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Impact of Artificial Intelligence on Teacher Training in Open Distance and Electronic Learning

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Abstract. Conventional methods of teacher training are now constrained by series of barriers such as limited resources and distance-related barriers. The emergence of new technologies that involve artificial intelligence (AI) became a paradigm shift in teacher training. Nevertheless, there are challenges attached to these new methods of teacher training. The purpose of this paper was to assess the impact of AI in Open Distance and Electronic Learning (ODEL) teacher training. Through a process of data collection, the study employed a quantitative approach. As a survey, copies of a questionnaire were provided electronically to relevant respondents. A random sampling strategy was employed using teachers and student teachers from various institutions. A total of 115 respondents took part in this research by filling out a questionnaire. In the process of reviewing relevant literature on teacher training and AI were, more emphasis was placed on integration of AI as a new technology in teacher training. Empirical data were descriptively analysed through a Statistical Package for the Social Sciences (SPSS) application. The results included multiple opportunities as well as limitations attached to AI implementation in an ODEL teacher training. The study recommended a proper evaluation of AI prior to implementation to ensure that ethical issues and education assessment integrity are not compromised.

Keywords: Artificial intelligence; teacher training; Assessment; Open distance and electronic learning

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1. Introduction

The emergence of AI brought on by the Fourth Industrial Revolution (4IR) digital technology offers huge potential for the transformation of teacher training methods in Open Distance and Electronic Learning (ODEL) institutions (Mohamed & Kirk, 2022). Owing to multiple disturbances that might interrupt teaching and learning in various institutions, it is of cardinal importance to incorporate and implement innovative and transformative methods in teacher training to remain apprised of the new educational landscape and teacher training. No matter how improbable it may be to accept the reforms, transformation is a requirement in education and in teacher training. The advent of this technology may compromise the integrity of assessments in ODeL, leading to the issuing of qualifications to non-deserving recipients.

AI, also known as machine intelligence, includes devices such as robotics, software such as ChatGPT, networking such as Global Positioning System (GPS), and other forms of technology imitating human behaviour (Sasti & Sasti, 2021). ChatGPT can be used by students to complete their assignments without proper understanding of the content. This software can take instructions from the user to complete the task just like a human being (Tripathi, 2018). On the other hand, robotics is used in industries such motor assembly to perform tasks that used to be done by humans (Pfeiffer, 2016). People are also now able to navigate their respective destinations through GPS. All these tasks used to be performed by human beings.

Various sectors such as health, industry and finance have started to implement some form of AI. Unfortunately, the mother of all professions, education shows a low response rate to this innovation (Jamal, 2023). No matter what each teacher offers in their field of specialisation, all subjects need to be integrated with this technology to improve the quality of education offered in all countries of the world. Up to standard teacher training will automatically produce quality teachers who can solve education-related challenges through technology. An inclusion of AI in teacher training will equip teachers with enhanced teaching skills as well as problem-solving skills (Kim, 2023). This purpose of this paper was to assess the impact of AI technology in teacher training. Although AI has brought positive and innovative methods to teacher training, one needs to understand both the opportunities and challenges that might be delivered by this technology in teacher training today. Therefore, this paper seeks to establish the impact of AI on teacher training. The objectives guiding this study are:

- To assess the impact of AI on ODeL teacher training.
- To identify the challenges and opportunities associated with AI in an ODeL teacher training.
- To establish artificial intelligence effectiveness on teacher training optimisation.

2. Literature review

2.1 Artificial Intelligence

The tackling and breaking down of complex problems as well as the development of possible solutions that can be understood by a computer called computational

thinking forms part of AI (Sasti & Sasti, 2021). This AI technology allows a variety of electronic devices to resemble the behaviour of a human being in terms of behaviour with the aid of relevant software and networks. Nabiyevev (2012) defines AI as the capability of a computer to perform tasks related to processes that require logic such as perceiving, interpreting, generalising, learning through past experiences, and finding solutions like humans in the face of a problem. This is a computer system built to simulate some aspects of a human being. AI brought drastic changes to the way in which people interact as well as on their daily lives (Jamal, 2023). AI is a 4IR technology that needs to be considered by all students in the current 21st century (Lindner & Romeike, 2019) in order to process and solve a variety of daily socio-economic problems. These scholars further insist that this AI technology can be used to assess teachers' content knowledge. The emergence of radical changes in daily life as well as in professional life has resulted in multiple technologies becoming a natural part of daily life and problems that were considered very complex in the past fifty years can now be solved by the mouse click. As a result of new technology, complex problems can now be solved with the click of your mouse (Ferikoğlu & Akgün, 2022). Despite enhanced methods of problem solving brought about by AI, a human being remains a primary element of all Information and Communications Technology (ICT). Therefore, there are opportunities and challenges attached to this innovation. These challenges involve, among other things, the manipulation of such technology in a process of committing a variety of cybercrimes as well as the violation of some ethics.

AI is not just a single component but is an umbrella term depicting a set of modelling capabilities (Sharples & Pérez, 2022). Figure 1 displays the components, fields and subfields of AI including, among other things, robotics, machine language and automation.

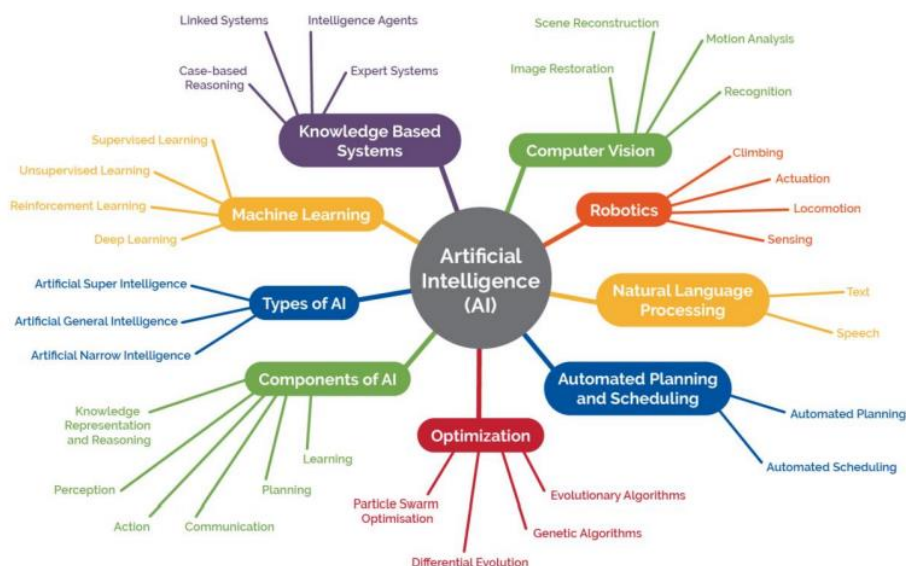


Figure 1. Components, types and subfields of Artificial Intelligence
Source: Regona et al. (2022)

2.2 The incorporation of Artificial Intelligence in teacher training

The use of AI in the classroom is strongly recommended by teachers and students (Joshi et al., 2021). It is of cardinal importance to look at both the opportunities and risks attached to this technology. In various businesses and service sectors, AI integrations in many educational technologies, especially in Learning Management Systems (LMS), have attracted attention (Roll & Wylie, 2016). This technology can be viewed as a method of improving teacher training in terms of skills development, knowledge acquiring, facilitation of learning processes as well as ethical issues (Jamal, 2023). It is believed that AI can bring innovative transformation to teacher training, but it requires careful implementation and ethical considerations. AI is primed to make vital changes in education and is already implemented successfully within several domains in various societies (Schiff, 2022).

Institutions of higher learning responsible for teacher training need to implement innovative methods that will shape and define new route of educational experience for the future. Teachers' roles in education can neither be replaced nor remain static and should be dynamic and flexible. This can be made possible by changing the method of teacher training in various institutions of higher learning by aligning it with the latest technology. One might say it is time to transform teacher training as necessitated by 4IR technology. The integration of AI in teacher training, and in other aspects of life, raises certain ethical and social concerns (Pedro et al., 2019). This includes security issues such as data protection since AI systems contain large amounts of data about students and teachers in various institutions of learning (Jamal, 2023).

Jamal (2023) highlights the considerable promise of AI within teacher education, underscoring the necessity for thorough examination of ethical, social, technical, and cultural dimensions during its deployment. While AI stands poised to elevate the standard of teacher training, augment educators' capabilities, and enable tailored learning experiences, it concurrently prompts apprehensions regarding privacy of data, bias mitigation, and cultural appropriateness.

Canales-Tapia (2022) envisages the creation of an Educational Multimedia elective course for teacher training. This scholar further insists that undergraduate teachers should take this module from the first to their final year of the programme. According to Canales-Tapia (2022), this program can transform and enhance teacher training in terms of today's technologies to be used in education.

2.3 Digital divide

Inequality is a challenge facing various groups of people in our society. Researchers from Development Studies have conducted series of studies trying to address this challenge. The field of ICT is also experiencing the common inequality called digital divide. Inequality is among the major challenges facing various societies in the world, and there are significant concerns about the contribution of digital technology to inequality (United Nations, 2020). Some countries in the world, particularly in Africa, have been and remain victims of past social injustices. Therefore, those countries are still struggling when it comes to ICT infrastructure and/or resources. These are said to be technical challenges

facing the implementation of AI in these countries. The lack of digital skills in conjunction with the lack of ICT resources in some societies is said to be another stumbling block in the implementation of AI in education and other areas (James, 2021).

The digital divide is evidence of inequality in terms of socio-economic status among the populations of a nation and their access to technologies pertaining to information and communication (Afzal et al., 2023). Multiple reasons perpetuating such a divide includes economic inequality, level of education among societies, and access to information.

In South Africa, numerous individuals face barriers to accessing contemporary communication methods due to high costs associated with data bundles, absence of electricity in certain areas, expensive hardware and software, inadequate technical ICT proficiency, limited technical assistance, absence of computer-related subjects in schools, especially those historically marginalized, and various additional obstacles (Mbambo, 2022).

Student teachers find themselves doing their teaching practice in schools that lack the required ICT resources. This becomes a challenge for them as they are unable to portray and test their ICT skills and capabilities. During their training, student teachers need to be placed at schools that will provide constructive learning environments (Du Plessis, 2013). The latter statement indicates that schools are lacking ICT resources and such schools cannot provide adequate and relevant training or mentoring to student teachers whose training is technologically driven.

2.4 Open Distance and Electronic Learning and assessment integrity

The use of AI such as ChatGPT can violate ethics such as copyright protection (He et al., 2024). This happens when students simply extract information from ChatGPT without citation or referencing. In this scenario, different students might end up producing common academic projects which they cannot account for. The production of such assignment projects can also compromise assessment integrity and increases the rate of plagiarism in various institutions of learning. Such acts cannot be divorced from academic cheating. According to Kalhori (2014), academic cheating is an immoral method of achieving a goal in an academic field. This is an unfair manner of acquiring qualification. As a result of such acts committed by certain ODeL students, modern technology should be scrutinised to ascertain that students produce their own original work with a support in an innovative manner (van Grunsven et al., 2024).

2.5 Theoretical perspective

It is a professional requirement that teacher training should equip teachers to engage actively with findings of educational research (Orchard & Winch, 2015). These scholars further argue that former teachers working in universities as second career academics and specialising in teacher education are particularly well-placed to support new teachers in the demands of on-the-job learning. In order to address the impact of AI and technology at large on teacher training, this article adopted the Concerns Based Adoption Model (CBAM) theory. This theory

is about adoption of innovation. Developed in 1970s by the Research Development Centre for Teacher Education in Texas, the theory bases its concern on foundational research about experienced teacher's skills development and abilities in teaching (Hall & Hord, 1987). This study is aligned to the CBAM model, the theory that enables teachers themselves to act pragmatically as the key players of any change in education. It also encourages the implementation of changes in policy and provides a useful framework for designing teacher training (Khoboli & O'Toole, 2011).

According to Hosman and Cvetanoska (2013), CBAM encompasses of two dimensions which are Stages of Concern (SoC) and Levels of Use (LoU). SoC describes the feelings and concerns experienced regarding an innovation, while LoU deals with an individual's behaviour as they undergo the process of change. Under the SoC dimension, adopters of change need to adapt and progress from early-stage concerns about self-oriented issues. On the other hand, LoU shows how the performance and activities change as the adopters get used to an innovation and more on how to use it. Just like SoC, LoU is also developmental in nature.

As stated earlier, teachers are key role players in innovation in education. They are always anticipated to adopt and adapt to educational or technological reforms (Abedi, 2023). As teacher trainees, they must accept the continuous changes occurring in education and take this forward as stated under LoU dimension. An introduction of AI in education and teacher training calls for novice or teacher trainees to accept it as an innovation to be used in their own training and they must also use it in their daily routine. AI software such as ChatGPT needs to be used ethically and with integrity as a guide for student teachers to carry out their academic work, not as a third party that will complete tasks on the behalf of student (Azoulay et al., 2023). Having mentioned integrity, plagiarism must be circumvented as it forms part of cybercrimes. The relevance of this theory in this study is attached to digital technology brought on by 4IR in the field of education, and in all spheres of life worldwide.

3. Methodology

3.1 Research design

The purpose of this paper was to assess the impact of AI on teacher training in ODeL. Therefore, a descriptive research design was found suitable for this quantitative study. McCombes (2020) describe descriptive research design as a design in which researchers' interest is to establish frequencies, trends, characteristics and categories of a phenomenon.

3.2 Respondents

This study employed a random sampling strategy. A total of 115 respondents, which included student teachers, novice teachers and experienced teachers, were randomly selected from two different institutions offering ODeL and three different schools respectively in the Gauteng Province in South Africa.

3.3 Data collection and analysis

As an established systematic method of gathering and measuring information on variables of interest (Kabir, 2018), data collection enables one to answer a stated research question, test hypotheses, and evaluate outcomes. Data collection was made possible by using closed-ended questions in a Four Likert scale questionnaire (see Appendix A). This numeric data collection instrument was developed by using Google forms and was electronically administered to the respondents. The data collection instrument was validated through Cronbach's coefficient, to determine internal consistency. The Cronbach coefficient alpha (α) obtained here was 0.79 which indicates the acceptance and the reliability of the instrument used since it is higher than critical value of alpha which 0.7. Ethical issues of conducting this research, which includes respondents' protection from harm, informed consent, anonymity, and confidentiality, were considered. Ethical clearance was obtained from the University of South Africa's Ethics Review Committee.

4. Results

Quantitative empirical data were descriptively analysed by using SPSS software. This was supplemented by the usage of relevant tables. For the purpose of attaching meaning to the collected data, the researchers made an interpretation after each statistical test and table.

4.1 Respondents' demographic data

Tables 1-3 show the biographic data of all respondents who managed to complete and return their questionnaires.

Table 1: Respondent categories

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Student teacher	40	34.8	34.8	34.8
	Novice teacher	40	34.8	34.8	69.6
	Experienced teacher	35	30.4	30.4	100.0
	Total	115	100.0	100.0	

Table 1 presents a frequency (115) of all respondents who returned their fully completed questionnaires. These respondents were categorised into three categories: 40 student teachers, 40 novice teachers and 35 experienced teachers. Table 2 presents gender for all respondents: 40 male and 75 female respondents.

Table 2: Gender

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Male	40	34.8	34.8	34.8
	Female	75	65.2	65.2	100.0
	Total	115	100.0	100.0	

Table 3: Respondents age distribution

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	18-25	36	31.3	31.3	31.3
	26-30	42	36.5	36.5	67.8
	31-35	23	20.0	20.0	87.8
	41-45	5	4.3	4.3	92.2
	46-50	1	0.9	0.9	93.0
	51-55	6	5.2	5.2	98.3
	56-60	2	1.7	1.7	100.0
	Total	115	100.0	100.0	

Table 3 analysed respondent's age distribution. A large percentage (86%) of respondents were between 18 and 35 years old. Only 14% were between 46 to 60 years old. This indicates that a large percentage of respondents fall under the youth category.

4.2 Importance of AI on teacher training in ODeL

Table 4: Respondents opinion on the importance of AI on teacher training in ODeL

Statements		Frequency	Percentage	Mean
Artificial Intelligence should form part of teacher training	Strongly Agree	87	75.7	0.87
	Agree	28	24.3	0.85
I am specializing in computers as a student teacher	Strongly agree	30	26.1	0.87
	Agree	8	7	0.87
	Disagree	58	50.4	0.86
	Strongly disagree	19	16.5	0.86

Table 4 shows that all respondents agreed on the fact that AI needs to be incorporated in teacher training. This positive agreement indicates that the respondents believe that AI can play a significant role in optimising the method of training new teachers. No respondent indicated disagree nor strongly disagree for this question. It also shows that only 33.1% of the respondents were specialising or specialised in computers in their teacher training, while 66.9% indicated that they disagree or strongly disagree. This indicates that a large percentage of the respondents do not take ICT as their major subjects.

Table 5. Usage of computer and AI as to respondent's type

Statements	Respondent type	Strongly agree	Agree	Disagree	Strongly disagree
I am specialising in computers as a student teacher	Student teacher	30	8	2	0
	Novice teacher	0	0	28	12
	Experienced teacher	0	0	28	7
I use ChatGPT to complete	Student teacher	32	8	0	0

my assignments	Novice teacher	0	17	12	11
	Experienced teacher	0	0	28	7

Table 5 shows that only 38 respondents were specialising in computers which also indicates the continuing shortage of teachers who will equip learners with the 4IR digital skills, which is the requirement in the 21st century. This Table also shows that all student teachers are using ChatGPT to do their academic work. This table also indicates that 17 novice teachers use this software and that none of experienced teachers are using ChatGPT. In a total of 115 respondents, only 57 are using ChatGPT.

Table 6: Impact of AI on teacher training

Statements	Respondent type	Strongly agree	Agree	Disagree	Strongly disagree
Artificial Intelligence can enhance teacher training	Student teacher	33	7	0	0
	Novice teacher	0	37	3	0
	Experienced teacher	33	44	35	3

Table 6 shows that 40 student teachers and 37 novice teachers, in all a total of 77 respondents, agreed on the fact that AI can enhance teacher training. All experienced teachers disagreed with this statement. This also shows that experienced teachers still believe in a conventional method of doing things.

Table 7: Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
AI should form part of teacher training	115	1	2	1.24	0.431
AI is effective in teacher training	115	1	4	2.12	0.966
I am specialising in computers as a student teacher	115	1	4	2.57	1.052
I am a regular user of computers	115	1	4	2.03	0.853

1 = Strongly agree, 2 = Agree, 3 = Disagree, 4 = Strongly disagree

The descriptive statistics shown in Table 7 focused on the central tendency, the mean for the above stated four Likert scale statements. Statement numbers 1, 2 and 4 show the mean of 1.24, 2.12 and 2.03 which indicates that most participants indicated strongly agreed and agreed respectively. Only statement number 3 showed a mean of 2.57 which was getting closer to disagree.

5. Discussion

The evolvement of technology calls for transformation in teacher training as it cannot remain static in the 21st century. This innovation has been brought about by the new digital world involving AI, the Internet of Things (IoT), and other forms of technology. Nevertheless, teachers play a vital role in educational

innovation and improvement. They can adapt to various forms of educational reform that determines whether innovations being introduced will prosper or not. In the absence of an active intervention introducing change, teachers' general perceptions of good teaching remain rooted in their own educational experiences as students, from the primary level all the way through their days as a pre-service teacher (Tunks & Weller, 2009).

On assessing the impact of AI in ODeL, stipulated in objective number 1, the results indicate that an introduction of this technology comprises positive impact, yet ethical issues should be observed. As per the requirements of the digital world, teachers are first adopters of AI. CBAM theory bases its focus on such adoption. Teacher trainees are the ones adopting and using this innovation and they are expected to transfer the new knowledge and skills brought by the innovation to their learners. Despite a series of positives brought by innovation, the misuse of AI in teacher training is another gap identified in this research.

The focus of objective number 2 was to identify the challenges and opportunities associated with AI in ODeL teacher training. Empirical and desktop data in this study constitute series of technology-related challenges such as poor ICT infrastructure and the lack of resources as a motive that drags down student teachers in their academic quest. In their study, Ferri et al (2020: 1) argue "the technological challenges are mainly related to the unreliability of the internet connections and many students' lacks necessary digital skills." Students' adaptation of AI and other forms of modern technology are also hindered by low internet connectivity or unreliable network coverage. Since the focus of this study was on ODeL, numerous student teachers were found coming from remote areas where connectivity remains a challenge. These technological challenges result in pedagogical challenges as teacher training now relies on the internet, particularly in an ODeL environment. In this case, student teachers are anticipated to interact with the interphase which is technology before interacting with the subject content.

Inequality in terms of technology known as a digital divide was found among the challenges posing a threat to in teacher training, particularly for students from remote areas. This was also mentioned as a socio-economic challenge to be addressed by scholars in the field of Development Studies. Government and institutions of learning are not exempted from this challenge. The digital divide was also exposed by the Corona virus (COVID-19) pandemic where institutions of learning had to change their mode of curriculum delivery to an online mode. This was an emergency employed to keep the ball rolling in the field of education. It was also discovered that numerous institutions were not able to provide emergency remote teaching and learning. All forms of ICT-related stumbling blocks are attached to the digital divide.

As per the focus of objective number 3 of establishing AI effectiveness on teacher training optimisation, this technology was found effective. However, its incorporation into teacher training should be meticulous. The need for transformation in teacher training or in education at large cannot be ignored.

There is a need for improvements of priorities to teaching and learning which are not yet met. These priorities should be addressed in order to ascertain that they are safe, effective, and accessible to instructors and their students. AI software, which includes ChatGPT, is perceived as an innovative method of completing assignment projects but special attention is required to ascertain that students do not rely on it for their academic work. Production of assignment projects without recognition of original owners of information called plagiarism is a possible threat and is categorised under cybercrimes. Therefore, students and instructors need to know and understand the risks attached to the use of AI. This was also mentioned as a variable which might compromise assessment integrity in various institutions of learning. Another form of threat attached to this technology is a Garbage In Garbage Out (GIGO) approach. Students need to understand that the wrong input results in the wrong output. As a result, meticulous attention must be paid whenever one is working with such technology.

Since the theory CBAM encompasses two dimensions, SoC and LoU, the LoU shows high percentage of users among student teachers nowadays compared to experienced teachers (refer to Table 5 and 6 respectively). Additionally, SoC shows the negativity of experienced teachers towards this innovation. The reason for this is the fact that some people are conservative and will often react negatively to newly introduced innovation. Finally, both the CBAM theories (SoC & LoU) are in line with this innovation as they describe the feelings and concerns experienced regarding the innovation as well as individuals' behaviour as they undergo the process of change.

6. Limitations

This study employed a quantitative research approach with close-ended questions which may limit respondents' liberty to share their experiences and perceptions on impact of AI in teacher training. It is therefore, recommended for future studies to employ mixed-method approach. Out of nine provinces of South Africa, this study focused on one province which is Gauteng. This may limit the generalisation of the findings.

7. Conclusion

The purpose of this paper was to assess impact of Artificial Intelligence on teacher training. The study was informed by Concerns Based Adoption Model. One of the objectives of the study was to assess the effectiveness of AI in ODeL teacher training. Despite the point that AI was found effective in teacher training, this study results constitute positive and negative impact of AI in ODeL teacher training. Based on this study results, it was concluded that AI is a transformative, dynamic and evolving field in education, and it brought serious innovation in teacher training. AI also avail opportunities of enhancing teacher training, particularly in ODeL. This was found positive in education landscape at large. Nevertheless, this innovation can compromise critical thinking as users depend on technology to solve educational related problems as well as social problems. The results also constitute that AI underscores the socio-economic gap that exist among students as some are technologically disempowered and they are

victimised by their educational poor backgrounds. This study also concluded that the skills gap among students is a negative part of AI in teacher training.

The incorporation of AI in teacher training within ODeL holds a vast possibility for optimising the methods of preparing teachers today. As a result of all emerging technologies, the method of training teachers is being transformed drastically. Nevertheless, AI presents opportunities, but its implementation requires a serious consideration of possible ethical implications as the results of this study constitute multiple opportunities as well as limitations attached to AI implementation in an ODeL teacher training. Assessment integrity and ethical implications need to be considered by education establishments prior to the implementation of AI.

8. Recommendations

The results in this research recommended a proper evaluation of AI prior to its implementation in all education establishments to ascertain that education integrity is not compromised. It was also recommended that the Department of Education and other institutions of learning should invest in ICT infrastructure to enable 4IR driven technology to transform the method of teacher training. Adoption of AI as an innovation in education was another recommendation in this study. Students should be equipped with ICT-related skills from their early stages of education in order to combat the digital divide. Owing to experienced teachers showing negativity and reluctance to adopt AI, this study also recommended the implementation of developmental workshops for teachers based on the use of modern technology such as AI.

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Appendix A

Impact of Artificial Intelligence in teacher training

QUANTITATIVE DATA COLLECTION INSTRUMENT (Questionnaire for the respondents)

* Indicates required question

Demographic data

1. State your gender *

Mark only one oval.

- Male
 Female

2. State your age category *

Mark only one oval.

- 18 - 25
 26 - 30
 31 - 35
 36 - 40
 41 - 45
 46 - 50
 51 - 55
 56 - 60

3. Artificial Intelligence should form part of teacher training *

Mark only one oval.

- Strongly Agree
 Agree
 Disagree
 Strongly Disagree

Importance of Artificial Intelligence Teacher training

4. I am specializing in computers as a student teacher *

Mark only one oval.

- Strongly Agree
 Agree
 Disagree
 Strongly Disagree

5. I am specialising in computers as a student teacher *

Mark only one oval.

- Strongly Agree
 Agree
 Disagree
 Strongly Disagree

9. Artificial Intelligence is effective in teacher training *

Mark only one oval.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

10. I am specialising in computers as a student teacher *

Mark only one oval.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

11. I am a regular user of computers *

Mark only one oval.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

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