# Impact Of Artficial Intelligence (AI) In Teaching And Learning Of Physics Education In Secondary Schools In Otuocha Education Zone

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*Abstract*
*This study investigated the impact of artificial intelligence in teaching and learning of physics education in secondary schools in Otuocha education zone. Three research questions were formulated to guide the study. Descriptive survey design was used for this study. The sample of the study comprises of 20 secondary school physics teachers which was selected using total population sampling technique and 150 secondary school physics inclined students who were randomly selected using simple random sampling technique. The instrument used for data collection was a 15 items structured questionnaire with four degree of responses of strongly agreed (SA=4), agreed (A=3), disagree (D=2) and strongly disagree (SD=1). The instrument was face and content validated by experts in the field of measurement and evaluation as well as experts in physics. A trial test was administered and reliability index of 0.86 was obtained using Cronbach Alpha. The data collected were analyzed using mean and standard deviation. The findings revealed that AI systems can analyze data and understand individual student learning patterns by adjusting the material's content, teaching methods, and difficulty level to meet each student's needs and understanding. The study concluded that Artificial Intelligence (AI) has the potential to revolutionize physics education in Nigeria, paving way for sustainable futures. It is recommended that AI should be integrated into teaching and learning of physics from secondary schools in order to prepare students into tertiary institution.*

***Keywords:*** *Impact, Artificial Intelligence, Teaching, Learning & Physics Education.*

## Introduction

Physics is the study of energy and its interaction with matter. It is one of the pre- requisite subjects for the study of engineering, medical and other applied science courses in the university. Physics is the bridge between science and technology because many of the tools on which the scientific and technological advancement depend are the direct products of physics (Ukoh & Nicholas, 2022). It is necessary to have vast knowledge of physics concepts in order to have good understanding of the complexities of modern technology and sustainable technological advancement of a nation. Some of the contributions of physics can be seen in the fabrication of electronic devices such as diodes, transistors, resistors and integrated circuits which are basic components of radio transmitters and receivers, computers, televisions, modern machines such as x-rays machines used in the health sector for taking the images of the internal structures of patients and treatment of cancer. The development of solar energy which involves preservations and utilization of sun light for electric power generation are among the contributions of physics knowledge. It is very fundamental to technological development hence, there is need to lay a good foundation for integrating artificial intelligence (AI) to enhance pedagogies and provide greater opportunity for

improving teaching and learning physics.

**Definition of Artificial Intelligence**

Artificial Intelligence has many different definitions. In the headlines of newspaper articles, AI is a machine that thinks, understands languages, solves problems, diagnoses medical conditions, keeps cars on the highways and plays chess. AI is often defined as a computer system with the ability to perform tasks commonly associated with intelligent beings. As this definition somewhat problematically requires us to define intelligence and is inconveniently tautological, artificial intelligence is now commonly defined as a scientific discipline; as the activity that creates machines that can function appropriately and with foresight in their environment, (Bruner, 1986). The first explicit definition of artificial intelligence was suggested in a funding proposal to the Rockefeller Foundation in 1955. It was based on the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. This early definition rapidly led to deep controversies. In practice, the early developers of AI interpreted intelligence and thinking as mechanical processing of logical statements, thus, in effect, defining human intelligence as computation of truth values.

AI is currently high on the political and research agendas around the world. With the emergence of every new technology, there is always both a lot of hype and skepticism around its implications for society and the economy. Although acknowledging that the foundations for AI have been already around for several decades, recent technological breakthroughs are accelerating what AI could do.

All human actions are based on anticipated futures. We cannot know the future because it does not exist yet, but we can use our current knowledge to imagine futures and make them happen. To appreciate the opportunities and challenges that artificial intelligence (AI) creates, we need both good understanding of what AI is today and what the future may bring when AI is widely used in the society. AI can enable new ways of learning and teaching in education and it may also change the society in ways that pose new challenges for educational institutions. It may amplify skill differences and polarize jobs or it may equalize opportunities for learning. The use of AI in education may generate insights on how learning happens and it can change the way learning is assessed. It may re-organize classrooms or make them obsolete, it can increase the efficiency of teaching or it may force students to adapt to the requirements of technology, depriving humans from the powers of agency and possibilities for responsible action.

Autor (2015), estimated that almost half of U.S. jobs were at a high risk of becoming automated, AI has been on top of policymakers' agenda. Many studies have replicated and refined this study and the general consensus now is that AI will generate major transformations in the labor market. Many skills that were important in the past are becoming automated and many jobs and occupations will become obsolete or transformed when AI will be increasingly used.

**Two Types of Artificial Intelligence**

The history of AI can relatively clearly be categorized into three alternative approaches: *databased, logic-based*, and *knowledge-based.* The first of these is now also called artificial neural networks and machine learning. Perhaps surprisingly, the recent successes in AI also represent the oldest approach to AI.

**Data-based Neural Artificial Intelligence**

Mathematical models of neural networks were first developed by Nicolas Rashevsky in the early 1930s (Engestrom, Virkkunen, Helle, Pihlaja & Poikela, 1996) and they became famous when his student Walter Pitts interpreted biological neural networks in 1942 as networks of logical switches. The publication of these ideas by Warren McCulloch and Pitts occurred at a time when Alan Turing had shown that formal logic can be

mechanized and the first digital computers were being developed (EPSC, 2018). It was therefore quickly recognized that all formal logical operations could be simulated by such neural networks. Brain started to look like a computer and the computer became known as the electronic brain. This twoway metaphor has since then become widely influential. It underpins cognitive science and research in organizational information processing and now influences economics and many areas of scientific and popular thinking (Ferguson, Clow, Cooper, Hillaire, Mittelmeier, Rientes, Ullmann, & Vuorikari, 2016).

The present neural AI is to a large extent based on neural network models that were informed by neurobiology. An important early contribution was made by Frank Rosenblatt (1958), when he inspired by neuropsychologist Donald Hebb's idea that learning occurs in neural networks through synaptic modifications and economist Friedrich Hayek's work on distributed learning—suggested that learning in biological neural networks could be modelled as gradual change in network connections (Freire, 1972). The multi-layer photo-perceptron described by Rosenblatt is in many ways identical to current state-of-the-art image processing neural networks (Frey, 2013). Its main difference with today's neural AI systems is that modern systems have very many neural layers and deep learning in such multi-layer networks is done using machines that are about trillion times faster than the IBM 704 computer that Rosenblatt used for his experiments.

**Logic- and Knowledge-based Artificial Intelligence**

Neural network models were popular in the 1950s and 1960s. They were also a key area of study—among learning, language, creativity and abstraction—in the Dartmouth summer research project in 1956 that established the term Artificial Intelligence. Although work continued on neural networks, research on AI soon moved to symbolic processing. As mathematicians and logic-oriented philosophers had since Hilbert and Russell believed that logical truths could be derived by formal manipulation of sentences, it was apparent that computers could do all those inferences that are logical. A pioneering effort in this line of AI was the Logic Theorist, developed by Allen Newell, John Shaw and Herbert Simon over the Christmas break in 1955. It was able to manipulate logical statements and derive proofs for logical theorems, and its creators were certain that they had produced a machine that thinks. The Logic Theorist was soon followed by the General Problem Solver that was supposed to be able to solve any logically well- defined problem that had a solution. This logic-oriented approach to AI was the dominant one from the late 1950s to early 1970s (Gane, Sania & James, 2018).

By the 1970s, it was generally acknowledged that human thinking cannot be simulated just by formal manipulation of logical statements. As a result, domain-specific knowledge and different ways of representing knowledge became the central focus of AI research. This led to what is now known as expert systems or more broadly, knowledge-based systems. Early examples of these include the SHRDLU natural language understanding program and the MYCIN medical diagnostic system that recommended antibiotics and their dosage based on the symptoms and the patient. Knowledge-based systems typically consisted of a relatively general inference engine and a domain-specific knowledge base that was used to make inferences based on human input. In particular, in expert systems, domain knowledge tried to imitate knowledge structures used by human experts. Expert systems were very popular in the 1980s, with two thirds of Fortune 500 companies using them in the daily activities. Since then they have been widely used in various sectors of economy, for example in the financial sector, logistics, semiconductor chip design, manufacturing planning and business process automation. Many expert systems have also been developed for learning and education since the early 1980s.

The interest in knowledge-based AI waned

towards the end of 1980s as it became clear that the development of domain-specific knowledge bases required specialized knowledge engineers and also because the spread of computer networking and the Internet shifted the interests towards system integration and automation of routine business processes. Many ideas from stand-alone expert systems are now widely used in standard programming environments. As the boom of knowledge-based AI decayed at the end of the 1980s, neural AI research became again popular for a few years. Difficulties associated with parallel programming and system integration, however, kept most neural AI systems in university laboratories and attention moved to new areas such as mobile computing and the World-Wide Web.

**The Use of Artificial Intelligence in Physics Education and Teaching**

**Personalizing and Enhancing Education:** One of the primary goals of using artificial intelligence in education is to improve the learning experience for each student. By leveraging this technology, education can be personalized and enhanced in various ways. One of these methods is analyzing student data, where data related to academic performance, test responses and interaction patterns with educational content can be collected and analyzed. This helps in understanding the individual needs of each student, thereby enhancing the effectiveness of education. Based on these analyses, personalized learning guidance can be achieved where each student is directed toward a learning path that aligns with their current level and individual learning style. This approach allows students to engage with the content in a way that suits their unique needs. Moreover, personalized educational content can be provided to meet students' needs. The existing content can be adjusted or additional educational resources can be made available to ensure that it accurately meets each student's requirements.

Regarding progress monitoring and performance evaluation, artificial intelligence can track students' progress and assess their performance periodically. This provides an opportunity to offer suggestions for adjustments in instructional guidance based on students' needs. AI can also provide immediate educational assistance to students during the learning process. Whether through direct guidance or offering additional explanations, this contributes to enhancing students' understanding of the educational content. Ultimately, AI can be utilized to improve the online learning experience through digital learning platforms. This allows for the creation of a personalized and effective learning experience for each student, thereby enhancing their academic outcomes.

In summary, through these methods, artificial intelligence can effectively achieve personalized education, enhancing the learning experience and boosting students' academic success (Abdul Rahman Al-Omari, 2020).

**Curriculum Development:** Personalization and improvement of education are among the primary objectives of using artificial intelligence in education. By analyzing student data, it is possible to collect and analyze information related to academic performance, test responses and interaction patterns with educational content. This process contributes to understanding the individual needs of each student thereby enhancing the effectiveness of education and improving the learning experience. Based on these analyses, personalized learning guidance can be achieved. Each student is directed toward a learning path that aligns with their current level and individual learning style. This approach enables students to interact with the content in a way that suits their unique needs.

Moreover, personalized educational content can be provided to meet the needs of students. Existing content can be modified or additional educational resources can be offered to ensure that it precisely meets the requirements of each student. This helps enhance students' understanding and facilitates their absorption of information. In addition, artificial intelligence can monitor students' progress and assess their performance periodically. This can provide an

opportunity to offer suggestions for adjustments in educational guidance according to students' needs. It also allows for providing immediate educational assistance to students during the learning process, whether through direct instructions or by offering additional explanations.

In conclusion, artificial intelligence can be used to enhance the online learning experience through digital learning platforms. This allows for the creation of a personalized and effective learning experience for each student, thereby improving their academic outcomes. Thus, it can be said that artificial intelligence significantly contributes to the customization and improvement of education, enhancing students' success in various educational fields.

**Enhancing the Learning Experience:** Smart technologies such as machine learning and data analysis can be used to enhance the educational experience. By utilizing these technologies, engaging and interactive learning experiences can be provided to students, motivating them to participate and learn effectively. For example, machine learning can be used to analyze students' responses and interests, allowing for the provision of educational content tailored to their personal interests and learning styles. Additionally, data analysis can help identify students' behavioral patterns and better understand their learning methods, enabling a more precise and effective direction of the educational process. Thus, this intelligent use of technologies contributes to enhancing the learning experience and motivating students to achieve better outcomes and further develop their skills.

**Providing Immediate Feedback and Accurate Assessments:** Artificial intelligence can provide immediate feedback and accurate assessments of student performance, helping them identify strengths and weaknesses and improve their performance effectively. Offering this immediate feedback can be a motivating factor in enhancing the learning experience. Through the use of AI, student performance can be thoroughly analyzed and precise assessments can be provided, highlighting strengths and weaknesses. This allows students to better understand their performance and identify areas that need improvement. Additionally, the instant feedback from AI can guide students immediately toward correction and improvement, contributing to an enhanced level of understanding and overall performance.

By using this technology, students can be motivated to actively engage in the learning process, encouraging them to make the most of their educational experience. Ultimately, artificial intelligence contributes to the development of effective teaching strategies that support student success and help them achieve their academic goals (Hussein & Rasheed, 2018).

**Developing Smart Educational Tools:** Artificial intelligence can be used to develop innovative and intelligent educational tools, contributing to enhancing the learning experience and making it more enjoyable and effective. For example, AI-based educational applications and games can be created to allow students to learn challenging concepts in interactive and engaging ways. Additionally, game-based learning and virtual simulations can be employed to provide realistic and interactive learning environments where students can actively engage with educational materials and experiment with concepts in a practical manner.

**Objectives of the Study**

1. The general objective of this study is to determine the impact of AI in teaching and learning of Physics education in secondary schools in Otuocha education zone:
2. Identify how Artificial Intelligence can be effectively integrated into physics education to promote sustainable futures in Nigeria.
3. Determine the challenges of using AI in physics education in secondary schools in Otuocha education zone.

**Research Questions**

1. What are the impact of AI in teaching and learning of physics education in secondary schools in Otuocha education zone?
2. How can Artificial Intelligence be effectively integrated into physics education to promote sustainable future in Nigeria?
3. What are the challenges of using AI in physics education?

**Method**

The study adopted a descriptive survey design. The population of the study comprises of 20 secondary school physics teachers which were selected using total population sampling technique due to the low number of physics teachers and 150 secondary school physics students who were randomly selected using simple random sampling technique. The instrument used for data collection was a structured questionnaire with 15 items, four degree of responses of strongly agreed (SA=4), agreed (A=3), disagree (D=2) and strongly disagree (SD=1). The instrument was validated by expert in the field of measurement and evaluation and physics and after, a reliability coefficient of 0.86 was obtained using Cronbach Alpha.

The data collected using questionnaire were analyzed using mean and standard deviation.

**Result**

**Research Question 1:** What are the Impacts of AI in teaching and learning of physics in secondary schools in Otuocha education zone?

**Table 1: Mean and Standard Deviation of Respondents on the Impact of AI in Teaching and Learning of Physics**

| s/n | Item | Mean | stdv |
|---|---|---|---|
| 1 | Personalized approach with AI help me grasp science concepts more effectively and at my own pace | 2.31 | 1.03 |
| 2 | AI-powered systems provide customized learning materials and real- time feedback for me to understand complex science concepts. | 3.15 | 0.94 |
| 3 | Virtual experiments, simulations, and games stimulate and foster a deeper understanding of physics principles. | 3.25 | 1.06 |
| 4 | AI help me visualize abstract concepts, and make predictions based on real-world data | 3.11 | 0.83 |
| 5 | AI can facilitate collaborative learning experiences by connecting students from different parts of Nigeria | 2.20 | 1.24 |
| 6 | AI can analyze students' learning patterns and preferences to tailor educational content to their individual needs | 2.52 | 1.04 |
| | **Aggregate Mean and Standard Deviation** | **2.82** | **1.05** |

simulations, and games can stimulate and foster a deeper understanding of physics principles since it has the highest mean of 3.25 and standard deviation of 1.06. AI can be used as a research assistant tool for science students and educators with mean of 3.20 and standard deviation of 1.20. This is followed by AI-powered systems provide customized learning materials and real-time feedback for understanding complex science concepts with mean of 3.15 and standard deviation of 0.94. AI can analyze students' learning patterns and preferences to tailor educational content to their individual needs with mean of 2.52 and standard deviation of 1.04. Since the aggregate mean value of 2.82 is above the criterion mean of 2.5, all the above mentioned items are considered to be the impacts of AI in teaching and learning of physics education in secondary schools.

**Research Question 2:** How can Artificial Intelligence be effectively integrated into physics education to promote sustainable futures in Nigeria?

**Table 2: Mean and Standard Deviation of Respondents Response on how to Integrating AI in Physics Education to Promote Sustainable Future in Nigeria**

| s/n | Item | Mean | stdv |
|---|---|---|---|
| 1 | Providing equitable access to AI tools and resources can promote sustainable futures in Nigeria | 3.21 | 1.02 |
| 2 | AI can be used as a research assistant tool for physicists and educators | 2.42 | 0.87 |
| 3 | By promoting inclusivity and ensure that all learners have equal opportunities to use AI in their education journeys towards sustainable futures in Nigeria | 2.46 | 1.32 |
| 4 | AI can be used to help students visualize abstract concepts, test hypotheses, and make predictions based on real-world data | 3.14 | 1.14 |
| 5 | Through interactive simulations and virtual laboratories. AI technologies can enable sustainable future. | 3.82 | 0.74 |
| | **Aggregate Mean and Standard Deviation** | **3.01** | **1.02** |

Table 2 revealed that through interactive simulations and virtual laboratories, AI technologies can enable sustainable future because it has the highest mean value of 3.82; also providing equitable access to AI tools and resources can promote sustainable future in Nigeria (mean value of 3.21 and standard deviation of 1.02). AI can be used to help students visualize abstract concepts, test hypotheses and make predictions based on real-world data (mean value of 3.14 and standard deviation of 1.14). Thus, the aggregate mean value of 3.01 shows that all the items indicated how AI can be effectively integrated into physics education to promote sustainable future in Nigeria through interactive simulations and virtual laboratories, providing equitable access to AI tools and resources.

**Research Question 3:** What are the challenges of using AI in physics education in Secondary Schools in Otuocha Education Zone?

**Table 3: Mean and Standard Deviation of Respondents Responses on the Challenges of using AI in Physics Education in Secondary Schools in Otuocha Education Zone**

| s/n | Item | Mean | stdv |
|---|---|---|---|
| 1 | There is no restriction on any student when using AI in my institution | 3.21 | 1.12 |
| 2 | There is adequate assistive technologies like text-to-speech software or closed captioning for video content for learners with disabilities | 2.31 | 1.10 |
| 3 | We have adequate technological infrastructure and resources in my institution to support the implementation of AI | 2.45 | 0.76 |
| 4 | Lack of regular power supply, hinder our engagement with AI- powered educational tools. | 3.46 | 1.02 |
| 5 | There is sufficient funds allocated for acquiring and maintaining AI technologies for educational purposes | 1.34 | 0.54 |
| 6 | There are barriers that hinder student engagement with AIpowered educational tools | 2.32 | 1.03 |
| | **Aggregate Mean and Standard Deviation** | 2.52 | 0.93 |

In Table 3, lack of regular power supply with mean of 3.46 and standard deviation of 1.02 is the most challenging factor that hinder engagement with AI-powered educational tools. Insufficient funds allocation for acquiring and maintaining AI technologies for educational purposes is another challenge having a mean of 1.34 and standard deviation of 0.54. Other factors like inadequate technological infrastructure and resources to support the implementation of AI and no adequate assistive technologies like text-to-speech software or closed captioning for video content for learners with disabilities are also considered to be challenges.

## Discussions

From the findings of this study, AI technologies enabled the creation of interactive simulations and virtual laboratories, also with equitable access to AI tools and resources for promoting sustainable future. Students can also visualize abstract concepts, test hypotheses and make predictions based on real-world data. This finding aligned with the findings of Abbas, Ali, Manzoor, Hussain & Hussaini (2023), Da Costa, De Castro,

De Medeirous & De Pinhgo (2020), Pardamean et al., (2022) and Waladi & Tao (2023), which revealed that AI systems can analyze data and understand individual student learning patterns, by adjusting the material's content, teaching methods and difficulty level to meet each student's needs and understanding. This can help students understand physics concepts better and improve their academic performance.

The findings also revealed some challenges like lack of adequate power supply, insufficient fund for acquiring and maintaining the AI technologies and resources and inadequate assistive technologies like text-to-speech software or closed captioning for video content for learners with disabilities. It was revealed in the study of Chaudhari, Sandino, Cole, Larson, Gold, Vasanawala, Lungren, Hargreaves & Langlotz (2021), Cheah, (2021), Imran & Almusharraf, (2023) that lack of access to adequate technological infrastructure such as a stable internet connection and sufficient hardware are some of the challenges of using AI. Also, adequate teacher training and in-depth research are needed to understand and effectively utilize AI in physics learning.

## Conclusion

The study concludes that AI technologies enabled the creation of interactive simulations and virtual laboratories for teaching and learning of physics concepts. Through equitable access to AI tools and resources, students can also visualize abstract concepts, test hypotheses, and make predictions based on real-world data. Lack of adequate power supply, insufficient fund for acquiring and maintaining the AI technologies and resources are among some challenges of using AI in tertiary institutions. Therefore, Artificial Intelligence (AI) has the potential to revolutionize physics education in Nigeria, paving the way for sustainable futures. By harnessing the power of AI analytics, educators can gain valuable insights into students' performance trends, enabling timely interventions and targeted support mechanisms.

## Recommendations

The following recommendations were made:

1. Adequate funds should be provided to secondary schools by the state government in order to purchase and maintain computers for teachers and students use.
2. Teachers should be sponsored by the State government through the Ministry of Education to attend workshop and training on how to use AI tools and resources for teaching.
3. Teachers should encourage students to collaborate with AI systems on research project in exploring new areas of physics.
4. Teachers should develop AI driven games to teach physics concepts and promote interactive learning.

## References

Abbas, N., Ali, I., Manzoor, R., Hussain, T., & Hussaini, M. H. A. L. (2023). Role of Artificial Intelligence Tools in Enhancing Students' Educational Performance at Higher Levels. *Journal of Artificial Intelligence, Machine Learning and Neural Network* (*JAIMLNN) ISSN: 2799-1172, 3(05), 36–49*.

Abdul Rahman, A. (2020). *Applications of Artificial Intelligence in Education*. Saudi Arabia: Dar Al-Malahim.

Autor, David H. (2015). Why Are There Still So Many Jobs? The History and Future of Workplace Automation. *Journal of Economic Perspectives 29 (3): 3–30.* https://doi.org/10.1257/jep.29.3.3.

Bruner, J. (1986). *Actual Minds, Possible Worlds*. Cambridge, MA: Harvard University Press.

Chaudhari, A. S., Sandino, C. M., Cole, E. K., Larson, D. B., Gold, G. E., Vasanawala, S. S., Lungren, M. P., Hargreaves, B. A., & Langlotz, C. P. (2021). Prospective

deployment of deep learning in MRI: a framework for important considerations, challenges, and recommendations for best practices. *Journal of Magnetic Resonance Imaging, 54(2), 357–371.*

Cheah, C. W. (2021). Developing a gamified AI-enabled online learning application to improve students' perception of university physics. *Computers and Education: Artificial Intelligence, 2, 100032.*

Da Costa, R. D., De Souza, G. F., De Castro, T. B., De Medeiros Valentim, R. A., & De Pinho Dias, A. (2020). Identification of learning styles in distance education through the interaction of the student with a learning management system. IEEE, *Revista Iberoamericana de Tecnologias Del Aprendizaje, 15(3), 148–160*

Engeström, Y., J. Virkkunen, M., Helle, J., Pihlaja, & R. Poikela. (1996). The Change Laboratory as a Tool for Transforming Work. *Lifelong Learning in Europe 1 (2): 10–17.*

EPSC. (2018). The Age of Artificial Intelligence: Towards a European Strategy for Human-Centric Machines. *29 EPSC Strategic Notes. European Political Strategy Centre. https://ec.europa.eu/epsc/sites/epsc/files/epsc_strategicnote_ai.pdf.*

Ferguson, R., Brasher, A., Clow, D., Cooper, A., Hillaire, G., Mittelmeier, J., Rientes, B., Ullmann, T. & Vuorikari, R. (2016). Research Evidence on the Use of Learning Analytics: Implications for Education Policy. *JRC Science for Policy Report*. JRC. *http://europa.eu/!cB93Gb*

Freire, P. (1972). *Pedagogy of the Oppressed*. Harmonds Worth: Penguin.

Frey, C. B. and Michael A. O. (2013). The Future of Employment. Working Paper. Oxford: *Oxford Martin Programme on Technology and Employment. https://www.oxfordmartin.ox.ac.uk/downloads/academic/future-of- employment.pdf.*

Gane, B. D., Sania Z. Z. & James W. P. (2018). Measuring What Matters: Using Technology to Assess Multidimensional Learning. *European Journal of Education 53 (2): 176–87. https://doi.org/10.1111/ejed.12269.*

Hussein A. R. & Rasheed, D. (2018). *Artificial Intelligence in Education: Principles, Applications, and Challenges*. Jordan: Dar Wael for Publishing and Distribution.

Imran, M. & Almusharraf, N. (2023). Analyzing the role of ChatGPT as a writing assistant at higher education level: A systematic review of the literature. *Contemporary Educational* Technology, 15(4), p464.

Pardamean, B., Suparyanto, T., Cenggoro, T. W., Sudigyo, D., & Anugrahana, A. (2022). AI-based learning style prediction in online learning for primary education. *IEEE* Access, 10, 35725–35735.

Ukoh, E. E. (2016). Physics teacher effectiveness and time management: Issues in teacher education in Africa. *Gbenga Adewale Eds. pp 319 – 330.*

Waladi, T. & Tao, C. (2023). A literature review on the effect of artificial ıntelligence on education. *Journal of Human and Social Sciences, 6(2), 276-288.*