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Original Article

Ethics of Artificial Intelligence (AI) and Teacher Integrity in the Deployment of Smart Technologies in the Digital Era in Cross River State, Nigeria

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ABSTRACT

As artificial intelligence (AI) gains more traction in education in the digital era, questions arise about the number of empirical studies available that have useful outcomes on the protocols for deploying the technology in the sector. This univariate descriptive survey was consequently conducted to examine whether the ethics of AI predict teacher integrity in the application of smart technologies in public primary schools in the digital age in Cross River State, Nigeria. Two hypotheses were formulated for the research. 1,600 teachers were recruited from 16 public primary schools across four education zones of the state to participate. Ethics of AI and Teacher Integrity in the Application of Smart Technologies Questionnaire (EAITIASTQ) was adopted to generate data. Based upon the Value Sensitive Design (VSD), simple linear regression was used to analyze data, aided by SPSS. Findings suggest that user transparency significantly predicts teacher integrity in the application of AI in public primary schools; user accountability significantly predicts teacher integrity in the utilization of AI in public primary schools. It is recommended that a sound ethical protocol on the application of AI in school be codified in documents and made available for all primary school teachers; experienced and skilful personnel in computer and AI operations have to conduct regular supervision of teachers in relation to the use of AI in elementary schools.

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INTRODUCTION

Ethics of artificial intelligence (AI) is taking centre stage following the upsurge in efforts to digitize education in Nigeria. A technology that possesses such a pervasive power in social circles as AI requires relevant rules to regulate its usage by teachers in primary schools. The integration of AI into education modernizes the sector further, enhances teacher skills, facilitates classroom instruction and produces a new generation of young people who can work with AI under regulations. Its rapid advancements and use in educational domains (Holmes, Bialik & Fadel, 2019; Zawacki-Richter, Marín, Bond & Gouverneur, 2019) involving primary school teachers nonetheless raise pressing concerns relating to the protocols on smart devices. Ethics of AI is a sub-discipline of technology ethics, and in the context of this research, pertains to the moral standards that govern the behaviour of teachers in the application of smart technologies: robots, computers and applications, to perform tasks in the digital age (*cf.* Nyholm, 2020; Gunkel, 2018; Lin, Abney & Bekey, 2014). According to Bird, Fox-Skelly, Jenner, Larbey, Weitkamp & Winfield (2020), what sits at the core of the ethics of AI is the need to minimize biases and risks to children's rights, arising from designs which are not fit for purpose and misuse.

Imagine, in no distant time, the appearance of AI in Nigeria's education policy. Having it in education policy is a reform measure that helps to mainstream its implementation in schools to benefit the educator, colleagues, pupils and parents. Even in the process of this research efforts are underway involving certain stakeholders at various fora to develop a framework for provisioning AI in national education, making sure it has a trickle-down effect on subnational governments. With AI, an opportunity arises for the creation of a more powerful and engaging mode by which the teacher imparts the contents of a subject to the learners. As the teacher gets used to AI as a teaching assistant (Ewa, 2024; Shrier, 2023), there is a propensity for the technology to be manipulated. Also, teacher excitement and curiosity are potent influences which can shape the use of AI in school. Driven by these feelings, the educator may breach the requirement for ensuring age-appropriateness in the use of AI in teaching juveniles. Do not be surprised to find a teacher becoming excessive in his or her adventure, and/or using virtual machines to navigate areas which do not have educational benefits. Such apprehension is a forewarning. It is not enough to provide such a powerful teaching aid. Guidelines on the implementation of the AI are crucial to foster user transparency (Cheong, 2024) and rectitude, and to make the tutor accountable in its usage in primary schools. This is a perspective shared by Okereke and Alhassan (2018), documented in qualitative research entitled *Ethical Dimensions of AI-driven Educational Technologies in West African Universities* in which they also examined the canons of fairness, transparency and accountability in the use of AI technologies. These researchers stressed the importance of ethical guidelines to govern the development and deployment of AI systems in educational settings.

An AI-powered education system that has no sound codes of conduct to regulate the way teachers deploy digital resources in teaching and learning serves as a leeway for unwholesome practices. More so, the challenges associated with the ethics of AI are much like those involved in designing smart tools to improve educational delivery and

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developing a robust policy to occasion its effective deployment in schools in a way that does not fall short of moral standards. Non-stop sophistication in AI algorithms blur the boundaries of decisions and actions, and that becomes problematic for the user to comprehend how far the tool shapes human lives. That indicates having a self-watch mechanism that seeks to always keep the user in check. A challenge, nonetheless, is that, as a product of human creativity and programming, AI cannot compete with the Human Intelligence (HI) in some critical areas such as to transfer intellect from a digital device to an organic brain. Donatus, Obinna, Samuel, Odera & Nkechi (2024) added that the technology does not have the finesse and the emotions that a pedagogue has after many years of training in children's character and psychology.

This points to the vulnerabilities in the technology. It is possible for teachers to take advantage of the situation to engage in unethical practices, especially when there are no strong protocols for the use of AI, regular supervision and disciplinary measures. According to Ross (2016), an educational system that operates based on human-machine collaboration is built upon public trust, to safeguard the management of AI services in a manner that is consistent with social norms and values, protect individual privacy and personal data, and ensure human dignity. These safeguards may prove effective in mitigating potential threats to the integration of AI in well-resourced and under-resourced education systems. Attached to such a hi-tech equipment the onus falls on the users to ensure strict compliance to human rights, goals of education and local cultures in schools. Furthermore, an audit system (Bird et al., 2020) of AI activities is important to ensure that operators are held responsible for any breaches. Establishing rule-oriented approaches involving AI operations serves as mechanisms to keep the teacher alert to professional ethos, even when not being watched. Applying such a strategy to emphasize adherence to set procedures is a means to maintaining discipline so that the user would feel restrained to even contemplate subverting the purpose for which it is being deployed in education. It assumes a self-image of being inherently ‘good’ in its intentions and portrays such good intentions as being automated to avert pitfalls (Holmes, Porayska-Pomsta, Holstein, Sutherland, Baker, Shum, Santos, Rodrigo, Cukurova, Bittencourt & Koedinger, 2021) that could pose (existential) threats to humanity, education and school administration.

Despite this positive self-image that the AI adopts, it does not suggest that teachers would relinquish their entire responsibilities to smart technology. Rather, the functioning of the machine serves as a complement to the teacher and vice versa. Being compliant with the ethics of AI enables the teacher to leverage AI capabilities to deter any notion to weaponize it, politicize it, commit plagiarism and examine malpractices. Quite frankly, the introduction of AI into education can alter the culture of practice in the school system in Nigeria, thus enabling educators to keep up with the pace of the changes in teaching methods determined by digital platforms. The enactment of clear principles to provide acceptable directions in the manner in which these materials are used in school creates some checks and balances and eases tension (Green, Singh & Chia, 2022) in the usage, except it is a system that is also limiting. Where the teacher has to always abide by the dictates of the codes of usage, there is limited opportunity for the user to independently exercise ingenuity in the application of the tool during lessons. Ensuring uprightness and responsibility in the use of AI should not deny teachers the chance to also demonstrate the capability and capacity to adapt the use of the equipment to social context, especially in a situation where the technology itself is still in maturation. The more the rules are created and modified by humans to suit the context, the better it is to work with AI resources in schools located in a Nigerian environment.

Consequently, Friedman (2019) conceptualized the Value Sensitive Design (VSD) in considering the

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development of the ethics of AI to guide the appropriate utilization of smart resources to reflect the sociocultural context. The postulation highlights the incorporation of human values, cultures, beliefs and the good of the host society in the design and implementation of AI (Afolabi, 2024). VSD is an approach in the realm of AI which assists in identifying possible infringements on the principles of transparency, accountability, privacy, and autonomy, addressing the tensions and dilemmas associated with deploying the technology, thus averting issues which could compromise user integrity in the application of AI in elementary schools (*also see*, Larsson and Heintz, 2020). The model presents a formative framework embedded with ethical and moral concerns which place powerful influences that shape the ethical constructs and value inclinations that attend the usage of AI. In contrast to other theories, VSD does not attempt to prescribe or describe the processes for engaging with robot teachers. Its purpose differs whereby it focuses on the responsiveness of the technology to social situations (Hendry, Friedman& Ballard, 2021), including education.

However, as AI gains more attention in education in Nigeria concerns arise about the amount of empirical studies available that have useful outcomes on the ethics of deploying the technology in the sector. As the field evolves in the country, questions are also rife in regard to teacher skills in translating the knowledge of digital tools into actions in a manner that can reduce risks to human rights and learning. Social values, norms, and tensions are powerful influences that can shape the conduct of teachers in their engagements with AI. Hence, in Cross River State, the concerns are in terms of the extent to which the guidelines can guarantee transparency and accountability in the use of the resources by educators in primary schools. This is because a significant number of users do not seem to be clear about the dimensions of the ethics of AI, and that impinges on the value orientation of teachers regarding the application of virtual apparatuses in schools.

Purpose of the research

This research examined whether the ethics of AI predict teacher integrity in the application of smart technologies in public primary schools in the digital age in Cross River State, Nigeria. It specifically looked at whether:

- User transparency predicts teacher integrity in the utilization of smart devices in schools.
- User accountability predicts teacher integrity in the use of smart resources in schools.

Research questions

These questions were posed for the study:

- To what extent does user transparency predict teacher integrity in the application of AI in public primary schools?
- How does user accountability predict teacher integrity in the utilization of AI in public primary schools?

Research hypotheses

Two null hypotheses (Ho) were formulated at a .05 level of significance for the study, viz:

H_{O1}: User transparency does not significantly predict teacher integrity in the application of AI in public primary schools.

H_{O2}: User accountability has no significant prediction of teacher integrity in the utilization of AI in public primary schools.

RESEARCH METHODS

The quantitative methodology (Asim, Idaka & Eni, 2017; Check and Schutt, 2012; Muijs, 2011; Creswell, 2003) served as the overall principle herein, guiding access to and analysis of data in accordance with stated research hypotheses. Also, the decision taken in this direction is informed by the need to measure the identified variables in a quantitative manner, thus allowing for the gathering of numerical data and the application of appropriate

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statistics to analyze the data (Ewa, 2024). According to Williams (2007) and Creswell (2003), this strategy follows the positivist/empiricist philosophy to ensure the scientific values of accuracy, validity, objectivity and reliability in data generation and analysis. Other research strands e.g. the qualitative and mixed methods (Creswell, 2003), as well as their characteristics, are in consequence discarded because they do not fit into the purpose of the present study.

Research design

In alignment with the quantitative approach, the univariate descriptive survey (Muijs, 2011; Creswell (2003) was consequently adopted to serve as the research design. It enables the examination of the knowledge, attitudes and practices of educators in relation to the ethics of AI and teacher integrity in the use of smart technologies in primary schools in the research context. Furthermore, this design allows the deployment of paper and pen questionnaires to collect numerical data from a potentially large population within the research location via a face-to-face method (Ewa, 2024; Check and Schutt, 2012).

Area of Study

Cross River State hosted this research. It is among the 36 states in Nigeria, located south-east of the country. Four (4) education zones: Calabar, Ugep, Ikom and Ogoja, exist in the area, and in each of them primary schools are established and managed by the government via the Cross River State Universal Basic Board, an agency of the State Ministry of Education. The government have made provisions for some Information and Communication Technology (ICT) equipment for some of the schools. Teachers from various social backgrounds serve in the schools and are expected to use these technologies to provide educational services.

Research population

More than 111,290 teachers, including males and females, are practising in over 648 primary schools in the area (Cross River State Universal Basic Education Board – SUBEB, 2023). The practitioners included veteran and new teachers from various social backgrounds.

The sample

1600 tutors, comprising 800 males and 800 females, were randomly selected from 16 schools, four in each education zone, for the study. It translates to 400 educators per education zone. The overall sample size represents 1.44 per cent of the population. The sample was so decided to enhance generalizability, while also taking cognizance of the challenges, including limited time, energy, finance and skill, that sometimes attend to the management of huge research data.

Sampling procedure

A stratified sampling technique (Asim, Idaka & Eni, 2017; Check and Schutt, 2012; Muijs, 2011) was applied to recruit the participants. All teachers were placed in four categories: education zone, gender, veteran teacher and new teacher. These identifiers were developed to ensure equal representation of the backgrounds of teachers in the sample. A balloting system (Asim, Idaka & Eni, 2017) was deployed to perform a random selection of research subjects. Other methods e.g. convenience sampling, purposive sampling, probability sampling etc (Creswell, 2003) were ditched as they were unsuitable for the study.

Instrumentation

A data collection tool codenamed Ethics of AI and Teacher Integrity in the Application of Smart Technologies Questionnaire (EAITIASTQ) was deployed to generate numerical data. It has two sections: A biodata and B scaling item. Section A was designed to elicit such personal information as education zone, gender, age and years of work experience from the participants. Section B had four

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Likert scales of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). 20 items were developed to test the hypotheses, made up of 10 statements for each hypothesis. Respondents were required to place a tick in a box to indicate the extent to which they agreed to the statements. All respondents are adults and familiar with the questionnaire. As such, the instrument is designed in a way that would enable the collection of rich data from participants.

Establishing trustworthiness

Given that it is a study which leaned onto the positivist/empiricist paradigm, its evaluation is based on validity, reliability and generalizability (Mertler and Charles, 2014) in order to ensure trustworthiness. The researcher is research active and can construct data collection tools. In spite of that, EAITIASTQ was also passed to other qualified and competent persons for member checks and psychometric inspection. Having gone through these processes successfully, a pilot study was undertaken in one school outside Cross River State using 60 teachers so as to subject the questionnaire to testing in real-life situations. The mock research was conducted outside the original location in order to avert bias. Data that emanated from it was analyzed using Cronbach Alpha via a computer program called Statistical Package of the Social Sciences (SPSS) to establish the reliability of EAITIASTQ. The result produced a reliability index of .88, indicating that it is suitable for use in the main study.

Procedures for data generation and data preparation

A calendar was created to guide data generation activities. Data gathering and preparation took five months. One month was spent in each of the education zones to collect data from participants. The fifth month was used to prepare data for analysis and to produce this report to disseminate the findings. The schedule was prepared this way to allow enough time for travels between schools, to administer and retrieve the EAITIASTQ. All completed questionnaires were returned. Data preparation took place thereafter. One mark was allocated to each variable in the biodata section of the EAITIASTQ. Conversely, marks assigned to items in the scaling item section were as follows: SA = 4, A = 3, D = 2, SD = 1. Data was inputted into SPSS to facilitate analysis.

Ethical protocols

Authorities at SUBEB, headmasters and teachers gave approval to the research. Staff of the agency used their records to identify the public schools. Participation sheets and consent forms were distributed to enable participants to give informed consent to take part. They were also given the opportunity to withdraw participation from the study at any time without giving a reason. Data collection activities took place during school hours when the teachers were still in school. Participants had one week to fill in and return the EAITIASTQ. A standby school was provided in each zone as a contingency arrangement so that the research could continue in case any unforeseen and unpleasant circumstances occur. All items in the questionnaire were worded in a manner that would prevent raising emotive issues in the respondents. Names of participants are written in pseudonyms and their data is held securely by the researcher.

RESULTS

Data contained in the participation sheets was meant to educate participants about the research and to obtain consent from them. However, data arising from the demographic section of EAITIASTQ was analyzed via simple percentage while the simple linear regression was employed to analyze data from the scaling item section of the questionnaire hypothesis-by-hypothesis. SPSS was deployed to analyze data. See SPSS output in tables 1, 2 and 3:

Article DOI : https://doi.org/10.37284/eajass.8.1.2595

Table 1: Participants' Bio-data

S/N	Category	Variable	Number	Percentage (%)
1	Education zone	Calabar	400	25
		Ugep	400	25
		Ikom	400	25
		Ogoja	400	25
		Total	**1600**	**100**
2	Gender	Males	800	50
		Females	800	50
		Total	**1600**	**100**
3	Age	25-35	806	50.38
		36-45	597	37.31
		46+	197	12.31
		Total	**1600**	**100**
4	Years of work experience	0-10 years	821	51.31
		11-20 years	456	28.5
		21-30 years	197	12.31
		31-35 years	126	7.8
		Total	**1600**	**100**

Data in Table 1 show that 1600 teachers from across four education zones participated. 400 practitioners representing 25% took part in each zone. Among these educators, 800 of them representing 50% were males and an equal amount of the tutors were females. 806 from the sample representing 50.38% were young teachers; the middle-aged tutors were 597, representing 37.31% while the older teachers were 197, representing 12.31% of the sample. It means that the representation of the young teachers outnumbered their colleagues in the other groups in the study. In terms of years of experience, 821 of the practitioners representing 51.31% are relatively new in the job, having spent less than 10 years in service. 456 others, representing 28.5% have been in service for up to 20 years; 197 of their colleagues, representing 12.31% have between 21-30 years of work experience, whilst 126 of the participants are teachers who are nearing retirement, having spent close to 35 years in service. This illustrates that a significant amount of young teachers participated, and some of these practitioners are probably more familiar with the application of AI in education compared to the older co-teachers.

Table 2: Regression of user transparency on teacher integrity in the application of AI in public primary schools

R	R Square	Adjusted R Square	Std. Error of the Estimate
.088[a]	.008	.006	12.26672

Sources of variation	Sum of Squares	df	Mean Square	F-value	p-value
Regression	682.242	1	682.242	4.534	.034*
Residual	87424.513	1596	150.472		
Total	88106.755	1597			

Variables	B	Std. Error	Beta	t-value	p-value
(Constant)	24.514	2.470		9.926	.000
User transparency	.277	.130	.088	2.129	.034

*p<.05

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The statistical computation in Table 1 shows that an R-value of .088 was obtained, resulting in an R-squared value of .008. This means that the variation in user transparency accounted for about 8% of the total variation in teacher integrity in the application of AI in public primary schools, thus the p-value (.034) associated with the computed F-value (4.534) is less than .05. As a result, the null hypothesis is rejected. This means that user transparency does significantly predict teacher integrity in the application of AI in public primary schools. Thus, demonstrating user transparency gives the power to influence outcomes, and helps teachers ensure discipline while utilizing AI in school.

To test the significance of the combination of both the regression constant (24.514) and the regression coefficient (.277) making a significant contribution in the prediction model that is, prediction of teacher integrity (t=9.926 & 2.129 p=.000 <.05), thus, the presence of user transparency can predict teacher integrity in the use of AI in school. The mathematical relationship (predict model) is depicted by the following equation y=24.514+.277x where y = user transparency and x = teacher integrity in the application AI in public primary schools.

Table 3: Regression of user accountability on teacher integrity in the utilization of AI in public primary schools

R	R Square	Adjusted R Square	Std. Error of the Estimate
.083[a]	.007	.005	12.27171

Sources of variation	Sum of Squares	df	Mean Square	F-value	p-value
Regression	611.081	1	611.081	4.058	.044*
Residual	87495.674	1596	150.595		
Total	88106.755	1597			

Variables	B	Std. Error	Beta	t-value	p-value
(Constant)	33.688	2.063		16.331	.000
User accountability	-.258	.128	-.083	-2.014	.044

*p<.05

Table 2 shows that an R-value of .083 was obtained, resulting in an R-squared value of .007. This means that the variation in user accountability accounted for about 7% of the total variation in teacher integrity in the utilization of AI in public primary schools, thus the p-value (.044) associated with the computed F-value (4.058) is less than .05. As a result, the null hypothesis is rejected. This suggests that user accountability has a significant prediction on teacher integrity in the utilization of AI in public primary schools. Thus, users who are accountable can ensure discipline in the application of AI in primary schools.

To test the significance of the combination of both the regression constant (33.688) and the regression coefficient (-.258) making a significant contribution to the prediction model that is, the prediction of teacher integrity in the utilization of AI in public primary schools (t=16.331 & -.2.014 p=.000 <.05), thus, the presence of user accountability can predict teacher integrity in the use of smart technologies in public primary schools. The mathematical relationship (predict model) is depicted by the following equation y=33.688+-.258x where y= user accountability and x = teacher integrity in the utilization of AI in public primary schools.

Summary of findings

From the analyses, findings are summarized as follows:

- User transparency significantly predicts teacher integrity in the application of AI in public primary schools.

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- User accountability significantly predicts teacher integrity in the utilization of AI in public primary schools.

DISCUSSION OF FINDINGS

Findings are being discussed based on hypotheses as follows:

Hypothesis one

The finding revealed that user transparency does significantly predict teacher integrity in the application of AI in public primary schools. The finding emanated in this regard because being transparent is a value in an ethical protocol of AI which can ensure that the teacher remains disciplined in applying smart technologies at school. Transparency involves being open and honest, allowing other stakeholders e.g. school management, parents, pupils, co-teachers and community leaders to see and evaluate the way a teacher engages with AI resources and manages the data that emanates therefrom. Larsson and Heintz (2020) assert that transparency benefits from a broader conceptualization of the concept including explainability of AI algorithms, understanding and trust. Emphasis on this ethos of AI creates an opportunity for public scrutiny regarding the manner a teacher deploys the tools to perform his or her duties. Such a strategy helps others who are more experienced and skilful with AI to detect issues in which a user indulges in unwholesome practices and/or introduces countermeasures to ensure integrity in the functioning of the technology. In a simple term, the concept, serving also as a criterion, prevents abuse and misuse of the technology by an educator. Transparency regulation is a necessary standard (Vasse'I and McCrosky, 2023) for defining the boundaries of decision-making, thus assisting in checking dominant influences of local cultures, values and norms in the utilization of AI by teachers in primary schools.

Hypothesis two

The result of data analysis for this hypothesis suggests that user accountability has a significant prediction on teacher integrity in the utilization of AI in public primary schools. Such a finding emerged in this direction to indicate that 'responsibility' is a catchword for ensuring teacher integrity as a means to safeguard well-being (Cheong, 2024) in the use of digital devices to perform professional tasks in school. The nexus between the application of AI and welfare stresses the wider social impact of technology and the role of the teacher in public service. Data protection and privacy of others in school are aspects of social well-being which are impacted by the use of AI. With the application of risk management procedures, it becomes helpful to assess the educational implications of AI prior to its deployment. That implies auditing, a system which serves as an avenue for detecting and mitigating areas where a teacher may become biased, malicious and even discriminatory in the use of AI systems (Kroll, Huey, Barocas, Felten, Reidenberg, Robinson & Yu, 2017). Such a situation is likely to occur in practice because the ethics of AI sometimes can be incomprehensive, unclear and quite challenging for the educator to effectively apply. Sound and proactive AI governance guidelines therefore present a justification for demanding accountability and minimising obstacles to teacher integrity in the use of digital infrastructure in education. In consequence, a system of scrutinizing teacher values, assumptions and beliefs, and input and output processes lays a framework for regulating behaviours and fostering trust in practitioner skills to effectively deploy smart equipment in elementary school.

CONCLUSION

Efforts have continued to gain momentum to integrate AI into public education in Nigeria. Smart devices are offering significant alternatives for enhancing teacher professional roles in primary schools in the digital age. A potent and pervasive

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technology such as AI also makes it compelling for the formulation of comprehensive ethical guidelines to govern teacher deployment of the equipment in (state) schools. This is because, as stakeholders develop measures to retool public primary education in Cross River State with these super technologies, concerns also arise about the potential risks to teaching and learning, human rights, the environment, local cultures and values. Furthermore, there tend to be insubstantial empirical studies with valuable findings on the subject. These issues inspired the present research, and the outcomes suggest that ethical protocols on AI significantly predict teacher integrity in the utilization of digital resources in schools. For example, strict compliance to such tenets as user transparency and accountability serve as safeguards against possible violations of human rights, education and the school due to teacher application of AI resources in the context.

Recommendations

Based on the findings, the following recommendations were made:

- A sound ethical protocol for the application of AI in schools has to be codified in documents and made available for all primary school teachers.
- Experienced and skilful personnel in computer and AI operations have to conduct regular supervision of teachers in relation to the application of AI in elementary schools.
- Awareness campaigns are to be conducted via various media to develop public trust and confidence in people about teachers' ability to use AI in primary schools.

Educational implications

Concepts on AI shall enter the curriculum designed for pre-service teachers in educational institutions. Coupled with that, provisions are going to cover AI equipment for educational institutions for use by both teachers and learners. Such arrangements will also include the creation of opportunities for developing engineers who can design AI systems locally for the state. Employers would subsequently make AI literacy a requirement for the recruitment of teachers going forward.

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