



Views of Science Educators on ChatGPT as a Learning Paradigm: Implication for Attaining Sustainable Development Goal 4

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Abstract

Artificial Intelligence tool such as ChatGPT has found applications in almost all fields, including education. This study investigated views of science educators on ChatGPT as a learning paradigm and its implication for attaining Sustainable Development Goal 4. The study was conducted at Department of Science Education, University of Nigeria, Nsukka, using a descriptive survey research design. It has a population of 59 science educators who were used as participants since the population was manageable. Data were collected using researchers-developed Likert-type scale titled "Scale on Science Educators' Views on the Use of ChatGPT (SSEVUC)". It was face-validated and has an overall reliability of 0.93, determined using Cronbach's Alpha. Data were analyzed using mean and standard deviation. The findings revealed that science educators view ChatGPT as a tool that enhances students' engagement, personalized learning, varied learning needs, complements traditional teaching method and addresses students' frequently asked questions through automation. It also showed the concerns science educators have for ChatGPT, and their views on ways of integrating ChatGPT as a learning paradigm. It highlighted the implication of the findings for attaining Sustainable Development Goal 4 as ChatGPT serves as a free or low-cost tutor which offers explanation, summaries and practices in diverse subjects at any time. It was recommended among other things that ChatGPT should be used wisely for effective learning.

Key-words: Artificial Intelligence, ChatGPT, Science Education, Learning

Introduction

This study explores the perspectives of science educators on the integration of ChatGPT as a transformative learning paradigm, examining its potentials to enhance teaching and learning practices in line with sustainable development goal 4, which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Science is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe (Boulton, 2021). It involves observing, questioning, experimenting, and drawing evidence-based conclusions in order to solve problems. Science education is the field concerned with teaching and learning of science. It improves students' scientific knowledge, develops their critical thinking and problem-solving skills as well as develops their pedagogical competence. Science teaching can be conventionally done using the traditional methods

which sometimes do not encourage students' active participation nor encourage self-regulated learning during instructional processes. Thus, traditional teaching methods seem not to encourage inquiry among learners as they often rely on lectures, textbooks, and rote memorization. They sometimes fall short of addressing the diverse learning needs of students. This gap has led educators to explore innovative teaching approaches that can make learning more interactive, personalized, and inclusive. In recent times globally, teaching/learning paradigm is revolving around artificial intelligence. This could be because AI technology possesses the potentials to serve as a significant asset in education, occupying various roles that enrich both learning and pedagogical experience (Grassini, 2023). In science education, where conceptual understanding, problem-solving, and

inquiry-based learning are pertinent, AI tools could become a requisite paradigm.

Artificial intelligence (AI) is a computer system that is capable of learning from its past experiences and apply the same knowledge to new situations. It has pervaded and revolutionized different sectors of life including education, health, and business among others due to its capability to automate tasks, process large quantities of data, and provide predictive insights to prompt (Yang, 2022). For instance, AI in the education sector, can be in the form of intelligent books, web browsers, education apps, and learning platforms (Karsenti, 2019). It brings about novel ways of teaching, learning, assessment and research. Thus, increasing the efficiency of educational activities by providing access to a wide range of information (Thomas & Gambari, 2021). The characteristic of inclusivity of AI tools provided through access to wide range of information and self-regulated learning could be prime to the achievement of goal 4 of the sustainable development goals.

Globally, educational policies are geared towards promoting inclusive, equitable, and quality education. These are encapsulated in the Sustainable Development Goal 4 (SDG 4), which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (United Nations [UN], 2015). One of the targets of the SDG 4 is to build and upgrade inclusive and safe schools that have access to basic services such as electricity, internet, computers, water and sanitation among others thereby prioritizing the integration of AI tools in learning paradigm. Such integration of AI tools is a transformative force that could reshape instructional delivery and access in learning generally. One of the AI tools is generative artificial intelligence (GAI) in the form of Generative Pre-trained Transformers (GPT) (Jovanovic & Campbell, 2022; Bozkurt, 2023). ChatGPT is an example of the Generative Pre-trained Transformers (GPT).

The integration of ChatGPT as an AI tool appears to cut across all the sectors. It is trained by its developers using machine learning algorithms on large amounts of text, including books, news articles, websites, and Wikipedia (Scharth, 2022). With such training using trillions of data, ChatGPT model acquires patterns and structure of language that enhance prediction which occurs in response to any prompt; thereby providing its users with relevant and meaningful content to their requests (O'Reilly, 2023). The capabilities of ChatGPT in generating human-like

text and facilitating automated conversations, have implications in various sectors including education (Grassini, 2023). ChatGPT is reorganized and used in learning (Martin, 2019). ChatGPT is supportive to educators including learners and plays a very crucial role in education (Rudolph & Tan, 2022; Sharma, 2023). A large proportion of students could use ChatGPT for their homework, revision and research. It is pre-trained to answer all questions, fix mistakes, turn down wrong request as well as provide customized answers in response to learners' messages, grade their performance and provide tips on areas learners need to improve (Pokrivcakova, 2019). Sharma (2023) added that ChatGPT makes learning more personalized by letting students learn at their own pace. The stated benefits of ChatGPT are likely to be enjoyed in science education.

The integration of ChatGPT in science education could help students in simplifying tasks given as homework, concept clarification, and interactive learning experiences. A study by Chen and Heffernan (2020) as well as Jara and Ochoa (2023) demonstrated that ChatGPT was able to provide personalized math tutoring to students, provide explanations that were tailored to students' misconceptions and adapt to their level of understanding resulting in improved learning outcomes. Tang, Chang and Hwang (2023) showed that ChatGPT was able to understand students' knowledge and adjust the difficulty of the problems it generates. Montenegro-Rueda, Fernández-Cerero, Fernández-Batanero and López-Meneses (2023) stated that ChatGPT presents itself as an invaluable assistance tool for scientific writing but should not be considered a complete solution for scientific content creation. Cooper (2023) added that the answers provided by ChatGPT might need further refinement. As such, ChatGPT has some shortcomings.

Despite the immense potential and the positive contributions of ChatGPT, it could have shortcomings for educators and students who use it as a learning tool. Halaweh (2023) averred that some educators are doubtful and view ChatGPT as a potential danger, with a risk of leading to a decrease in educational activities by fostering laziness among teachers and students due to reduced analytical skills. Tan, Charman, Domenghino and Olaleye (2023) argued about the quality and correctness of ChatGPT's output. As a result, Celik (2023) claimed that educators have not maximized the potential of AI in teaching and learning contexts. Conversely, Montenegro-Rueda, Fernández-Cerero, Fernández-Batanero and López-Meneses

(2023) upheld that the use of ChatGPT in education is of immense educational support in the teaching and learning process for both students and teachers. But, argued that lack of teachers' training regarding the use of ChatGPT limit its application in classrooms as many teachers do not have the necessary skills to apply it efficiently following ethical guidelines. The same could be said about students.

Students tend to abuse the use of ChatGPT. Some students hardly refine the answers gathered from ChatGPT. Some undergraduate students largely depend on ChatGPT for their assignments without modifications. Wen and Wang (2023) revealed that students utilizing ChatGPT for their assignments are more likely to engage in plagiaristic behaviour than their counterparts who do not use the tool. This limits critical thinking, which education is meant to engender in learners (Erikson, 2019). The use of ChatGPT in education poses challenges related to its accuracy and reliability (Sallam, 2023). Hyper-dependence on ChatGPT destroys art of inquiry/research and it is can generate incorrect information as often reported by both users and the scientific literature (Sallam, 2023; Gravel, D' Amours-Gravel & Osmanllium, 2023). Stojanov (2023) opined that answers provided by ChatGPT were occasionally superficial. In some instances, contradictory responses were given. Chaudhry *et al.* (2023) conducted an empirical study to evaluate the capability of ChatGPT in solving a variety of assignments from different level courses in undergraduate degree programmes. The findings emphasize the need for universities to adapt their practices to ensure academic integrity and monitor the quality of student learning. The reviewed studies showed the applications of ChatGPT and its potential challenges. However, the views of science educators who are catalysts for scientific thinking regarding the use of ChatGPT as a learning paradigm in an increasingly scientific and technological world create a lacuna. Hence, this study investigated views of science educators on ChatGPT as a learning paradigm: Implication for attaining sustainable development goal 4.

Research Objectives

The following research questions were posed for the study:

1. What are the science educators' views on the use of ChatGPT as a learning paradigm?
2. What are the science educators' concerns about ChatGPT as a learning paradigm?

3. What are science educators' views on the way forward in integrating ChatGPT as a learning paradigm?

Method

The research design adopted in this study was a descriptive survey research design. The design was appropriate because of its ability to collect data from a significant number of respondents and analyze the same efficiently for generalization (Sarantakos, 2013). The study was carried out in the Department of Science Education, University of Nigeria, Nsukka. The area was chosen because in the Faculty of Education, it is in the said department that science educators who promote STEM education are mostly found. The population of the study comprised 61 science educators in the Department of Science Education, University of Nigeria, Nsukka who were also used as participants in the study as the number was manageable.

The study utilized a researchers-developed Likert-type rating scale titled "Scale on Science Educators' Views on the Use of ChatGPT (SSEVUC)" in collecting data for this study. The instrument has three clusters that respectively captured science educators' views on the use of ChatGPT as a learning paradigm, their concerns about ChatGPT as a learning paradigm and their views on the way forward in integrating ChatGPT as a learning paradigm. The response options of the three clusters are strongly agree (SA), agree (A), disagree (D) and strongly disagree (SD). The instrument was validated by three experts in Science Education, University of Nigeria, Nsukka. The validated instrument was pilot-tested using 20 lecturers from other departments in the Faculty of Education University of Nigeria and subjected to reliability measures using Cronbach's Alpha. It yielded reliability values of 0.93, 0.87 and 0.89 for clusters A, B and C, with an overall reliability value of 0.93, which shows that the instrument is reliable.

Data were collected by distributing copies of the instrument to the respondents physically. They responded to the copies of the instrument, which were collected on the spot. This was to ensure a high percentage return of the responded instrument. The collected data were quantitatively analyzed using descriptive statistics. Thus, mean and standard deviation were used to address the research questions posed for this study. While scoring the instrument, SA was scored 4, A was scored 3, D got a score of 2, whereas SD was scored 1. Thus, the criterion mean was 2.50.

Results

Table 1: Science Educators' Views on the use of ChatGPT as a Learning Paradigm

n= 61

S/N	Item Statement	Mean (X)	Std. Dev.	Remarks
1.	ChatGPT is a way to enhance students' engagement for personalized learning.	3.22	.77	Agree
2.	ChatGPT is effective tool for supporting students' varied learning needs.	3.32	.60	Agree
3.	ChatGPT is a useful resource that complements traditional methods.	3.25	.58	Agree
4.	ChatGPT saves students' time by answering frequently asked questions through automation.	3.25	.69	Agree
5.	ChatGPT promotes inclusivity.	3.78	.39	Agree
	Cluster Mean	3.36	.89	Agree

Table 1 showed that respondents agreed that ChatGPT serves as an effective learning paradigm. This is evident from the mean values of items 1–5, which were above the cutoff mean of 2.50. The small standard deviation values showed that the respondents were homogeneous in their responses. The cluster mean of

3.36 further confirms that science educators had positive views about ChatGPT as a learning paradigm in terms of promoting personalized learning, answering students' frequently asked questions through automation and encouraging inclusivity among others.

Table 2: Science Educators' Concerns about ChatGPT as a Learning Paradigm

n=61

S/N	Item Statement	Mean (X)	Std. Dev.	Remarks
1.	ChatGPT affects academic integrity.	3.47	.69	Agree
2.	Over-reliance on ChatGPT decreases critical thinking among students.	3.32	.73	Agree
3.	ChatGPT is capable of undermining the essential teacher-student relationship that is necessary for motivating and guiding students.	3.23	.73	Agree
4.	ChatGPT may provide superficial or incomplete information especially for complex topics or specialized subjects.	3.19	.75	Agree
	Cluster Mean	3.31	.59	Agree

Table 2 revealed that the respondents expressed concerns about the use of ChatGPT as a learning paradigm. The mean scores of cluster B items (1-4) exceeded the cutoff point of 2.50 indicating those items as concerns science educators have about the use of ChatGPT as a learning paradigm. The small standard deviation scores indicated that the respondents were

similar in their responses. The cluster mean of 3.31 further affirms that science educators have concerns about the use of ChatGPT as a learning paradigm as it affects academic integrity, reduces critical thinking, weakens teacher-student relationships, and has the potential to provide superficial information.

Table 3: Science Educators' Views on Way Forward in Integrating ChatGPT as a Learning Paradigm
n=61

S/N	Item Statement	Mean (X)	Std. Dev.	Remarks
1.	Academic institutions should create clear guidelines/policies on how ChatGPT can be used in academic setting.	3.36	.69	Agree
2.	Lecturers should sensitize the students through seminars and workshops on when to use ChatGPT as well as how to properly attribute its content in academic writing.	3.25	.71	Agree
3.	Educational institutions should consider adding AI literacy in their curricula through which they teach students the responsible use of AI tools like ChatGPT.	3.13	.71	Agree
4.	Students should be informed through awareness campaign on the limitations of ChatGPT and the best practices for its usage in learning.	3.32	.68	Agree
5.	Students should be taught to question, verify, and build upon ChatGPT-generated information to prevent over-reliance.	3.34	.63	Agree
6.	Lecturers should encourage students to use ChatGPT as a springboard for critical thinking rather than as a substitute for original ideas.	3.25	.66	Agree
	Cluster Mean	3.29	.50	Agree

Table 3 revealed that the respondents agreed on several key strategies for effective integration of AI tools like ChatGPT as a learning paradigm. All the items in cluster C recorded mean values above the cutoff mean of 2.50 showing those items as way forward in integrating ChatGPT as a learning paradigm. The small standard deviation scores showed that the respondents were consistent in their responses. The strategies for integrating ChatGPT as a learning paradigm include establishing institutional guidelines, promoting AI literacy, sensitizing the students through seminars and workshops on when and how to use ChatGPT, adding AI literacy in the curricula of academic institutions, informing students through awareness campaign on the limitations of ChatGPT, verifying and building upon ChatGPT-generated information to prevent over-reliance and encouraging students to use ChatGPT as a springboard for critical thinking rather than as a substitute for original ideas. The cluster mean of 3.29 further confirms those items as way forward in integrating ChatGPT as a learning paradigm.

Discussion

The findings of this study revealed that science educators perceive AI tools such as ChatGPT as a valuable tool for enhancing learning among undergraduate students. The results among other things indicate that ChatGPT can help deliver content and serve as guidance to learners who may lack access to personalized tutoring or other educational resources thereby promoting inclusivity. As such, ChatGPT ensures that all students, irrespective of ability, background, identity, or circumstance, can use it for learning. This aligns with findings by Kasneci *et al.* (2023), who emphasized the potential of AI tools like ChatGPT to personalize learning and engaging students across disciplines. The use of ChatGPT bridges educational gaps in under-resourced contexts thereby promoting the attainment of SDG 4 which emphasizes equitable access to quality education (UNESCO, 2022). This is because learners can access ChatGPT anytime and anywhere thereby breaking barriers related to time zones, class schedules or physical location. Also, the results are in line in terms of promoting personalized learning because ChatGPT can communicate in multiple languages and simplify complex texts thereby making learning more inclusive for non-native

speakers. The findings of this study also support the self-determination theory propounded by Edward Deci and Richard Ryan in 1985 that focuses on personalized learning since ChatGPT can provide customized feedback, generate practice questions and offer explanation that fosters engagement of the students. ChatGPT explains concepts visually in simpler terms thereby accommodating diverse cognitive and learning needs. Again, promoting inclusivity shows that ChatGPT is culturally neutral, generate diverse materials and differentiate instruction to meet varied students' needs. Finally, pairing ChatGPT with screen readers or other assistive technology can help students with learning disabilities and visually impaired.

Science educators expressed concerns regarding the application of ChatGPT as a learning paradigm. Such primary concerns include affecting academic integrity, decreases critical thinking among students when wholly depending on it, undermines the essential teacher-student relationship that is necessary for motivating and guiding students as well as providing superficial or incomplete information especially for complex topics or specialized subjects. The findings corroborate with Sallam (2023) as well as Gravel, D' Amours-Gravel and Osmanllium (2023) that ChatGPT may generate incorrect or superficial information and such issues can be problematic for students who rely on ChatGPT as a learning tool. Dwivedi (2023) also revealed that while generative AI can aid learning, its unethical use can compromise students' ability to critically evaluate information and produce original work. This is so because assignments meant to build research, writing, and reasoning skills can their worth if AI such as ChatGPT completes them. In such situations, students tend to miss out on learning to evaluate sources or form authentic arguments. Again, if students rely on ChatGPT for answers instead of working through problems themselves, they may not develop essential thinking skills. Thus, creating in students a "copy and paste" mentality thereby discouraging deep engagement or analysis. This also encourages plagiarism and misuse that undermine learning and contravene academic honesty policies.

In response to these concerns, lecturers advocate for the development of institutional policies, integration of AI literacy in the curriculum, awareness creation, sufficient sensitization of students through seminars and workshops as well as the promotion of ethical and critical use of ChatGPT. These proactive standpoints are in line with recommendations by Holmes, Bialik & Fadel (2022), who argue that

educational institutions must guide students in understanding not just how to use AI tools, but also when and why. They also support Luckin *et al.* (2016) that AI in education should be leveraged to support deeper thinking and inquiry, enabling learners to build on AI-generated content rather than depend on it. These mean that emphasizing AI literacy and responsible usage can help mitigate misuse and promote critical engagement, thereby reinforcing the educational value of ChatGPT rather than undermining it. Additionally, sensitization of students on ChatGPT's limitations and encouraging creative thinking, reflect a growing consensus that AI should augment, not replace, human cognition.

Conclusion

The views of science educators on ChatGPT as a learning paradigm revealed different and growing viewpoints. While science educators acknowledge ChatGPT's prospects to enhance teaching and learning, particularly in fostering inquiry, supporting differentiated instruction, and providing immediate access to information, they also express concerns about issues such as academic integrity and the accuracy or superficial nature of AI-generated contents among others. In conclusion, from the views of science educators, ChatGPT can become a valuable pedagogical tool depending on its guided use and integration of critical thinking. This will make educators and students alike to harness its capabilities in ways that align with sound scientific and educational practices essential in realizing the goal 4 of the sustainable development goals.

Implication for Sustainable Development Goal 4

Goal 4 of the SDG focuses on ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all. ChatGPT gears towards achieving this goal by serving as a free or low-cost tutor which offers explanation, summaries and practices in diverse subjects at any time. Also, it can translate and explain concepts in many languages thereby supporting learners from different linguistic background. This shows that ChatGPT breaks barriers related to time zones, class schedules or physical location. Thus, by fostering inclusivity, ChatGPT is culturally neutral, generates diverse materials and differentiates instruction to meet varied students' needs. Through such practices as promoting individualized learning and offering explanations based on learners' level of understanding, ChatGPT tend to contribute

towards reducing dropout rates. ChatGPT can also support educators to generate lessons and learning materials thereby improving teaching quality and reducing educators' workloads. In promoting lifelong learning as stated in SDG 4, ChatGPT can be used by adults for development of skills, improving general knowledge and to support continuous learning throughout life. It has the tendency to bridge digital and educational gaps in areas that have internet access but limited educational infrastructure thereby serving as a digital learning assistant which help to reduce teachers' shortage.

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