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"African magic" or "African science": Issues of technology in African higher education

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Abstract

African ideas, science, technology, scholarship and worldviews have been disproportionately displaced and marginalized in relevant global dialogues. In academic circles, African methods of knowing have been questioned, undervalued, mocked, misconstrued, and disregarded, causing apprehension. These negative attitudes are internalized via the educational system, stifling agency and conditioning African learners to rely on technology from outside sources, resulting in the exteriorization of innovation and creativity. African inventiveness becomes "African magic" with no real desire to interrogate, explain, or grasp its basic mechanics. This article contends that technology and creative imaginations exist in African societies. The task, however, remains the exploration and integration of African knowledge systems into higher education. The study aims to demonstrate how the interaction of two components of traditional African education—a sense of community and informal learning—could assist in the embrace, facilitation, and mainstreaming of marginalized African technologies. Although the paper may appear eclectic, it is intended to conscientiously push the paradigm that technology has been integral to African education. Regardless of Africa's technical challenges, salvation does not lie in excessive external reliance but rather in investing and building on Indigenous African knowledges/practices in order to establish an African technological identity.

KEYWORDS

African knowledge, African magic, African science, African technological identity, informal learning

Practitioner notes

What is already known about this topic:

- African dependency on foreign technology.
- Lack of interest in African science and technology.
- Lack of African technological identity.
- Low technology penetration in African higher education.

What this paper adds:

- The need to explore African science and technology.
- Mind-set change towards African science and technology.
- Mainstreaming African achievements in science and technology.

Implications for practice and/or policy:

- Indigenization of science and technology.
- Indigenous empowerment.
- Exploring alternate ways of knowing.
- Changing perspectives on science and technology.

INTRODUCTION

Africans appear to trivialize the impact of the Euro-colonial venture on their current circumstances and realities (see e.g., Tamale, 2020). The rejection of African principles in the design and execution of the colonial educational system launched a long legacy of Euro-colonial or Westernization of education in Africa. This history has moulded a framework for research, and cemented educational practices, structures, and concepts of privilege. Dominant research frameworks and methodology are based on European cultural worldviews, resulting in a "ideology of cultural supremacy" (Higgs, 2012, p. 37) to the disadvantage of non-Europeans, and in this case, African cultural perspectives.

The pursuit of African cultural resurgence has a long history (see Blyden, 1856; Diop, 1974; Du Bois, 1903; Hayford, 1911). Despite some tangible achievements like political independence and the opportunity to seemingly control colonially contrived jurisdictions, the dominance of Eurocentric paradigms in African education continues to demand critical attention (Kessi et al., 2020; Tamale, 2020). A situation that makes mental salvation from Europe's vicissitudes elusive. According to Hoppers (2000), the African perspective on education in the latter half of the twentieth century "Is the voice of the radical witness of the pain and inhumanity of history, the arrogance of modernisation and the conspiracy of silence in academic disciplines towards what is organic and alive in Africa" (p. 1). This is "The voice of 'wounded healers' struggling against many odds to remember the past, engage with the present, and determine a future built on new foundations" (Hoppers, 2000, p. 1).

The phrase "remembering the past" will be examined in a subsequent section to serve as a conduit to "engage with the present" and thrust subsequent conversations in the paper. Africa's yearning for self-determination "Invokes the democratic ideal of the right of all to 'be', to 'exist', to grow and live without coercion, and from that to find a point of convergence with the numerous others" (Hoppers, 2000, p. 1). This search "Exposes the established hegemony of Western thought, and beseeches it to feel a measure of shame and vulgarity at espousing modes of development that build on the silencing of all other views and perceptions of reality" (Hoppers, 2000, p. 1). This achievement may not restore Africa's lost and forgotten

grandeur but it may boost self-esteem and self-worth, causing Africans to contribute considerably to the "Momentum for a return of humanism to the centre of the educational agenda" (Hoppers, 2000, p. 1). Hoppers also further advises African educators to view learners as persons being "Culturally and cosmologically located in authentic value systems" rather than "A bundle of Pavlovian reflexes" (Hoppers, 2000, p. 1).

I concur with Higgs' (2012) exposition that, the African educational renaissance is founded on the notion that "The overall character of much of educational theory, practice and research in Africa is overwhelmingly either European or Eurocentric" (p. 38). Therefore, "Much of what is taken for education in Africa is in fact not African, but rather a reflection of Europe in Africa" (Higgs, 2012, p. 38). Accordingly, this paper draws on Hoppers' (2000) and Higgs' (2012) elucidations to contend that the educational renaissance required to nurture an African imagination must have a historical basis (*remembering the past*) in order to analyse and comprehend current realities (to *engage with the present*) with the aim of charting alternate pathways (to *determine a future built on new foundations*). The myth of Africa's primordial position will not be seriously addressed to thrust meaningful scientific and technological discussions unless African education disabuses students' minds from the colonial anthropologically created primitive past. The need to establish that real achievements happened prior to European conquest becomes vital.

It is based on these suppositions that the paper aims to demonstrate how the interaction of two facets of indigenous African education—a sense of community and informal learning—could assist in the embrace, facilitation, and mainstreaming of marginalized African technologies.

The purpose of this paper is to conscientiously promote the idea that technology has been intrinsic to African education since antiquity. Currently, despite the obvious technological disparity between Africa and other continents, there are numerous technologies and technological ingenuities on the periphery of society that Institutions of Higher Learning (IHL) might embrace in an effort to foster an African technological identity. However, achieving this goal will need a fundamental shift in mind-set across the board.

MIND-SET CHANGE

Capturing the psyche of the colonized was the most insidious success of the colonial era. Thus Biko's (1978) remarkable declaration that "The most potent weapon in the hands of the oppressor is the mind of the oppressed" (p. 68). Similarly, Asante (2006) reminds us that colonialism goes beyond territorial dominance. Therefore, anti-colonialists must critically "Interrogate issues related to education, information and intellectual transformations" (p. ix) because whoever controls a person's "thinking" should not bother about their "actions" for even without instructions, they will find their "proper place" and will stay in it" (Woodson, 2016, p. 5). Woodson further contends that if this person is assigned a non-existent "back door", they "will cut one" for their "special benefit" because their "education makes it necessary" (p. 5). This is the predicament of Euro-colonial education in Africa.

Africa has not featured positively in scholarship. The continent's glorious antiquity and elaborate cultures that accomplished a plethora of scientific and technological advancements fail to feature significantly in school curriculum. According to Woodson (2016):

> The same educational process which inspires and stimulates the oppressor with the thought that he is everything and has accomplished everything worthwhile, depresses and crushes at the same time the spark of genius in the Negro by making him feel that his race does not amount to much and never will measure up to the standards of other people. (p. 5)

In keeping up with the drive for White supremacy, the design of Africa's higher education curricula generally situates discussions on the origins of science, innovation, and technology in Eurocentric perspectives. The Greeks, Romans and other Europeans are the "fathers" of everything worthwhile, making the African conception of science largely Western. The lack of genuine education has made Africans a parody of others and unfortunately "No systematic effort toward change has been possible" (Woodson, 2016, p. 5). African learners are still being "Taught the same economics, history, philosophy, literature and religion which have established the present code of morals" (Woodson, 2016, p. 5). Consequently, the African's "Mind has been brought under the control of his oppressor" (Woodson, 2016, p. 5). And those likely to govern their societies (the "educated") experience this sustained indoctrination (see Ekeh, 1975). Higgs (2012) thus argues that colonial Western education set up the framework for the systematic suppression of Africa's "Cultural, scientific and economic" (p. 38) and technological aspirations in many ways. This intellectual servitude impacts the ways African people perceive and act in the world—however, in Africa, this process is what is called education. As Higgs (2012) suggests, "The influence of Western Eurocentric culture on Africans needs to be forcefully arrested by all critically conscious African educators in the struggle for the establishment of an African identity in education theory and practice" (p. 39).

RE-MEMBER-ING THE PAST

Engaging in a re-member-ing project will be a key step in fostering a mind-set shift among African learners. Not simply an act of recall (remembering) but personifying the remembrance process—this is where the deficit in consciousness may be addressed. Denying a people access to meaningful knowledge perpetuates negative stereotypes as well as an ingrained sense of inadequacy. While Kemet (ancient Egypt) has received enormous attention largely because of its location, legacy and impact on other jurisdictions, African history and achievements that extend beyond Kemet are rarely divulged. This paper deliberately ignores Kemet, not because of the confusions created about the ethnicity of these ancient people (see Diop, 1974; Van-Sertima, 1989) but to demonstrate that equally sophisticated and remarkable scientific and technological inventions occurred elsewhere on the continent.

According to Myerhoff (1982), the term "Re-membering" can be utilized to call "Attention to the reaggregation of members, the figures who belong to one's life story" (p. 111). To this end, human experiences, events, and situations must be critically examined and re-examined because "A man who does not know where the rain began to beat him cannot say where he dried his body" (Achebe, 2012, p. i). Even though critical reflection rests on the past, Africa's past is overlooked when addressing African concerns although "No situation, concept or person can ever be fully understood without probing their histories" (Tamale, 2020, p. 1). Africa's past is either non-existent, denied, contested or dismissed. However, charting desirable paths towards development and mental liberation must engage the past because "It is only with such a comprehension that there can be a successful extrication from the bondage of colonization and domination" (Tamale, 2020, p. 1).

Africa's historical trajectory post-15th century has culminated in an "academic reliance" on Europe and North America (Nyoka, 2013, p. 3). The situation, with its subtle connotations, leads to the recurrence of pejorative ideas about Africa because "The nerve of the world has been deadened for centuries to the vibrations of African genius" (Van Sertima, 1983, p. 5). However, several myths about Africa and Africans are being dismantled as a result of "Astonishing discoveries" in "agricultural and pastoral science, architecture, aeronautics, engineering, mathematics, mining, metallurgy and medicine, navigation, and physics" (Van Sertima, 1983, p. 5). Despite these revelations, many people remain ignorant; hence, the need to highlight some in the process of re-member-ing.

ASTRONOMY AND ASTROLOGY

Astronomy and astrology were important in many ancient cultures (Haynes, 2000; Holbrook et al., 2008), shaping ideas and reflecting in religions (King, 2014; McCluskey, 2014; Schoener, 2002). Maoris in Aotearoa (New Zealand) commemorate Manawatia a Matariki, the Maori term for the Pleiades star cluster. The constellation is visible for eleven months but disappears for a month in winter until reappearing in mind-June around the winter solstice. Maori culture recognizes its rising as the start of the New Year, and it has been designated as a public holiday since 2022 (see Whaanga et al., 2020; Williams, 2013).

In Kenya, a team of American scientists found the African Stonehenge, a megalithic astrological observatory dating from around 300 BCE, on the outskirts of Lake Turkana (Van Sertima, 1983). They also found that the "Modern Cushites had a calendar based on the rising of certain stars and constellations" (Van Sertima, 1983, p. 10). The team concluded that there was evidence of the "Complexity of prehistoric cultural developments in sub-Saharan Africa, and strongly suggested that an accurate and complex calendar system based on astronomical reckoning was developed by the first millennium B.C in eastern Africa" (Van Sertima, 1983, p. 10). In West Africa, the Dogons of Mali provided a more "complex" astronomical knowledge (Van Sertima, 1983, p. 11). The priests appeared to have had "A very modern view of our solar system and of the universe–the rings of Saturn, the moons of Jupiter, the spiral structure of the Milky Way Galaxy, in which our planets lie" (Van Sertima, 1983, p. 11). They knew over five centuries ago that "The moon was a barren world" (Van Sertima, 1983, p. 11) and that "A billion worlds spiralled in space" (Van Sertima, 1983, p. 11). The Dogons recognized the Sirius star system, stating that it had major and subordinate stars (the latter now called Sirius B) and although not visible to the naked eye, they plotted its orbits "up until the year 2000" (Van Sertima, 1983, p. 11). The education of the Dogon astronomer-priest was lengthy, lasting longer than attaining a Ph.D. in American universities. While Marcel Griaule and Germaine Dieterlen are credited with pioneering the study of Dogon culture, knowledge of Dogon culture prompts disagreements (Livingston, 2004). The mysteries surrounding the depth of Dogon's knowledge led Sagan (1979) to suggest that they might have experienced a technological civilisation.

MATHEMATICS

The thought that some mathematical concepts originated in Africa (beyond) Kemet may appear absurd to some people. The Ishango bone, discovered in Congo (Zaire) over eight millennia ago was Africa's earliest number system. According to the researchers who unearthed it, "It was used as a linear calendar" (Van Sertima, 1983, p. 14). The ancient Yorubas (in present-day Nigeria) also developed a numeration system (Van Sertima, 1983; Zaslaysky, 1973). The mathematician Conant calls the Yoruba system "The most peculiar number scale in existence" (Van Sertima, 1983, p. 15) because it is "A system based on twenty" and relied on "Subtraction to a very high degree"—something regarded as an "Unusual feature" requiring advance mathematical acumen (Van Sertima, 1983, p. 15). To Robert Armstrong, "It is a testimony to the Yoruba capacity for abstract reasoning that they could have developed and learned such a system" (Van Sertima, 1983, p. 15). Van Sertima (1983) however cautions that "Not all Africans had Mathematics … neither did all Europeans" (p. 14).

ARCHITECTURE AND ENGINEERING

In several African cities, sophisticated architectural and technical structures were built. Great Zimbabwe (circa 12th century) witnessed spectacular stone monuments in a two-part stone city—"The Royal Enclosure" and "Great Enclosure" (Van Sertima, 1983, p. 16). The former was on the hill and served the Kings, and the latter, in the valley, had "The largest of all the buildings" (Van Sertima, 1983, p. 16). This architectural piece with a curved granite wall around it, 250 m long and weighing 15,000 tons, was built by the Shona People. Their settlements spread across Zimbabwe and Mozambique (Van Sertima, 1983, p. 16). In West Africa, Timbuktu in the Mali Empire had its own impressive built-environment accommodating academic and religious institutions (Apotsos, 2017). These accomplishments "Crystallised the science and technology of that people, place, and time" (Van Sertima, 1983, p. 17). Great Zimbabwe's built environment used dry stone building technology (Chirikure et al., 2018). This technology was utilized to construct a number of facilities over a period of time.

MEDICINE

Prior to the European conquest, African plant medicine was comparatively the most developed globally. There is evidence of the use of "African traditional medicine, not just its plant science but its psychotherapy, its approaches to diagnosis of disease, its very early knowledge of anaesthetics, antiseptics, vaccination, and the advanced surgical techniques in use among African doctors" (Van Sertima, 1983, p. 22). There was the usage of the back of *Salix capensis* (a species of plants that produce salicylic acid—active ingredient in aspirin) to treat musculoskeletal pains. In Mali, kaolin (active ingredient in Kaopectate) was used to treat diarrhoea, and in other parts of the continent, anti-bacteria, anti-cancer extracts and properties were used in treatment. Vaccination was also common and treatments were efficacious as contemporary ones. Practices such as autopsy, vaccination, dental procedures, anaesthesia and Caesarean sections among other surgeries predate Europe (see Van Sertima, 1983). Despite medical advances, African physicians continue to recite the Hippocratic Oath—"re-member-ing" Greece/Greeks despite the fact that Imhotep (whom the Greeks called Asclepius) lived 2000 years before Hippocrates.

OTHER AREAS

Other aspects of ancient African competence included navigation, where Van Sertima (1976) postulates that Africans arrived in the Americas centuries before any European. Boat building was an associated skill developed in the process and expeditions were made to Asia to trade. Metallurgical and tools development across the continent comprised carbon steel prepared "In a pre-heated forced-draft furnaces" a technology that was more "Sophisticated than any developed in Europe until the mid-19th century" (Van Sertima, 1983, p. 9). The temperature in the furnace was higher than those reached in "The European cold blast bloomeries" because the Africans pre-heated their air blast (Van Sertima, 1983, p. 9). On writing systems, "Half a dozen scripts were invented before the holocaust" (Van Sertima, 1983, p. 24).

The diverse and varied technologies utilized in iron production within the Great Zimbabwe region in metallurgy were the shaft furnaces, forced-draft technology and natural draft technology among others (see Mtetwa, 2021).

AFRICAN MAGIC

Despite the above-mentioned scientific and technological achievements, African ingenuity has often been associated with conceptions of magic. This section explores the concept of African magic and potentially related ideas to assess its theoretical or speculative complexity. The supernatural and spirituality hold an undeniable significance in African culture. Mazama (2002) avers that "Spirituality has always historically played an important role" in many African "Struggles for liberation, from Nanny in Jamaica to the Haitian revolutionary war and Nat Turner" (p. 218). African cultural outlooks hold that there is an inextricably linked visible and invisible worlds. The interplay of these domains affects moral codes, ethos, conventions, values, and acceptable behaviours. According to Uduagwu (2016) "This is why sometimes, certain types of knowledge are referred to as superstition, mystical power and magic such as the making of rain, the healing of human bone dislocation using chickens" (p. 74). According to Mbiti (1970), "Every African who has grown up in the traditional environment will, no doubt, know something about this mystical power which often is experienced or manifests itself, in form of magic" (p. 194). However, "It is not all forms of knowledge in Africa that are experienced or referred to as magic" (Uduagwu, 2016, p. 74).

The idea of magic or African magic has a long history. According to Jackson (1995), the Kemetic (ancient Egyptian) multi-genius, Imhotep (circa 2700 BCE) was attributed with magical prowess, indicating the thin line "Between magic and science" (Uduagwu, 2016, p. 75). Notions of magic and dispositions towards it are not exclusive to so-called primitive people because mathematics in 17th century Europe was viewed with suspicion because the church felt it was the work of the devil. Furthermore, during the Spanish Inquisition, being caught studying mathematics was punished by death. Van Sertima (1983) quotes Zaslaysky (1973) as saying that "Mathematics was looked upon with fear in Europe because of the magical use of numbers" (p. 14). Magic may vary from inadequate understanding or knowledge deficiencies (inability to comprehend the workings of a phenomenon) to outright ignorance. In other cases, it might be an awe-inspiring or amazing occurrence, hypnosis, or downright deceit. According to Nukunya (2003), magic is connected with witchcraft, sorcery, divination, and mystical actions. Despite the limitations, confusion, incomprehensibility and speculations, James (1954) notes that "Magic was applied religion or primitive scientific method" (p. 134). Emedolu (2015) however dares to suggest that "Magic was the mother, not just the "bastard sister" of empirical science" (p. 68). Uduagwu (2016), in an attempt to distinguish between magic and science, avers that magic is "An illogical practice enshrouded in illusions and false manifestations" (p. 75) while science is "A practice that is systematized and follows the research tradition of empirically demonstrable protocol" (p. 75). However, contrasting Uduagwu's (2016) definition of magic with Jackson's (1995) attribution of magic to Imhotep demonstrates the concept's fluidity because Imhotep was neither irrational nor delusional. However, in his subsequent expositions, Uduagwu (2016) agrees with Emedolu (2015) that "Any sufficiently evolved magic may as well become science" (p. 75). Uduagwu supports his stance with an Igbo (Nigerian ethnic group) example:

> Among the Igbo, magicians perform some of their arts to give the illusion of disappearance and re-appearance using some physical structure they built. They create the impression to make things disappear and re-appear, even though in reality, this is not the case. The architectural structures they use help them to make this illusion seem real. However, with time, advancement in method gave birth to what the Igbo call ikwu-ekiri. (p. 75)

Ikwu-ekiri is "An Igbo expression for travelling by fire, water and air" (Uduagwu, 2016, p. 74). It is "Similar to the modern day Western Science fiction ideas of tele-transportation or time

travel" because it "Carries the same idea of disappearance and re-appearance of bodies as is magic but in this case, it is actual rather than illusory" (Uduagwu, 2016, p. 75). Uduagwu (2016) argues that a change in method has caused an "Elementary magical idea has sufficiently advanced into science…and became scientific" (pp. 75–76).

Many African endeavours are intertwined with rituals and, at times, cloaked in mystery. The situation is further aggravated by the fact that these activities and developments are carried out by scientists in restricted groups. In the case of Igbos, it is "Those called Dibia (members of a secret society) who are at once physicians, technologists, scientists, soothsayers, sorcerers, etc" (Chimakonam, 2012 cited in Uduagwu, 2016, p. 76) who perform these acts. However, Uduagwu (2016) argues that this is not different from contemporary scientists in universities and research institutions, as they are equally a secret group of a sort. Ikwu-ekiri developed a "Machine called opu" that can travel at a "Speed of nearly 100 km per hour" to shorten long-haul travel (Uduagwu, 2016, p. 76). It has evolved technologically from its aquatic origins through a "Fire-based model" to an "air-based model" that eventually proved very safe and fast" (p. 76). The grounds for these model changes and experiments included health and safety issues such as "hypothermia," "heat stroke" and death in certain cases. To Uduagwu (2016), these sequence of development demonstrates "How a practice that began like magic can eventually developed into science" (p. 76). Some important question that may evade an accurate response is: when does magic become "sufficiently advanced"? Why is the first initiative not science unless subsequent improvements are made? Do "scientific" initiatives avoid these fundamental processes? The subtleties of this discourse cannot be fully explored in this paper.

AFRICAN SCIENCE

There is, indeed, a fine line between African science and African magic (Emedolu, 2015; James, 1954; Uduagwu, 2016). In some contexts, African magic and African science are used interchangeably, whereas, in others, magic, sorcery, witchcraft, mysteries and so on are referred to as African science (see Ashforth, 2005). Ashforth (2005) states that, regularly in South Africa, "Witches as well as healers are referred to as 'African scientists'" (pp. 222–223) and "African science is secret knowledge" (p. 217). These narratives have emerged due to Eurocentrism's hegemonic proclivities, where what is science and scientific has been colonized by Eurocentric frameworks, constructs and pedestals (see Smith, 2021). Horton (1967) thus sees the binary between Western and non-Western science as a battle for supremacy. For example, Western and non-Western science are, respectively, judged as "Intellectual versus emotional; rational versus mystical; reality-oriented versus fantasy-oriented; causally oriented versus supernaturally oriented; empirical versus non-empirical; abstract versus concrete; analytical versus non-analytical" (p. 69). These dichotomies tend to reinforce prejudiced dominant Eurocentric episteme that does not accommodate plurality, diversity, or alternate ways of knowing and being. However, de Sousa Santos (2007) implores Africans to endeavour to learn "Through the epistemology of the South" and challenges "The monoculture of modern science with the ecology of knowledges" (p. 66).

Scholars like Abdi (2011), Dei (2012) and Semali (1999) have pointed out that traditional African education possessed meaningful scientific knowledge. There were many forms literacies; spiritual, ecological, cosmological, medicinal and pastoral among others (Semali, 1999). However, colonial invasions systematically discredited African ways of learning and achievements. Europe's domination of the press fuelled myths that marginalized Africans (see Amuzu, 2022a). Guided by history, Van Sertima (1983) proclaims that "African science does not have to apologize for its apparent paucity for enough has already been discovered in a short time to make it quite clear that a great deal still remains to be

brought to life" (p. 6). African science is a body of systematic knowledge that has what Chimakonam (2012) calls "Mmeputa Isiokwu or the articulation of research problem through this, its research sojourns towards a systematized knowledge" (p. 76). Africa's scientific and technological enterprises, as well as their practitioners, have been pushed to the edges of the school system, raising the question of whose science the schools are teaching. The importance of IHL reaching out to these practitioners cannot be overemphasized thus the need to connect with the community.

SENSE OF COMMUNITY

In a 2017 TED Talk, Chika Ezeanya-Esiobu discussed how a Western-based irrigation technique used in a World Bank Irrigation Project in Niger did not produce the desired results when contrasted to another irrigation project that used a traditional irrigation system known as Tassa in another town (Ezeanya-Esiobu, 2017). Eseanya-Esiobu (2019) further mentions the "Traditional Rain-Fed Irrigation Project in Chad" (p. 57), "Neem Biopesticides in Togo and Niger" (p. 58), "Ethno-Veterinary Medicine and Fishing in the Niger River" (p. 59) and Indigenous knowledge of the environment as important scientific and technological advancements in agriculture left on the margins of the school system. These technologies reiterate the essence of local knowledge and experiences as well as the limitations of Western knowledge and science (Addae & McIntyre-Mills, 2022). The tendency to look to the West for scientific solutions to Africa's issues must be reconsidered (Ake, 2012).

This calls for Africa's IHL to rekindle their sense of community to collaborate with communities to create a symbiotic relationship that would mainstream these technologies. Nurturing a meaningful sense of community is crucial for eradicating erroneous conceptions of elitism, exclusivity, Ivory Tower mind-set (Amuzu, 2019) and undue reliance on foreign technology. As Ngara (2007) suggests, "Other alternative ways of knowing are needed to jumpstart the African intellect and imagination towards giftedness for technological development" (p. 17). These are critical because a fundamental impediment to true African development is the gap between the school system, development plans, ideology and African reality (Eseanya-Esiobu, 2019).

While the African sense of community has been addressed in a variety of ways, it has received little attention as a philosophical framework (Higgs, 2012; Letseka, 2000; Oyenuga, 2021). According to Higgs (2012), "Community-sensitive philosophical framework, as articulated in African philosophy, can also, contribute to the construction of empowering knowledge that will enable communities in Africa to participate in their own educational development" (p. 52). Mbiti (1970) illustrating the significance of the sense of community says "Whatever happens to the individual happens to the whole group, and whatever happens to the whole group happens to the individual. The individual can only say, 'I am, because we are; and since we are, therefore I am'" (p. 108). If a person's life and existence are so inextricably linked to the community, then IHL cannot divorce from the community. According to Higgs (2012), community-based teaching and research are required to attain community-centred education, identifying them as a "Kind of research and teaching that is conducted by, with, and for the community" taking "Cognisance of indigenous African knowledge systems and values present in the community for purposes of fostering the communal discourse" (p. 45).

The community-based strategy "Aims to integrate indigenous African knowledge systems with modern knowledge systems, and in the case of education, schools are seen to be one location-point of integration" (Higgs, 2012, p. 46). This will "Give education research and practice in Africa a social basis by linking research and practice with community needs and experiences" (Higgs, 2012, p. 46). A symbiotic relationship between IHL and society might

dispel some of the misconceptions surrounding "African magic," paving the path for critical scrutiny. Given the delicate boundary between magic and science, scientific concepts clouded by mysticism may exist inside thoughts and acts of magic. Scholars must thus be wary of being excessively dismissive. The ultimate goal should be pragmatic; does it work? Subsidiary issues that arise can be addressed subsequently.

Ultimately, the community must be "Recognised as a primary stakeholder" and "Actively participates in determining the ends to which research resources are dedicated" (Higgs, 2012, p. 45). A community would be empowered to become an "Active agenda setter for science and technology rather than just a passive data provider and consumer of research results" (Higgs, 2012, p. 45).

INFORMAL LEARNING

Given the importance of informal learning (IL) to Indigenous peoples, I advocate for the use of informal learning as a means of directing learning between Africa's IHL and their communities. This is not to say that the educational process should be strictly informal. Abdi (2011) contends that "Informal systems of learning in Africa were effective platforms of educational and social development" (p. 81). Nonetheless, IL, like many other African methods and traditions, was colonially scorned and "Derided as useless and not fit to be used" (p. 82). To Rodney (1982) "Altogether, through many informal means, pre-colonial African education matched the realities of pre-colonial African society and produced well-rounded personalities to fit into that society" (p. 239). Conceptually, Livingstone (1999) sees IL as "Any activity involving the pursuit of understanding, knowledge or skill which occurs outside the curricula of educational institutions, or the courses or workshops offered by educational or social agencies" (p. 51). Decius et al. (2022) contend that IL occurs inside the formal architecture of educational institutions, and then provide a scale for assessing such learning.

The pursuit of IL would surely have consequences for curriculum design and execution, an endeavour whose breadth cannot be completely explored in this study. Winter and Cotton (2012) distinguish three forms of curricula in higher education: formal, hidden, and informal. The scope of the formal curriculum includes recommended courses; the hidden curriculum includes the silent or undeclared academic, social, and cultural values that learners acquire unconsciously in school; and the informal curriculum includes learning experiences obtained from institutions other than the school or "Personal and unstructured information transfer from lecturers to learners before or after lessons" (Decius et al., 2022, p. 3). The hidden and informal curricula though distinct, complement each other because they both denote the implicit learning occurring outside the formal curriculum (Decius et al., 2022). The informal is learner-centred and includes student initiatives and extra-curricular activities (Winter & Cotton, 2012). The informal curriculum, according to Hopkinson et al. (2008) is "Largely student directed, voluntary, open to all and non-credit bearing" (p. 439). Informality, however subtle it may appear in the curriculum, is recognized in the school system. According to Decius et al. (2022), IL is a multidimensional construct with behavioural, intellectual, and motivational components. IL empowers learners to set objectives or identify a problem, work towards achieving those goals, and evaluate these processes.

Strategies for meaningful involvement with society must be developed by African IHL. This relationship will also allow IHL to meet with technology creators and consumers. Since IL is experiential, it fosters an educational process in which information, skills, and attitudes are socially formed and/or co-constructed before being learned consciously or subconsciously (Cranton et al., 2015). This strategy might lay the groundwork for the development of an African technological identity.

DEVELOPING AN AFRICAN TECHNOLOGICAL IDENTITY

Identity is essential for the survival of species in any ecology and the contestations of notions of identity are attempts to claim it. It is constructed socially and/or historically, and for Africans, the historical conditions contribute to extinguish a technological identity. Identity is connected to questions of power, value systems, ideology and opportunities and challenges people are presented with. It also influences human interactions by shaping how people understand and experience the world.

African IHL must use its power to create, sustain and internalize values to initiate a technological consciousness awareness project. This requires African scholars to locate and reveal African scientific and technological achievements (as aforementioned) to offer the historical basis for "member-ship" in technological discourses and the nurture of a technological identity. The current optic of technological "member-ship" is mostly Euro-Asian, necessitating the need to improve African agency in both technological narratives and "member-ship"

The project should aim to create a space for educators to examine the parameters of engaging in provocative enquiries. It must situate African higher education experience in African realities to offer knowledge of self and agency, which can be socio-politically and economically liberating. It will also give Africans agency in the technological conversations and help to create a common sense of purpose through ideological coherence and values systems.

Nurturing an African technological identity is essential for the development, embrace and adoption of technology in African higher education. Africans have become consumers of technology and not seen as developers, but a technological identity can act as a catalyst to reinstate the shattered African personality and character, reversing deleterious beliefs and assumptions about Africans, and building confidence in self. It can also create the opportunity to have a stake in the technology space and a competitive advantage. The paradox of African education remains "The voice of 'wounded healers' struggling against many odds to remember the past, engage with the present, and determine a future built on new foundations" (Hoppers, 2000, p. 1).

Evidence from other jurisdictions has shown that identity formation in various fields of endeavour has helped societies create niches and accomplish feats. The Germans have built an identity in the automotive industry just as Indian exploits in the information communication technology space. China on the other hand has been influenced by its cultural revolution to become a technological and manufacturing hub. The role of culture in nurturing technological identity is further emphasized by Akachi Ezeigbo (2013) when she points to Japanese' "Love" and awareness and willingness to "Live their culture" and make it the fulcrum of "An identity that they are proud of" (p. 8). Japanese culture and identity remarkably is the "Consciousness that drives their technology today" (p. 8).

Identity is an element of reasoning therefore Africa's technological issues cannot be addressed adequately without tackling foundational philosophical concerns. Without making an effort to correct underlying philosophical flaws, the technology enterprise and the discussion surrounding its integration in higher education in Africa would not yield meaningful results. The current technological gap and the conditioning that has led Africans to internalize these disorders could benefit from higher education institutions serving as sites to redress.

Tapping into how other nations have utilized the nexus between identity and reason in developing identities could help Africans nurture technological identity to create, adopt, and use technology in solving Africa's challenges. Without this awareness, Africans could be creating and utilizing technology that could possibly annihilate them. A technological identity would instigate a belief in self because "A total rejection of the African heritage will leave

African societies in a vacuum that can only be filled with confusion, loss of identity, and a total break in inter-generational communication" (Ocitti, 1973, p. 105).

Ocitti's proclamation and the importance of technological identity are buttressed by Jackson's (2013) disclosure that historically Black colleges or universities (HBCUs) provide conducive environments that support STEM identity formation for Black women moving from community college because they are less culturally startling and representative of their ethnicity. The finding emphasizes the importance of a sense of community and culturally appropriate ways of learning in African higher education. To develop a technological identity would require curriculum changes, well-planned practicums and conscientised teachers and facilitators.

Adepoju (2022) reports that Africa spends "Just 0.42%" of its GDP on research, compared to the "Global average of 1.7%" (n.p). This is a threat to the nurture of a technological identity as other countries have spent considerable resources on research and development (R&D) to attain their technological identities. The situation makes IHL vulnerable to the whims and caprices of powerful institutions in the quest to meet their material needs. Investment in R&D is vital in the global scheme of technological thought and academic research hence Africa cannot wait in indolence for the (in) actions of others to provide leverage. Notions of superiority embedded in (technological) identity reflects in the unequal opportunities, privileges, and remuneration, as well as stereotypes, and marginalization. Race obviously influences a person's technological, socio-economic, and political power therefore Africa must be strategic and guided by the historical forces that inform contemporary realities. Africa can gain power through research narratives that use the subjective power of presentations to construct meaningful ideas and values related to its technological culture. The academe can also serve as a site for change through the advancement of alternate or emancipatory narratives. African scholars must act intentionally through multiple forms and approaches to present outlooks that nurture the required ideological strands.

CONCLUSION

The drive for technology and conversation around its development, embrace, acceptance, or utilization in African higher education cannot be effectively explored without attempts to redemy foundational philosophical errors. As Eseanya-Esiobu (2019) suggests, "Western intervention in Africa brought with it a repudiation of Africa's originality, and a belittling of the continent's authentic experiences" (p. 1). This has caused "Africans' environment, lived experiences, way of life, their cultural values, belief systems, and educational structure and curriculum (among others)" being "considered backward, unscientific, and barbaric" (p. 1). Africans have been conditioned to internalize these disorders, and the prevailing technological gap makes amelioration daunting. However, it cannot be abandoned.

Addressing the philosophical aspects of African's technological gap is indispensable for a comprehensive and inclusive approach to technology development, deployment and adoption. It will help to foster cultural significance, confront biases, promote ethics and empower African societies to actively participate in determining Africa's technological future. The core functions of IHL—teaching, research and extension or community service provide the platform to engage in this drive.

The world has changed significantly and certain old methods may no longer serve or be relevant in contemporary times. However, these methods and knowledge, like other technologies, should be assessed in light of current demands (Amuzu, 2022b). Africa's technological advancement must be steered within the framework of a technological identity pivoted on mental emancipation. These institutions must not appear to be serving the interests of the powerful or the highest bidder as their interests that may not align with

Africa's economic, political, or cultural interests. African knowledge production, validation, and dissemination must redefine its relationship with schemes that blatantly dominate, demean, and subjugate its worldviews and rethink the kind of knowledge it privileges. IHL must endeavour to create opportunities for learners to experience, define, and decipher the conceptual and theoretical limits of discourses without de-centring themselves in such analysis. In this way, institutions will be educating people who can comprehend and analyse concerns of their society and develop the capabilities to participate in meaningfully addressing them. This outlook is important because issues of technology is political thus the need for subjective politics to disruption dominant narratives that work to sustain the creation, validation, and dissemination of distorted and denigrating narratives about African dispositions.

The need to re-member and connect to African communities is to assert that contrary to the school curricula—where Africans are portrayed as the "simple people" who neither developed nor had any meaningful technology, Africans initiated a lot of scientific and technological advancements that influenced the development of science and technology. The suggestions in this paper may not suffice to address the technologicaly gap between Africa and other continents but provide a path to instigate change.

CONFLICT OF INTEREST

There is no potential conflict of interest in this study.

ETHICS STATEMENT

No human participant was involved in this study.

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DATA AVAILABILITY STATEMENT

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