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Challenge and Ethical Aspects of technological use in Rwanda Basic Education

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Abstract

The implication of artificial intelligence in education brought significant improvement to traditional models of teaching and learning processes. This paper was aiming at bringing to the right prospects, challenges and ethical aspects of technological use in Rwandan basic education. Purposive non probability sampling technique was used to select study participants. Descriptive statistics and thematic approach were used to analyze collected quantitative and qualitative data. Effective creation and implementation of technological with various adaptive learning platforms (Liushuo in China, NLP in USA, PAM in Germany, Education Technology company Greekie in Brazil and M-shule in Kenya), Advanced data analytic platforms, the introduction of technological use as major course in universities, and Investment for technological use research were established as prospects of technological use at the level of 26.80%, 24.10%, 26%, and 23.10% respectively. Besides, other potential prospects like multi-source of data analysis and audio-Visio teaching and learning materials were revealed as key prospects of technological use. Fragile technological infrastructure, inadequate government expenditure in education, achievement gap in education, resistance to implement technological use and unprepared teacher for technological use implementation were found as challenges of technological use at 85%, 75%, 65%, 60%, 40% respectively. In addition, curriculum transition, culture and religion of some countries, resistance to change mindset were suggested as other challenges of technological use. Cultural integration; accountability; fairness, equity and affordability; security, and privacy were found out as the main ethical aspects of technological use at 33.3%, 28.6%, 14.3%, 14.3% 9.5% respectively. Increasingly Humanity, singularity, authentication and profitability, personal interests' investment, humanitarianism, and solitary were suggested as ethical aspects of technological use. The paper recommends that technological use theorists carefully mitigate the impacts of technological use on humans.

Keywords: *Technological use, ethical aspect and technological challenges*
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1.0 Introduction

Recently, several research studies were carried out to establish the prospects of artificial intelligence in education worldwide, the findings of such studies presented contradictory views concerning the incorporation of technological use its challenges and ethical aspects. In one hand, researchers undoubtedly argue that artificial intelligence has started and by at least 2030, it will be plying a significant assistance in education in line of achieving the 21st century skills 1 in a personalized technological use system. Evidence provided for this assertion were found in different technological use adaptive learning platforms already developed and made use for one teacher to teach hundred thousands of students at once and provide individual feedback, marking close or open tests against a humanlike precision of 92%, providing a customized learning experience over thousand schools like Liushuo in China, NLP in USA, PAM in Germany, Ed. Tech company Greekie in Brazil M-shule in Kenya respectively UNESCO (2019); Perera & Aboal, (2018); WISE (2011); Rundle, (2015); Rigby, (2016).

In the same line, are advanced data analytic platforms designed and already incorporated in education system which have capacity of containing all kinds of educational data, tracking and analyzing students' performance like an technological use advanced information management system in United Arab Emirates; M-Shule in Kenya; Daptio in south Africa (Leading Countries of the World (2018; UNESCO, 2019). Subsequently, introduction of AI major courses in high level of universities (master's and doctoral) and technical and vocational education and training (TVET) in China and France plus introduction of technological use in other existing courses (biology, psychology, sociology.); launch of national initiative of producing thousands of graduates in AI and even specialists in Republic of Korea and big investment (€1.5 billion, 2 billion, 5 million RMB (≈726,427 USD)) provided by governments of states like France, Korea and China respectively (Government of the People's Republic of China (2017); China Daily (2018); Villani (2018); Campus France (2018); Sharma, (2018).

On the other hand, some of the scientific community worry that the integration of AI in education is like a Pandora"s Box 2with dangerous consequences. To take a case in point, technological use was claimed as the end of human era due to the fact that it exceeds the human intelligence (Hawking, 2014; Vinge, 1993). While Gray Scott denied that "There is no reason and no way that a human mind can keep up with an artificial intelligence machine by 2035" (Marr, 2020). After all, the Economist Intelligence Unit (2018) refuses that no country in the world is ready for intelligent automation in a genuine manner and insisted that those considered as leaders in AI to have intelligent automation response it is only nascence. The point hereunder discusses the challenges encountered by technological use in education system. The existing literature has been highlighting several challenges hindering the implementation and success of technological use system worldwide. Inadequate funding, infrastructure, ICT skills, internet connectivity, language and culture were found most hindrances of technological use (Nye, 2015).

Normally, government of the country worldwide is the prime funder of education system through Government grants in education system. However low-income countries recorded low amount of money devoted to education from GDP or government expenditure (budget) (UNESCO, 2000; Samarrai, Cerdan-Infantes & Lebe, 2019). It was then found spending in education from GDP for most of the low- and middle-income countries3 remained relatively unchanged, at about 4.5

percent despite the fact that global spending on education has risen significantly over the past two decades (Samarrai, Cerdan-Infantes & Lebe, 2019). Even though the governments of low and middle-income countries face a challenge of scarce educational infrastructure, it becomes worse when it comes to technological infrastructure. As a matter of fact, US Internet council (2000) reported that from 2001 considered 818 million African population, it was noted that only: 1/4 has a radio, 1/13 has a television, 1/35 has a mobile phone, 1/40 has a fixed line phone, 1/130 has a personal computer (PC), 1/160 uses internet, 1/400 has a pay TV. Associated with this, was the prevalence of telephone, personal computers, and internet host out of 1000 per economic groups, world Bank (2001) indicate that the number of people having telephone in sub-Saharan Africa, low income, middle income, high middle income and high income were (World Bank, 2018) 1000 respectively, computer. Without doubt, UNESCO (2017) confirmed that fragile infrastructure and connectivity hindered the progress of digital literacy in education.

AIED is hindered by unprepared teachers to facilitate learners in interaction of this new education initiative. This should further be seen in teacher's digital illiteracy (Dashtestani, 2014). For example, insufficiency level of digital literacy among Iran language teachers, Japanese University teachers, Indonesian English teachers, Ugandan teachers (Dashtestani, 2014; Son et al., 2011; Andama, 2014; Madan, 2018; UNESCO, 2011). Abdul (2010) elucidated that African teachers are not only ICT and digital illiterate but also technophobic. The crux of the matter is resistance to technology in both teachers and community found in Cameroon, where teachers often see digital tools as an additional burden for their daily work UNESCO (2018).

One of the existing biggest unsolved issues in education is shortage of teachers to the extent that 33 countries currently have insufficient teachers to provide every child with primary education even without a hope of solution by 2030 (UNESCO, 2015). To solve this issue, at least 25.8 million schools across the world are in need in order to achieve this goal. Since this seems impossible another suggested solution was technological use where a technological use adaptive learning platform can be used for one teacher to effectively teach thousands of students at once. Even though this may be true, there is fear of losing job for many teachers despite the view of UNESCO (2019) and Luckin, Holmes, Griffiths and Forcier, (2016) of assistance not replacement. Due to this speculation of losing job, resistance to implement technological use can rain a big barrier.

According to Conroy and Rothstein (2013) students from poorer backgrounds perform worse than students from richer backgrounds. One of the proposed solutions by technological use for this gap is the reduction in cost of technological use leading to its affordability to schools and school system. Yet, Lowincome parents may also have had limited education opportunities, meaning they may face serious challenges in providing at-home learning support to their children (Paton, 2014). As the proposed solution in tackling achievement gap is to make technological use assistants available to all parents to ensure that they are well informed, supported, and engaged in their child‟s education (Luckin, Holmes, Griffiths & Forcier, 2016). Initiation of technological use remains critical with these questions remains: will AI be provided to both students and parents in low- and middle-income countries out of affordable price? Will technological use simultaneously teach both students, teachers and parents to the extent of handling social economic gap leading to achievement gap?

Human and societal behavior are being quantified objectively due to the influence of this age of big data resulting in tracking, modeling and predicting people easily (Mayer-Schönberger & Cukier, 2014). There is no question that, this can also affect education sector once technological use is incorporated in When treating this issue of datafication in education such problems are raised: who can use technological data, who owns the data, who can use it, for what purpose, and who is held accountable? So far as ethical aspects of technological use is concerned, privacy, transparency, accountability, security, fairness, equity and affordability, cultural integration are briefly discussed.

In the first place, considering the ways in which algorithms are designed, there is a worry concerning teachers, students‟ data privacy as such a large data from algorithms might be targeted by cyber criminals (Luckin, 2016). It was also revealed that people are not sure of usage of their data even if informed consents have been offered, which create worries in teachers about AIED as a classroom spy to record and report their suboptimal performance (UNCTAD, 2016; Luckin, Holmes, Griffiths & Forcier, 2016). Legal framework therefore has to ensure a strong protection of personal data against cyber-attacks and ensure citizens that their data will no longer be used for unwanted surveillance (World Wide Web foundation, 2017; Wright, 2018). Immediately following is transparency in technological use where the users' wonder problems like, how can we make technological use as transparent as possible? How can we explain how an AI-based decision was made, what that decision was based on, and why it was taken the way it was taken?

Leslie (2019) explained transparency as interpretability (opening the black box6) of a certain technological use. For instance a student solving a mathematical problem using technological use model and it can give outcome that the answer is either right or wrong. In case it says wrong, a student wants to know at which stage s/he was wrong, and what s/he needs to change in order to get the right answer. In these case the school has therefore to have a necessary understanding of how such a decision has been drawn and be able to explain it the students in a an understandable language. On the next occasion, is accountability which actually comes in when negative consequences or impact appeared or when recognizing who or what causes errors, failures or harm. It is therefore a difficult matter to identify whether owner, the assigned teacher, the algorithm or technician team should held accountable in case one of those negative impacts happens. Several debates and discussions failed to solve this matter, due to the complexity of technological use production process involving multi agent character of the development and use of this system (Leslie, 2019). Following the accountability is security refers cyber-security and defensive capacity.

According to Leslie (2019) the aim of security in technological use in education system is protecting several operational dimensions of an technological system while confronted with adversarial attacks. Associated with this was a view of Kose (2018) who adds that even technological use itself might be targeted by threat actors for the intention of damaging or subverting an organization effort. As an example, adversarial data can be used to challenge, confuse or redirect an AI model. So threat actors need to be prevented from educational technological use model access so as for them not to manipulate social dynamics or cause misinformation in the system. Subsequently, fairness, equity and affordability are a matter of ethics in technological use in education, as the educational personnel wonder how fair technological use will it be, to what extent will it be equitable, and how affordable will it be in terms of cost. Since

this technology has been created by a human being who is subjected to bias, this kind of bias, misjudgment, or errors committed in the technological use design life cycle, it is undoubtedly believed that such a type of unfairness will affect the input, process and the output produced at a given level.

Furthermore, a question whether the cost of technological use system in education will be equal in all countries which are not in the same economic group, if yes, will it be affordable for all schools? What will happen to the schools which will fail to afford to price set? This keeps worry that the least developed countries will be at risk of suffering new technological, economic and social divides with the development of technological use, hence lack of equity and affordability which can lead to school apartheid (Santry, 2018). As far as cultural integration is concerned, since the issue of building cultural norms into technological use has already started, worries were raised that technological use models might be a tool for dominant cultures such as Chinese culture or American culture to influence subcultures or vice versa depending on the country which developed technological use (Hadfield-Menell, Andrus, & Hadfield, 2019; Malle, Bello, & Scheutz, 2019). More emphatically, Zgrzebnicki (2017) elucidated that countries developing or designing technological use may use it to serve as a colonial agent by advancing and spreading their social cultural norms.

To this end, from the aforementioned existing literature, there is no question that same steps have been made in line of introducing technological use system as a new educational reform which will serve as advantageous in learning. yet, only high and some few middle-income countries were found to make a substantial progress, under which prospects of technological use were indeed remarkable while less or nearly nothing has been done in low and most of middle income countries. By contrast, some worries have been raised claiming that technological use is an idea which currently seems to be valuable but really a curse plus various challenges which might hinder the success of technological use. What's more, it was noted that less has been done about technological use of the related ethical aspects. Basing on this inconsistency, a conclusion that technological use will have significantly assisted in achieving an educational SDG, 21st century skills and in eradication of existing biggest unsolved issues in education by at least 2030 should not be drawn. Afterwards, it has also been noted that the study addressing the prospects, challenges and ethical aspects of technological use at once, has never been conducted. This current study therefore intends to explore the prospects, challenges, and ethical aspects of technological use.

2.0 Research Methods

The data that formed the basis for the conclusions of this paper was collected from educationists and technologist respondents. Data was collected all-over the world by using google forms, majority of them were from East Africa (Rwanda, Kenya and Tanzania). Purposive nonprobability sampling technique was used to select participants of this study. Structured questionnaires were used as data collection tool. Descriptive statistics and thematic approach were used to analyse both quantitative and qualitative data collected.

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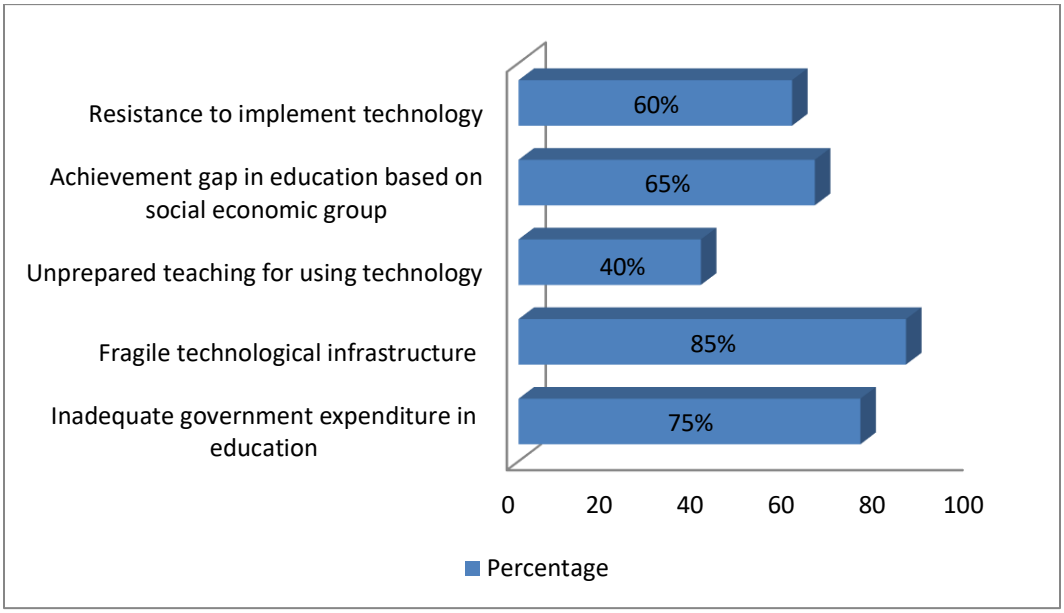
3.0 Findings

The study findings were presented in sections.

3.1 Challenges associated with technological use

The first objective was to indicate the challenges of technological use. To achieve this, the respondents were asked to select the greatest among these challenges. The results are summarized in Figure 1.

Figure 1: the challenges of associated with technological use



The results in figure 1 shows that fragile technological infrastructures, inadequate government expenditure in education, achievement gap in education based on social economic group, resistance to implement technology in daily teaching activities because of fear to be replaced by technological use, and unprepared teacher for using technology implementation were found as challenges of technological at 85%, 75%, 65%, 60%, 40% respectively. In addition curriculum transition, culture and religion of some countries, resistance to change mindset were suggested as other challenges of technological use.

3.2 Ethical aspects of AIED

The second objective of this paper was to identify the ethical aspects of technological use. To achieve this objective, the respondents were asked to express their perception about the ethical aspects listed. Results are summarized in the Figure 2.

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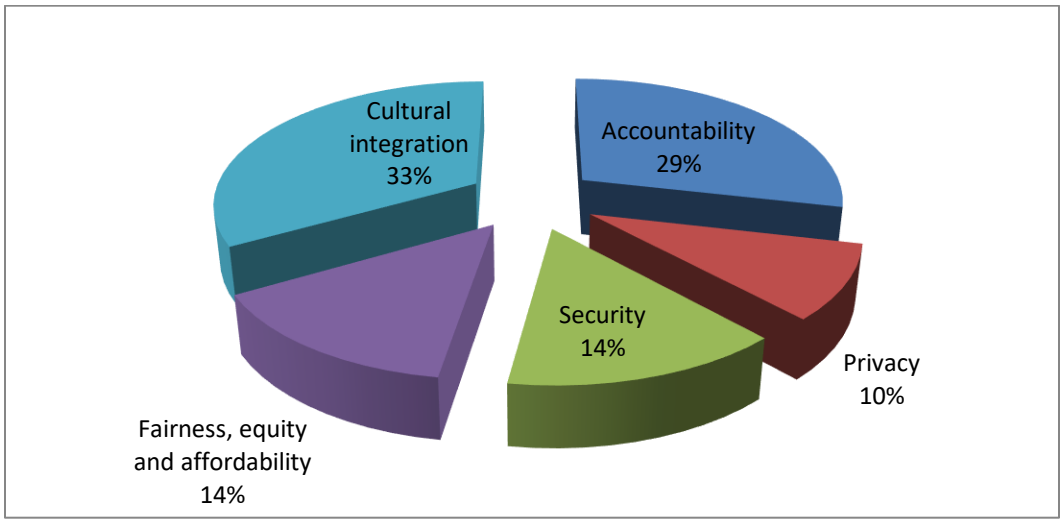
Figure 2: Ethical aspects of technological use



The results in figure 2 showed cultural integration; accountability; fairness, equity and affordability; security, and privacy as the main ethical aspects of technological use at 33.3%, 28.6%, 14.3%, 14.3% 9.5% respectively. From the views of respondents, Humanity, singularity, authentication and profitability, personal interest' s investment, humanitarianism, and solitary were suggested as ethical aspects of technological use.

4.0 Discussions

The data was analyzed using descriptive statistics to identify the prospects, challenges, and ethical aspects. For the possibility of technological use to happen in the future, it was found that 26.8% of various adaptive learning platforms (Liushuo in China, NLP in USA, PAM in Germany, Educational technology company Greekie in Brazil and M-shule in Kenya) and 26% of the introduction of AI major courses in universities (Doctoral and masters) & TVET plus introduction of AI in existing courses (biology, psychology, sociology, law etc.) are a great evidence that technological use will happen in future. These findings were against the views of Hawking (2014) and Vinge (1993) who indicated that implementation of AI could put an end upon humankind due to the fact that 50% of respondents rejected the idea of technological use failure because of worries that it could end humankind. Moreover, a contrarians' view of technological use failure due to lack of readiness for any country for intelligence automation in a genuine manner was also rejected by the majority of respondents at 45% / 10% who accepted. Despite these prospects, it was further indicated at 85% that fragile technological infrastructure, and at 75% inadequate government expenditure in education as the main challenges of technological use which requires enough and sustainable technological infrastructure to serve the purpose. These findings were in line of the assertion articulated in a report of the Economist Intelligence Unit (2018) refuses that no country in the world is ready for intelligent automation in a genuine manner and insisted that those considered as leaders in AI to have intelligent automation response it is only nascence.

Furthermore, the majority of respondents expressed their worries that technological use could be a tool for culture integration which seems as colonial agents for the countries developed

technological use. This finding corroborated with the worry raised by Zgrzebnicki (2017) that countries developing or designing technological use may use it to serve as a colonial agent by advancing and spreading their social cultural norms. Increasingly was lack of accountability as main ethical aspects. This indicated that community worry about drawbacks of technological use like errors, failures, or harm with no one to be held accountable about mistakes caused whether program owners, assigned teachers, or technician team. This finding was in line of the view of Leslie (2019) that the issue of accountability in technological use remained unsolved because of complexity of production process involving multi-agent character of both development and use of this system.

5.0 Conclusion

The study established that various adaptive learning platforms, introduction of technology major courses in universities (Doctoral and Masters) & TVET plus introduction of technology in existing courses (Mathematics, sociology, psychology, law etc.), investment for technological research, data analytic platforms as the prospects of technological use; fragile technological infrastructure, inadequate government expenditure in education, achievement gap in education based on social economic group, resistance to implement technology because of fear to be replaced by technological use, and unprepared teacher for technology implementation as the main challenges of technological use. The culture integration, accountability, fairness, equity and affordability; security, and privacy were ethical aspects of technological use. The study concludes that adaptive learning platforms, the introduction of technology major courses in universities & TVET plus introduction of technology in existing courses are the main prospects of technological use and that fragile technological infrastructure. Inadequate government expenditure in education are the main challenges of technological use whereas culture integration and accountability are the major ethical aspects of technological use.

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