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Review Article

Digital Transformation Education, Opportunities, and Challenges of the Application of ChatGPT to Emerging Economies

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Significant advancements have been achieved in the field of artificial intelligence in recent years. OpenAI has emerged as a trailblazer in the domain, regularly spearheading research endevours. The ChatGPT language model has received much attention owing to its exceptional natural language processing capabilities. The potential of this technology to enhance education, particularly in emerging nations, necessitates a comprehensive analysis of its forthcoming influence. The primary objective of this research is to conduct a comprehensive evaluation of OpenAI, particularly ChatGPT, in relation to the educational environment of developing nations. Utilizing the critical document analysis methodology, this study examines the advantages of ChatGPT, including its capacity for flexible and personalized instruction, its ability to provide access to high-quality education, and its provision of language help, among other benefits. This study provides a complete examination of the advantages and drawbacks associated with this technology. Its objective is to enhance our understanding of the potential impact it may have on education in developing nations, achieved through an extensive evaluation of ChatGPT.

1. Introduction

Given its potential to revolutionize current teaching and learning practices, the application of artificial intelligence (AI) in education has attracted a lot of interest recently [1–3]. By supplying personalized feedback and giving students access to a multitude of educational resources, AI technology can improve the learning experience [4–6]. In addition, real-time feedback and insights into student learning can be given to teachers via AI-powered technology, allowing them to modify their pedagogical approaches and enhance student outcomes [3–5]. AI can also help teachers grade and evaluate student work, freeing up their time so they can concentrate on other crucial facets of education [2, 7]. The creation of intelligent tutoring systems (ITSs) is one of the most exciting uses of AI in education. By giving each student personalized feedback and content depending on their strengths and limitations, these systems can personalize learning [3]. The learning process can be made more effective and engaging by using ITSs that can adjust to each student's learning preferences, pace, and style [5]. The creation of chatbots and virtual assistants that can aid students in real-time and respond to their enquiries is another area where AI has shown promise [6, 8, 9]. These technologies can offer individualized support right away, eliminating the need for pupils to wait for input from teachers or tutors.

ChatGPT, a remarkable creation by OpenAI, stands poised to exert a profound influence on the education sector in emerging markets, where access to high-quality educational opportunities is often constrained. OpenAI, a technology company specializing in AI, has fundamentally reshaped our interaction with technology. Among its remarkable advancements, ChatGPT, a large language model with multifaceted capabilities such as answering queries and generating text, stands out. In recent times, there has been a growing fascination with the potential advantages of OpenAI and ChatGPT, particularly in the education sector of emerging economies like Brazil, India, and China, as noted by Mhlanga [8, 9] and George and George [10]. This interest has been driven by the prospect of leveraging these technologies to enhance teaching and learning, as explored by academics like Bernacki et al. [11], Starkey et al. [12], and Qureshi et al. [13].

Despite criticisms and bans in certain communities and regions, large language models are firmly entrenched in the AI landscape, as emphasized by Kasneci et al. [14]. These models represent a significant leap in AI, with the underlying technology serving as a linchpin for further innovations. Kasneci et al. [14] engage in a comprehensive discussion about the potential benefits and challenges of using large language models in education, considering both student and teacher perspectives. They contend that effectively integrating large language models into educational settings necessitates the development of expertise and information literacy among educators and students, enabling them to comprehend the technology's capabilities, limitations, and potential vulnerabilities—a formidable challenge that must be addressed. Furthermore, Kasneci et al. [14] assert that a clear strategy within educational systems and a pedagogical approach that prioritizes critical thinking and fact-checking skills are imperative prerequisites for harnessing the full potential of large language models in learning and teaching. This is non-negotiable, as such integration cannot occur without these fundamental components. In conclusion, Kasneci et al. [14] emphasize that AI deployment in education faces challenges that extend beyond its domain, encompassing concerns about bias in outputs, the need for ongoing human supervision, and the potential for misuse.

Nonetheless, Kasneci et al. [14] posit that if these challenges are navigated thoughtfully, they can offer valuable insights and learning opportunities, introducing students early in their academic journeys to the nuances of social biases, critical thinking, and the risks associated with AI applications. Susnjak [15] conducted an examination of ChatGPT's capacity to perform high-level cognitive tasks and generate human-like text. This investigation, as reported by Susnjak [15], has raised apprehensions about the potential for academic dishonesty, particularly during online examinations, where ChatGPT's adeptness at critical thinking and text generation with minimal input could pose ethical concerns. Susnjak [15] also suggests that a return to invigilated and oral examinations may be part of the solution. However, even as improved proctoring techniques and AI-text output detectors are considered as potential remedies, achieving flawless solutions in this realm remains uncertain.

Ventayen [16] sheds light on the growing utilization of ChatGPT in academia, especially for complex cognitive tasks, yet underscores concerns about its potential for enabling academic dishonesty, as students may use it to create essays and other academic assignments. Ventayen [16] highlights the critical issue of safeguarding academic integrity, particularly in higher education environments where such assignments are commonplace. To delve deeper into this matter, Ventayen [16] examined ChatGPT-generated output using Turnitin and a paraphrasing tool to gauge its similarity index. Results from research paper titles published by Pangasinan State University revealed that ChatGPT's output met the institution's required similarity index, indicating a potential threat to academic integrity.

In light of these discussions and concerns, this study aims to provide a comprehensive analysis of the advantages and drawbacks associated with the use of OpenAI's ChatGPT in the education sector of emerging markets. The objective is to assess how ChatGPT can positively impact education in emerging regions while also delving into the potential limitations and risks it may entail. This study is of utmost importance because emerging markets face unique challenges, including limited access to quality education, and ChatGPT presents potential solutions to bridge this educational divide. However, it is imperative to ensure that its utilization does not compromise the integrity of academic pursuits.

2. Digital Transformation in Education

Digital transformation, as described by Balyer and Öz [17], Mhlanga [18], and Mhlanga [19], is the comprehensive adoption of various technological tools and strategies aimed at enhancing the outcomes of teaching and learning across all facets of the educational system. This encompassing shift entails the integration of digital resources, online platforms, and instructional software, all of which contribute to an improved educational experience for both students and educators. Notable examples of educational technology encompass online education, virtual classrooms, electronic books, and educational applications [17–19]. Presently, higher education is in the midst of a significant transformation, primarily driven by the incorporation of technology into the instructional process. This transformation, mandated by the necessity to furnish students with a more engaging, personalized, and effective learning environment for their preparation in the digital era, has profound implications not only for students' learning methods but also for instructors' teaching approaches [17, 20, 21].

The digitization of higher education brings substantial advantages, as it grants students the freedom to access educational resources at their convenience and from any location. Advanced technologies like ChatGPT, as discussed by Mhlanga [8, 9] and George and George [10], have significantly impacted the education sector, particularly in emerging markets. A prominent benefit of these technologies lies in their potential to break down barriers to education faced by various student groups. For instance, students residing in remote rural areas may encounter difficulties in accessing quality education due to limited resources and infrastructure. Similarly, students with disabilities may find it challenging to attend conventional brick-and-mortar schools ill-equipped to cater to their unique needs. In addition, individuals engaged in full-time employment may struggle to balance their work commitments with traditional schooling. Nonetheless, the proliferation of online education platforms powered by technologies such as ChatGPT has made quality education accessible to all, irrespective of location or personal circumstances. Online education offers students the flexibility to learn at their own pace and from any location, enabling them to harmonize their educational pursuits with other responsibilities, including work and family obligations, without compromising their personal or professional lives. Furthermore, the implementation of tools and instructional software empowers educators to tailor the educational experience to the individual needs and interests of each student,

as highlighted by Mhlanga [8, 9]. Research conducted by Walkington and Bernacki [22], Li and Wong [23], and Mhlanga [8, 9] underscores that personalized instruction in the classroom contributes to heightened motivation and engagement among students.

3. Review of Literature ChatGPT in Education

The acronym "Chat Generative-Pretrained Transformer," commonly referred to as "ChatGPT," represents a significant milestone in the realm of natural language processing (NLP). Developed by OpenAI [8, 9], this advanced language model has undergone extensive training on a vast corpus of text data, enabling it to generate text responses that closely mimic human language [24, 25]. Rooted in the Transformer architecture, specifically designed for sequential data processing, ChatGPT stands as a pivotal innovation [24, 25]. The primary mission of ChatGPT is to enhance the generation of human-like text across various applications, ranging from customer service to language translation and content creation [8, 9, 24, 25]. Its versatility allows it to produce a wide spectrum of text outputs, from simple responses to complex, well-structured compositions, depending on the complexity of the input query. As García-Peñalvo [26] has observed, the year 2022 marked a significant technological development, characterized by its unpredictability, often referred to as a "black swan." This innovation garnered immense attention in both traditional and digital media, putting AI back in the spotlight. García-Peñalvo [26] argues that the ChatGPT phenomenon has rekindled discussions about the positive and negative impacts of AI on society, providing substantial evidence to support this claim.

García-Peñalvo [26] further notes that reactions to the launch of ChatGPT have been diverse, ranging from enthusiasm among early adopters and innovators to apprehensions akin to those depicted in science fiction, such as the Terminator franchise. These reactions are primarily influenced by the model's accessibility and ease of use, and they particularly center around its potential implications in education and academic institutions, given its ability to produce text that closely resembles human-authored content [26]. According to García-Peñalvo [26], we are at the cusp of a technological transformation, where ChatGPT has evolved from being a novelty to potentially becoming a disruptive innovation. The success of this technology as a disruptive force hinges on a multitude of factors. Nonetheless, attempts to deny or prohibit its use are unlikely to impede the ongoing wave of innovation in this domain. Therefore, it is imperative to thoroughly comprehend the capabilities, advantages, and drawbacks of large language models like ChatGPT, particularly in the context of education [26].

Cotton et al. [27] concur that the application of AI in education has become a focal point of interest, reflecting the broader discussion surrounding the use of ChatGPT in academic settings. Furthermore, Qadir [28] raises ethical concerns related to the use of generative AI in education, including the potential for unethical student behavior and the displacement of human jobs due to technological automation. Tate et al. [29] emphasize that the public release of ChatGPT, with its remarkable capabilities, has thrust AI-driven text generation into the forefront of academic and educational discourse. These authors highlight the complex challenges posed by ChatGPT and similar technologies for educational practitioners, lawmakers, and scholars. In addition, they provide insights into the historical context of technology's relationship with reading, cognition, and education, underscoring the need for a deeper investigation into the performance and limitations of new language generation software [29, 30]. Bishop [30] advocates for a shift in the educational approach, suggesting that instead of focusing solely on teaching writing mechanics, educators should emphasize advanced writing skills that promote critical thinking. This perspective reflects the potential impact of large language models like ChatGPT on traditional writing instruction.

Kung et al. [31] have evaluated ChatGPT's performance on the United States Medical Licensing Exam, demonstrating its ability to achieve or approach passing scores across all three assessments without specialized training. They also note the high concordance and insightful nature of ChatGPT's explanations, hinting at its potential utility in medical education and clinical decision-making. Pavlik [32] delves into the transformative potential of generative AI, particularly ChatGPT, in the field of journalism and media output. By collaborating with ChatGPT to produce an essay, Pavlik [32] illustrates the platform's capabilities and limitations, shedding light on the implications of generative AI for journalism and media education. Azaria [33] highlights the effectiveness of large language models like ChatGPT in various domains, including education and conversational agents. While discussing ChatGPT's bias toward digit use, Azaria [33] draws attention to the correlation between digit regularity in ChatGPT-generated text and human preferences for certain numbers. The article explores both the advantages and constraints of ChatGPT's conversational agent design. Cotton et al. [27] suggest that ChatGPT's integration into higher education could yield benefits such as increased student engagement, collaboration, and accessibility. However, they also express concerns related to academic integrity and plagiarism. Qadir [28] underscores the significance of staying abreast of technological advancements in engineering education and outlines the potential advantages of incorporating generative AI technologies like ChatGPT. Nevertheless, both Qadir [28] and Cotton et al. [27] caution against overlooking the technology's limitations, including biases in training data and the risk of perpetuating false information.

4. Materials and Methods

This study employs the critical document analytical method, wherein it assesses individual records such as newspapers and blogs, alongside authoritative sources like authored journals and books. The objective is to evaluate the potential advantages of integrating ChatGPT into the education sector of emerging economies while also scrutinizing any associated drawbacks and risks. The research aims to address two key questions: first, what are the potential benefits of implementing ChatGPT in the education sector of emerging economies,

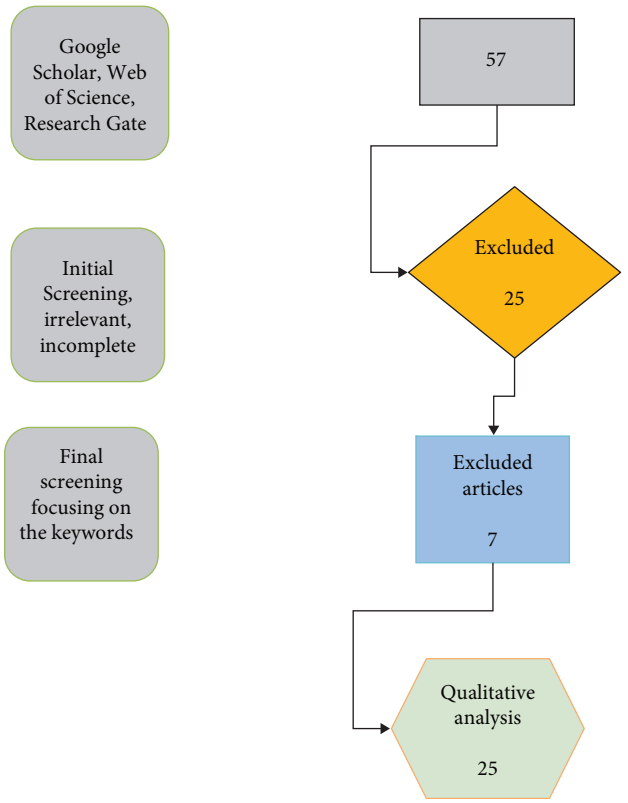

Figure 1: The steps that were used to determine which articles were included and which were omitted. (Source: author's analysis.).

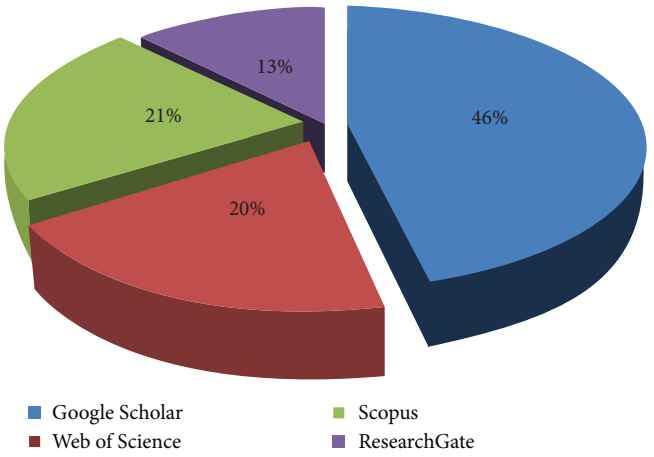

Figure 2: Articles used from various sites.

and second, are there any disadvantages and risks associated with the utilization of ChatGPT in the education of emerging economies? The primary focus of this paper lies in the intersection of ChatGPT and education, with an emphasis on examining studies that investigate the role of AI within educational contexts. The research commenced with a comprehensive search for works pertaining to the utilization of AI in educational settings and ChatGPT. During the initial phase of document collection, a total of 57 articles were identified from four major academic websites: Web of Science, Google Scholar, ResearchGate, and Scopus. The articles considered were primarily those published from 2005 onward, aligning with the topic's relevance to digital transformation and the increasing prominence of ChatGPT in recent years. Subsequently, a secondary round of screening was performed to isolate articles specifically discussing the use of ChatGPT in educational settings. This screening process resulted in the selection of 25 publications to be included in the study and subjected to subsequent analysis (refer to Figure 1 for details).

Throughout the document analysis process, articles were chosen based on their relevance to the research question or the subject under investigation. However, it is important to note that not all identified articles were incorporated into the review. Several factors, including the significance, comprehensiveness, and recency of the articles, influenced the decision to exclude certain papers. These selected papers constituted the primary sources of information utilized to derive the findings discussed within this research. The findings were synthesized using the information gleaned from these selected publications. Following the completion of the investigation, a thematic data analysis procedure was undertaken to categorize the identified issues into distinct themes. These themes predominantly revolved around the advantages and disadvantages that ChatGPT presents within the education sector of emerging economies. For a detailed breakdown of the steps involved in the publication of articles from various reputable websites, please refer to Figure 1, which provides a comprehensive overview of the entire process. In addition, Figure 2 offers insights into the distribution of studies across different authoritative sites, with Google Scholar contributing 11 articles, Scopus 5 articles, Web of Science 4 articles, and ResearchGate 5 articles.

The distribution of papers on several websites such as Google Scholar, Scopus, and Research Gate is outlined in Figure 2 above. Figure 1 outlines the steps that were used to determine which articles were included and which were omitted.

Articles were chosen for the document analysis based on their potential usefulness in answering the research question. However, not all of the retrieved papers were used in the analysis. Sometimes articles weren't included since they weren't necessary or weren't up-to-date.

4.1. Keywords Used in the Study. The search strings and phrases that were utilized in the research are presented in the figure below (Figure 3). The list is not comprehensive, but it does its best to paint a sense of how the study's terms were used.

The keywords and phrases that were searched for throughout this investigation are illustrated in the chart above (Figure 3). The list is not exhaustive, but it does its best to give an idea of how the concepts that were employed in the study were used. These keywords were used in the screening process and searching for the relevant articles among other mechanisms like the period of publication and relevance of the article in answering the research questions.

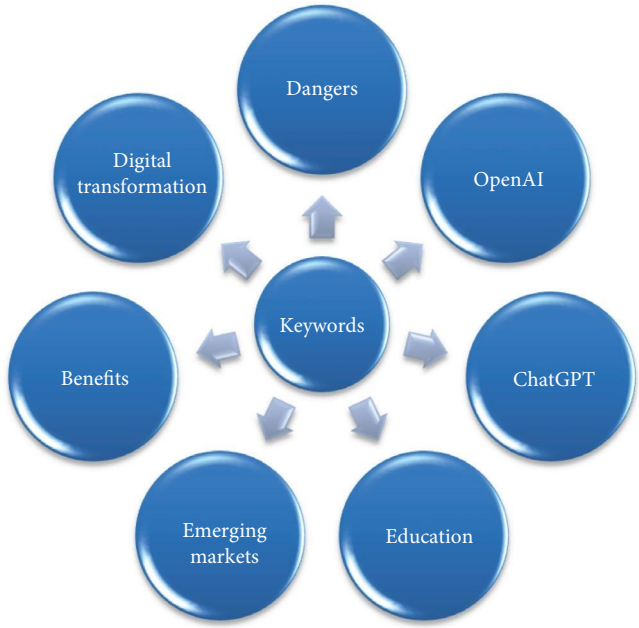

Figure 3: Keywords used in the study.

Table 1: The following articles were utilized in the present study.

Reference	General description and focus	Year
Lund and Wang [34]	The article is discusses ChatGPT. How do AI and GPT affect academic institutions and libraries?	2023
Pavlik [32]	The paper focuses on thinking about the impacts of generative AI on journalism and media education in collaboration with ChatGPT	2023
Maseleno et al. [35]	The article focuses on demystifying learning analytics in personalized learning	2018
Tapalova and Zhiyenbayeva [6]	Artificial intelligence in education: AIEd for personalized learning pathways	2022
Mikheev et al. [21]	Current trends in the digital transformation of higher education institutions in Russia	2021
Mhlanga [9]	Digital transformation in education: relevant paradigms and theories of teaching and learning in the industry 4.0	2023
Prain et al. [36]	Personalized learning: lessons to be learnt	2013
Tapalova and Zhiyenbayeva [6]	Artificial Intelligence in education: AIEd for personalized learning pathways	2022

The documents that were selected to be included in the investigation are listed in Table 1 above. The table only contains a small selection of the entire number of publications that were taken into account for the study.

5. Results and Discussion: The Benefits of Open AI'Ss ChatGPT for Education in Emerging Markets

There may be several benefits to be gained from implementing ChatGPT by OpenAI in the education sector of emerging markets. The education industry in emerging economies is confronted with several obstacles, such as limited resources, a lack of access to quality education, and the requirement to accommodate a wide variety of students' educational requirements. The broad language model known as ChatGPT which was developed by OpenAI can completely transform how education is provided in these areas. ChatGPT can assist in closing the achievement gap between kids and excellent education because it offers pupils an education that is both individualized and easily available. ChatGPT can provide students with fast answers to their queries thanks to its capacity to understand and respond to natural language. This enables students to learn at their own pace and from anywhere by giving them the freedom to study in their own time. In addition, ChatGPT can assist educators by supplying them with beneficial materials and insightful information that can help them improve their teaching methods. The implementation of ChatGPT in educational settings has the potential to significantly enhance the learning results and experiences of students, particularly in emerging economies with restricted access to education of a sufficient standard. Some of the reasons include the fact that it can answer student questions, provide personalized feedback, and generate educational content. ChatGPT's ability to operate at scale is beneficial in emerging economies with limited resources and large class

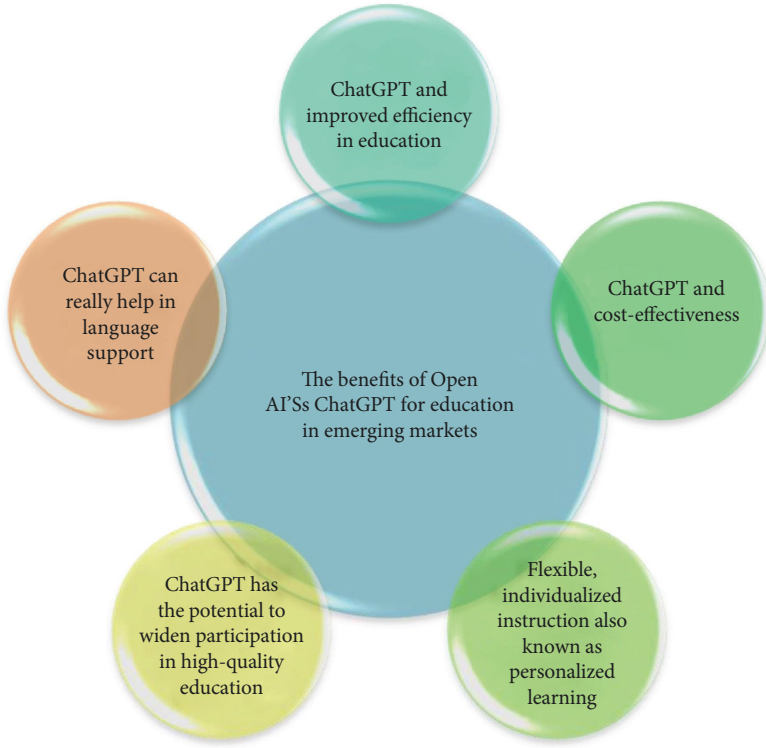

Figure 4: The benefits of Open AI'Ss ChatGPT for education in emerging markets.

sizes, and its ability to understand natural language and tailor responses to individual students can bridge gaps in knowledge and understanding. In addition, ChatGPT can provide access to high-quality educational resources and information. However, it's important to acknowledge that this tool has limitations as will be outlined in the sections below. These strengths will be broken down into their parts in the following paragraphs.

Figure 4 outlines the benefits of Open AI'Ss ChatGPT for education in emerging markets which include flexible, individualized instruction also known as personalized learning, ChatGPT the potential to widen participation in high-quality education, ChatGPT can help in language support among others.

5.1. Flexible, Individualized Instruction Also Known as Personalized Learning. The conversational AI capabilities of ChatGPT can be utilized to provide individualized educational experiences for individual pupils. A method of education known as personalized learning considers the unique skills, passions, and requirements of each student to fashion a one-of-a-kind educational experience that is founded on the student's specific characteristics. Students and teachers collaborate to design individualized lesson plans that will be implemented in the classroom [35–38]. The fact that ChatGPT can respond to questions, provide explanations, and feedback, and assist students in real time makes it possible for it to provide personalized learning, which makes the learning process more efficient and effective. The ability of ChatGPT to offer personalized learning in emerging markets also emanates from its NLP capabilities and its large training dataset. ChatGPT can understand the questions asked of it and answer them in a way that is human-like thanks to NLP. This enables it to engage in conversational learning with users and this interaction can be modified to accommodate the requirements and preferences of the user. This can be especially helpful for emerging economies that have less access to educational resources than more developed countries. As it interacts with more users, ChatGPT can improve its understanding of their learning style and provide more personalized recommendations. As an AI language model, ChatGPT can analyze the input it receives from users, including their responses to questions, their language patterns, and the content they provide. By analyzing this data, ChatGPT can gain insights into users' learning styles, preferences, and needs. The other important aspect is that ChatGPT's machine learning algorithms enable it to adapt to the specific requirements and preferences of each user. Regarding the problem of accessibility, ChatGPT may be accessed through a straightforward chat interface. This makes it simple to use for those in emerging markets who might not have access to conventional educational resources or technology. By utilizing these qualities, ChatGPT can completely transform how individuals living in emerging markets gain access to and receive an education. This could assist to close the knowledge gap and provide everybody, regardless of where they live or their socioeconomic status, with opportunities to study and improve.

5.2. ChatGPT has the Potential to Widen Participation in High-Quality Education. Emerging markets generally have insufficient resources for education, including a shortage of trained teachers [39–41]. ChatGPT can contribute to the closing of this knowledge gap by giving students access to

educational information and resources of a high standard, as well as by providing students with support and direction in a wide range of topics. The recent developments in AI and NLP have prepared the way for a new approach to learning and education. Individuals can engage in conversational learning because ChatGPT is equipped with sophisticated NLP capabilities that enable it to understand user questions and answer them in a manner that is analogous to how a human would. For instance, a person in a developing market may ask ChatGPT a question about a specific topic, and it would offer a response that is pertinent and correct. This may help alleviate the problem of insufficient educational resources. On the other hand, this is contingent upon the availability of essential resources such as internet connectivity, electrical power, and electronic devices. But individuals in emerging economies who may not have access to traditional educational resources or technology may find it easy to use ChatGPT because it can be accessed through a straightforward chat interface, as was mentioned earlier. For instance, a person living in a emerging nation that has restricted access to the internet could use a smartphone with only the most fundamental features to use ChatGPT and obtain a high-quality education. What we are seeing is that ChatGPT can completely transform how people living in emerging markets gain access to and receive an education. It has the potential to provide high-quality education to anyone, regardless of their geographical location or socioeconomic background, by leveraging its NLP capabilities, large training dataset, adaptability, and accessibility. ChatGPT has the potential to become a significant weapon in the battle against the knowledge gap and the effort to guarantee that all people living in emerging economies have access to education of a sufficient standard if it is further developed and put into practice.

5.3. ChatGPT Can Help with Language Support. ChatGPT has been trained in a wide variety of languages, including some of the languages spoken in emerging markets like Shona in Zimbabwe, and Zulu in South Africa among many others. Because of this, it is possible for students who are not proficient in the language that is most spoken in the classroom to still benefit from the educational possibilities of the ChatGPT model. Language support is an essential component of education, particularly in emerging economies where people may not have access to resources or teachers who are fluent in their mother tongue [42, 43]. The recent developments in AI and NLP have opened the door to novel ways to language support, and these new methods have the potential to make great education accessible to people from all backgrounds, regardless of the language they speak. This is especially useful for emerging economies, where people frequently lack access to resources or educators who are fluent in their local tongue. For instance, a person in a developing nation who is fluent in Spanish or Shona, Zulu as their first language may ask ChatGPT a question about a certain topic in Spanish or Zulu, and it can offer an answer that is pertinent and correct in the same language. The fact that ChatGPT was even trained in languages in the remotest parts of Africa like Shona, a Bantu language that is commonly used in Zimbabwe and the nations that border it makes this tool powerful.

The other important aspect that can be very instrumental for the education sector in emerging economies is the fact that ChatGPT offers translation in real time. ChatGPT is capable of translating text from one language to another in real-time, users can participate in educational conversations in the language that is most natural to them, even though the language of the resource or the instructor may be different. For instance, a person living in a developing nation who grew up speaking Shona or French as their first language could use ChatGPT to translate an English-language textbook into their mother tongue, which would make it easier for them to comprehend and retain the information contained within the book. As was highlighted earlier, ChatGPT can customize itself to the specific requirements and inclinations of each user thanks to its machine learning algorithms. This comprises linguistic preferences and capabilities, which enable the provision of individualized linguistic help to individuals in emerging markets. For instance, a person in an emerging market who is having trouble understanding a specific topic in English could ask ChatGPT for assistance, and it would provide explanations and extra resources in their native language, so assisting them in better comprehending the subject matter. What we are observing is that ChatGPT possesses the potential to usher in a new era of language support in the educational sector of emerging economies because of its capability to be used in several languages, translation in real-time, ability to be personalized, and general accessibility, it is a perfect tool for those who may not have access to materials or teachers who are fluent in their original language. ChatGPT offers the ability to give an excellent education to anyone, regardless of language obstacles, by harnessing these skills. This would assist to bridge the knowledge gap and enable access to quality education for all individuals in emerging countries.

5.4. ChatGPT and Improved Efficiency in Education. The usage of tools like ChatGPT that are powered by AI can assist to streamline the educational process, which in turn frees up more time for teachers to focus on other critical responsibilities. This can lead to more consistent and accurate grading and evaluation of the student's work. In emerging nations, as outlined before, the education sector is frequently confronted with substantial obstacles, such as insufficient resources, poor infrastructure, and a lack of skilled educators. This can lead to inefficiencies in the delivery of education, which can result in fewer individuals being able to access quality educational opportunities [41, 44]. However, recent developments in AI and NLP have paved the way for new methods of education delivery which can enhance efficiency and enable access to quality education for everyone. Individuals in emerging markets can receive automated assistance from ChatGPT, which enables them to receive answers to questions and access information without the need for a trained teacher or any other educational resource. ChatGPT can do this because it can provide automated assistance. This has the potential to assist in lowering the pressure placed on scarce resources and enhancing the education industry's overall level of productivity. For example, a person in a developing

market who is having difficulty with a specific topic could ask ChatGPT for assistance, and it would provide a response that is accurate and pertinent, thereby enhancing the individual's understanding of the material and increasing the effectiveness of their learning.

In addition, the machine learning algorithms that power ChatGPT make it capable of conforming itself to the specific requirements and inclinations of each user [45, 46]. This individualized method of education has the potential to contribute to an improvement in the effectiveness of the education system by cutting down on the amount of time and resources that are required to give a decent education. For instance, a person in a developing market who is having difficulty with a specific topic could ask ChatGPT for assistance, and it would provide explanations and additional resources that are tailored to their specific needs. This would improve the effectiveness of their learning and reduce the demand for resources. The other benefit is that ChatGPT is accessible at all times of the day and night and because ChatGPT may be accessible at any time, it enables people in developing economies to receive education and support whenever they may require it. This results in an improvement in the effectiveness of the education sector by lowering the threshold at which individuals are required to take time off from work or other responsibilities to pursue their educational goals and by making the learning environment more adaptable and convenient. An individual in a developing market who works long hours could, for instance, utilize ChatGPT in the evenings to obtain education and increase their comprehension of a particular subject, hence boosting the effectiveness of their learning. ChatGPT has the potential to completely change the way education is provided in emerging economies, resulting in increased productivity and enhanced access to education of a higher standard for everyone. The automated support, tailored learning, round-the-clock availability, and accessibility make ChatGPT a perfect tool for those in developing markets who possibly do not have access to traditional educational resources. ChatGPT has the potential to improve the overall efficiency of the education sector in emerging economies by capitalizing on these capabilities, thereby contributing to the closing of the knowledge gap, and ensuring that all individuals have access to education of a high standard.

5.5. ChatGPT and Cost-Effectiveness. As indicated throughout this study, due to low financial resources, there is restricted access to education of a sufficient standard in development. In emerging markets, the education sector is facing several issues, such as limited resources, large class sizes, and insufficient teacher preparation in countries [47, 48]. Because of the growing demand for high-quality education, there is a pressing need to find solutions that minimize the financial burden associated with addressing these issues [49–51]. Through its ability to deliver low-cost and individualized learning experiences, ChatGPt has the potential to revolutionize the education sector in emerging economies, with students having the opportunity to receive individualized instruction through one-on-one tutoring sessions made available through ChatGPt. The model can communicate with students in normal language, responding to their inquiries, providing explanations, and suggesting more resources based on the student's capabilities and requirements. A student who is having difficulty with a certain topic in mathematics, for instance, can ask for assistance with ChatGPt and receive individualized, step-by-step explanations and examples that will assist them in better comprehending the issue.

Students in developing economies, who may not have ready access to high-caliber educators or resources, can benefit enormously from this, making it an especially important opportunity. Again, ChatGPt can also be utilized in the grading of assignments and the provision of feedback to students on the work that they have completed. The model can comprehend the larger context of the assignment, evaluate the student's work, and provide written feedback that is specifically catered to the student's areas of strength and vulnerability. This can save teachers time and cut down on the cost of grading and providing feedback, making it more accessible for students in developing markets. Students can also use ChatGPt to prepare for standardized examinations using this tool. Students will be able to enhance their scores with the help of the model, which can provide individualized practice questions and feedback.

Educators and students in emerging markets may benefit from a reduction in the cost of test preparation as a result of this, making it easier for them to participate. As a result of all this, we can see that ChatGPt has the potential to change the education sector in developing regions by offering low-cost and individualized learning experiences. The ability of the model to interact with students in their native language, provide feedback in real-time, and grade assignments can contribute to a reduction in the cost of education while simultaneously improving the quality of learning. ChatGPt has the potential to be a game-changer for students in underdeveloped nations who are seeking access to excellent education because of its adaptability and cost-effectiveness. However, some restrictions need to be considered, even though implementing OpenAI's ChatGPT in the education sector of emerging markets may result in many positive outcomes as will be discussed in the following section.

5.6. Challenges to ChatGPT's Implementation in Emerging Markets' Educational Institutions. While the use of OpenAI's ChatGPT in the education sector of emerging markets could bring many benefits, there are also limitations to consider. Some of these limitations include the ones listed in Figure 3 below.

Figure 5 outlines some Challenges to ChatGPT's Implementation in Emerging Markets' Educational Institutions. Some of the challenges include a high possibility of bias, lack of empathy, and That GPT only works where there is connectivity among other limitations. The objectivity of ChatGPT and other AI-powered applications hinges upon the nature of the training data they are exposed to, a fundamental consideration as elucidated in prior research [52, 53]. The responses generated by such models possess the potential to mirror the biases inherent in their training data,

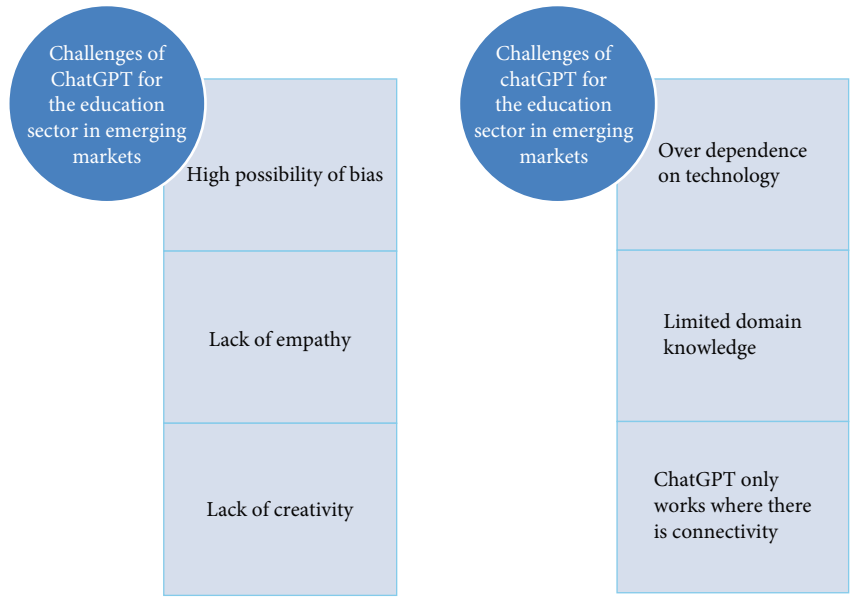

Figure 5: Challenges of using ChatGPT in the education sector of emerging markets.

should said data be tainted by biases. This inherent risk carries profound implications, especially in contexts where individuals, such as students, may lack the critical acumen to discern and evaluate the information they receive. For example, when an AI model is imbued with prejudiced language through its training, it may inadvertently produce responses that contribute to the perpetuation of negative stereotypes or prejudices. This scenario raises the alarming prospect of educational chatbots disseminating biased information or furthering harmful stereotypes, which, in turn, could exert a detrimental influence on the cognitive and moral development of students. Moreover, it is conceivable that the model might assign disproportionate importance to specific categories of information over others. This predilection could engender an imbalanced representation of diverse perspectives and experiences, thus culminating in educational chatbots that dispense information characterized by either incompleteness or distortion. Such a state of affairs, as it stands, would undoubtedly cast a negative pall over the educational landscape, impeding the holistic growth and development of students.

Human biases can potentially influence the creation and implementation of chat-based standardized testing in the educational sector, especially when the people responsible for developing the technology have preconceived notions, which may result in the development of models that support these preconceived notions. In addition, people who deploy the technology may utilize it in ways that reinforce their prejudices, which may harm the learning and growth of the students.

Lack of empathy is one of the challenges of ChatGPt. ChatGPT should disseminate knowledge and provide answers to questions without empathy and comprehension. Students who are having difficulty in a subject or who require emotional assistance may find this to be an especially stressful situation. It is essential to use both successful teaching and learning so that individuals can comprehend and identify with the emotions and experiences of those around them. Again, ChatGPt won't be able to offer the psychological assistance and social connection that kids require to flourish and achieve their goals since it lacks empathy. A lack of empathy can result in a lack of personal connection with pupils, which is something that ChatGPT often struggles with.

Empathy is a critical component in developing personal connections with kids. Because of this, children will be less likely to feel encouraged and respected by the chatbot, which can have a detrimental impact on students' motivation, engagement, and overall school achievement. For instance, if a student is having difficulty mastering a certain subject, That GPT may be able to deliver accurate information; yet it may not be able to establish a relationship with the student that motivates and inspires them to continue their education. It is also essential to have empathy to comprehend the specific requirements and experiences of each learner and to respond appropriately to these. Due to ChatGPT's lack of empathy, its chatbots may be unable to provide students with support that is specific to the context of their problems. For instance, if a student has difficulty grasping a certain subject due to a learning handicap, That GPT might not be able to comprehend this requirement or respond to it encouragingly. The usage of ChatGPT in the educational sector in emerging economies may also prolong dependence on technology rather than encourage critical thinking and problem-solving skills. This is because ChatGPT is designed to facilitate communication between users. Although ChatGPT has been educated on a wide variety of subjects, it is possible that it does not have an in-depth understanding of all subjects, particularly the ones that are specialized. In circumstances like these, the model might not be able to deliver information that is accurate or helpful.

The other most significant obstacle presented by the utilization of chatbots in the educational setting is the restricted domain knowledge that they possess. This can lead to

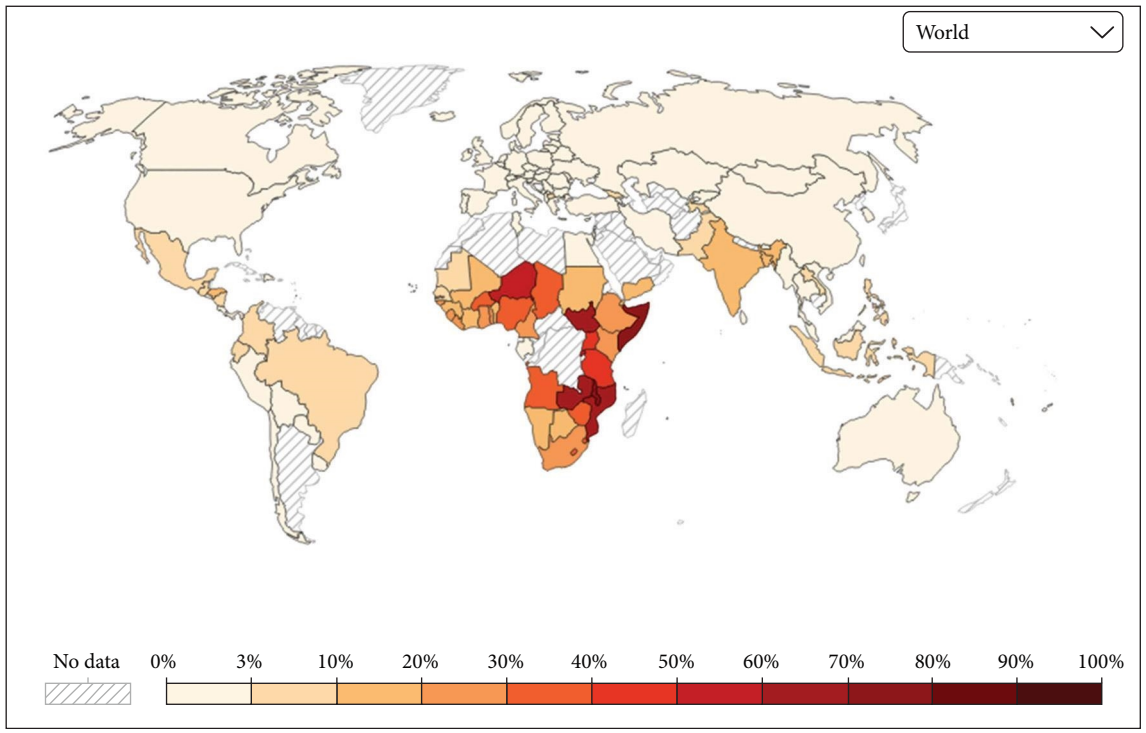

Figure 6: Share of population living in extreme poverty, Our World in Data [55].

chatbots giving students incorrect or partial information, which can have a negative influence on students' ability to learn and their level of involvement in their studies. It's possible that ChatGPT doesn't comprehend the cultural nuances and sensitivity that exist in many countries and areas, because of this, the chatbot will provide answers or responses that are culturally offensive or unsuitable. Again, ChatGPT's grasp of subjects or areas may be restricted, although it has been trained on enormous amounts of text data. Because of this, the chatbot may provide information that is not correct or may provide answers that are not based on strong evidence or knowledge that has been established. Again, there is a possibility that ChatGPT does not have complete knowledge of a certain topic or subject, which can result in students receiving responses that are not complete with their inquiries. This can be a barrier to learning and engagement for students, as well as a potential source of frustration or confusion.

ChatGPT may be able to deliver answers to questions, but it may not be able to think up new ideas or respond creatively to them [34, 49, 54]. As a result, the program's capacity to assist pupils who require more creative or original solutions may be diminished. Emerging markets' education sectors are increasingly seeking technology-based solutions to solve difficulties such as a shortage of competent teachers, limited resources, and a lack of access to technology. This trend is expected to continue. In addition, ChatGPT is unable to be customized to meet the specific requirements and preferences of each student. This can lead to a one-size-fits-all approach to learning that does not consider the unique requirements and preferences of each student in terms of how they learn. ChatGPT is not intended to stimulate creative thinking or the solving of problems in any way. This can put a damper on students' creative abilities, hamper their capacity to think creatively and come up with new ideas and solutions, and limit their ability to think beyond the box. The other problem is that ChatGPt is only functional in areas that are connected to the Internet, but many people in emerging nations are living in poverty and do not have reliable Internet access. Furthermore, many people in rural areas of emerging nations are not connected to the national electricity grid. People will only be able to experience the benefits of ChatGPT in settings where they have reliable access to the internet.

Figures 4 and 5 provide an overview of the regions that are particularly hard hit by poverty and that continue to struggle with gaining access to modern conveniences like electricity. In these regions, as shown in the figure, particularly Africa and parts of Asia, ChatGPT will have a minimal contribution to the field of education because the people living there are impoverished, do not have access to the internet, and struggle to use electronic devices such as laptops and cellphones. The percentage of the whole population that lives in abject poverty is depicted in Figure 6.

Extreme poverty is defined as a living standard that is lower than the International Poverty Line, which is currently established at $2.15 per day. These numbers have been adjusted to take into account the effects of inflation as well as regional and national variations in the cost of living. Emerging markets like Africa and India, as well as many other parts of the world, nevertheless have a considerable proportion of people living in poverty in comparison to

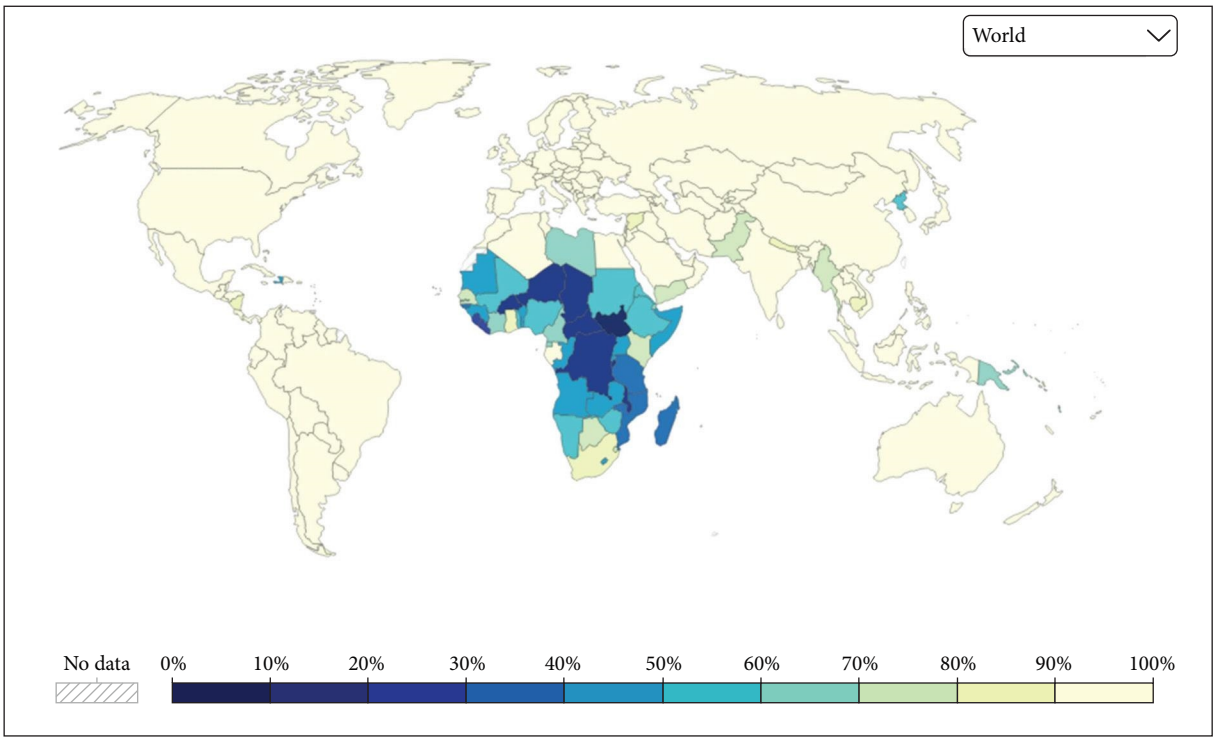

Figure 7: Global access to electricity, Our World in Data [56].

the rest of the world. The application of the ChatGPT program may present a substantial challenge. Access to electricity around the world is depicted in Figure 7.

There has been a steady increase over the past several decades in the number of people all over the world who have access to electric power. In the year 1990, over 71% of the world's population had access to the Internet; by 2016, that number had increased to 87% [56]. On the other hand, there is still a large problem with connectivity over the entirety of Africa, which provides a significant impediment, particularly regarding the deployment of ChatGPt in education.

6. Conclusions and Recommendations

OpenAI and CHATGPT both represent important advancements in the field of AI and have the potential to have a substantial impact on the education sector in economies that are still developing. The objective of this study was to examine the potential impact of OpenAI and CHATGPT on the education sector in emerging economies. Using a critical document analytical method, in which individual records newspapers and blogs and hard evidence authored journals and books were evaluated and interpreted, the findings suggest that these technologies have the potential to enhance student learning outcomes and increase access to information. However, caution must be exercised, and the benefits and drawbacks of technology must be analyzed thoroughly, including ethical considerations. This study implies that while AI has the potential to transform education in emerging nations, it is crucial to approach technology responsibly and with a well-informed understanding of its effects. The positive impacts of AI on education should be maximized, while negative effects should be minimized, such as a lack of data privacy, unequal access to technology, and the need for educators to update their skills. Future recommendations include further research to better understand the impact of AI technologies on education in emerging nations. It is important to ensure that the benefits of these technologies are harnessed effectively while minimizing the negative effects. Ultimately, the goal should be to use AI to provide more equitable and effective educational opportunities for everyone.

Data Availability

No data was analyzed in this study.

Conflicts of Interest

The author declares that there is no conflicts of interest.

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