

Perception and Competence of Secondary School Teachers in Leveraging Artificial Intelligence in Lesson Delivery: A Panacea for Sustainable Global Society

¹Eden, Mabel Ini-Ibehe (PhD), ² Umoetuk, Emmanuel Usoudo

^{1&2} Department of Science Education,
Akwa Ibom State University, Ikot Akpaden

³Mbuk, Williams Ekong

Department of Science Education,
University of Uyo. Akwa Ibom State

Abstract

Although the relevance of integrating artificial intelligence (AI) in education grows, the lack of teachers' readiness hinders the leveraging of AI in schools since teachers are at the fore front of implementation. Hence, this study sought to ascertain the perception and competence of secondary school teachers in leveraging artificial intelligence in lesson delivery in Akwa Ibom State, Nigeria. Three questions were formulated to guide the study. The design of the study was a descriptive survey design with a population of 156 science teachers in the 12 secondary schools in Ibiono Ibom Local Government Area of Akwa Ibom State. A simple random sampling technique by balloting was used to select 89 secondary school science teachers in 8 public secondary schools from the study area. The instruments for data collection was a researcher made instrument titled: Leveraging Artificial Intelligence in Lesson Delivery (LAILD) Questionnaire with a reliability index of 0.82 using Cronbach alpha statistics. The data collected was analysed using descriptive statistics of mean and standard deviation. Findings of the study showed that there is a high positive perception of secondary school teachers in leveraging artificial intelligence in lesson delivery but there was a low competence of secondary school teachers in leveraging artificial intelligence in lesson delivery. Challenges of teachers in leveraging AI include lack of appropriate digital tools, educational qualification, lack of incentive from government to motivate teachers and socio-economic factors affect leveraging AI. It was concluded that teachers' perception was high but competence was low. It was recommended among others that teachers should be trained and allowed to leverage AI in their lesson delivery across the state and participate in AI creation, development and integration through Government sponsorship for sustainable global society.

Key words: Teachers, Perception, Competence, Artificial Intelligence, Lesson delivery and Secondary schools

Introduction

In the past decade, there has been a rapid global shift towards the adoption of fifth generation (5G) internet, also known as education-centric internet. Interest in utilizing artificial intelligence (AI) for educational purposes has been growing significantly. The importance of AI became evident during the lockdowns of universities and schools due to the 2019 coronavirus pandemic (Darayseh, 2023). The term artificial intelligence was initially introduced by John McCarthy in 1956.

Artificial intelligence is notoriously difficult to define and comprehend. As a result, we propose two complementary definitions: i. a collection of sciences, theories, and methods aimed at replicating the cognitive abilities of a human being using machines. Current advancements strive to enable machines to handle complex tasks previously assigned to humans (Council of Europe, 2021). ii. Machine-based systems capable of making predictions, recommendations, or decisions that impact real or virtual environments, based on human-defined objectives. AI systems engage with us and influence our surroundings, either directly or indirectly. They often operate autonomously and can adjust their behaviour by learning from the context (UNICEF, 2021).

Artificial intelligence and education (AI&ED) refer to the various intersections between AI and education, encompassing aspects such as "learning with AI," "learning about AI," and "preparing for AI." "Learning with AI" is also known as "artificial intelligence for education." On the other hand, Artificial Intelligence in Education (AIED) is an academic discipline established in the 1980s that focuses on researching AI tools to enhance learning (i.e., learning with AI).

Artificial Intelligence (AI) involves machines, particularly computer systems, simulating human intelligence processes. In education, AI plays a supportive role for instructors in their daily teaching tasks such as creating lesson plans, assigning homework, and engaging students (Wang *et al.*, 2020). Some applications of AI in education include supporting student collaboration, personalizing learning experiences, scheduling learning activities, providing adaptive feedback on learning processes, easing teachers' workload in collaborative knowledge building, predicting student dropout rates or admissions, profiling student backgrounds, monitoring progress, and automating essay grading. Despite the opportunities presented, the leveraging of AI in education lags behind expectations compared to other sectors like banking, finance, and healthcare. Some of the AI employed in education are;

- i. Virtual reality (VR) which is AI built into a very high-end computer, teaching can be done with it by evolving simulation (Eden *et al.*, 2023a; Eden *et al.*, 2023b) and interface through numerous sensorial channels. These sensorial modalities involve the senses of sight, hearing, smell, feeling aural, and others (Kundalakesi *et al.*, 2017). VR tools available for usage in the teaching of science are Labster Virtual and PhET simulation (Halabi, 2020; Xue and Wang, 2022).

- ii. Adaptive learning systems which uses technologies that are capable of adjusting to the course contents and the learners' ability are called adaptive learning. The purpose is to improve students' learning outcomes in both teachers' instruction and machine learning (Capuano & Caballé, 2020).
- iii. Teaching robots used in teaching robots include every robot that is utilized for the sole purpose of teaching and learning. When robots are used as tools, they are either utilized as a teaching tool for learners or used as an avenue to transmit knowledge as the robots are manipulated.
- iv. Intelligent tutoring system is a software used in education that has a part of AI incorporated into it. Learners' academic process pathway in terms of their assignment, readjustment in feedback and provide directions as the learning goes on.
- v. Learning analytics dashboards is an application that indicates learners' online conduct patterns in a virtually simulated instructional environment. This is termed a learning analytics dashboard. Learners' log files are monitored by the use of helping tools and digging large quantities of data to discover meaning by having a mental image of the results that will aid understanding from a surface view (Park & Jo, 2015).

Mahmoud's (2020) investigation delineated the various imminent roles that artificial intelligence (AI) plays in the realm of education. The leveraging of AI into educational practices presents opportunities for enhancements in teaching and learning outcomes. This enables students to engage in personalized learning experiences tailored to their individual needs. Abstract concepts can be elucidated in a manner conducive to student comprehension, aiding educators in identifying learning disabilities and providing students with timely feedback on their academic progress. The utilization of AI has the capacity to facilitate global education. Despite the promising prospects AI holds for the field of education, there exists uncertainty regarding the extent to which educators will embrace its integration within instructional practices (Nja *et al.*, 2023). The effectiveness of teaching is not guaranteed, as instructors have yet to fully embrace the methodologies of AI-based instruction (Ayanwale *et al.*, 2022). Consequently, this research endeavour aims to examine teachers' perspectives and proficiency in leveraging AI for the establishment of a sustainable global society.

The term "teacher perceptions" pertains to individuals' beliefs and comprehension of a particular subject matter. In the context of artificial intelligence implementation for the promotion of a sustainable global society, teachers' perceptions encompass their attitudes towards the incorporation of AI in effective lesson delivery. These perceptions are influenced by teachers' personal beliefs, which significantly impact the utilization of AI. Their beliefs shape their pedagogical knowledge and decision-making regarding the leveraging of AI to meet the educational requirements of contemporary students in the twenty-first century (Tondeur *et al.*, 2017).

Ukoh and Nicholas (2022) conducted a study focusing on teachers' perception on the utility of AI and found a substantial correlation between teachers' perceptions and their

adoption of AI. Similarly, research conducted by Li & Gu (2023) revealed that teachers are more inclined to utilize AI when they perceive minimal risks, suggesting that apprehension may arise when employing AI technologies. A study by Nja *et al.* (2023) explored the adoption of artificial intelligence in science education from the standpoint of African science educators, indicating a high level of approval for AI implementation, as evidenced by an average score of 3.00. Likewise, Buenano-Fernandez *et al.* (2019) investigated the integration of AI in computer engineering education and observed a positive enhancement in students' academic achievements.

Competence pertains to an individual's capacity to demonstrate appropriate skills and abilities in order to accomplish a specific objective. The concept of competence in utilizing artificial intelligence for sustainable global society encompasses a broader scope than just training procedures and the application of technologies within educational settings (Cabero-Almenara, *et al.*, 2023). Within the realm of AI for science education, competence extends beyond mere technology utilization in classrooms to include the optimization of its potential, the facilitation of the teaching-learning process, and the overall learning environment. It is crucial to highlight the necessity for both teachers and students to undergo training, ensuring the provision of essential resources and tools that enable active engagement in the digital society and readiness to navigate this novel educational landscape (Redecker, 2023).

In a recent investigation by García-Delgado *et al.*, (2023) concerning emerging technologies and their correlation with digital competence among educators, findings revealed that teachers generally exhibited moderate levels of digital competences (particularly at levels B1 and B2) and a nascent integration of emerging technologies in their instructional practices. Less than half of the participants were observed to incorporate these technologies into their daily teaching routines, with those possessing higher digital competence more inclined to utilize them consistently. These results align with previous studies, underscoring the average digital aptitude of educators. Hwang *et al.*, (2020) delved into the determinants influencing the adoption of AI in higher education and identified that 70% of teachers' readiness to adopt AI hinged on factors such as self-efficacy, anxiety levels, perceived usefulness, and comfort with its application.

A study by Zhang *et al.*, (2021) investigated the factors impacting teachers' utilization of e-books for teaching AI, revealing that the ease of use significantly influenced their adoption of this technology. While there is a keen interest among teachers to incorporate AI into their pedagogy, many face challenges regarding its practical implementation. Thus, comprehensive training programs focusing on AI are imperative. This underscores the crucial role of user-friendliness in driving the uptake of AI among educators (Dimitriadou & Lanitis, 2023). The integration of AI in STEM education to support teachers in lesson delivery has shown promising outcomes, with reports of enhanced student achievement and positive responses in academic performance (Deo *et al.*, 2020; Hellings & Haelermans, 2020). The evident gap between the perceptions and competencies of secondary school teachers in leveraging AI

underscores the urgency of further exploration into their beliefs and skills concerning artificial intelligence implementation in secondary schools within Akwa Ibom State.

Statement of the Problem

The Nigerian education system has encountered numerous challenges. A meticulously crafted curriculum may be formulated, only to encounter obstacles during implementation. Various stakeholders have initiated calls for the Federal Government of Nigeria to explore the leveraging of Artificial Intelligence (AI) into the curriculum. Based on the aforementioned circumstances, it is anticipated that science educators will possess a favorable attitude and a certain level of skills necessary for incorporating AI into science instruction. The science curriculum is specifically structured to promote students' active participation in practical and theoretical activities. Consequently, the leveraging of AI into teaching and learning has the potential to enhance students' academic performance (Popenici & Kerr, 2017). Therefore, it is imperative to conduct a research study to evaluate the perceptions and capabilities of science educators in leveraging artificial intelligence for the advancement of a sustainable global community in Akwa Ibom State, Nigeria.

Purpose of the Study

The study investigated the perception and competence of secondary school teachers in leveraging artificial intelligence in lesson delivery in Akwa Ibom State, Nigeria.

Research Questions

1. What is the perception of secondary school teachers in leveraging artificial intelligence in lesson delivery in Akwa Ibom State?
2. What is the competence of secondary school teachers in leveraging artificial intelligence in lesson delivery?
3. What are the challenges of secondary school teachers in leveraging artificial intelligence in lesson delivery in Akwa Ibom State?

Methodology

The design of the study was a descriptive survey design. The population of the study consisted of all the 156 science teachers in the 12 secondary schools in Ibiono Ibom Local Government Area of Akwa Ibom State. A simple random sampling technique by balloting was used to select 89 senior secondary school's science teachers in 8 public secondary schools from the study area. The instruments for data collection was a researcher made instrument titled: Leveraging Artificial Intelligence in Lesson Delivery (LAILD) Questionnaire. The LAILD questionnaire consist of two sections. Section A was on bio-data of respondents, while section B consisted of 24 items divided into three parts covering perception, competence and

challenges of science teachers in leveraging artificial intelligence in lesson delivery. The items are scored using the modified 4-point Likert scale of strongly agree-4points, agree-3points, disagree-2points, and strongly disagree-1point respectively. The instrument was face validated while to ascertain the reliability index of the instruments, copies of the instruments were administered to teachers not part of the sample size. The result obtained after administration was subjected to Cronbach alpha statistics and found to be 0.82. The researchers administered the instruments in the selected schools personally and retrieved immediately to obtain a high return rate. The data collected was analysed using descriptive statistics of mean and standard deviation. A mean of 2.50 and above indicated that respondents agreed with items on the questionnaire while any mean response below 2.50 indicated respondents disagreed with the items.

Results

The results are presented in Tables as follows:

Research Question 1: What is the perception of secondary school teachers in leveraging artificial intelligence in lesson delivery in Akwa Ibom State?

Table 1: Mean and Standard deviation on perception of secondary school teachers in leveraging artificial intelligence in lesson delivery
(N=89)

S/N	Items Teachers' Perception	Mean	SD	Decision
1.	Leveraging AI will help teachers in enhancing their instructional practices in lesson delivery	3.24	0.71	Agree
2.	Leveraging AI will increase interaction between teachers and students	3.00	0.55	Agree
3.	Leveraging AI will motivate students to be more actively involved in learning activities	3.70	0.70	Agree
4.	Leveraging AI will increase students' academic achievements in science	4.30	0.68	Agree
5.	Leveraging AI will enable students to understand more easily what they learn	3.80	0.63	Agree
6.	Leveraging AI will make choosing instructional materials for teaching easier	3.70	0.69	Agree
7.	Leveraging AI will build courage in the teacher to deliver	4.40	0.50	Agree

8.	Leveraging AI will make teachers facilitators instead of information providers	3.70	0.70	Agree
9.	Leveraging AI will encourage students to concentrate more on learning activities	4.60	0.49	Agree
Aggregate		3.83	0.63	Agree

The result in Table 1 above showed that all items had their mean ratings above 2.50 and were above the cut-off point of 2.50. This indicates that the teachers had a high perception (grand mean= 3.83). Hence, there is a high and positive perception of secondary school teachers in leveraging artificial intelligence in lesson delivery. The standard deviation of all the items range from 0.55 to 0.71, which showed that the respondents were not too far from the mean and opinion of one another in their perception in leveraging artificial intelligence in lesson delivery

Research Question 2: What is the competence of secondary school teachers in leveraging artificial intelligence in lesson delivery?

Table 2: Mean and Standard deviation on competence of secondary school teachers in leveraging artificial intelligence in lesson delivery (N=89)

S/N	Items	Mean	SD	Decision
Teachers' Competence				
1.	I can switch on the computer and switch it off after use	4.15	0.66	Agree
2.	I can stall an Artificial Intelligence app	2.99	0.53	Agree
3.	I understand the basic concept and components of AI	1.54	0.54	Disagree
4.	I can search for AI relevant learning tools or materials for use in my lessons	1.65	0.63	Disagree
5.	I can generate content from my AI app for my lessons	1.47	0.96	Disagree
6.	I can use the virtual reality tools for teaching of science	1.55	0.56	Disagree
7.	I often engage myself with e-books/ AI library to give class instruction	1.66	0.63	Disagree
8.	I can use the adaptive learning system to adjust to my lesson content	1.75	0.56	Disagree
9.	I understand the copyright when using open educational resources	2.99	0.53	Agree
Grand mean and standard deviation		2.19	0.62	Disagree

The result in Table 2 above showed that only 3 items had their mean ratings above 2.50 and were above the cut-off point of 2.50. The other items were below 2.5 which indicated a low mean and is below the cut-off mean. This indicates that the teachers had low competence (grand mean= 2.19). Hence, there is a low competence of secondary school teachers in leveraging artificial intelligence in lesson delivery. The standard deviation of all the items range from 0.53 to 0.96, which showed that the respondents were not too far from the mean and opinion of one another in their competence in leveraging artificial intelligence in lesson delivery.

Research Question 3: What are the challenges of secondary school teachers in leveraging artificial intelligence in lesson delivery in Akwa Ibom State?

Table 3: Mean and Standard deviation on challenges of secondary school teachers in leveraging artificial intelligence in lesson delivery (N=89)

S/N	Items Teachers' Challenges	Mean	SD	Decision
1.	Lack of appropriate digital tools	3.70	0.70	Agree
2.	Educational qualification of the teacher	3.40	0.90	Agree
3.	Not having access to the right AI app	3.30	0.45	Agree
4.	Socio-economic factor can affect leveraging on AI	4.50	0.78	Agree
5.	Lack of enabling environment for learning can hinder the use of AI	4.14	0.65	Agree
6.	Lack of incentive from Government to motivate teachers to leverage on AI	4.50	0.78	Agree
Grand mean and standard deviation		3.92	0.71	Agree

The result in Table 3 above showed that all items had their mean ratings above 2.50 and were above the cut-off point of 2.50. This indicates that the all teachers agreed that the items are challenges in leveraging artificial intelligence in lesson delivery (grand mean= 3.92). The standard deviation of all the items range from 0.45 to 0.90, which showed that the respondents were not too far from the mean and opinion of one another in their agreement to challenges in leveraging artificial intelligence in lesson delivery.

Discussion of Findings

Perception of Secondary School Teachers in Leveraging Artificial Intelligence in Lesson Delivery

The findings on perception of secondary school teachers in leveraging artificial intelligence in lesson delivery in Akwa Ibom State showed that there is a high and positive

perception of secondary school teachers in leveraging artificial intelligence in lesson delivery. This could be attributed to the fact that leveraging AI promises to be more interesting and will build enthusiasm in students to learn especially when it comes to gamification. Students will be able to learn in their space and have personalized tutoring. When it comes to the use of AI tools children in general are willing and eager to engage with their devices. This is in line with Ukoh & Nicholas (2022) whose findings that teachers' perception of the usefulness of AI significantly contributed to their adoption of AI. The findings of this study are also in line with the findings of Nja *et al.*, (2023) in a study on adoption of artificial intelligence in science teaching from the vantage point of the African science teachers showed that the approval for the utilization of AI was high with an overall mean score of 3.00.

Competence of Secondary School Teachers in Leveraging Artificial Intelligence in Lesson Delivery

Results on the competence of secondary school teachers in leveraging artificial intelligence in lesson delivery showed that there was a low competence of secondary school teachers in leveraging artificial intelligence in lesson delivery. This can be attributed to the lack of exposure and availability of AI tools at the teachers' disposal. The lack of competence in usage is also attributed to inexperience and possibly anxiety, attitude and procrastination on the part of the teachers and government to practice and implement same. This is in line with Zhang *et al.* (2021) who found that teachers are interested in the use of AI in the classroom but are handicapped in terms of how to use the AI tools. The findings of this study are in contrast with García-Delgado *et al.*, (2023) which showed average levels of teachers' digital competence and an incipient use of emerging technologies by teachers, with less than 50% of the sample not using these technologies in their daily classroom activities, those who show a higher level of digital competence are those who integrate them more in their daily work

Challenges of Secondary School Teachers in Leveraging Artificial Intelligence in Lesson Delivery

Findings on the challenges of secondary school teachers in leveraging artificial intelligence in lesson delivery in Akwa Ibom State showed that all teachers agreed to all the items on challenges in leveraging artificial intelligence in lesson delivery. This means that the challenges of teachers in leveraging AI range from lack of appropriate digital tools, educational qualification to lack of incentive by government to motivate teachers and cover the cost to access AI tools. This is in contrast with Hwang *et al.*, (2021) who investigated the factors influencing the adoption of AI in higher education and found that 7 out of 10 teachers' willingness to adopt AI was attributed to self-efficacy, anxiety, usefulness, and comfort of use

Conclusion

The result of this study concluded that there is a high and positive perception of secondary school teachers in leveraging artificial intelligence in lesson delivery but there was a low competence of teachers in leveraging artificial intelligence in lesson delivery. Challenges were identified to include but not limited to lack of appropriate digital tools, not having access to the right AI app and Lack of incentive from Government to motivate teachers to leverage AI for effective lesson delivery.

Recommendations

Based on the findings of the study it was recommendations that:

1. Teachers should be trained and allowed to leverage AI in their lesson delivery across the state for sustainable global society.
2. Institutions should provide the necessary AI tools to be accessible to secondary school teachers for enhancement of content knowledge and lesson delivery
3. There should be regular training and development on AI advancement for secondary school teachers by NGOs' and associations like STAN
4. Greater learning is achieved by "doing"; hence, online teaching should be highly encouraged and implemented in the curriculum by school authorities and teachers. This will increase the competence of secondary school teachers in leveraging AI for effective lesson delivery
5. Teachers themselves should participate in AI creation, development and integration for sustainable global society.

References

- Buenano-Fernandez, D., Gil, D., & Lujan-Mora, S. (2019). Application of machine learning in predicting performance for computer engineering students: A case study. *Sustainability*, 11(10), 1–18.
- Cabero-Almenara, J., Barroso-Osuna, J., Rodríguez, A.P., Llorente-Cejudo, C. (2020). Digital Competency Frames for university teachers: Evaluation through the expert competence coefficient. *Rev. Electrónica Interuniv. Form. Profr*, 23, 17–34.
- Capuano, N., & Caballé, S. (2020). Adaptive Learning Technologies. *Ai Magazine*, 41 (2), 96–98
- Council of Europe (2021). The Reference framework of competences for democratic culture in brief, <https://rm.coe.int/prems-004721-the-reference-framework-of-competences-for-democratic-cul/1680a27f24>
- Darayseh, A. A. (2023). Acceptance of artificial intelligence in teaching science: Science teachers' perspective. *Computers and Education: Artificial Intelligence*. <https://doi.org/10.1016/j.caeai.2023.100132>

- Deo, R. C., Yaseen, Z. M., Al-Ansari, N., Nguyen-Huy, T., Langlands, T. A. M. & Galligan, L. (2020). Modern artificial intelligence model development for undergraduate student performance prediction: An investigation on engineering mathematics courses. *IEEE Access*, 8, 136697–136724
- Dimitriadou, E. & Lanitis, A. (2023). A critical evaluation, challenges, and future perspectives of using artificial intelligence and emerging technologies in smart classrooms. *Smart Learning Environment*, 10, 12. <https://doi.org/10.1186/s40561-023-00231-3>
- Eden, M. I., Akpan, I. F. & Umanah, F. I (2023a). Virtual laboratory and hands-on activity approaches on students' academic performance in soap production in Akwa Ibom State, Nigeria. *International Journal of Education Framework*, 3(1), 135-150
- Eden, M. I., Akpan, I. F. & Umanah, F. I (2023b). Practical approaches and senior secondary school students' acquisition of entrepreneurial skills in soap production in Uyo Local Government Area of Akwa Ibom State, Nigeria. *Interdisciplinary Journal of Science Education*, 4(2), 153-165
- García-Delgado, M. A, Rodríguez-Cano, S, Delgado-Benito, V & Lozano-Álvarez, M (2023). Emerging technologies and their link to digital competence in teaching, *Future internet*, 15, 140. <https://doi.org/10.3390/fi15040140>
- Halabi, O. (2020). Immersive virtual reality to enforce teaching in engineering education. *Multimedia Tools and Applications*, 79 (3–4), 2987–3004.
- Hellings, J., & Haelermans, C. (2020). The effect of providing learning analytics on student behaviour and performance in programming: A randomized controlled experiment. *Higher Education*, 83(1), 1–18.
- Hwang, G. J., Xie, H., Wah, B. W., & Gašević, D. (2020). Vision, challenges, roles and research issues of Artificial Intelligence in Education. *Computers and Education: Artificial Intelligence*, 1, 100001.
- Kundalakesi, M., Swathi, T., Ashapriya, B., & Sruthi, R. (2017). Virtual reality. *International Journal of Trend in Research and Development*, 4(3), 374–377
- Li, S., & Gu, X. (2023). A risk framework for human-centered artificial intelligence in education. *Educational Technology & Society*, 26 (1), 187–202
- Mahmoud, A. (2020). Artificial intelligence applications: An introduction to education development in the light of corona virus pandemic COVID 19 challenges. *International Journal of research in Educational Sciences*, 3(4), 171–224.
- Nja, C. O., Idiege, K. J., Uwe, U. E., Meremikwu, A.N., Ekon, E. E., Erim, C. M., Ukah, J. U., Eyo, E. O., Anari, M. I. & Cornelius-Ukpepi, B. U. (2023). Factors influencing

science teachers' Artificial Intelligence (AI) utilization in Calabar Education Zone of Cross River State, Nigeria. *Smart Learning Environments*, 10, 42

- Park, Y., & Jo, I. (2015). Development of the learning analytics dashboard to support students' learning performance. *Journal of Universal Computer Science*, 21 (1), 110–133.
- Popenici, S. A., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. *Research and Practice in Technology Enhanced Learning*, 12(1), 22.
- Tondeur, J., Van Braak, J., Ertmer, P. A. and Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Edu. Tech. Rese. Devel.* 65, 555–575. doi: 10.1007/s11423-016-9481-2
- Redecker, C. (2023). Digital competencies and 21st century skills of university teachers. *European framework for the digital*, 1 (2), 1-22
- Ukoh, E. E., & Nicholas, J. (2022). AI adoption for teaching and learning of physics. *International Journal for Infonomics (IJI)*, 15 (1), 2121–2131.
- UNICEF (2021), Policy guidance on AI for children, available at www.unicef.org/globalinsight/media/2356/file/UNICEF-Global-Insight-policy-guidance-AI-children-2.0-2021.pdf, Accessed 10th April, 2024.
- Wang, Y., Liu, C., & Tu, Y.-F. (2021). Factors affecting the adoption of AI-based applications in higher education: An analysis of teachers' perspectives using structural equation modeling. *Educational Technology & Society*, 24(3), 116–129.
- Xue, Y., & Wang, Y. (2022). Artificial intelligence for education and teaching. *Wireless Communications and Mobile Computing*, 2022. <https://doi.org/10.1155/2023/9830273>.
- Zhang, X., Tlili, A., Shubeck, K., et al. (2021). Teachers' adoption of an open and interactive e-book for teaching K-12 students Artificial Intelligence: A mixed methods inquiry. *Smart Learning Environment*. <https://doi.org/10.1186/s40561-021-00176-5>