificial Intelligence (AI) tools for minority groups involved in STEM education and workforce preparation. This extension reinforces the importance of inclusive access and broadens the focus to examine the challenges and opportunities of emerging AI technologies from 2020 to 2024. The main objective is to explore how these tools can bridge the disparities that underrepresented minorities face, thereby fostering inclusion in the evolving STEM workforce. This study's fundamental research question is: "How can equitable access to AI tools be ensured for minority students while preparing them for the STEM workforce?"

BACKGROUND: AI, EDUCATION, AND WORKFORCE PREPAREDNESS

Artificial Intelligence (AI) has become an increasingly transformative force in the education and workforce sectors, reshaping how knowledge is acquired, applied, and adapted to industry needs. AI's role has evolved beyond automation and predictive analytics, becoming central to personalized learning, adaptive teaching, and skill development (Luckin & Holmes, 2016). Despite its potential, the benefits of AI in education are not evenly distributed across all demographic groups. For minority students and underserved communities, disparities in access to relevant AI tools have exacerbated inequalities in acquiring essential skills needed for future careers (Selwyn, 2019). As the demand for AI-related competencies grows, these disparities risk further entrenching socio-economic divides.

Building on 2024's foundational research, this study investigates the digital divide through the lens of minorities' access to AI, focusing on the technological and socio-cultural barriers that limit participation. Current literature illustrates that minority higher-education students face limited infrastructure, inadequate exposure to AI-driven technologies, and insufficient representation in STEM fields (Brougham & Haar, 2018). These challenges underscore the need for comprehensive policy interventions and community-based initiatives to bridge these gaps.

PURPOSE AND NECESSITY OF THE STUDY

This expanded study explores the disparities identified in prior research more deeply through a broader bibliometric approach, utilizing additional datasets to develop a nuanced understanding of AI equity in education. The necessity of this research is heightened by the recent surge in generative AI tools, such as ChatGPT, which offer opportunities to democratize access to knowledge while posing risks of exacerbating the digital divide if marginalized groups are left behind (Floridi & Chiriatti, 2020). Generative AI tools in educational settings have the potential to offer personalized learning experiences that could greatly benefit minority students if equitable access is ensured.

However, gaps in the existing literature remain, especially concerning how minority students interact with generative AI technologies and the role of policy in facilitating equitable AI access. By expanding this research to include new databases, such as SCOPUS and ERIC, and exploring these dimensions, the paper aims to address critical questions regarding the accessibility of emerging AI technologies for underrepresented groups, providing actionable recommendations for educators, policymakers, and stakeholders.

RESEARCH QUESTIONS

The current study aims to answer several key research questions that build upon and expand the findings from the initial research:

1. How can equitable access to AI tools be ensured for minority students in STEM education?

Justification: This question seeks to understand the systemic barriers that minority students face in accessing AI tools. Addressing this is crucial to ensure that all students have equal opportunities to succeed in STEM education and careers regardless of their background.

2. What trends and gaps exist in AI equity research from 2020 to 2024?

Justification: Identifying trends and research gaps will help highlight areas of progress and those that need further exploration. This understanding is essential to guide future studies and policy-making efforts to promote equity.

3. How can community-based and policy-driven strategies address barriers to AI access for minority students?

Justification: This question emphasizes the role of community engagement and policy initiatives in overcoming barriers to AI access. Community-based strategies are often more culturally relevant and effective for reaching underserved groups, while policy initiatives can institutionalize these efforts at a broader scale.

4. What role do emerging AI technologies, such as generative AI platforms like ChatGPT, play in enhancing workforce preparedness for minorities?

Justification: Understanding the role of generative AI tools in preparing minority students for the workforce is critical to assess their potential benefits and challenges. This insight will help design interventions that effectively leverage these technologies to enhance workforce readiness.

These questions are designed to guide the study in exploring the state of AI access among minorities and proposing practical solutions to close the digital divide. The answers to these questions will help inform educators, researchers, and policymakers about strategies that can be employed to enhance inclusivity and preparedness for the AI-driven STEM workforce.

RESEARCH QUESTIONS DEVELOPMENT

The development of these research questions is informed by the gaps identified in prior research, specifically related to the accessibility and impact of AI tools among minority groups in STEM education. Each question is carefully aligned with observed barriers and emerging opportunities, ensuring they collectively address the existing inequities and potential pathways to overcome them. The justifications for each question are meant to clarify their importance, linking them directly to current challenges such as the digital divide, policy inefficacies, and the uneven adoption of generative AI technologies. By focusing on these questions, the study offers a comprehensive approach to enhancing digital literacy, equity, and workforce readiness for minority students in the context of AI advancements.

Additionally, this research takes on a new dimension with the recent designation of the author's institution as a Hispanic Serving Institution (HSI). This recognition adds a layer of urgency and significance to exploring equitable AI access and workforce readiness. As an HSI, the institution is directly responsible for ensuring that Hispanic and other minority students are adequately supported, particularly regarding new and emerging technologies. Reviewing existing policies and creating new ones that reflect the institution's commitment to equity becomes even more critical. By ad-

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dressing these aspects, the study aligns itself with the broader institutional goals of fostering diversity, equity, and inclusion. It ensures that the research questions have practical implications for transforming educational policy supporting minority students.

LITERATURE REVIEW

The literature review examines existing research, highlighting key themes and gaps in AI equity, minority education, and STEM workforce preparation.

CASE STUDIES ON EQUITY

This section incorporates diverse case studies from various geographic regions and educational levels to illustrate the different manifestations of AI inequities and their impact on minority groups. By examining initiatives in both urban and rural settings, this section highlights how infrastructure disparities affect access to AI-driven education. Additionally, examples from countries with varying levels of technological advancement provide insights into global differences in AI equity. These diverse examples emphasize that AI inequity is not monolithic but varies significantly based on socioeconomic conditions, policy frameworks, and community engagement.

The importance of international collaboration to address AI-related educational inequities is also underscored, as diverse case studies can highlight regional disparities and their varied impacts across educational levels (Li, 2023). Equitable participation in AI development is essential to addressing barriers faced by diverse groups, as illustrated through the various regional manifestations of AI inequities (Okolo, 2023). Furthermore, Roshanaei, Olivares, & Lopez (2023) emphasize AI's role in education through case studies showcasing diverse geographic and educational contexts, highlighting opportunities and inequities. Holstein & Doroudi (2021) discuss four lenses for examining how and why Artificial Intelligence in Education (AIEd) systems risk amplifying existing inequities, offering possible paths toward more equitable futures for AIEd while highlighting debates surrounding each proposal.

COMMUNITY ENGAGEMENT

This section discusses participatory research methodologies and culturally relevant pedagogy, which are crucial for bridging the gap between digital literacy and the lived experiences of minority students. Participatory research methodologies involve engaging community members as active partners in the research process, ensuring that solutions are relevant and tailored to their needs. Culturally relevant pedagogy connects the learning experience to students' cultural backgrounds, making AI and digital literacy more accessible and meaningful. These strategies demonstrate the importance of community engagement in addressing the digital divide and enhancing workforce readiness among minority students.

POLICY DEVELOPMENTS AND AI ACCESS

This section reviews recent policy developments to improve AI access in educational settings, focusing on how these policies have been implemented across different jurisdictions and their effectiveness in promoting equity. Additionally, the literature review explores the intersection of policy initiatives and community engagement strategies, providing a comprehensive understanding of how institutional and grassroots efforts can work together to foster equitable AI access for minority students.

PARTICIPATORY RESEARCH METHODOLOGIES

Participatory research methodologies significantly enhance community engagement initiatives that promote digital literacy among minority students. By involving community members in the research process, these methodologies ensure that initiatives are tailored to participants' needs and contexts. This approach fosters ownership and increases the relevance and effectiveness of digital literacy programs. Key strategies include:

- **Community-Centered Frameworks**: As seen in the Kenyan case study, developing frameworks prioritizing community input ensures that digital literacy programs are designed with local needs in mind. Integrating participatory research methodologies involves actively involving minority students in developing and implementing digital literacy programs, ensuring their needs and perspectives shape the initiatives (Oguna & Strachan, 2023).

- **First Mile Approach for Indigenous Communities**: Engaging Indigenous communities through a First Mile approach allows for integrating culturally relevant practices in digital literacy initiatives. This approach ensures community members shape research goals and processes, enhancing the relevance and ownership of digital literacy initiatives among minority students through localized engagement (McMahon et al., 2016).

INCLUSIVE PARTICIPATION

- **Digital Storytelling and Participatory Mapping**: Utilizing participatory methods like digital storytelling and mapping can empower marginalized groups, enhancing their involvement in research and digital literacy efforts. These methods involve co-creating resources and tutorials that empower minority students using visual and sound elements to enhance engagement and effectively promote digital literacy (Loignon et al., 2021)

- **Addressing Barriers for Individuals with Limited Literacy Skills**: Addressing barriers faced by individuals with limited literacy skills is crucial for equitable participation in digital literacy programs. Ensuring these initiatives are inclusive and accessible helps bridge the digital divide and empowers all community members.

METHODS SECTION

The Web of Science Core Collection (WoSCC) was selected as the primary data source for this study due to its status as a highly regarded and essential research platform by several researchers (Donthu et al., 2021; Hall, 2010; Shu et al., 2023; Zhan et al., 2022). WoSCC provides comprehensive coverage across various disciplines, including the natural sciences, social sciences, arts, and humanities, making it an invaluable resource for obtaining accurate and reliable information. Its extensive database includes publications from the world's most trusted publishers, ensuring the data collected is of the highest quality. Utilizing WoSCC enabled us to perform a thorough bibliometric analysis, providing the robustness and validity of our research findings. The insights gained from this bibliometric analysis will later inform a systematic literature review conducted on additional databases, including ERIC, SCOPUS, and Google Scholar, to cross-reference and validate the results further.

SEARCH STRATEGY

The data was collected on August 1, 2024. The retrieval strategy included the following: (i) Topic = Artificial Intelligence AND (Equity in Education, Minority Students, STEM Education, STEM Workforce); (ii) Document Type = article; (iii) Publication Year (custom year range) = 2020–2024; (iv) Rank = Relevant and highest citation. Boolean operators were used to combine keywords, ensuring a comprehensive search and enhancing the reproducibility of the process. Complete records and corresponding cited references were downloaded in plain text and RIS format for further analysis. The database used to administer this information was Zotero version 6.0.36. The flowchart of included publications is shown in Figure 1 (Del-Río-Carazo et al., 2022).

The Boolean operators and keyword combinations used were carefully detailed to enhance the transparency of the search strategy. The search focused on publications from 2020 to 2024, and no language restrictions were applied, thereby expanding the inclusivity of the analysis.

INCLUSION CRITERIA

The inclusion criteria focused on studies that examine both quantitative and qualitative aspects of educational access and success, including research on technological infrastructure, educational resources, and curricular changes that address the needs of diverse student populations. Specifically, the criteria were articles on Artificial Intelligence and its intersections with Equity in Education, Minority Students, STEM Education, and STEM Workforce; articles published between 2020 and 2024; and articles retrieved from the Web of Science Core Collection (WoSCC). There were no limitations placed on the language of the studies reviewed.

EXCLUSION CRITERIA

The exclusion criteria were as follows: articles collected by hand or from newsletters, notices, announcements, calls for papers, and conference papers; articles not officially published; conference abstracts and proceedings, corrigendum documents; duplicate publications or the same study; Early Access, Proceeding Papers, and Data Papers; and items that do not address higher education.

ANALYSIS TOOL

VOSViewer bibliometric analysis software is a citation visual analysis tool that enables the exploration of knowledge potential in scientific literature and networks. This study utilized VOSViewer version 1.6.18 to analyze relevant research. The software was used to create a map based on the bibliographic data using the RIS format. The first type of analysis performed was co-occurrence, using keywords as the unit of analysis with 'full counting.' The minimum number of occurrences of a keyword was set at 5. Of the 2133 keywords, 33 met this threshold; since this number is less than 50, all keywords were selected. During the verification step, the keywords "AI" and "Artificial Intelligence (AI)" were removed to avoid duplication with the term "Artificial Intelligence." Additionally, the keyword "Intelligent Tutoring System," which was not connected to the network, was removed. Figure 2 presents the overlay visualization.

To complement the VOSViewer analysis, a qualitative tool, NVivo, was also incorporated to capture insights that bibliometric analyses might overlook. This allowed for the inclusion of narrative themes and contextual analysis, providing a more comprehensive understanding of how AI influences educational equity.

The image is a network visualization map generated using VOSViewer, showing the co-occurrence of keywords in Artificial Intelligence and related educational topics. The

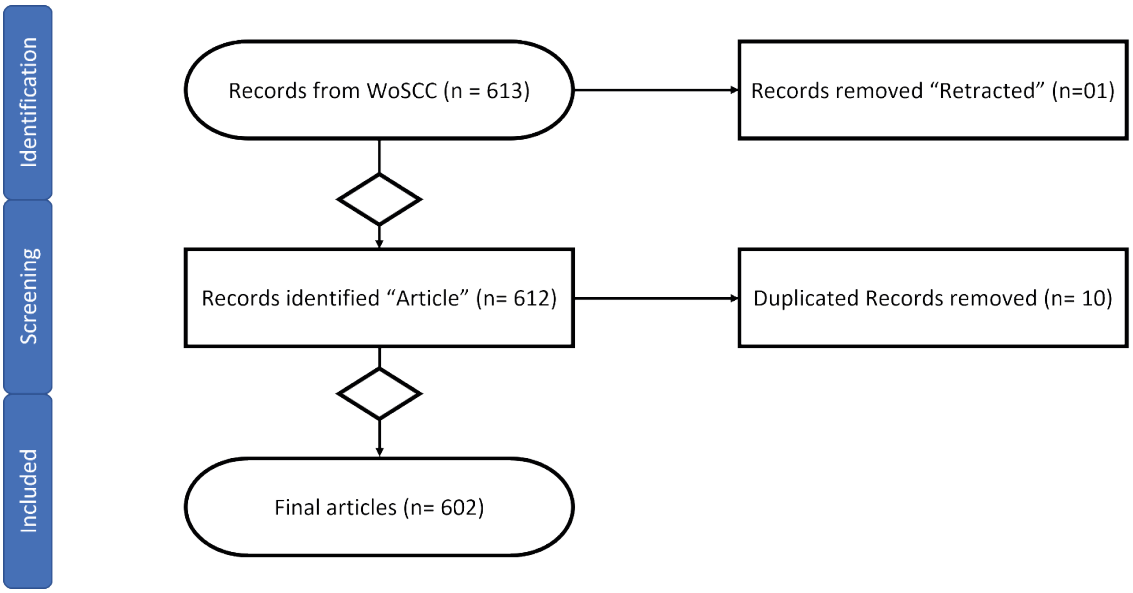

Figure 1. *PRISMA Flow Diagram for Article Selection Process*

Note. The diagram was created, inspired by ideas found in the following paper: Fei, L., Kang, X., Sun, W., & Hu, B. (2023). Global Research Trends and Prospects on the First-Generation College Students From 2002 to 2022: A Bibliometric Analysis via Citespace. *Frontiers in Psychology*, 14, 1214216. https://doi.org/10.3389/fpsyg.2023.1214216. © 2023 Fei, Kang, Sun and Hu. An openaccess article distributed under the terms of the Creative Commons Attribution License (CC BY).

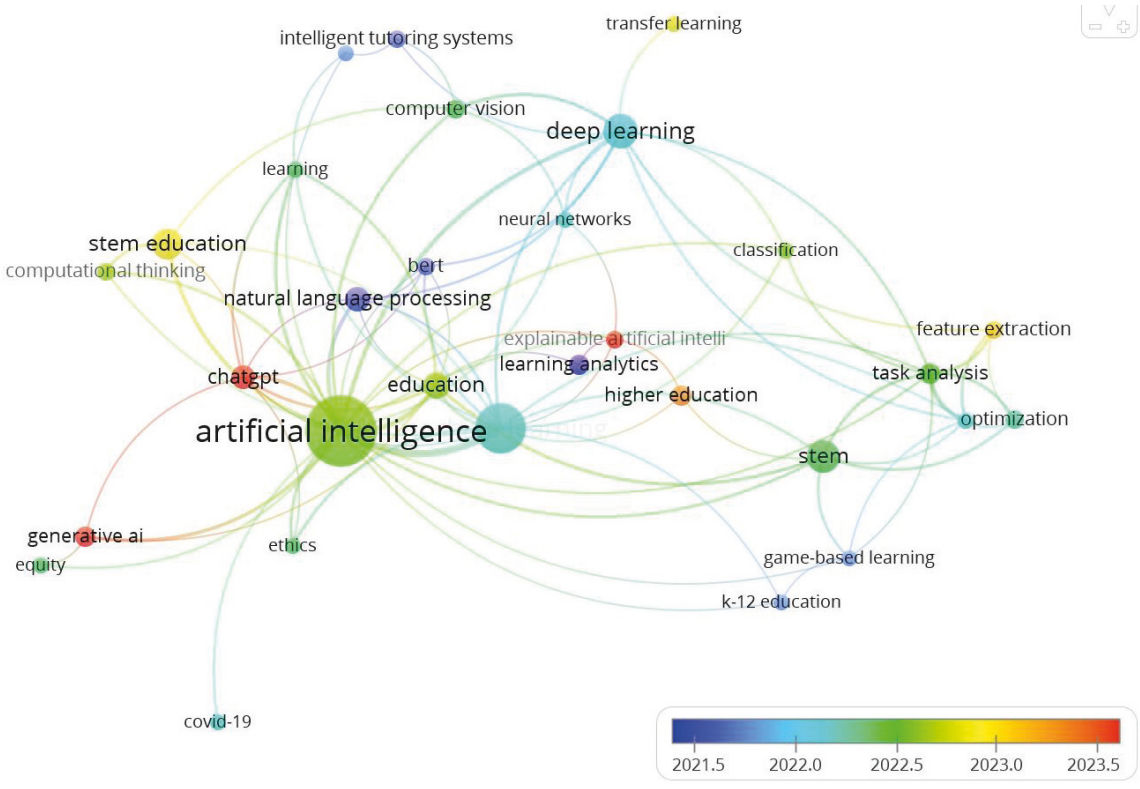

Figure 2. *Overlay Visualization of Co-occurring Keywords in AI and Education Research (2021-2024)*

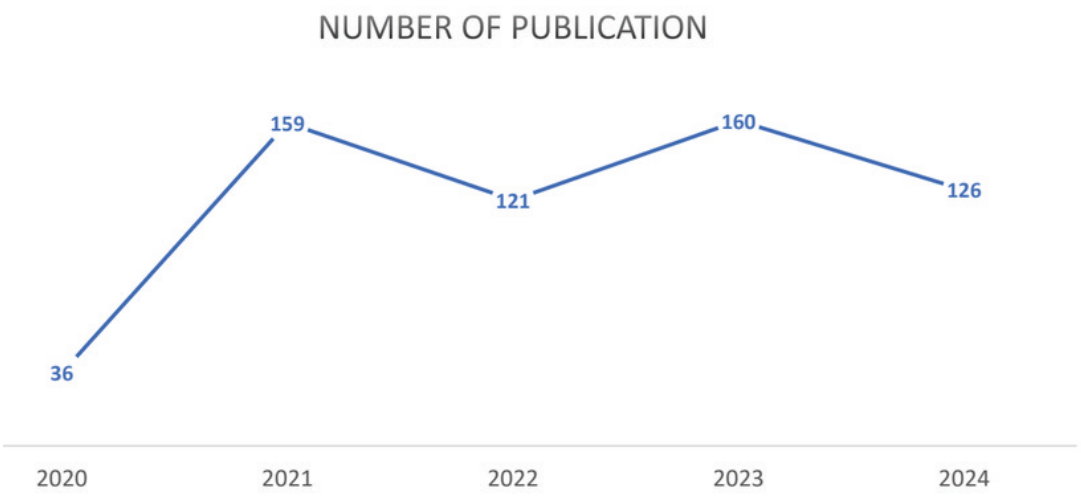

Figure 3. *Publications by Year (2020–2024)*

central node is "artificial intelligence," connected to various other keywords, indicating the field's research trends and hot topics. The colors represent different periods, providing insights into the evolution of these research areas from 2021 to 2024. Key terms such as "deep learning," "natural language processing," "STEM education," and "equity" are prominently featured, highlighting their significance in recent scholarly discussions. The objective was to provide evidence-based support for researchers, gain insights into the current state and trends in the field, and generate new ideas for future development.

DATA ANALYSIS

This study utilized VOSViewer software to identify citation bursts across various dimensions, including publication year, author, research institution, journal, and keywords. VOSViewer generates visual knowledge graphs consisting of nodes and links, where nodes represent elements such as authors and cited references, and links between nodes indicate collaborative or co-cited relationships. The size of nodes reflects their frequency or significance, while different colors represent different years, with darker colors indicating earlier years and lighter colors indicating more recent years. Nodes with higher centrality, marked by specific visual indicators such as increased font sizes, are regarded as relevant. These nodes are of particular interest as they often signify influential connections, relationships, or emerging trends that can shape the future direction of the discipline.

NVivo software was used alongside VOSViewer to perform a qualitative thematic analysis of the key papers identified. This enabled the extraction of insights regarding the context of AI's impact on minority students, such as the barriers they face and the strategies proposed to mitigate those challenges. NVivo helped to identify underlying themes that were not immediately apparent in the bibliometric data, providing a richer understanding of the research landscape.

The statistical summary of the number of publications authored by various contributors in a research study shows a maximum of 250 authors for one article, with an average of 7 authors per article and a median of 5. When examining the first authors named in an article, the majority had one occurrence (n=581 unique authors). The number of articles with two or three occurrences of the same first author decreases, and only one author appears as the first author four times.

SYSTEMATIC LITERATURE REVIEW

A Systematic Literature Review (SLR) is a rigorous and methodical approach to reviewing existing research literature on a specific topic (Booth et al., 2012; Fisch & Block, 2018). Unlike traditional narrative reviews, an SLR follows a well-defined protocol to minimize bias and ensure comprehensive coverage of relevant studies. The process involves several key steps: defining research questions, establishing inclusion and exclusion criteria, conducting systematic searches across multiple databases, and critically appraising the collected studies. An SLR aims to synthesize findings from the literature to provide a clear, evidence-based answer to the research question (Jesson, 2011). To answer the question: "How has Artificial Intelligence (AI) integration influenced educational equity, focusing on minority students, STEM education, and the STEM workforce from 2020 to 2024?" the authors used the following search string:

"Artificial Intelligence" AND ("Equity in Education" OR "Minority Students" OR "STEM Education" OR "STEM Workforce" IS "Higher Education")

As each database has different tools, adjustments were made accordingly. For ERIC, the search parameters were set as follows: (i) Publication date: Since 2020 (last five years); (ii) Publication Type: Journal Articles; (iii) Education level: Higher Education; (iv) Location: United States. A total of 11 articles were added to the database (Bannister et al., 2024; Crompton & Burke, 2023; Gupta et al., 2024; Kamdjou, 2023; Moscardini et al., 2022; Oravec, 2022; Pineda & Steinhardt, 2023; Polat et al., 2024; Rybinski & Kopciuszewska, 2021; Schlegelmilch, 2020; Yang et al., 2024) responding to both the bespoke challenges for the sector and longstanding calls to define and disseminate quality implementation good practice. Design/methodology/approach: A virtual nominal group technique engaged experts (n = 14.

Web of Science's search parameters were set as follows: (i) No additional search parameters. A total of 1 article was added to the database. From the original Bibliometric analysis, a selection of the most relevant and cited papers has yielded a total of 6 documents (Ashford-Hanserd et al., 2021; Baker & Hawn, 2022; Dwivedi et al., 2023; Kong et al., 2024; Lin et al., 2021; Manasi et al., 2022) engagement, learning, knowledge, and persistence in CS and STEM (science, technology, engineering, and mathematics.

ProQuest's search parameters were set as follows: (i) No additional search parameters. A total of 4 books were added to the database (Barkatsas et al., 2019; Bruce M McLaren et al., 2022; Roll, 2021; Thomas et al., 2021)technology, engineering and mathematics (STEM

For Google Scholar, the search parameters were set as follows: (i) Custom range: 2020-2024; (ii) Type: Review articles. A total of 4 articles were added to the database (Bronson & Long, 2023; Hamad et al., 2024; Johnson & Chichirau, 2020; Zhan et al., 2022)technology, engineering, and mathematics (STEM(Bronson & Long, 2023; Hamad et al., 2024; Johnson & Chichirau, 2020; Zhan et al., 2022). The search string used was:

"Artificial Intelligence" AND "Equity" AND "Minority Students" AND "STEM Education" AND "STEM Workforce".

RESULTS OF THE SLR

The most glaring result of the above literature search is the lack of current research on access and equity concerning AI tools for minority students in higher education. The existing studies are scattered and tend to focus on broad concepts or very narrow issues, failing to address the specific challenges faced by minority groups comprehensively. The literature review identified three primary groupings within the existing research:

1. Diversity, Equity, and Inclusion (DEI) in STEM Education: Many studies, such as Ashford-Hanserd et al. (2021), highlight the barriers that African American and Hispanic students with disabilities face in accessing computer science education. These barriers emphasize the need for inclusive teaching practices and policy changes to better serve these communities. However, these studies often focus on K-12 education, leaving a significant gap when considering higher education settings.

2. Role of Artificial Intelligence (AI) in Education: Works like Crompton & Burke (2023) provide an overview of AI's potential to transform education, but they do not specifically address how these tools can be equitably accessed by minority students. Gupta et al. (2024)particularly large language models (LLMs discuss the development of critical AI literacies through metaphors for ChatGPT, stressing the need for critical thinking skills. While useful, these studies do not fully explore the systemic biases and access limitations that minorities face, nor do they delve deeply into how AI tools might exacerbate or alleviate existing disparities.

3. Evaluation of Teaching and Learning Methodologies: Research like that by Oravec (2022) explores the ethical implications of using AI for academic integrity, such as biometric analysis for cheating detection. This line of research highlights some important technological advancements but falls short of addressing how AI can be used inclusively to benefit minority populations. There is little examination of whether these technologies inadvertently disadvantage those who lack consistent access to digital tools.

As the focus shifts to higher education and policy development, informed by best practices, it becomes evident that more specific guidance is required on effectively serving minority populations through equitable AI access. While Bannister et al. (2024) offer insights into the impact of generative AI in transnational higher education cultures and Polat et al. (2024) perform a bibliometric analysis of research trends, these studies merely touch the surface of the equity issues at play. The key gaps remain in understanding how AI can be leveraged to equitably prepare minority students for future STEM opportunities.

Several themes emerged from the SLR, emphasizing the need for future research in the following areas:

- **Comprehensive Policy Frameworks**: There is a lack of comprehensive policy frameworks to ensure that AI tools are accessible to minority students in higher education. Existing policies tend to be fragmented and often overlook the structural barriers that minorities face in accessing technology. Policy development must prioritize equity and inclusivity to bridge this gap effectively.

- **Localized and Culturally Relevant AI Initiatives**: The literature highlights the need for localized approaches that consider the unique cultural and social contexts of minority students. Community-based participatory research methodologies, like those described by McMahon et al. (2016), can serve as models to engage minority students and ensure that AI tools and initiatives are relevant and accessible.

- **Bridging the Digital Divide**: The digital divide remains a persistent barrier, with limited access to both technology infrastructure and digital literacy skills among minority students. Future research must investigate targeted interventions

to address this gap, including public-private partnerships to improve technology access in underserved communities.

- **Ethical Considerations and Bias in AI Systems**: There is also a significant need to explore ethical considerations related to AI use in education, particularly concerning bias in AI systems that may disproportionately impact minority students. Studies such as those by Oravec (2022) are foundational, but more work is needed to understand how AI systems can be audited and improved to prevent exacerbating educational inequities.

The existing literature underscores the importance of addressing these issues to ensure that minority students can benefit from AI in education. By expanding the focus on equitable AI access and providing actionable policy recommendations, future research can play a critical role in closing the digital divide and preparing all students for the demands of the modern STEM workforce.

ChatGPT4.O AND AI TOOLS

This section delves into the expanded use of ChatGPT, particularly its latest iteration, ChatGPT-4, and the newly introduced canvas capabilities. The recent advancements in ChatGPT-4.0 present opportunities and ethical challenges requiring thorough exploration. ChatGPT-4 has improved in its contextual understanding, reasoning abilities, and conversational flow, which can be leveraged to enhance personalized learning and support minority students in STEM education. However, this advanced AI tool also has the potential to replicate or even amplify existing societal biases, making it crucial to analyze its application with a critical perspective.

A balanced discussion is necessary, highlighting both the positive opportunities provided by generative AI in education and the ethical concerns it raises. For instance, while ChatGPT-4.0 and canvas capabilities offer personalized tutoring, assistance in complex subjects, and support in improving digital literacy, these tools may also inadvertently propagate biases in the training datasets. This necessitates careful scrutiny of AI integration into educational systems to ensure that it promotes rather than hinders equity.

The canvas capabilities, a new feature of ChatGPT-4.0, provide interactive and visual elements that enhance engagement, particularly in STEM learning. These capabilities can offer a more immersive learning experience by visualizing complex scientific concepts or modeling problem-solving steps. However, it is essential to evaluate how accessible these features are for minority students, considering potential disparities in access to requisite technology and digital skills.

To address these issues, this section will explore contrasting viewpoints regarding AI tools in education, emphasizing the transformative potential of generative AI and the need for rigorous ethical oversight to prevent exacerbating inequalities. This balanced approach will support educators, policymakers, and technologists in making informed decisions about utilizing these technologies to benefit all learners, particularly those from underrepresented groups.

DISCUSSION

This section will discuss the implications for practice and policy, focusing on actionable recommendations for stakeholders such as educators, policymakers, tech companies, and community organizations. Following this, collaborative strategies will be explored to address the challenges identified in this study, involving partnerships across different sectors to promote equitable AI access in education. Additionally, recommendations for future research will be presented before concluding the discussion.

IMPLICATIONS FOR PRACTICE AND POLICY

The findings of this study have several important implications for practice and policy, particularly in ensuring equitable access to AI tools in education. Below are specific, actionable recommendations tailored for different stakeholder groups:

- **Educators**: Professional development initiatives should be prioritized to help educators integrate AI tools into their curriculum effectively. Training workshops and resources must be provided to develop digital literacy and pedagogical strategies that incorporate AI to support all learners, particularly those from minority backgrounds. Emphasizing culturally responsive pedagogy can ensure that AI applications are used in a way that respects and acknowledges students' diverse experiences.

- **Policymakers**: To promote equitable access to AI, policies that provide funding for technology infrastructure in underserved communities must be developed. This includes grants for schools and higher education institutions that lack the necessary technological resources. Moreover, regulations should ensure that AI tools used in educational contexts are subjected to fairness audits to minimize bias and prevent discrimination against minority students.

- **Tech Companies**: Companies developing AI tools for education must engage directly with minority communities to understand their needs and perspectives. Developing partnerships with educational institutions can help ensure that AI technologies are designed inclusively. Additionally, tech companies should implement transparent data practices and include diverse datasets in training AI systems to mitigate biases.

- **Community Organizations**: Community organizations can play a critical role in bridging the digital divide by supporting digital literacy programs. These organizations should collaborate with educational institutions to facilitate workshops that improve technology skills among minority students and their families, enhancing their capacity to engage with AI tools.

COLLABORATIVE STRATEGIES ACROSS SECTORS

Collaboration across sectors—including technology companies, non-governmental organizations (NGOs), academic institutions, and government agencies—is essential to effectively address the challenges identified. Below are proposed strategies to foster these collaborations:

- **Public-Private Partnerships**: Establish partnerships between tech companies and academic institutions to provide hardware, software, and training to underserved schools and colleges. These partnerships can help address resource disparities and foster the development of AI literacy among minority students.

- **NGO Involvement**: NGOs can act as intermediaries to facilitate partnerships between community groups, educational institutions, and tech companies. For example, NGOs can coordinate digital literacy programs that leverage AI tools, making them accessible to communities that are typically left behind in the technological revolution.

- **Cross-Institutional Research Initiatives**: Encouraging research collaborations across different academic institutions can foster a deeper understanding of AI equity issues and allow for sharing resources and expertise. Collaborative research projects that include minority-serving institutions can focus on piloting AI-based educatio-

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nal interventions and measuring their impact on equity outcomes.

- **Government and Policy Collaboration**: Government bodies should work alongside educational institutions and tech companies to develop policies incentivizing equitable AI access. This may include tax breaks for companies that invest in education technology initiatives targeting underserved communities or grants for universities implementing AI-focused programs aimed at underrepresented groups.

RECOMMENDATIONS FOR FUTURE RESEARCH

Future research should focus on exploring the following areas:

- **Longitudinal Impact Studies**: It is crucial to conduct longitudinal studies to understand the long-term impacts of AI integration in educational settings, particularly for minority students. Such studies would provide insights into how AI tools contribute to educational outcomes over time and whether disparities in access are addressed effectively.

- **Exploring Intersectionality**: We need to explore how intersecting identities (e.g., race, gender, socioeconomic status) influence access to and benefits from AI tools in education. Understanding these nuanced dynamics can lead to more targeted interventions that address multiple forms of inequity.

- **Participatory Design and Community-Centric Approaches**: Engaging minority students and their communities in designing and developing AI tools can help ensure that these technologies meet their specific needs. Participatory design approaches can also help mitigate biases by incorporating diverse perspectives.

- **Ethics and Bias Mitigation in AI Systems**: More research is needed to understand how AI systems can be designed, tested, and implemented to reduce bias. Investigating techniques such as fairness auditing, diverse data sampling, and algorithmic transparency will ensure that AI tools serve all students equitably

CONCLUSION

The systematic literature review (SLR) findings are crucial deliverables identifying knowledge gaps, influential researchers, and thought leaders. They provide a clear direction for addressing critical needs and topical issues related to AI in higher education, especially for minority students. However, much more work is required to explore this complex topic thoroughly, focusing on equitable policies and support systems to address the unique challenges underrepresented groups face.

This study has also highlighted the pressing need to identify seminal researchers and educational practitioners who can collaborate to develop best practices. Thought leaders and other stakeholders must urgently co-design social innovations, policies, and guidance for institutions of higher education across the USA. Addressing these issues will require AI technology and broader systemic change driven by collaboration across sectors.

Aligned with these findings, there is a need for a dedicated convening to address these challenges and gather diverse perspectives from stakeholders. Technology moves rapidly, yet higher education institutions often struggle to adapt to disruptive innovations that reshape educational landscapes. AI is increasingly becoming an integral part of the STEM workforce, and it is essential to prepare minority students to effectively use these technologies, understand their implications, and address the digital divide that persists at all levels of education.

Building on the goals of this study and the findings presented, a comprehensive strategy incorporating diverse perspectives is essential. This includes engaging higher education, government, non-profits, and industry stakeholders. Innovative policies and methods can be developed by fostering a collaborative environment to bridge the existing gaps and support institutional and community transformations. Such initiatives will ensure equitable access to AI tools and build the necessary capacity to prepare minority students for successful integration into the STEM workforce, ultimately promoting a more inclusive educational environment. This section concisely summarizes how this paper addresses previously identified research gaps. Specifically, it highlights the need for comprehensive policy frameworks, culturally relevant AI initiatives, bridging the digital divide, and mitigating biases in AI systems. By focusing on minority students in higher education, this paper contributes to the ongoing discourse on equitable AI integration, offering specific and actionable recommendations for stakeholders.

Future research should extend into several areas identified through this study. Longitudinal studies examining the impact of generative AI in community college settings would provide valuable insights into how these technologies support minority students over time. Additionally, investigating intersectional influences on AI access and effectiveness can help tailor interventions to address multiple inequities simultaneously.

A call is made for stakeholders, researchers, and practitioners to participate in an upcoming conference discussing these challenges and opportunities in advancing AI equity in education. Such a forum will facilitate sharing insights, collaboration across disciplines, and developing practical strategies to promote inclusivity in the AI-driven educational landscape.

This study highlights significant gaps in current research on the equitable use of AI tools in higher education for minority students. Through a comprehensive analysis of existing literature, we have identified several areas that require urgent attention to ensure that all students.

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