

## APPLICATION OF ARTIFICIAL INTELLIGENCE IN TEACHING SCIENCES IN GOVERNMENT OWNED COLLEGES OF EDUCATION IN ENUGU STATE: LECTURER'S STANDPOINT

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### Abstract

*The study examined the application of Artificial Intelligence (AI) in teaching sciences in government owned colleges of education in Enugu state. The AI tools examined in the study include: ChatGPT, PowerPoint Speaker Coach, Quillbot, Perplxity, Scholarcy, Gradescope, Mendeley, Gemini, MATHia, ChatPDF, Consensus, Research Rabbit, Class Point, Gauth and Scite. The study adopted three research questions and one hypothesis guided the study. The population of study comprised of lecturers in the government owned colleges of educations. Data for the study was collected with researchers developed questionnaire tagged Lecturers' Awareness of Artificial Intelligence Tools for Teaching and Research Questionnaire (LAAITTRQ) on whatsapp. Mean and standard deviation was used to answer research questions. A sample size of 218 respondents was randomly selected from the populations using stratified random sampling techniques. Findings reveal that lecturers are aware of AI tools for teaching and research. However, it was discovered that there was no significant difference in awareness according to gender. Some constraints hindering the lecturers' usage were identified. Based on the findings, the following recommendations among others were made; workshops and training on the use of AI tools in teaching and research should be organized in the various colleges of education to boost their knowledge and skills among others.*

**Keywords:** Artificial Intelligence (AI), Lecturer's Standpoint

### Introduction

Integrating Artificial Intelligence (AI) into the education system has the potentials to enhance learning outcomes, streamline administrative tasks, and offer personalized instruction.

Over the past five decades, Artificial Intelligence (AI) has been developed as a broad field encompassing various technologies that are built to enhance machine tasks performances that originally required human intelligence, such as perceiving, reasoning, learning, and interacting (Ergen, 2019). The current developments in Artificial Intelligence (AI) have important consequences for higher education (workers), as research shows that AI is applied in a variety of ways to automate and augment the work of academics (Bearman, Ryan & Ajjawi, 2022). AI refers to a set of technologies that have the ability to interpret data and learn from it to achieve specific objectives through adaptation Kaplan & Haenlein (2019), based on imitating natural intelligence through sensing and perceiving the environment (Russell &

Norvig, 2022). Artificial intelligence tools refer to software applications, platforms, or systems that leverage artificial intelligence (AI) technologies to perform tasks, solve problems, or assist with decision-making (Parthiban & Ganesh, 2024). These tools can range from simple algorithms to complex systems and can be applied across various domains of education sectors.

Conventionally, requiring Lecturer's awareness of the application of artificial intelligence (AI) in science education varies, but generally, there's a growing recognition of its potential benefits and a need for increased training and integration. While many are aware of AI's general capabilities, practical application and integration into teaching methods still lag behind.

In a world where technology is rewriting the rules of learning, this groundbreaking platform is setting a new standard for homework assistance through the AI tools. Academics may find it challenging to keep up with rapidly changing technologies adding to their job demands, meaning that the potential utility of these platforms as research tools may be under recognized and underutilized. However, this could also trigger more interdisciplinary research between technically savvy scholars and those who are ethically aware. Scholars could investigate how AI adoption in different contexts can contribute to the research productivity of academics (Renkema & Tursunbayeva, 2024). By leveraging advanced artificial intelligence, Gauth AI for instance, offers more than just answers as it provides students with a deeper understanding of complex concepts through instant solutions and detailed explanations.

Our education system is in dire need of managing new opportunities and hazards as technology modification picks up speedily. The effective use of these technologies, especially artificial intelligence (AI), offers a distinct chance to brace the education systems in implementing new applications, as a method of teaching and learning which places a powerful prominence on equipping students with the abilities, awareness, attitudes, and values they will need now and subsequently. Artificial Intelligence (AI) has the capacity to increase the efficacy of education systems designed to prepare students for the future by expanding their reach. However, there are hazards and difficulties for both educators and students (Bello, Olabimitan, Hamza, Nafisatu, Eze & Haruna, 2024). The potential benefits of using AI in education are significant. Personalized learning, one of the most significant advantages of AI in education, can lead to better student outcomes, as students can learn at their own pace and in a way that suits their learning style (Shrivastava, 2023). AI encompasses a range of technologies that enable machines to perform tasks that typically require human intelligence. This includes capabilities such as learning from data, understanding natural language, recognizing patterns, and making decisions. In education, AI can be applied in various ways to support both teachers and students. The expansion of education will likely make the role of AI to evolve as it continues to strive with speed. Future developments may include more sophisticated AI systems that further personalize learning experiences, improve educational outcomes, and support teachers in new and innovative ways. Ongoing research, ethical considerations, and collaboration among educators, technologists, and policymakers will be key in shaping the future of AI in education (Bello, Olabimitan, Hamza, Nafisatu, Eze & Haruna, 2024). Artificial intelligence in education represents a promising frontier that has the potential to enhance learning experiences, streamline educational processes, and support both educators and students.

As we navigate this evolving landscape, it is essential to address challenges and embrace opportunities to maximize the benefits of AI in creating a more effective and equitable educational environment (Bello, Olabimitan, Hamza, Nafisatu, Eze & Haruna, 2024). The field of AI is rooted in various scientific disciplines, such as philosophy, mathematics, psychology, and statistics (Russell & Norvig, 2022). AI is an umbrella term that refers to systems that emulate natural intelligence characteristics such as sensing and learning to augment and automate human tasks (Strohmeier, 2022). IBM (2023) proposed that the types of AI can be understood by examining its capabilities and functionalities.

Infrastructure deficits, including inconsistent electricity supply, limited access to high-speed internet, and inadequate digital devices in schools, remain pervasive challenges, Oye, Iahad, Madar & Rahim, (2012). The crucial role of teachers in the teaching and learning process cannot be overemphasized. This becomes more evident when new ideas and topics are to be introduced to students. The emergence of AI education as a subject place new demands on teachers, researchers, and policymakers to ensure its effective implementation in schools. While the adoption of new curricula material necessitates state policy analysis and future needs, Sanusi, Oyelere & Omidiora, (2022), further reported that there are increasing initiatives by researchers to ensure the democratization of AI among students across grade levels. Such initiatives include the design of curricula, tools, resources, and approaches that support teaching and learning AI concepts, (Xia, Chiu, Lee, Sanusi, Dai & Chai, 2022).

Notwithstanding that several researcher-designed curricula and resources exist to introduce the AI concept, teachers possess limited knowledge to teach AI to their students, Sanusi, Oyelere, Agbo & Suhonen, (2021). Existing research further indicates that teachers' conceptions of specific subjects have pervasive influences on their classroom practices and teaching efficacy (Mishra, 2020). However, as Lin & Van, (2021), that stated, teacher conceptions are a multifaceted construct that may have complicated or even contradictory influences on their teaching practices. Xia, Chiu, Lee, Sanusi, Dai & Chai, (2022), reported that machine learning education has neither been considered a standalone subject nor integrated into a country-wide curriculum, therefore exploring teachers' concept of the subject matter is essential. Teachers' conception should consist of machine learning subject matters and cognitive methods expected to affect their decision making and not only their conceptions of students, class, society, and emotions (Lin & Van, 2021). Thus, a great deal of research has been examining teachers' conceptions concerning their teaching practices).

The ethical implications of AI in education extend beyond technical considerations to encompass broader societal impacts, such as privacy protection and social justice (Hermansyah, Najib, Farida, Sacipto and Rintyarna, 2023). Lee, Hwang & Chen, (2022), argued that AI-based tools such as chatbots can help students become cognitively more active in the learning process.

### **Importance of Integrating AI Tools into the Educational System**

**Intelligent Tutoring System (ITS):** An AI-driven tutoring system simulates one-on-one instruction by offering feedback, hints, and explanations. Example: **Carnegie Learning's MATHia** provides real-time to students in math education, (Vanlehn, 2011). This helps in preparing the students for the future, as AI becomes Learning

Artificial Intelligence (AI) holds significant importance in education due to its transformative potential across various aspects of teaching and learning.

**Personalized Learning:** AI algorithms analyze student data to tailor educational content to individual needs, learning pace, and preferences. Adaptive learning systems can recommend resources, quizzes, or lessons based on student performance. Examples: Platform like Squirrel AI and Content Technologies Inc. use AI to create customized learning paths, (Luckin, Holmes, Griffiths & Forcier, 2016).

### **3. Automated Grading and Assessment**

This enhances teaching efficiency; AI automates administrative tasks such as grading, attendance tracking, and lesson planning, freeing up teachers' time to focus on designing engaging lessons and providing personalized support to students, (Shermis & Burstein, 2013), reported that AI can reduce teacher workload by automatically grading multiple-choice tests, short answers, and even essays using natural language processing (NLP). Example: ETS's e-rater engine uses AI to assess writing qualities in standardized tests.

### **4. Virtual Assistants and Chatbots**

This facilitates students learning as AI-powered tools assist in interactive simulations, virtual learning can significantly increase student engagement by offering interactive and immersive learning experiences.

AI-powered chatbots can assist students by answering FAQs, providing reminders, and supporting administrative processes like course registration or fee inquiries. Example: **Georgia State University's Pounce bot** reduces summer melt by engaging students via SMS, (Page & Gehlbach, 2017).

### **5. Predictive Analytics**

AI system can analyse trends in student performance to identify at-risk students early and recommend interventions, thereby improving retention and success rates, (Baker, 2019).

### **6. Curriculum Development and Resource Management**

AI can assist in identifying curriculum gaps, analyzing learning outcomes, and suggesting new learning materials aligned with national standards (Chen, Chen & Lin, 2020). AI can assist in advanced teaching methods by enabling the creation of innovative teaching methods, such as adaptive learning systems that adjust content in real time based on student responses. This flexibility allows educators to tailor instruction to meet individual learning needs effectively.

## **Statement of the Problem**

AI importances in education are inexhaustible due to increasingly prevalent needs in various sectors, of education. Inculcating AI tools into classrooms assists in preparing the students for future careers by equipping them with essential digital literacy and problem-solving skills.

Considerations on ethical and responsible use in fully understanding the importance of AI in education involves addressing ethical concerns, such as data privacy, algorithmic bias, and ensuring equitable access to AI-driven educational resources. Educators and policymakers perform a key role in ensuring the responsible integration of AI technologies in educational sectors.

Through personalized learning experiences, AI has been able to enhance its potential in revolutionizing education, improving teaching efficiency, encourage innovation in pedagogy, and preparing students for the evolving demands of the digital age.

Therefore, it is essential to approach AI adoption in education thoughtfully, considering both the opportunities, challenges and constraints it dispenses.

Concerted curricular and pedagogical initiatives, with the inclusion of the introduction of contemporary subjects such as Artificial Intelligence, will be undertaken to develop these various important skills in students at all levels as observed by the National Education Policy 2020. Hence, it has become patent that adequate research on the application of artificial intelligence for teaching sciences in government owned colleges of education in Enugu state: lecturer's standpoint is analyzed.

### **Purpose of the Study**

1. Ascertain educational AI tools that lecturers are aware of in government owned colleges of education in Enugu state.
2. Ascertain the extent of usage of AI tools for teaching and research between male and female lecturers of government owned colleges of education in Enugu state.
3. Ascertain constraints to awareness and use of AI tools by lecturers in government owned colleges of education in Enugu State.

### **Research Questions**

1. Which educational AI tools are lecturers in government owned colleges of education in Enugu State aware of?
2. What is the extent of usage of AI tools for teaching and research between the male and female lecturers of government owned colleges of education in Enugu state?
3. How can some of the constraints be attended to?

### **Research Hypothesis**

1. There is no significant difference in the awareness of AI tools for teaching and research among male and female lecturers of government owned colleges of education in Enugu State.

### **Methods**

This study conducted at government owned colleges of education in Enugu state (Federal College of Education, Eha-Amufu and Enugu State College of Education Technical), it adopted a descriptive survey research design. The population for the study comprised of 650 lecturers at the both colleges from 6 different schools. A sample size of 218 respondents was randomly selected from the population using stratified random sampling techniques. The research instrument was a 17-item questionnaire centered on awareness of the listed AI tools for teaching and research. The instrument was thereby validated by three experts from the Department of Measurement and Evaluation at the Federal College of Education, Eha-Amufu, Enugu State. Their comments and suggestions led to the modification of the items in the questionnaires. All the items in the questionnaire were judged to be relevant to what is being measured thereby ensuring adequate content and face validity of the instrument. The research instrument was administered to the population sample using

WhatsApp. Out of the 218 questionnaire distributed, only 196 were duly filled and returned giving a return rate of 91.1%. Data collected from the survey were analysed using SPSS software version 23. The research questions were answered using mean and standard deviation scores. The decision rule was that means scores 2.5 and above is accepted significant awareness while means scores below 2.5 were rejected. Independent samples t-test was used to compare mean scores of male and female lecturers as it is best suited for it. Percentage rate was used to analyse question 3 and it was observed that 97 % of the listed items were in agreement with the factors been the constraints while 3 % were in disagreement with the constraints. The basic assumptions of normality and homogeneity of variance required for tests were checked and none of them was violated. The null hypotheses were rejected when the calculated sig. value was less than 0.05; on the other hand, the researchers fail to reject the null hypotheses when the sig. value was more than 0.05.

## **DATA COLLECTION/ANALYSIS/ INTERPRETATION**

### **Findings**

#### **Research Question 1**

1. Which educational AI tools are lecturers in government owned colleges of education in Enugu State aware of?

**Table 1:** Lecturers' mean score on their awareness of AI tools for teaching and research

| S/N | Item                     | N   | $\bar{X}$ | STD | Decision |
|-----|--------------------------|-----|-----------|-----|----------|
| 1   | Gradescope               | 196 | 2.36      | .88 | Rejected |
| 2   | PowerPoint Speaker Coach | 196 | 2.76      | .67 | Accepted |
| 3   | ClassPoint               | 196 | 2.66      | .86 | Accepted |
| 4   | MATHia                   | 196 | 2.25      | .83 | Rejected |
| 5   | AudioPen                 | 196 | 2.28      | .84 | Rejected |
| 6   | Eduaide                  | 196 | 2.34      | .82 | Rejected |
| 7   | ChatGPT                  | 196 | 3.26      | .67 | Accepted |
| 8   | Medley                   | 196 | 2.36      | .85 | Rejected |
| 9   | Consensus                | 196 | 2.27      | .81 | Rejected |
| 10  | Research Rabbit          | 196 | 2.44      | .82 | Rejected |
| 11  | Quillbot                 | 196 | 2.88      | .69 | Accepted |
| 12  | Scholarcy                | 196 | 2.24      | .80 | Rejected |
| 13  | Scite                    | 196 | 2.23      | .75 | Rejected |
| 14  | ChatPDF                  | 196 | 2.72      | .70 | Accepted |
| 15  | Perplexity               | 196 | 2.64      | .76 | Accepted |
| 16  | Gemini                   | 196 | 2.89      | .67 | Accepted |
| 17  | Guath                    | 196 | 2.29      | .82 | Rejected |
|     | Cumulative Mean          |     | 2.52      |     | Accepted |

Data presented in Table 1 show that only seven items out of the seventeen items received mean score above 2.5 while 10 items received mean scores below 2.5. The seventeen items received a cumulative score of 2.52 which is slightly above the

benchmark of 2.5, hence it was concludes that the lecturers were aware of AI tools for teaching and research. But it can also be deduced that there is insufficient awareness of most of the AI tools listed.

### Research Question 2

What is the extent of usage of AI tools for teaching and research between the male and female lecturers of government owned colleges of education in Enugu state?

**Table 2:** Extent of usage of AI tools for teaching and research between the male and female lecturers of government owned colleges of education in Enugu state.

| Extent of usage between male and female lecturers | N   | $\bar{X}$ | STD  | Mean Diff. |
|---------------------------------------------------|-----|-----------|------|------------|
| Male                                              | 108 | 41.56     | 8.96 | .16        |
| Female                                            | 88  | 41.40     | 8.71 |            |

Table 2 show that the extent of usage of AI tools for teaching and research mean score of male lecturers is ( $M = 41.56$ ,  $SD = 8.96$ ) and that of the female lecturers is ( $M = 41.40$ ,  $SD = 8.71$ ). Though there is a slight difference in the mean of the two groups, the difference is .16 which is not really significant.

### Research Question 3

What are the constraints of using AI tools by the lecturers at government owned colleges of education in Enugu State for teaching and researching?

**Table 3:** The constraints of using AI tools by the lecturers at government owned colleges of education in Enugu State for teaching and researching?

| S/N | ITEMS                                                                   | PERCENTAGE(%) | DECISION  |
|-----|-------------------------------------------------------------------------|---------------|-----------|
| 1.  | Inadequate power supply to sustain the gadgets.                         | 100           | AGREED    |
| 2.  | High cost of data.                                                      | 100           | AGREED    |
| 3.  | Lack of awareness to on how to use some of the gadgets/applications.    | 94            | AGREED    |
| 4.  | Adapting new technology.                                                | 94            | AGREED    |
| 5.  | Not digital competent.                                                  | 94            | AGREED    |
| 6.  | Unable to easily adapt technical advancement and allied infrastructure. | 80            | AGREED    |
| 7.  | None availability of the gadgets in the institutions.                   | 90            | AGREED    |
| 8.  | Poor internet coverage.                                                 | 90            | AGREED    |
| 9.  | AI is not versatile enough for some field of studies.                   | 90            | AGREED    |
| 10. | Dislike of AI.                                                          | 95            | DISAGREED |

|     |                                               |    |           |
|-----|-----------------------------------------------|----|-----------|
| 11. | Some AI tools require constant subscriptions. | 95 | AGREED    |
| 12. | AI does not always give accurate information. | 95 | DISAGREED |

Out of the 196 dully filled and returned questionnaire, item 1 and 2 had 100% acceptance and in agreement, item 3, 4 and 5 had 94% acceptance and in agreement, item 7, 8 and 9 had 90% acceptance and in agreement, item 6 and 11 had 80% acceptance and in agreement while item 10 and 12 had 95% acceptance in disagreement. Hence, it can be deduced that about 97% of the listed items are constraints of using AI tools while about 3% are not in agreement or constraints of using the AI tools.

### Hypothesis 1

There is no significant difference to the extent of usage of AI tools for teaching and research between the male and female lecturers of government owned colleges of education in Enugu State.

**Table 4:** Summary of t-test of significant mean difference on awareness based on gender

| Extent of usage of AI tools for teaching and research between male and female lecturers | N   | Mean  | SD   | T    | Df  | p-value | Decision        |
|-----------------------------------------------------------------------------------------|-----|-------|------|------|-----|---------|-----------------|
| Male                                                                                    | 108 | 41.56 | 8.96 | .096 | 196 | .919    | Not Significant |
| Female                                                                                  | 88  | 41.40 | 8.71 |      |     |         |                 |

Data presented in Table 4 show that there was no significant difference in mean scores on the extent of usage of AI tools for teaching and research between the male and female lecturers ( $M = 41.56$ ,  $SD = 8.96$ ) and ( $F = 8.71$ ,  $SD = 8.71$ ;  $t(193) = 0.96$ ,  $p = .919$  two tailed). The inference was based on the p-value of .919 which is more than the significant level of 0.05. Therefore, the researchers fail to reject the null hypothesis.

### Discussion

The findings of the study have revealed that the lecturers in Government owned Colleges of Education in Enugu State who participated in the survey were not aware of a majority of the AI tools that can be used in teaching. However, a closer look at the details indicates that the lecturers are only aware of PowerPointSpeaker, ClassPoint, ChatGPT, Quillbot, ChatPDF, Perplexity, Gemini. AI tools out of the 17 listed for the study. This infers that the lecturers may be moderately aware of the AI tools that are being developed with swift. Being aware of a particular set of tools may not be enough hence lecturers should keep up with AI technological developments if they must be part of their countless aids in education. This result supports the findings of Nyaaba, et al., (2024), and Ghimire, Prather & Edwards (2024) that reported

increasing awareness of lecturers of AI tools for teaching and learning. It also shows discrepancy with Madu & Musa (2024) that were of the opinion that moderate awareness of these tools on the part of Government owned Colleges of Education in Enugu State lecturers. This could be due to the fact that these tools are fast evolving at a speed that lecturers are yet to be abreast with due to the dynamic nature of technology. It has also been noted by the findings of this study that there is no difference in awareness of AI tools for teaching and research between male and female lecturers who participated in the study. This result aligns with a research carried out at the Federal University of Technology Minna by Thomas (2022).

## **Conclusion**

There is no doubt with the integration of some current trends in technology such as (AI) into the curriculum; it will be of numerable benefits to lecturers in tertiary educational institutions. The integration of these technologies into higher education has become imperative as it's characterized by rapid advancements in Information Technology (IT). It is evident from the study that lecturers at Government owned Colleges of Education in Enugu State are aware of some AI teaching and research tools with no significant difference between male and female lecturers. There are no differences in awareness of these tools by neither the male nor female lecturers. The importance of integration of AI into teaching and research is numerous and the lecturers at Government owned Colleges of Education in Enugu State cannot be left out as a result of lack of awareness of relevant tools.

## **Recommendations**

Based on the findings of this research work, the following recommendations have been made.

1. Government owned Colleges of Education in Enugu State authorities should as a matter of necessity mount mandatory awareness workshops and trainings for the different school staff on emerging AI technologies to enable them to be well informed about how to integrate them into teaching and research.
2. Ethical consideration should be addressed by the colleges establishing guideline to be followed in the integration of AI in curriculum thereby promoting transparency and fairness in AI-enabled assessment practices.
3. Further studies should be carried out in the named colleges of educations to ensure that there is an upgrade in the awareness and also in other colleges and universities.

## **References**

- Baker, R. S. (2019). Challenges for the future of educational data mining: The Baker Learning Analytics Prize. *Journal of Educational Data Mining*, 11 (1): 1 - 17.
- Bearman, M., Ryan, J., & Ajjawi, R. (2022). Discourses of artificial intelligence in higher education: A critical literature review Higher Education. 0.1007/s10734-022-00937-2.
- Bello, I. K., Olabimitan, E. O., Hamza, S. N., Nafisatu, S. A., Eze, L. E., & Haruna, A. E. (2024). Leveraging artificial intelligence for enhancing entrepreneurship and creativity in stem education. *Journal of Educational Research and Practice*, 4(8).

- Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review, *IEEE Access*, 8, 75264 – 75278.
- Ghismire, A., Prather, J., & Edwards, J. (2024). Generative AI in education: A study of Educators' Awareness, Sentiments, and Influencing Factors. Retrieved from <https://arxiv.org/pdf/2403.15586v1>.
- Haenlein, M., & Kaplan, A. (2019). A brief history of artificial intelligence: On the past, present, and future of artificial intelligence. *California Management Review*, 61(4) : 5-14
- Hermansyah, M., Najib, A., Farida, A., Sacipto, R., & Rintyarna, B. S. (2023). Artificial intelligence and ethics: Building an artificial intelligence system that ensures privacy and social justice. *International Journal of Science and Society*, 5(1):154–168. <https://doi.org/10.54783/ij soc.v5i1.644>.
- IBM. (2023). Understanding the different types of artificial intelligence. IBM Blogs. <https://www.ibm.com/blog/understanding-the-different-types-of-artificial-intelligence/>.
- Lee, Y. F., Hwang, G. J., & Chen, P. Y. (2022). Impacts of an AI-based chatbot on college students' after-class review, academic performance, self-efficacy, learning attitude, and motivation. *Educational Technology Research and Development*, 70(5), 1843–1865. <https://doi.org/10.1007/s11423-022-10142-8>.
- Lin, P., & Van Brummelen, J. (2021). Engaging teachers to Co-design integrated AI curriculum for K-12 classrooms. Proceedings of the CHI conference on human factors in computing systems, pp. 1-12.
- Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence unleashed: An argument for AI in education. Pearson Education.
- Madu, C. O., & Musa, A. (2024). Lecturers' level of awareness of artificial intelligence as correlate of their digital competence at Federal University Wukari, Nigeria. *Journal of Education Research in Developing Areas*, 5(1) : 59-67.
- Maarten, R., & Aizhan, T. (2024). The future of work of academics in the age of Artificial Intelligence: State-of-the-art and a research roadmap. *Elsevier*, 163; 103453 - 103461.
- Mishra, L. (2020). Conception and misconception in teaching arithmetic at primary level. *J Crit Rev*, 7 (5) : 936-939.
- Nyaaba, M., Kyeremeh, P., Majialuwe, E. K., Owusu-Fordjour, C., Asebiga, E., & A-ingkonga, B. (2024). Generative AI in academics research: A Descriptive Study on Awareness, Gender Usage, and Views among Pre-Service Teachers. *Journal of AI*, 8(1) : 45 – 60.
- Onwuagboke, B. B. C., Nnajiето, C. C., Nzeako, R. C., & Umune, H. C. (2024). Lecturers awareness of artificial intelligence tools for teaching and

- research in Alvan Ikoku federal university of education, Nigeria. *Afropolitan Journal*, 17 (1): 1-14.
- Oye, N. A., Iahad, N., Madar, M. J., & Rahim, N. (2012). The impact of e-learning on students' performance in tertiary institutions. *International Journal Computer Networks Wireless Communications*, 2(2), 121–130.
- Page, L. C., & Gehlbach, H. (2017). How an artificial intelligent virtual assistant helps students navigate the road to college. *AERA Open*, 3 (4).
- Parthiban, V., & Ganesh, B. J. (2024). A Study on Awareness of Artificial Intelligence (AI) Tools among Prospective Teachers of Namakkal District. *International Journal of Innovative Science and Research Technology*, 9 (7) : 2456-2165.
- Radford, L. (2014). Towards an embodied, cultural, and material conception of mathematics cognition. *ZDM*, 46 (3): 349-361.
- Russell, S., & Norvig, P. (2022). *Artificial Intelligence: A Modern Approach*, 4th, Global ed. Pearson Education Limited.
- Sanusi, I. T., Oyelere, S. S., Agbo, F. J., & Suhonen, J. (2021). Survey of resources for introducing machine learning in K-12 context. *Frontiers in education conference*, pp. 1- 9.
- Sanusi, I. T., Oyelere, S. S., & Omidiora, J. O. (2022). Exploring teachers' preconceptions of teaching machine learning in high school: A preliminary insight from Africa. *Computers and Education Open*, 3 : 100072 – 100080.
- Shermis, M. D., & Burstein, J. (2013). *Handbook of Automated Essay Evaluation: Current Applications and New Directions*. Routledge.
- Strohmeier. (2022). Artificial intelligence in human resources-an introduction In *Handbook of Research on Artificial Intelligence in Human Resource Management*, Edward Elgar Publishing, pp. 1-22.
- Thomas, G. (2022). Assessment of lecturers' awareness, readiness and utilization of artificial intelligence for education in a Nigeria university. (Masters Thesis) submitted to Federal University of Technology Minna.
- Vanlehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. *Educational Psychologist*, 46 (4): 197 – 221.
- Xia, Q., Chiu, T. K., Lee, M., Sanusi, I. T., Dai, Y., & Chai, C. S. (2022). A self-determination theory (SDT) design approach for inclusive and diverse artificial intelligence (AI) education. *Computers and Education*, 189 : 104582 – 104582.