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Creating sustainable Posthuman Adaptive Learning environments for pregnant teenagers

Makeresemese Rosy Qhosola and Sechaba Mahlomaholo

abstract

Posthuman theorisation provides us with the conceptual tools to analyse and to understand how sustainable learning environments (SuLE) are created through adaptive learning (AL) as a form of artificial intelligence (AI) and as an aspect of a broader collective of relationalities. In this study our focus is on how pregnant teenagers relate to the curriculum, one another, other learners, parents, teachers, schools, communities, and non-human and more-than-human entities as they learn. Their condition currently makes them vulnerable and places them in less powerful positions to influence their learning in ways that align with their abilities and modes of being. The Posthumanist lens assists moves away from socialised gender, racial or generally underclass categories and dispositions. It enables us to situate pregnant teenagers' feminine subjectivities beyond Humanism's representations of this demographic as bearing-stigma, facing exclusion and marginalisation. This mode of seeing enables the possibility of re/imagining the pregnant teenager's experiences through modes of being in which participation in networks and collaborations through adaptive learning, among others, draw on pedagogic technologies of change. We argue for a dissolving of Humanist barriers that define, stigmatise and burden the pregnant teenagers as they are fully integrated in their relationalities as learners in AI learning networks. Access to AL and similar software and gadgets need to be massified and opened up for use by all, irrespective of gender, socio-economic status, religion or any marginalising marker.

keywords

Adaptive Learning, Sustainable Learning Environments, pregnant teenagers, Posthumanism

Introduction and background

In this article we use the notion of 'sustainable learning environments' in order to talk about relationalities that promote quality teaching and learning as well as gender equality as envisaged in United Nations Sustainable Development Goals (SDGs). In particular Goals 4 and 5 highlight the nature, value and importance of quality education and gender equality, respectively. The SDGs as a whole promote economic development in an environmentally sustainable

manner towards the social inclusion of all (Selwyn & Jandrić 2020; UNESCO 2015; Will 2017; Wallace, Rust & Jolly 2021). A closer look at these, focuses our attention on educational relationality, which entails the de-centring of Man, and centring of the environment, animals, non-humans. (Ceder 2019). The notion of relationality de-centres the entity and its assumed essentiality or individuality. It places the emphasis on the connections, interactions and processes between and among entities. It is an affirmation of the non-permanence of

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identities and entanglements that depend on their emergence and construction (Ceder 2019; Wallace, Rust & Jolly 2021). This understanding privileges the processes and not the entities as they are relational. Other humans, non-humans and more-than-humans, and how they have contributed to our beings thus have to be acknowledged even before we can talk about ourselves. For examples, what is important is not what could be considered to be the entity, but that which lies intersubjectively between and among assumed relationships. We are constituted and constructed in relationships and what is assumed to be our essence is the coming together of the interactions we have with others. Ceder asserts that Posthumanism posits that humans become truly empowered when they function and operate in unison and in concert within the bigger aggregate of other humans and machines and animals and objects (2019). Through Posthuman theorisation we attempt to address the learning relational needs of pregnant teenagers who to date remain a marginalised and often isolated group of teenagers within the education system (Selwyn & Jandrić, 2020; Will 2017; Wallace, Rust & Jolly 2021). Their numbers are increasing in South African schools as noted by Statistics South Africa, quoted by Office for the Coordination of Humanitarian Affairs (OCHA) (2021). In 2020 alone the number of pregnant learners increased by 60% (OCHA 2021). We argue that rather than being viewed as a burden and an individual problem of pregnant teenagers themselves, as the dominant neo-liberal and Western Humanist conceptualisation would have the world believe, they should be provided with whatever support is necessary in order to bring their children into this world successfully, and nurture them towards meaningful maturity, while they too benefit and realise their dreams of a better life, in conducive relationalities.

They represent a significant number of the demographic of females as a social category in male dominated relationalities. Recognising Posthumanism's possibilities we attempt to map the potential for transformation of young women away from misery, oppression and shame (Haraway 2004) by arguing for their access to cyber-technologies which are a part of the Fourth

Industrial Revolution.¹ Adaptive Learning (AL) is situated as the centre piece of a change process in which girls are provided tools to participate in learning through artificial intelligence (AI).²

We argue in this article that AL as an aspect of artificial intelligence enables pregnant teenagers to assume new identities that intensify their educational relationalities exponentially, as they connect and learn in national and international networks with others, objects, animals and non-human far beyond what Humanism would have ever imagined. Through AL the pregnant teenager, we argue, becomes recognisable as cyborg, who according to cyberfeminist theorist Donna Haraway (2004) is empowered and constituted through friendly technologies for women, technologies that constitute gender-equitable social relations. These are, technologies that unsettle male-centred Humanist limits, favour women (Selwyn & Jandrić 2020; Will 2017; Wallace, Rust, & Jolly 2021) and constitute social relations that are more equitable than those that were constituted by a prior technology or than those that prevail in the wider gender unequal society (Haraway 2004).

In this article our gaze is on the intersection of the status of pregnancy, gender, race, age and socio-economic status in the construction of poor, black and pregnant teenagers' educational relationalities that make them vulnerable and places them in less powerful positions to influence their own learning in ways that align with their abilities and modes of being (Erasmus, Knight & Dutton 2020; Thobejane 2015). Given this background therefore we want to propose that AI could be applied in ethical situations using AL to keep pregnant teenagers on track as learners in school, and possibly beyond. This proposal is borne out of a consideration of current research on the values and positive effects that AL programmes have for learners who experience challenges and marginalisation in the education system (Jones & Jo 2004). For example, Govender, Naidoo and Taylor (2020), Maputle, Lebese and Khoza (2015) as well as Mudau (2018) note in their studies that support from able others, in the form of parents, teachers, peers and the entire community can make a difference

in the lives of pregnant teenagers who were otherwise disempowered as a result of their condition. We thus propose that the support provided by these able others can be increased manyfold through ethical and appropriate technologies, especially the use of the technologies of AL (Jadhav 2021; Jamaan 2021; Kabudi, Pappas & Olsen 2021). The latter, explained later, enables pregnant teenagers (or any other learner, for that matter) who have a device and software that are automated to receive support on most subject matters or issues, ubiquitously (Dunkley 2013; Ellis-Sloan 2014; Farley & Kim-Spoon 2014; Jadhav 2021; Jamaan 2021).

The use of AI technologies raises ethical questions which Posthumanism and feminism are best poised to respond to. For example, if pregnant teenagers' academic performance is enhanced through AL and the blurring of the boundaries between what constitute their human abilities and what the computer offers, will this be fair to other learners whose learning may not be equally enhanced (Leidner & Tona 2021; Luckin et al. 2016; Madaio 2015)? Besides, some may even ask whether a perforation of the boundaries of human-machine respects traditional rights and privileges as it looks like the pregnant teenagers' identity is changed and possibly 'contaminated' through the encounter with cybernetics (Leidner & Tona 2021; Luckin et al. 2016; Madaio 2015). In this article we address these issues directly because due to the blurring of the boundaries, referred to above, pregnant teenagers are no longer located within Humanism's fixed binary gender identities (Dhai & McQuoid-Mason 2016; Luckin et al. 2016). Rather, they are co-constituted within Posthuman subjectivities in assemblages that include pregnant teenagers, technology/ machines, AL, other humans, non-human things, and relations.

Pregnant and socially rejected

Being pregnant as a teenager too often means being a source of gossip, scorn, stigmatisation, exclusion, disregard, disrespect, disdain, ridicule and being called names like "the fallen ones", to mention a few according to research (Dlamini 2016; Maputle, Lebese & Khoza 2015; Govender, Naidoo &

Taylor 2020). In the binary thinking of Humanist and Western Enlightenment's theorisation and influence, gender is fixed and defined in oppositional terms as either/ or, and in the case of feminine identity inferior or less than human. Pregnant teenagers are seen as capable of more than the contexts and the relationalities that they may be experiencing (Ceder 2019). Their condition apparently has nothing to do with other humans and non-humans in their environment, it is a matter of choices that they made (Maputle, Lebese & Khoza 2015; Govender, Naidoo & Taylor 2020). In contrast to the above, the argument we make is that the gender of a pregnant teenager is entangled with being black, poor and socially excluded and is relational (Brusilovsky & Millán 2007; Jadhav 2021). Schools remain mostly conservative institutions that are not open to change and tend to deny pregnant teenagers their rightful places in educational relationalities, and thus prevent them from accessing a better future. As argued in Bhana, Morrell, Shefer and Ngabaza (2010, p. 1):

many teachers view teenage pregnancy and parenting as social problems – a domain of sexual shame with negative effects and disruptive to the academic life of the school (including teachers and other learners).

Although not all teachers subscribe to this view, this has however remained the dominant perspective in schools for many years to date (Mudau 2018). Teachers are not the only ones who harbour negative views (Luckin et al. 2016; Kabudi, Pappas & Olsen 2021). Frequently, the culture of the schools and the communities that could offer support to pregnant teenagers are the main proponents of their marginalisation and exclusion (Dhai & McQuoid-Mason 2016; Dlamini 2016).

Some studies trace this marginalising perspective of the school back to the discriminating system of Humanism arising from Western Enlightenment as well as Christian National Education in South Africa and its Calvinistic religious views during Apartheid (Dhai & McQuoid-Mason 2016; Dlamini 2016). Schools, teachers, peers and the community generally regard pregnant teenagers as deviating from the principles of a proper upbringing (Skillen

2021a). They are regarded as defiant of the norms and mores of good conduct among teenagers at home and in particular at school. Pregnant teenagers also suffer at school because their bodies do not fit the acceptable classroom stereotype (Skillen 2021b). Research shows that schools make little or no adequate preparation and accommodation for pregnant teenagers (Mudau 2018). Even if pregnancy is permissible in terms of policy, and pregnant girls are not expelled, in effect they experience exclusion (Govender, Naidoo & Taylor 2020; Maputle, Lebese & Khoza 2015; Mudau 2018). Classrooms as aspects of educational relationalities are not adjusted for participation of pregnant teenagers. There are no rest rooms for them, nor medical facilities to support them while at school (Govender, Naidoo & Taylor 2020; Maputle, Lebese & Khoza 2015; Mudau 2018). Teachers do not necessarily enable them to catch up when they are left behind. They have to take responsibility and perform academically as individuals with essentialised identities, assumed to be independent, have volition as well as agency rather than constituted as part of educational relationalities (Morkel et al. 2021).

It thus should suffice to state that their entire beings as individuals are ultimately positioned negatively in these relationalities and discourses when they are disrespected, and experience discrimination. They cannot study and learn freely and effectively like their peers (Hayward 2011; Rukundo et al. 2019). The challenges mentioned above, combined with negative stereotyping, present barriers to learning, from the physical through to the socio-cultural, the juridical, to the ethical and aesthetic dimensions of their lives as pregnant teenagers (Odrowąż-Coates & Kostrzewska 2021).

The assumption informing our approach is that pregnant teenage learners require careful and focused relational attention so that they can develop the potential in their contexts to their fullest, in spite of the difficult conditions they may find themselves in (Kiani, Ghazanfarpour & Saeidi 2019). Their predicament does not have much to do with who they are and what they are able to do, but rather it has a lot to do with their relationalities and positionalities in the world (Coast et al. 2021).

Respectful technology in Adaptive Learning: A response

We propose the use of AL to effect positive changes to pregnant teenagers' relationalities as well as to their effective functioning (Lihua 2021; Redmon, Wyatt & Stull 2021). The precondition for the introduction of AL is that it should be used in a respectful and ethical manner among the pregnant teenagers and their relationalities. Technology has too often been used as an instrument of discrimination and exclusion favouring white, educated, middle-class men (Wajcman 1991; 2004). Unsettling the historically skewed relationship to technology requires that the software and gadgets are aligned and appropriately customised to pregnant teenagers and their orientations relationally. This should ideally include their needs, experiences, fears and aspirations (Shemshack & Spector 2021). Dziuban et al. (2017) recognise the need to be sensitive to context, and we add gender, race and class. In other words, to be adaptive AL should be programmed such that it is sensitive to the specific challenges faced as well as possible solutions for problems experienced by pregnant teenagers (Dziuban et al. 2017).

For our purposes in a developing context with marked social inequalities between the poorest and the wealthiest, this implies a departure from the norm of male, white, more affluent students, who have dominated spaces of technology and its use everywhere else, including in learning for some time now (Dziuban et al. 2017). Ensuring that pregnant teenagers have access to this advanced AI technology would undoubtedly contribute to the agenda of equity, gender justice, freedom, peace and hope (Luckin et al. 2016; Kabudi, Pappas & Olsen 2021). We advance the argument for AL aware of the many possible obstacles that will need to be confronted. However, dominant discourses on the Fourth Industrial Revolution must begin to hear the voices of Africa's girls and women and how they can benefit from learning technologies such as AL. There are cost implications and infrastructure costs, as well as the need to ensure data costs are subsidised for learners, as during Covid-19.

Researchers have noted that South African universities were slow in taking up remote teaching and learning technologies

for use by their staff and students prior to the Covid-19 pandemic (Shemshack & Spector 2021), but that when stringent lockdown measures became a reality then there was a huge upsurge in the acquisition and use of technology (Kabudi, Pappas & Olsen 2021). The point we make is that once there is a willingness on the part of the leaders of educational and social institutions to introduce advanced technologies, their development for appropriate application should be enabled, for broad access, particularly as AL holds potential to equalise uneven levels of learning among the affluent and the poor and to ensure equal educational access of girls/ young women and boys/ men (Luckin et al. 2016).

Next we advocate for AL's capacities to enhance various teaching and learning experiences for pregnant teenagers who are marginalised and neglected due to their relational conditions of existence (Luckin et al. 2016; Kabudi, Pappas & Olsen 2021). Adaptive Learning is a computer-based and online educational system that modifies the presentation of materials in response to the student's profile and performance (Makarova et al. 2018). The pregnant teenager does not have to attend in-person in classrooms as they could be taught from their homes or any place comfortable and less strenuous, depending on the device and infrastructure (Brusilovsky & Millán 2007; Jadhav 2021). Currently, the traditional model of classroom education continues to be 'the one size fits all' approach, where teachers are tasked with developing course syllabi for large groups of students, with little or no flexibility for individual needs and learning styles (Bekey & Goldberg 2012; Loizou et al. 2021). For instance, it may require a school to provide tutoring to those who can't get to class readily or easily (Dziuban et al. 2017). A pregnant teenager may have to be absent from school on certain days due to doctor's appointments and check-ups (Wallace, Rust & Jolly 2021). When this happens, it leaves them with a gap in their studies (Berg et al. 1979).

Sometimes such a pregnant teenager may present a lot of symptoms, like morning sickness that can cause her to be tardy or have to run out of class (Shemshack & Spector 2021). This invariably results in backlogs in studies (Luttrell 2014).

Sometimes they find themselves very tired and needing a rest or to take a nap from time to time (Liang, Zhang & Qiao 2021). When this happens, a strain is put on progress in their studies (Kalpokas 2021). In our current schooling system, it seems as if the needs and special circumstances of some students, especially pregnant teenagers, are not always catered for because they seem to be demanding more from the limited time and resources of a school than what is normally offered (Sarnquist et al. 2017; Cavanagh et al. 2020). While one teacher can provide individualised teaching to a certain finite number of students, AL can deliver materials to an unlimited number of students, without making a mistake or getting tired (Christiansen et al. 2020). For the pregnant teenagers constituting the focus of this article, to be assisted by a powerful tool like AL, is effectively to build confidence and reallocate power to them (Christiansen et al. 2020). The automatic functions of cybertechnology mean that AL 'performs' some of the cognitive functions that learners normally do, for example, memory and memorising functions. Their role would then be to operate at the higher level of their cognitive functioning where skills like collaboration, compassion, critical thinking and creativity are required.

Haraway's cyberfeminist technologies that work in ways never experienced before to free girls/ women, involves the blurring of the more-than-human, technology, with the human. An expanded and augmented reality, made up of a corporeality that embodies the technologies, evokes the notion of the cyborg or bionic beings (Leidner & Tona 2021). With AL part of their own meaning-making arsenal, new causality and agency may be found in this relationality (Yıldız-Alanbay 2020).

de Freitas, Rousell & Jäger (2020) describe students 'imbued' with AI as in charge of their learning. They are able to approach content and its understanding from the multi-perspectival and multi-layered orientations of AL. They are now able to produce rich and meaningful cognitive information demonstrating their agility in responding to assessment tasks and issues at hand (Clinkenbeard 2020). Research by Osborn et al (2020) describes that in spite of the low base from which

learners started; advanced levels of ownership of their subject matter is achievable as they increase their self-regulation “with/ in/ as/ for community”. Self-awareness has been intensified and advanced in terms of knowledge acquisition and construction (Selwyn & Jandrić 2020). This is the Posthuman condition where the boundaries among humans are blurred, as are those between humans and machines/ computers (Laird 2021).

In summary, literature reflects that pregnant teenagers in their relationalities are invested further with cognitive skills of collaboration, compassion and critical thinking through AL (Osborn et al. 2020). Their augmented reality means they transcend the normal boundaries of the classroom (Ferrando 2014a; 2014b). The boundaries and exclusions erected by an Anthropocentric or man-centred view are removed with the cartesian binary identities of race - black/ white, gender – male/ female and socio-economic status – affirming a unified reality (Chigangaidze 2021). Pregnant teenagers’ mis/ representation as less than capable and deviant is corrected as they are co-constituted as part of a collective assemblage that includes AL, curricula, other human beings, machines/ more-than-humans, non-humans and learning discourses. Posthumanism makes the United Nations 17 Sustainable Development Goals of social inclusion of all possible and desirable (Chandler 2018). The Posthuman condition affirms the power and relationality of the devices, machines, other people, animals and objects that come together to constitute reality, without borders (Will 2017). The notion of the Posthuman emphasises mutual respect among humans and non-humans, machines/ computers and animals. Binary categories are theorised out of existence and emerge for what are recognised as typically oppressive intentions and purposes (Airton & Woolley 2021).

Feminist perspective

Given the argument presented in which binaries are rendered as redundant, we argue that gender is an arbitrary social construct that varies across contexts and societies (Cunnally 2013), as postmodern feminists would advise (Haraway 2004). Rather gender is situated in how one is positioned

in discourses of relationality consistent with the Posthuman understanding (Midla 2021). The current South African society which is predominantly patriarchal is stratified on the basis of gender and other markers, like race and socio-economic status (Laird 2021). Though constituting the majority in the population according to recent statistics, women are the most oppressed and marginalised group, not sharing the status of their male counterparts. Fewer job opportunities exist for women, there is also evidence that women have long earned less for the same jobs with the same qualifications and experience (Haraway 2004). Negative stereotypes hold that they should not occupy positions of responsibility and influence. Law and policy are in place to redress the imbalances, yet the society stays to a large extent substantially unchanged (O’Regan & Shoba 2021). This takes place not only at the level of society, communities and neighbourhoods, but even in households/ families. Females are expected to discharge very demeaning household chores, look after the male members of the family while the latter often behave like bosses. Needless to say, power relations in intimate relationships are not equal and place pregnant girls in jeopardy. Society has used sex, or women’s reproductive capacity, as justification for discrimination and women’s subordinate status.

Viewing gender as located in one’s biology, essentialising woman’s identity, is a perspective adopted by cultural feminists, influenced by Humanist theorisation that affirms the anthropocentric standpoint privileging humans above everything else (Haraway 2004). The Humanist standpoint regards men as the standard and females as an inferior version of males, hence their exclusion from certain privileges and rights. Issues of race also come into the picture here where Humanism sees people of races other than white as less human, deserving of subhuman treatment. Humanism is known for its hierarchical approach to everything. From this perspective, the identity and status of pregnant teenagers would thus be seen as fixed by biological determinism. This Humanist informed argument posits that the biological attributes of pregnant teenagers (e.g., clitoris, vagina and breasts) make them behave in particular ways that are prescribed to their sex by

nature. When we argue for pregnant teenagers to move forward and beyond the Humanist limits placed on them by society through access to AI technologies, we are advocating for a Posthumanist position that sees identity as relational. It assumes that the identity of the pregnant teenagers is post-anthropocentric, one in which man is decentred, and made up of all experiences, fears and aspirations coming from the relationships that they have with other humans, objects, non-humans.

However, this positioning is not uncontested. Cultural feminism (Cunnally 2013; Haraway 2004; Kafer 2013) as a school of thought purportedly speaks on behalf of the pregnant teenagers and an innate essence of femaleness. It argues against striving towards the Posthuman condition – where the binary of man versus woman is fluid and where we talk about gender as non-determinist, a non-category – because women rely on this platform to argue and advocate for women’s rights (Bracken & Harney-Mahajan 2021). If we interrupt gender as the platform, then the exclusion of women as well as their marginalisation will continue unabated as cultural feminists, Humanists and anthropocentrism would argue (Haraway 2004; Kafer 2013).

We argue that to talk about sex and gender difference between females and males, may not elevate pregnant teenagers to a better position. This approach tends to only exacerbate their exclusion. Making gender, race or any of the binary markers unnecessary, means that the boundaries that create binary identities as well as the ‘othering’ of ‘others’ have been removed to make way for a united reality acknowledging people, animals and objects as relational nodes in a continuous mass of equals (Arnold 2021). This view is powerful because it dislocates identity from the finite limits of space and time (Bleier 1984; Ferrando 2014a; 2014b; Haraway 2004). Identity is strengthened and broadened to refer to positionality, where the gender binary is theorised out of existence; gender remains as a place and space where people who are non-binary in thought and action could ‘climb in and out’ as the meanings are no longer fixed (Fox-Keller 1985; Younus 2021). Postmodern feminism aligns with the thinking we are proposing where gender is not fixed (Odell et al.

2020), and its social construction contingent on relationalities within an all-encompassing collective (Nazar et al. 2018). African feminism (Mama 2019) has also questioned the essentialist and fixed notion of Western constructs of gender, that have been linked to colonialism. As discussed elsewhere in this article, Western constructs of gender are informed and influenced by Humanist and Enlightenment thought that locate and equate gender to biological differences and hierarchise white male at the top of the racial and colonial ladder with African women at the lowest rung of social class (Mama 2019). This article attempts to undo the discriminatory view of black African females that has fuelled colonial thought for many centuries, through proposing Posthumanist theorisation as the appropriate theoretical framing that decentres identity as relational.

This Posthuman view is strengthened further when pregnant teenagers adopt technologies like AI that extend their relationalities beyond their mere corporeal and temporal existence to include objects, humans, non-human and animals beyond the present time and space, globally and ubiquitously as allowable by advanced technologies (Costanza, Fioramonti, & Kubiszewski 2016). This ideal is achieved when all learners, curriculum, teachers, etc., irrespective of gender, race, and socio-economic status access use of appropriate and respectful advanced technologies to deepen relationalities even further (Halkos & Gkampoura 2021). The ethical concern of creating a privileged class of pregnant teenagers is thus attended to. The emphasis we want to place on the ethical question of AI is that the perforated boundaries between cybertechnologies and human that results in an augmented reality poses no danger. Appropriate control of learning is not compromised when learners delegate a machine to perform memory functions if they are then released to take on activities demanding creativity and critical thinking.

Conclusion: Adaptive Learning in a Posthuman approach to education

Couched in Posthuman theory, we initiated the argument in this article by proposing sustainable learning environments informed by the globally formulated and

accepted Sustainable Development Goals (SDGs). We noted that the Posthuman concept of relationality was compatible with the SDGs, especially goals 4 and 5 on the promotion of quality education and gender equality. We went on to discuss the marginal location of pregnant teenagers within education systems. Not only are they mostly left to fend for themselves after being left high and dry by the fathers of their babies, they are also left high and dry by society, families and teachers.

Using Posthuman theorisation we aimed to enhance the learning relationalities of the marginalised group of teenage learners focussing on AI and technologies like Adaptive Learning, as an example. Mindful of ethical issues raised by the challenges we addressed as well as the solution we proposed, it was advocated that AL should be cautiously applied to circumvent inappropriate and unethical processes. Pregnant teenagers are to be at the centre of such programmes to ensure the technologies meet their needs as learners, rather than reproducing programmes that target while middle-class boys/ men. The discussion was deepened to examine the liberating implications of Posthumanism's dissolving of the gender binary against cultural feminisms' articulations of feminine essentialism clarifying our understanding of pregnant teenagers in educational relationalities

We conclude that a Posthuman understanding of pregnant teenagers' learning accelerated by AL was useful in enabling the article to achieve its objectives of empowering theorised pregnant teenagers who ran the risk of getting lost to all their relationalities. We recommend further research on how AL development could address content and delivery appropriately to ensure that inequalities are not deepened, perpetuating patterns of exclusion of girls/ women from technologies for change in the Fourth Industrial Revolution in African schools.

Notes

1. "The Fourth Industrial Revolution is the current and developing environment in which disruptive technologies and trends such as the Internet of Things (IoT), robotics, virtual reality (VR) and artificial intelligence (AI) are changing the way modern people live and work". See: Whats.com (Accessed 10 November 2021).
2. Artificial Intelligence (AI) refers to sophisticated computer programming using algorithms and sensors among others to perform human-like functions in an automated way almost independent of human control. It is the simulation of human intelligence processes by machines, especially computer systems. The term AI is often used as an umbrella term for machines that are capable of perception, logic, reasoning, and learning. Another useful way to think about AI is in terms of a spectrum from automation (rules-based) to intelligence (learning systems) applied to various problems or use cases. See: https://www.altronsystemsintegration.co.za/ai-and-automation/?gclid=Cj0KCQiAweaNBhDEARlsAJ5hwdbdq-4409EbA17TdUE4qN4ltufO8tHgCsky4z9vrBggqPQ3P7G1cRsaAozeEALw_wcB (accessed 21 December 2021).

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