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Towards Decolonization and Africanization of Computing Education in South Africa

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Abstract:

There has been a clarion call for the decolonization of South African universities. Decolonization focuses on the dismantlement of Western epistemological traditions and practices entrenched in the university culture and knowledge domains. In this paper, we explore decolonization as a site of struggle in national institutions of higher learning, not only politically, but also epistemologically. More specifically, we examine how the Africanization of Computing education is governed by hegemonic and neoliberal policies that work to the detriment of decolonization and indigeneity. We conclude with critical recommendations that can support Computing departments and faculties in enriching the syllabus with indigenous knowledge.

Keywords: Computing Education, Decolonization, Africanization, Ethnocomputing.

1 Introduction

In 2015, South African universities experienced a series of violent student protests across the country, some of which persist today. These protests were a manifestation of inequality and exclusion experienced by predominantly black students who, *inter alia*, called for the decolonization of universities in Africa (le Grange, 2016). The discourse of decolonization focuses on the dismantlement of Western epistemological traditions and practices entrenched in current university culture and knowledge domains (Heleta, 2016). Decolonization involves the 'epistemological dismantlement' of higher education, from an ethnocentric and monolithic environment and towards a more inclusive and heterogeneous space that nurtures diverse cultural groups and indigenous knowledge systems. At a broader level, the decolonization debate is a reflective conversation about the economic inequalities and exclusions that persist among persons of color in a post-apartheid South Africa (Naicker, 2016).

Local student activists have been critical of the slow rate of transformation in South African universities and have criticized the national government for insufficient progress in addressing white economic hegemony in the country (Molefe, 2016). Activists argue that a white minority controls the country's economic wealth and resources, while most black Africans remain in poverty (Heleta, 2016). White hegemony extends beyond economic control; however, while university policies highlight the need for change, equity, and equality, African students continue to be marginalized in historically white universities (le Grange, 2016). At historically white or advantaged universities, black African students are structurally oppressed in terms of language, which is a critical attributive factor in academic failure (van Rooy & Coetzee-Van Rooy, 2015). By implication, disadvantaged black students must function in a learning culture and syllabus that are presented in contemporary English and predominantly rooted in Western history and thought. Indeed, the pressure to become proficient in English, to 'talk white', and to 'write white', makes for an alienating experience on the part of many black Africans (Bazana & Mogotsi, 2017).

We reflect on the dialectical relationship of past colonial policies in education and the praxis of current pedagogies that hinder the development of indigenous knowledge in the Computing disciplines at South African universities. Moreover, we argue that the decolonization of Computing cannot exist as a separatist movement. Indeed, 'decolonized' curricula should not favor some knowledge domains over others (Heleta, 2016). In the scope of this paper, decolonization instead suggests that both Western and non-Western worldviews have important and contributory roles in tackling hegemony in Computing education. By deploying hermeneutics as a theoretical framework and document analysis as a research strategy, this paper discusses the advancements that have been made concerning language policies in the Computing discipline and assesses the impact of colonial and contemporary neoliberal policies on the South African higher education sector.

2 Theoretical Framework

Hermeneutics will theoretically anchor this paper. Hermeneutics is a branch of knowledge that is concerned with the interpretation and re-interpretation of meaning embedded in text. Hermeneutics was initially only concerned with the interpretation of Biblical texts until Friedrich Schleiermacher, in the early nineteenth century, expanded its application to the systematic interpretation of texts from other fields. Schleiermacher's hermeneutics makes two classifications: the first is an examination of textual language, and the second is 'empathy,' i.e., to assume an author's position in an attempt to make sense of what they are endeavoring to communicate through their text (Svenaeus, 2012).

This involves undergoing an intersubjective process whereby one's interpretive effort of text recognizes another person's 'horizon' of understanding the world (Mkhize & Ndimande-Hlongwa, 2014). Gadamer (1975) defines 'horizon' as a collectivity of everything that can be known and cognitively processed by an individual at a historical point in time and in a specific cultural context. Gadamer's claim, therefore, is that meaning is partially revealed by culture and in part forged by the historical, social actors within that culture. Gadamer's concept of 'fusion of horizons' requires the interpreter to fuse their own horizon with the cultural, social, and metaphysical perspective of the social actor and textual resources in which he, she or it is historically located. In doing so, the interpreter engages with the hermeneutic circle to gain a holistic view of the 'whole', which in turn, requires an interpretational relationship with its constituent parts to add knowledge intending to make sense of the whole. Correspondingly, one needs to understand its constituent parts in relation to the whole (Mkhize & Ndimande-Hlongwa, 2014).

Within the scope of this paper, the ‘whole’ is the decolonization of Computing curricula. We strive to create a more comprehensive understanding of decolonization in Computing education by moving between the whole and the parts bi-directionally. We engage in a pre-understanding of the parts, i.e. text, language, experience, cultural expression, or phenomenon in indigenous communities. Here, our goal is to construct a new pre-understanding of the parts as mentioned earlier that are wrapped up in dialogues of decoloniality. The deeper and new understanding of the hermeneutic circle is essential to drive the bi-directional process, unearth new knowledge, and to close the hermeneutic circle. This process is illustrated in Figure 1.

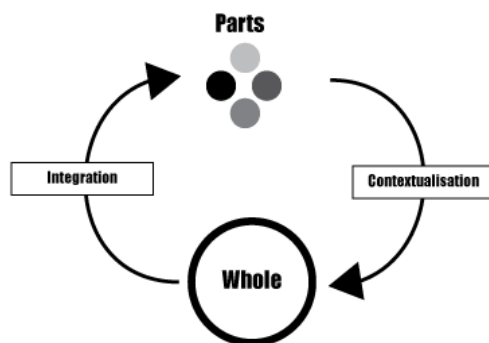


Figure 1. The Hermeneutic Circle of Interpretation (adapted from Timmer, 2015)

This paper frames the views and discourses that surfaced since the 2015 student protests within phenomenology, a twentieth-century German philosophical perspective. Phenomenology holds the view that humans living in a world of everyday life are capable of assigning meaning to a situation and then delivering judgments (Gadamer, 1975). For the phenomenologist, meaning does not only reside in language but is also a fundamental part of human understanding, which influences how we shape our actions, views, and thinking. Since human life undergoes various phases of understanding, phenomenology could be considered as a form of hermeneutics (i.e., the interpretation of meaning) (Svenaeus, 2012). Gadamer's (1975) phenomenological hermeneutics offers an analytical framework for examining subjective meaning in the sphere of colonization and decolonization, language, and their ramifications for indigenous ways of knowing.

Although we realize that it may be regarded as incongruous that coloniality in Computing education is criticized for using a Eurocentric hermeneutic approach, one also has to acknowledge the fact that Western society and epistemology regard themselves as free and, therefore, open to self-critique. Popper (1981) sees self-criticism as the scientific equivalent of Darwin's biological principle of survival of the fittest (i.e., the most adaptable): science progresses due to knowledge revolutions brought about by self-critical thinkers. Learning from our mistakes lies at the foundation of the scientific method, and this implies the need for tolerance and freedom in scientific thinking, as well as the need to identify and acknowledge earlier mistakes. Coloniality and eurocentrism, therefore, should be subjected to self-criticism in addition to critique from African (and other post-colonial) perspectives (cf. Popper & McIntyre, 1983).

3 Methodology

Methodologically, this paper is underpinned by the document analysis research strategy to produce data in an understandable and interpretable form to emphasize related trends that coincide with the research aims. The trends we identify are in accordance with the research objectives to allow the researchers to develop guidelines for Computing departments seeking to incorporate indigenous knowledge into their curricula. Oates (2005) distinguishes between two types of document analysis: found documents and research-generated documents. Found documents are created before the undertaking of a research study, e.g. procedural manuals, annual reports, policies, research publications, and so forth. Research generated documents are created by the researcher, particularly for the research task, e.g. in some instances of ethnographic research, the researcher documents their personal observations and thoughts in the form of taking photographs and writing field notes. We have consulted the following documents/resources to assess and explore the discourses in Computing education within South Africa's higher education landscape:

1. Moore's (2015) historical interpretation of imperial educational policies related to black Africans during the apartheid era.
2. The work of Berry (2008), who is critical of globalist educational technology initiatives, which, he believes, are mostly detrimental to indigenous knowledge.

3. The Department of Education's (DoE) (2004) policy framework, the *White Paper on e-Education*, as a guideline for using digital technology to address inequality in education.
4. Pillay (2016), who examines how decolonization movements challenge those Western epistemological practices that prevail at South African higher education institutions after the apartheid system was abolished. We discuss several studies (Gqirana, 2016; Jansen, 2017; Liebenberg & van der Walt, 2015; Naicker, 2016; Nudelman, 2015; Nyamnjoh, 2016) to reflect on the impact of decolonization movements – in particular, the entrenching language discourse – on present transformation agendas at universities.
5. The work of Dalvit, Murray, and Terzoli (2008), depicting a cultural juxtaposition between Western and African knowledge domains as these relate to the understanding of technology concepts and functionalities.
6. Work on gamification (von Holy, Bresler, Shuman, Chavula, & Suleman, 2017), Microsoft's Language Program (Microsoft, 2012), and 'ethnocomputing' (Dalvit et al., 2008; Sutinen & Vesisenaho, 2006; Thinyane & Terzoli, 2011), as a potential framework to instill the African experience in Computing education.
7. Naudé's (2015) reflections on reasons as to why and how decolonization research contributes to the oppression of indigenous knowledge.
8. Gyekye's (1988) African philosophical principles, which focus on the 'African experience' in development initiatives as a shift from Western ontologies.
9. A case study by Simonds and Christopher (2013) to empirically guide cultural pluralism in Computing education.

Mainly, an analysis of these sources constitutes a comparative and analytical literature review. By engaging these sources, we aim to offer a critical account of events and dimensions that influence the lived African experience in the adoption of indigenous knowledge in Computing education.

4 Education in Pre- and Post-apartheid South Africa

4.1 The Vestiges of Apartheid

Decolonization has historical significance; it is a reaction to segregation (Pillay, 2016). History is therefore deployed as an analytical device of hermeneutics to understand the evolution of decolonization into its current form (Gadamer, 1975). Moore's (2015) analysis of segregated education under the apartheid regime frames the historical context of this study. We ground Moore's interpretation of the past in Gadamer's (1975) philosophical hermeneutics: 'history of effects'. Gadamer describes the history of effects as a succession of interpretations of particular texts throughout its history. In this instance, Moore's (2015) historical interpretation and writing of the apartheid government's educational policies, which excluded black learners, connects us to the events from which decolonization arises.

The introduction of the Bantu Education Act of 1954 by the apartheid government at the time, is the most noteworthy case (Moore, 2015). According to Moore (2015, p. 19), the curricula of Bantu Education were designed for non-whites to have a "greater understanding of their masters' orders", to replace the preliterate knowledge of black Africans, and to instill attitudes of servitude to whites. This was mainly reflected in subjects that concerned agriculture and handwork. Therefore, blacks with limited skill sets were a steady supply of low-cost labor for the white-dominated industries. In 1994, the apartheid system was formally abolished. The end of apartheid initiated educational reform, such as the dismantlement of compulsory segregation in education with the institution of the South African Schools Act in 1996. But decades of inferior education left black South Africans with immense educational challenges to overcome (Moore, 2015).

4.2 Transformation through Technology

In 2004, the Department of Education (DoE) (2004) outlined in the White Paper on e-Education their vision of harnessing the power of information and communication technology (ICT) to redress past inequalities and improve the quality of South African education. This, of course, did not preclude other policies aimed at social and economic redress. In the goals and strategies introduced through this White Paper, digital technology is considered a transformative tool and forms part of a broader political drive of inclusionary, progressive, and innovative development to prepare learners for the competitive global economy. At a local level, the framework emphasizes the importance of mandating government and the private sector to absorb

ICT skilled workers in “building a domestic knowledge economy and promoting online transactional capabilities for the consumer, business, and government sectors” (DoE, 2004, p. 9).

Furthermore, the policy endorses indigenous knowledge creation, indicating that “local content development in terms of the number and quality of local websites, local language content and the use of local online content by key sectors” are critical activities that need to be introduced towards such an objective (DoE, 2004, p. 9). To accomplish this, the White Paper advocates for the mobilization of investments and funding to secure and sustain the provision of marketable ICT skills, multimedia content creation, and computer hardware and software. The identified funding sources include private-sector donations, international development organizations, institutions sponsoring academic research and public-private partnerships (DoE, 2004, p. 9).

4.3 The Rise of Student Movements and the Clarion Call for Decolonization

Since the promulgation of ICT, language, and other socio-economic policies, there has been general apathy from the South African government and education departments about facilitating the intellectualization of indigenous languages in higher education (DoHE, 2018). During this period, prevailing Eurocentrism in South African universities ignited a growing concern among black South African university students in 2014/5. A group of postgraduate students at the University of Witwatersrand (Wits) mobilized as the #TransformWits movement and penned the Wits Transformation Manifesto to express their disgruntlement with the slow transformation in South African institutions of higher learning (Earp et al., 2013). This movement initially championed the cause of decolonization of universities in the country, based on several pillars, including the Africanizing academia away from colonial culture into a more inclusive space; decolonize university curricula as an impetus for broader societal transformation; and eradicate the financial exclusion of black students (Wits Vuvuzela, 2015).

The movement gained momentum elsewhere in the country in March 2015, when a student at the University of Cape Town (UCT), Chumani Maxwele, hurled feces at the statue of Cecil John Rhodes in protest against the public commemoration of colonial figures. Maxwele’s act quickly gained attention and the incident went viral on social media, and particularly Twitter, with the hashtag, #RhodesMustFall. UCT – yielding to public and student pressure – removed the statue in April 2015 (Pillay, 2016). #RhodesMustFall gained traction as a critique of the inequalities that persisted in post-apartheid South Africa (ibid.). The protest foregrounded privilege, exclusion, broken political promises and poverty; these narratives were again raised during another student movement, #FeesMustFall. #FeesMustFall started after the University of Witwatersrand (WITS) announced a tuition fee increase of 10.5% for the 2016 academic year (Pillay, 2016).

The announcement came in response to the state declaring that it could only subsidize universities at 5% of its net increase in cost for academics’ salaries, journal subscriptions, library books, and research equipment. WITS claimed that the subsidy would not be sufficient to cover its overall net increase in expenses, research equipment, journal memberships, library manuals and the salaries of academics. In protest to the fee hike and drawing motivation from #RhodesMustFall, students at the University of Witwatersrand launched the #FeesMustFall campaign on 15 October 2015. Similar to #RhodesMustFall, the #FeesMustFall hashtag gained widespread reach on Twitter, propelling a series of student demonstrations across South African universities. Following ten days of student protests, the state was forced to announce a 0% increase for the 2016 academic year (Pillay, 2016).

The #FeesMustFall campaign inspired a nation-wide call for free education and placed a renewed focus on the decolonization of universities, for instance, the Open Stellenbosch campaign at Stellenbosch University (SU) which commenced mid-April 2015. Members of Open Stellenbosch argued that SU, a historically white university, still operated as a colonial institution that alienated black students from institutional culture (Naicker, 2016). Black students at SU felt particularly marginalized by the use of Afrikaans as the primary language medium. Black students felt Afrikaans symbolized, similar to the Cecil John Rhodes statue, a culture of apartheid and colonialism that seemed to persist on campus. For students, the bias towards Afrikaans as an instruction medium reproduces dichotomies of racial exclusion and inclusion that are perpetuated through institutional racism (Jansen, 2017).

Students demanded reform of the university’s language policy; this led to the adoption of English as the primary language medium at Stellenbosch University and the University of Pretoria in 2016 (Gqirana, 2016; Nyamnjoh, 2016). Despite English not being the home language of many black students, they demanded that their institutions educate them in English (Liebenberg & van der Walt, 2015). This rhetoric links to the widely-held perception of English as the de facto language needed to communicate effectively (verbally and

through the written word) within South Africa's political, academic, and business sectors, as well as globally (Nudelmann, 2015). English is also prevalent in Computing education (Berry, 2008), in that South African students are required to hone their English reading and writing skills, cultivated through group work, communication and problem-solving activities (Ponelis et al., 2012).

The prevalence of English in Computing can further be attributed to the following factors: indigenous African terminologies/languages have a limited presence in the discipline, and there is inadequate effort to develop it in digital literacy; English is the universal language of science instruction at university level, while everyday communication occurs in a variety of indigenous languages. Moreover, Computing departments are under pressure to compete in the global industry, which can reinforce the idea that English is superior and that African languages cannot make significant contributions with regard to knowledge building in the global arena (Dalvit et al., 2008).

4.4 Indigenous Languages in African Computing Education

The discussion above is necessary for understanding Western knowledge domains and their influence on formal education. Western paradigms should furthermore be problematized with the aim of defining the boundaries and roles of a decolonized Computing curriculum for the benefit of African students. The purpose of contemporary English in the decolonization of South African curricula is significant. As pointed out above, this proves especially challenging for Computing curricula since computing-related knowledge was predominantly created and consumed in Western countries, and therefore inevitably reflects Western epistemologies (Muwanga-Zake, 2010). Goals of decolonizing Computing curricula faces another threat in the form of black African students who willingly embrace English as a medium of instruction at universities (Liebenberg & van der Walt, 2015).

In this context, language and ideologies developed in the West infringe on some of the cultural traditions across a diverse African continent. Hermeneutics framed within ethical analyses is considered to make sense of how sciences and languages differ across cultural groups (Svenaeus, 2012). Svenaeus (2012) suggests that investigations need to steer between ethical relativism – i.e. ethical concepts reflect the practices of a specific cultural group – and hegemonic ethical objectivism – i.e. systems of ethics that originated in the West are concordant with truth and are applicable to any culture regardless of the ethical self-understanding of the other cultural group in question. To facilitate meetings of horizons by cultural tradition, we analyze Dalvit et al.'s (2008) classification of indigenous knowledge and its standing in ICT education according to three components: traditional knowledge, common knowledge, and specialized knowledge.

Traditional knowledge, another term for indigenous knowledge, is often based on occultism, religion and spirituality (Dalvit et al., 2008; Muwanga-Zake, 2010). In the apartheid era, traditional knowledge relating to Christianity was incorporated into formal education while African religious beliefs were intentionally opposed. This was an attempt to enculturate the local population into Western-style education. Dalvit et al. (2008) believe that this move created the association of a stigma with African indigeneity. This holds implications for ICT education as well since digital technology symbolizes modernity, which is often conceived in contrast to traditional knowledge, irrespective of whether its origins are Western or African.

Common knowledge refers to general knowledge that everyone applies to everyday life. Dalvit et al. (2008) argue that common knowledge forms a fundamental part of a group's culture and, therefore, support classroom instruction using metaphors. The inclusion of common knowledge is contentious as it ostensibly contradicts scientific epistemologies. Consider the example of a computer's Graphical User Interface (GUI) through which a user can operate software applications; the GUI icons of the desktop environment generally draws on the metaphor of an office desk and its items in terms of their functions and use. For someone from a first world country, executing tasks through GUI might be intuitive while an individual from an under-resourced area may find these metaphors, imbued with the GUI, meaningless (Dalvit et al., 2008).

Specialized knowledge is held by an individual who is an expert in a niche field and may be determined by culturally bound conventions such as language and color schemes. Dalvit et al. (2008) present an example of the color 'red' which symbolizes 'danger' in Western cultures while 'green' indicates 'safe to proceed'. In many African cultures, 'red' means tradition as opposed to 'blue', which signifies modernity. Attempts to Africanize Computing curricula are under further threat due to a lack of African languages in the ICT field. This leaves a wide gap in the transition of indigenous common knowledge to specialized knowledge in Computing. Take the example of a GUI list and menu, which has a different meaning in English, while in an African language, such as isiXhosa, the term 'uludwe' refers to both list and menu (Dalvit et al., 2008).

The cultural differences outlined by Dalvit et al. (2008) make it clear that black African students are at a disadvantage since there is a disconnect between their common knowledge and Western world metaphors that are typically applied to Computer education. Dalvit et al. (2008) further allude to claims that the West deliberately attempts to remove common knowledge by replacing it with specialized knowledge. This links closely with Moore's (2015) claim above that early missionaries intentionally modeled curricula to replace the preliterate tribal education of South African indigenous groups. Assimilating specialized Western knowledge into an indigenous culture is a subject that is under heated debate; for example, Dalvit et al. (2008) are critical of Gramsci, an Italian Marxist philosopher, who opposes the relativist stance in respect to common knowledge. Gramsci argues that common knowledge perpetuates an ignorant culture, remaining none the wiser to alternative forms of knowledge. Gramsci calls for scientific education to take the moral duty of 'rescuing' indigenous societies from their superstitions and folklore. Gramsci suggests specialized knowledge would reveal indigenous groups' social positioning to themselves (Morgan, 2002).

5 Towards Decolonizing South African Computing Curricula

The previous sections illustrate how challenging it has been in South Africa's post-colonial era to enhance African ways of knowing and knowledge creation in Computing education. Fortunately, research that propagates the integration of non-Western worldviews, beliefs, practices, and customs has been published and tested over recent years. In the sections to follow, we examine such efforts by scholars from Africa, and globally, to decolonize Computing education in response to oppressive Western hegemony in education. We ultimately argue for a balanced view and practical integration of Western and non-Western knowledge in Computing education, promoting an inclusive and diverse field of science.

5.1 Gamification

Heleta (2016) asserts that curriculums, embedded within prevalent Eurocentric epistemologies, do not contribute much toward the meaningful decolonization of knowledge systems at universities. Thus, the onus falls on progressive academics to decolonize their own curricula with the aim of democratizing the pedagogy and learning culture. This requires a collaborative effort by both educators and students, in which decolonization is understood as a critical process of amassing and reconstructing knowledge systems with indigenous content (ibid.). African and South African academics have responded to the call for local or indigenous content creation. von Holy et al. (2017, p. 1) designed an online digital library – a project entitled 'BantuWeb' – as a tool for motivating users to contribute "Resource Scarce Languages" (RSL) content on a web-based portal.

The researchers integrated gamification features to make RSL preservation and contribution an exciting activity as well as to generate rich content that increases over time. Gamification involves the use of game elements such as points, badges, ranking systems and other types of rewards to create an enticing experience for users (von Holy et al., 2017). The researchers found that gamification indeed motivates contributors to add content to the RSL. The paper proposes that Computing lecturers and students jointly use BantuWeb to advance and develop ICT-related terminology. To make such a curriculum reconfiguration possible, Computing departments should introduce dual medium instruction. We recommend that Computing departments harness software development and software engineering skillsets and models to embed underdeveloped African languages firmly into the discipline.

5.2 Existing Software

Microsoft's (2012) *Local Language Program* may be useful in guiding Computing departments towards the Africanization of their curriculum. The program makes provision for 108 languages and includes African languages such as Setswana, Sesotho sa Leboa, isiXhosa, isiZulu, Afrikaans, Wolof, Malagasy, Hausa and Kiswahili. For every available language, Microsoft offers a style guide to help localize digital technology solutions in a native tongue. The primary objective of the guide is to advance understanding of the required stylistic and linguistic nuances of the language in question for the localization of technological products and services. Microsoft (2012, p. 1) describes the program as follows:

The Microsoft Local Language Program provides people access to technology in a familiar language while respecting linguistic and cultural distinctions. The program bridges the gap to technology through language and culture as well as empowers individuals in local communities to create economic opportunities, build IT skills, enhance education outcomes, and sustain their local language and culture for future generations.

5.3 Ethnocomputing

We established that decolonizing Computing curricula are a cumbersome task due to the invention of computer technology in the West. As a result, Western values, cultural characteristics, science, and linguistic models tend to reflect on the application of ICTs. For students from the black African culture who speak native African languages, English – a language of scientific inquiry – is foreign. Moreover, mere attempts of simplifying ‘scientific language’ to ‘common language’ seem to be inadequate and in the local context of indigenous communities. Dalvit et al. (2008) advocate insights from Ethnocomputing to enhance cultural pluralism and relativism in Computing education. Ethnocomputing promotes the application of ICT solutions insofar as to address the needs of a specific culture. For example, Computing education can be informed by traditional art craft practices (Dalvit et al., 2008).

Ethnocomputing is based on the premise that encoded cultural life and experiences are expressed bi-directionally through technology to the benefit of the community (Dalvit et al., 2008). For such intervention to be successful, ethnocomputing shares the philosophical principles put forth by Gyekye (1988) and Gadamer (1975); indigenous communities mainly need to be active participants in development initiatives and the knowledge and way of life should be respected in the research domain. In this vein, we propose that curriculum designers who seek to translate the African experience and insights from ethnocomputing to a context-sensitive Computing curriculum, draw on common knowledge from indigenous African communities. Sutinen and Vesisenaho (2006) found that an ethnocomputing-based approach in ICT-related education could be successfully implemented on an indigenous community’s context-driven principles.

Sutinen and Vesisenaho (2006), in collaboration with Tumaine University in Tanzania, designed a contextualized introductory programming course offered to second-year students in an undergraduate teacher education program. The objective of the course was to inspire the students to design programs tailored to the needs of their own communities. The course content was designed to be representative of students’ everyday life. For example, the web-based instructional interface was visualized as a culturally-adapted metaphor – a village (cf. Figure 2). By clicking on people and the huts in the village, the student could access and obtain the learning content. This use of symbolism was deliberate to illustrate that programming concepts do not need to be explained in ‘high tech’ Western-styled formats, but it can be rendered easily comprehended if it is presented using concepts and visual symbols that are representative of students’ local socio-cultural context. The study’s findings show, inter alia, that students are enthusiastic about the economic and social opportunities that contextualized technology application may enable, in particular, to increase the speed of development initiatives and improve communication (Sutinen & Vesisenaho, 2006).

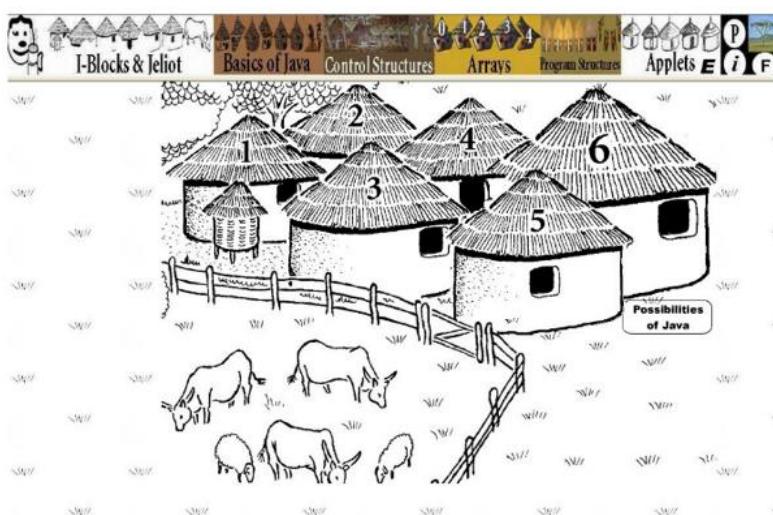


Figure 2. Sutinen and Vesisenaho's (2006) Instructional Interface as a Graphic Metaphor – A 'Learning Village'

We support Thinyane and Terzoli's (2011) ethnocomputing strategy, *technology adaptation*, in the teaching, design, and management of Africanized ICT solutions. Technology adaptation is based on the premise that *linguistic localization*, *cultural localization*, *application themes*, *metaphors*, *interaction frameworks*, and *indigenous knowledge integration* should be implemented as related societal constructs to support ICT intervention. Thinyane and Terzoli (2011) describe each of the components as follows:

- *Linguistic localization*: To avoid the unnecessary obstacle of teaching the indigenous user a foreign language, linguistic localization contextualizes the interface of the information system or application into the user's local language. This allows the user to operate the information system in a language he/she already speaks and writes proficiently.
- *Cultural localization*: This strategy refers to the integration of an indigenous community's cultural framework into an application. This means applications are designed along cultural dimensions such as interaction, beliefs, values, and aesthetics.
- *Application themes*: Different cultures perceive structures such as element positioning, colors, alignment, shapes and the application of symmetry differently. Therefore, the design and use of structures should be taken into consideration depending on the culture that is the subject of inquiry.
- *Metaphors*: Metaphors exemplify and articulate the worldviews of a culture. As we noted earlier in this paper, even the subtle and nuanced use of metaphors in Computing is interpreted differently by black Africans. We presented Dalvit et al.'s (2008) example of an application's "Menu" and "List" which has a different meaning in English but the same meaning in isiXhosa. Ethnocomputing denotes that the crucial use of English metaphor in Computing should be identified, deconstructed and then reconstructed as culturally relevant metaphors.
- *Interaction frameworks*: The way members communicate with each other within a culture also affects how they interact with digital technology. In some cultures, written stories, drawings and/or song and dance predisposes means of communication. Instead of text-based components, it might be more appropriate to place, for example, a drawing – that is native to the indigenous community – to communicate the purpose of a functionality of an information system.
- *Indigenous knowledge integration*: The application of digital technologies for development and to the benefit of indigenous groups is predicated on the assumption that local knowledge can be accessed and disseminated from and through, for example, the Internet. For this assumption to become and remain valid, it is imperative that ICT infrastructure should be available, maintained and upgraded to facilitate the submission, codifying, modification, sharing and preservation of local knowledge.

Dalvit et al. (2008) used an ethnocomputing intervention into an *Extended Studies Program* offered at a traditionally white South African university. The objective of this program focuses on integrating indigenous knowledge into teaching and learning practices. A focus group was conducted with members from a marginalized African community who speaks the African language isiXhosa. Members consisted of isiXhosa speaking experts from the Linguistics, Education, and Computer Science disciplines. The group drafted a glossary of computer terminology that they translated to isiXhosa. For example, the term 'wizard', a function in Computing that guides users through a procedure, was translated to *umvumisi*, a traditional healer in an isiXhosa community. An *umvumisi* asks a patient a series of questions to help diagnose a condition or disease.

Another example is the relationship between a server and a client computer. The group metaphorized this by means of an individual who assists a bride with preparations for her wedding; this relationship is known as *umxobisi*. The glossary was also converted to an online version, using the Learner Management System *Moodle*. Moodle allows students to comment on and rate entries, allowing an interactive experience. System logs make it possible for the researchers to monitor the terms students search for the most, allowing the collaboration team to include and develop new terminology. Multimedia in the form of images, videos and audio are used to strengthen the cultural context of terms for students in case they are not too familiar with the written version of indigenous terms. Dalvit et al. (2008) furthermore visualize terms from the glossary with a concept map by applying CMAPTools to elucidate taxonomies and relationships between concepts.

Thinyane and Terzoli (2011) designed a software architecture, which they call PIASK, that practically embeds the theoretical principles of ethnocomputing. To counter Western homogeneity that constrains the use of ICTs for Africans, Thinyane and Terzoli make heterogeneous provision in their software application in the form of different media format (e.g., different devices end-users use) and varied communication modes (e.g., gestures, text, speech, etc.). Thinyane and Terzoli use multi-modalities to make the system accessible to different types of users; for example, sound-based modalities for the visually impaired, character-free interfaces for the dyslexic and illiterate, and character-based modalities which suit various users' preferences. The different types of indigenous knowledge, expressed through the different multimedia formats, are handled through a functional access layer that handles requests between the software architecture and the end-user devices.

On a functional level, for example, Thinyane and Terzoli (2011) format the content for the different devices at a *presentation* level; for example, a request made from a PDA (Personal Digital Assistant) will return and convert and render content in a markup language such as HTML (HyperText Markup Language) to the interface and platform definition of a PDA. An autonomous *interaction* layer, depending on network signal strength or congestion, returns audio files, textual or graphical descriptors in an alternative format to optimally manage bandwidth use. Given the fact that the construction of knowledge takes place within a social context, Thinyane and Terzoli make use of a functional *social networking* layer that models the social behavioral patterns of community members. The layer models a protocol similar to the 'friend of a friend' standard that popular social media platforms use. The system is, therefore, community-orientated which creates a sense of belonging.

Thinyane and Terzoli make use of a *knowledge base* functional layer that handles the storage of knowledge that members populate. This layer is predicated by worldviews akin to a local indigenous group. The layer has functions and tools such as an Open Knowledge Base Connectivity interface, which allows interoperability among various knowledge repositories and enable members to capture and codify terminologies. Fig. 3 illustrates the interaction and dependencies between the *access*, *presentation*, *interaction*, *social networking* and *knowledge base* functional components within the software architecture. The rectangles indicate the inward dependencies, and the circles denote the outward dependencies between the functional layers. Thinyane and Terzoli explain interaction and dependencies as follows:

The access layer is mainly responsible for facilitating the interaction between the architecture and the end-user devices. The access layer depends on the presentation layer for the processing of content that a specific device requests. Therefore, from the access layer to the presentation layer, there is an outward relationship. For logical assessment and processing of requests, the access layer depends on the interaction layer. The complete architect logic is contained within the interaction layer, and as can be seen in Figure 3, the interaction layer is the most linked tier. As Thinyane and Terzoli point out above, knowledge creation and dissemination occur when community members interact with each other, hence the social networking layer's dependence on the knowledge layer. Therefore, the architecture adopts the normative pattern of social life that defines and characterizes the creation of new knowledge.

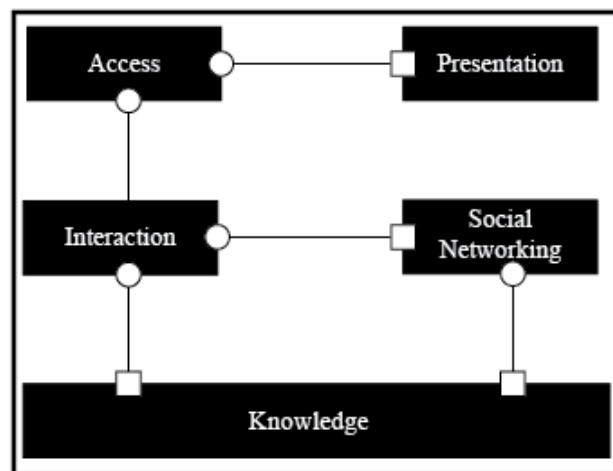


Figure 3. The System Level Interaction Adapted from Thinyane and Terzoli (2011)

6 Decolonization Research under Western Epistemological Hegemony

Endeavors such as the ones described above are not enough to sustain the larger goal. We base this assertion on the notion by Naudé (2015) that decolonization research lacks sufficient insight into how Western epistemological practices hinder indigenous knowledge production. Paradoxically, then, decolonization research contributes to the suppression of indigenous knowledge within a Western research tradition. We impute the suppression of indigenous knowledge creation to two factors: a socio-economic imperative and a mono-epistemic imperative. We discuss problems relating to the socio-economic imperative within contexts of funding norms in academia. Our discussion on the epistemic imperative examines how the epistemic power that Western traditions hold reduces indigenous knowledge as inferior.

6.1 Decolonizing Research under the Socio-economic Imperative

Muthama and Mckenna (2017) trace problematic funding formulas back to the era of Apartheid. Funding formulas for Bantu Education were used intentionally to discriminate against the black student population. Earlier, we cited Moore (2015) to highlight how colonial curricula intentionally limited education for black students by training them to perform low-cost manual labor. Again, this carefully coordinated curriculum would ensure that the foundations of white supremacy be sustained. Muthama and Mckenna (2017) conclude that Bantu Education was financed in such a way to achieve a minimum educational effect. Also, research at historically black universities were discouraged and considered not a core function due to restricted budgets (Muthama & Mckenna, 2017).

Post-apartheid funding policies formulated to redress research capacity building at historically black universities had unintended consequences. This follows from universities who increasingly conformed to international metrics of success – e.g. cross-country rankings – and orientated themselves to global institutional management and funding structures. The objective is to cultivate a positive impression among foreign institutions and donors, typically by acquiring status on metrics against which funding agencies merit funding allocation. But embracing international metrics and associated incentive models, however, means that its associating problems could also manifest locally (Nattrass & Seekings, 2015). Such problems emerge in the form of *rent-seeking*, an economic concept whereby a monetary policy is manipulated as a strategy for increasing financial incentives (Muller, 2016).

In universities, Muller (2016) views rent-seeking as a relevant concern in the following respect: scholars stating unwarranted claims regarding the societal benefits of their research to secure research funds. Academics would obtain funding for research projects under the guise of highlighting indigenous epistemologies while outputs are guided towards subjects favored by funders. This contributes little to illuminate the needs of communities under inquiry. Muller considers rent-seeking as a construct of neoliberalism. Neoliberalism is rooted in the ideas of traditional liberalism, which had its origins in the 1800s. Liberalism in its traditional form hinges on the idea of people favoring free-market capitalism – it emphasizes the right to accumulate wealth and pursue one's own interest. Neoliberalism expands liberalism by transforming its precepts applicable to contemporary global and postmodernism form of capitalism (van der Walt, 2017).

According to Berry (2008) neoliberal globalization is indistinguishable from Western epistemological systems. Because ICT is an invention of the West, it is closely linked to Western epistemology. Berry opines that ICT development – especially for education reform – is grounded in the principles of neoliberal globalization. In essence, capital fuels ICT development and implementation; in turn, capital is generated via profit. Interspersed in this view is the argument that epistemological elements are contained within the ideological constraints of capitalistic expansionism. While the increase of ICT procurement is conceived as a *sine qua non* of progress in global education, its destructive potential is often hidden when it is being considered similarly to emancipate and empower indigenous research. In Berry's view, this ostensive exemplification of progress is fundamentally a manifestation of *neo-colonialism*. Here, a Western and hegemonic degree of authentic 'knowledge' is defined globally. For Berry, these dominant knowledge domains are inseparable from neoliberal ideals that govern them. Moreover, it is paternalistic posturing by the West, in which they propose to imbue indigenous people with the 'right' knowledge.

6.2 Decolonization Research under the Mono-epistemic Imperative

Many scholars who participate in decolonizing research have good intentions. Investigated critically, however, their attempts transpire within the confines of Western epistemic traditions in which cultural emancipation is accompanied by further harm to indigeneity (Berry, 2008). The reality, which decolonization researchers face, is the 'inescapability' of the well-developed epistemologies that accompanies Western science. The intellectual 'journey' to decolonization research always begins in the West. Researchers undertake a metaphorical journey to the West to first come to terms with the complex and rich tradition of research ethics, philosophical paradigms, theories, and methodologies. They are introduced, for example, to great thinkers such as Gadamer. Once such a tradition is understood, they have developed discernible hermeneutical lenses. They then direct their gaze to a decolonization inquiry to reflect on indigenous values. The only intellectual points of departure they have at their disposal are Western ones because their local findings will have to be discussed in English and within an established Western theoretical ambit to be understood by outsiders (Naudé, 2015).

Naudé (2015) outlines three models of research ethics and philosophy that emerge (in ascending order) when decolonizing research is undertaken: the transfer model, the translation model, and the substantive model. Naudé specifically discusses these models within the context of 'African' business ethics, i.e., how business ethics can be developed from an 'African' perspective. In the explanation that follows below, we generalize these three models to decolonizing studies that seek to indigenize Western environments.

Transfer model: In this model, Western philosophy is adopted as the norm and presented as the ideal standard of ethics and philosophy. Western philosophy, then, is read and transferred as the dominant academic tradition to the indigenous context. Little transpires regarding contextual adaptation or critical reception. The vexing issue is that the case is presented as nothing more than a geographical reading location, e.g., 'Africa', etc. That is, it makes no difference whether one reads, for example, Aristotle and Kant in Cape Town, Cairo or Berlin. The indigenous approach to philosophy and ethics is highlighted later (if at all); when it is impossible to circumvent the chosen Western academic tradition. We consider Microsoft's (Microsoft, 2012) Local Language Program to be an exemplification of the transfer model. Although Microsoft claims that their efforts, via the language program, are to extend and sustain local culture and language, the following goals set forth in the IsiXhosa Style Guide aligns with Naudé's (2015) conceptualization of the transfer model: "to highlight where Microsoft has specific preferences ... and learn how to address all of the necessary linguistic and stylistic nuances of isiXhosa during the localization of your products and services.

Translation model: Naudé distinguishes between three types of translations from reading decolonization literature. First, Western ethics are critically appraised from an African perspective. In such instances, Western insights are normatively harnessed to comprehend local context with the consequence that the Western perspective itself is elucidated. In our view, an example of such a study is von Holy et al. (2017), who investigate how South African indigenous languages can be developed using a web-based repository. Thus, digital technology is translated into the indigenous context with specific implications for digital archives. A second method is using local case studies to contribute indigenous knowledge – interpreted within the frameworks of Western principles – to a body of knowledge. Our perspective is that Sutinen and Vesisenaho (2006) who examine the design process of a community-based ICT course at a Tanzanian university is an example of this method.

A third method is to address African moral dilemmas that are context-specific by deploying Western theories. We will now consider Mbithi (2014) who investigates how African philosophy can be explained by recourse to Gadamer's philosophical Hermeneutics as an example. In this instance, Mbithi – inter alia – focuses on moral dilemmas such as the lived experiences of African people that struggle to deal with ubiquitous influences of economic and cultural imperialism of the West. Because attempts to decolonize knowledge relies on Western theories for its construction, Naudé (2015) concludes that the contribution of the translation model is minimal at best. The problem is compounded by language as 'translation' that occurs in 'English', which Naudé considers a Western epistemic tradition.

Substantive model – Ubuntu ethics: In this model, researchers acknowledge Western tradition as valuable; however, there are aims of advancing theories unique to Africa. Ubuntu is typically advanced as a competing and alternative theoretical perspective to Western versions. This informs the naming convention, namely 'substantive'. Ubuntu expresses the communalism approach in contrast to the individualism of Western tradition. Ubuntu ideology is summarized as follows: An action is acceptable to the extent that it encourages a common identity among members grounded on benevolence; conversely, an action is inadmissible insofar as it fails to do so while encouraging malevolence. Ubuntu is additionally based on the following claim: It is upheld by the notion of universal respect for being-through-the-other or 'I am, because we are' whereby 'I' is shaped by 'we' towards a particular ethnic kinship; put differently, in an African tribe an individual is defined through other members close to him/her who benefit from that individual's patronage.

For Naudé, these claims are questionable. First, he rejects the communitarian view of Ubuntu, which refuses to acknowledge African personhood, i.e. individualism. Proponents of this view would argue that it is not possible for the individual to exist alone, except corporately. Arguing against this, Naudé holds on to the view that even within the social confines of an indigenous community, social construction exists as a prominent individuated activity. This notion maintains that individuals in an indigenous community have personal agency on the premise of moral agency and autonomy as dynamic negotiated entities. Second, Naudé decries the notion of humanness, which implies that an individual's humanness is validated through the humanness of others. Naudé attributes being-through-the-other as inherent to other societies, not a distinguished property of Ubuntu, but indeed integral to Western philosophy as well.

In response, Naudé recommends three decolonization acts. The first is to replace Eurocentrism with Afrocentrism. In other words, knowledge can be contextualized from African perspectives regardless of its origins. Decolonization researchers should, in addition, reject the notion of indigenous knowledge as an extension that merely adds an interesting dimension to Western philosophy. The second is to acknowledge the value of Western tradition and criticize it as misappropriated in decolonization research. Naudé states that for knowledge to be considered universal, it must also be viewed as 'pluriversal'; therefore, universities must be converted into 'pluriversities'. The third option is to inquire about the very epistemic nature of scientific knowledge. Western scientific knowledge would assume that customs (observable across Western and non-Western cultures) such as songs, dance, stories, and so forth, are tacit knowledge. It should, however, be acknowledged (as ethnocomputing research demonstrates) that these social customs, for indigenous communities, are a valid form of generating knowledge.

The preceding passages illustrate how decolonization research mimics the very same coloniality from which it tries to escape. We illustrated how decolonization research, entangled in a socio-economic imperative, sets a new power asymmetry where both international and local funding institutions leverages control of educational reform. Indigenous groups are targeted as they are perceived to be in most need of educational reform. Mere lip service, however, is paid to cultural diversity under the guise of humanitarian rhetoric, and in essence is tantamount to a neoliberal ethos to serve global financial elitism. Further analyses showed how this problem is also intertwined with a mono-epistemic imperative. To the extent that Western epistemologies are in conflict with indigenous empiricism, however, the consequence is that one form of knowledge generation is subordinated. In the next section, we examine the principles of the African lived experience to explore the potential of a multi-epistemic approach for knowledge generation in decolonization research.

6.3 The 'African Experience'

We believe that the construction of indigenous knowledge, in the post-colonial and globalization era of Computing education, requires insight into the fundamental principles and values of the so-called 'African experience'. This paper draws on Gyekye's (1988) critical exploration of traditional African life as normative and eclectic. Gyekye argues for philosophical analysis and interpretation of African experience concepts that he views as neglected and misunderstood in contemporary African political - and socio-economic life. Given the slow rate of transformation away from Western knowledge systems at South African universities, this paper advances Gyekye's views – expressed in an inaugural lecture he gave at the University of Ghana in 1987 – as a contemporary anti-colonial theory that remains pertinent for research that calls the traditionally embraced colonial experience into question.

6.3.1 Situating Philosophy, Science and Ideology

Gyekye (1988) does not consider 'development' – a primary goal for governments in the Global South – as a clearly defined concept. For Gyekye, there is too much emphasis on economic development; he argues that development also needs to be embodied as a behavioral concept that can channel itself morally, socially, culturally, and so forth. The goals outlined in the *White Paper on e-Education* (DoE, 2004), indeed capture Gyekye's (1988) conceptualization of development with the intention of addressing South Africa's history of oppression. To repeat: in the white paper, development involves harnessing the benefits of digital technology to produce quality education for social development, economic growth and access to learning content to the benefit and representation of a broad array of cultures and languages (DoE, 2004).

But considering the current decolonization discourse, the promotion of such a diverse education system seems to be merely 'symbolic' and without remarkable progress. The over-emphasis on economic development can be linked to the South African government's adoption of neoliberalism in education which has unintended consequences (van der Walt, 2017). Natrass and Seekings (2015) assert that neoliberal ideology in higher education allows the government to manage public educational institutions along corporate management lines and view students as human capital. The government strives to enculturate students with market-driven knowledge to service the capitalist-driven economy, compete in global economic markets and attract foreign investment (Natrass & Seekings, 2015).

The values that underpin development initiatives in such an 'academic society' are, therefore, expressed and executed through the concept of ideology. Gyekye (1988) also finds the conceptualization of 'ideology' in contemporary philosophy problematic. Ideology has a somewhat derogatory connotation, which according to Gyekye, was perpetuated by Karl Marx. Marx believed ideology defiles humans' understanding of social reality, e.g. when an arrangement of flawed notions and beliefs is propagated to the benefit of the

ruling, dominant class. For Marx, therefore, ideology constitutes the hegemonic class, and its values have a strong denigrating effect on how the concept is viewed in contemporary interpretations – it is understood as bias, subjective, partisan and impractical (Morgan, 2002). Gyekye (1988) rejects this notion of ideology, proposing a revisit to the origins of the term.

Gyekye (1988) traces the first use of ideology back to 1796 when French academic de Tracy described it as the ‘science of ideas’. According to Gyekye, de Tracy holds that the ‘science of ideas’ results in a comprehensive knowledge of human nature from which we can formulate social practices, laws and institutions to serve the needs of a society optimally. Ideology (the science of ideas), therefore, was ultimately founded on the principle that the political and social wellbeing of humans can be improved through the designs of socio-political criteria. In Gyekye’s view ideology, with reference to de Tracy’s inception of the concept, holds a positive connotation and should be conceived as a morally associated system of ideas which are normative, practical, impartial and actionable.

In this vein, Gyekye conceptualizes ideology as “a dominant set of ideas about the nature of the *good* society” (1988, p. 21). Given this definition, Gyekye considers the moral intent of applying ideology for building a socio-political system to the desires of a society, and not to maintain systems as it accords with the *status quo*. It is not conceivable for Gyekye to conduct a profound inquiry into development and its underlying ideology – if based on a system of a society’s collective moral value system – through the use of special sciences (and methods) such as sociology, political science, economics, anthropology, and so forth. Although Gyekye acknowledges that these sciences can make valuable contributions, he maintains that fundamental inquiry should be a philosophical reflection.

Similar to the question, ‘What is truth?’, Gyekye considers the question, ‘What is development?’ – a philosophical question. Gyekye argues that questions of such nature cannot be addressed using empirical methods. Throughout this paper, it is noteworthy that concepts of development and emancipation are rooted in politics and human life. Gyekye suggests that questions about political loyalty arise because a citizen reflects on his/her moral values system and free will that motivate support for a government’s policies and political strategies. For Gyekye, methods such as observation and experience cannot yield answers to questions about the extent to which or the sense in which humans have free will. Gyekye’s views are consistent with Gadamer’s (1975) ideas of truth and method in relation to philosophical hermeneutics. Both authors conceive ‘truth’ as a fundamentally ontological phenomenon and refute the application of method to address truth.

Gadamer rejects scientific methods in solving truth and argues that experience of truth transcends both the natural and social sciences, is located outside the sciences and is unable to be confirmed using methodologies from the sciences. In line with Gyekye’s (1988) thinking, Gadamer (1975) is in favor of arriving at the truth via experience based on subjectivism. This does not mean that truth is experienced through subjective self-certainty whereby method is deployed, but rather through everyday experiences in which the inquirer and the subject jointly participate. As we highlighted earlier, ‘understanding’ in hermeneutics is central to bridging horizons and attempts at understanding a society revolve around linguistic and historical constructs of the society in question.

The philosophical views of Gyekye (1988) and Gadamer (1975) hereafter ground this exposition’s goal of advancing the African experience as a concept to decolonize Western epistemologies and promote indigenous knowledge in Computing education. We challenge views that perceive indigenous languages and knowledge as ‘primitive’ and unscientific, thus hindering the development of indigeneity in academic spaces (Kaya & Seleti, 2013). As Gyekye argues, “how philosophy can and should conceptually interact with the African experience cannot be said to be different from how this has been done for other societies and cultures” (1988, p. 12).

7 Advancing Cultural Pluralism in Computing

Throughout this paper, we emphasized the importance of cultural pluralism for inclusive Computing education. That is, integration of non-Western worldviews with Western worldviews to digitize indigenous knowledge. We highlighted initiatives such as von Holy et al.’s (2017) gamification strategy, Microsoft’s (2012) Local Language Program, and ethnocomputing (Dalvit et al., 2008; Sutinen & Vesisenaho, 2006; Thinyane & Terzoli, 2011) as useful points of departure towards cultural pluralism. von Holy et al. (2017) and Microsoft (2012) focus on translating ICT-related terminology to African languages while principles of ethnocomputing advance the adaptation of software architecture to culturally suitable contexts.

Worldviews, however, encompass more than just language and in addition differ depending on the epistemic context. Mascolo defines a worldview, inter alia, as “philosophical belief systems that pre-figure and guide scholarly inquiry ... and ... [a] personal and socio-cultural belief system about the physical and social world” (2014, p. 2). Following Gyekye’s (1988) definition of philosophy, in which he defines it as a critical, rational, and systematic examination of the fundamental notions underlying human thought and experience, the empiricism comprised in indigenous knowledge then positions African philosophy as equivalent to Western philosophy. With regard to socioculturalism, sociocultural sources – besides languages – also include semiotic sources such as art, writing, storytelling, and so on (Palincsar & Scott, 2009).

In our view, ethnocomputing yields the most successful results from efforts to indigenize Computing education. Ethnocomputing recognizes the importance of integrating diverse sociocultural elements for indigenous knowledge-creation in Computing education. As evident in the ethnocomputing discussion, reconciling indigenous socioculturalism within Western constructs such as computing requires active community involvement. Indeed, the successful results that ethnocomputing studies (Dalvit et al., 2008; Sutinen & Vesisenaho, 2006; Thinyane & Terzoli, 2011) obtained were primarily achieved via community-based research approaches. Ethnocomputing research places strong emphasis on implementation methods of capturing indigenous knowledge via software architecture; on a philosophical level, however, no mention is made of how qualitative data was deductively collected and analyzed.

Kaya and Seleti (2013) would perhaps criticize these studies for emphasizing practical knowledge and system architecture at the expense of indigenous community engagement and knowledge generation. The critical concern here is that non-Western research lacks comprehension of the holistic nature of indigenous knowledge because the underlying methods and theories of Western epistemologies are fundamentally not indigenous (Kaya & Seleti, 2013; Naudé, 2015). Within this perspective, a primary concern for Simonds and Christopher (2013) is that Western research approaches – and even epistemologies unique to an indigenous community – can then not be used indiscriminately across indigenous communities as indigeneity is considerably diverse in customs and norms.

7.1 Adapting Western Epistemology to Indigenous Knowledge: Lessons Learned from a Case Study

To advance our call for integrating non-Western worldviews on equal footing with Western worldviews, we reflect on the ‘lessons learned’ from a decolonizing case study by Simonds and Christopher (2013). The authors’ case study, based on an intervention project called Messengers for Health (MFH), seeks to decolonize community-based participatory research (CBPR). In particular, the CBPR approach generates knowledge regarding cancer prevention and planning grants for cancer survivors amongst Native Americans. The collaborative research team, named the Community Advisory Board (CAB), including tribal leaders and cancer survivors from the Native America tribe, the *Crow Nation*, and researchers from the Montana State University. A series of research papers were published from the project; where they reflect on the experience of a graduate student who further analyzed qualitative interviews conducted with Crow Nation community members in 2006. The doctoral student contributed the data toward a doctoral dissertation.

The student, together with CAB, used the PRECEDE-PROCEED model to organize interview responses into themes. CAB members were handed interview transcripts and asked to read through the documents at home to identify salient themes using short phrases, words, and sentences. They reconvened over two follow-up meetings to discuss the themes identified from the transcripts; however, little conversation and exchange occurred. This prompted one of the university partners to ask, “Why is it so hard to analyze these interviews?” (Simonds & Christopher, 2013, p. 2187). A Crow Nation elder responded that transcripts were difficult to read, and when categorized into themes, everything becomes scattered, which confuses them. The elder added that Crow people do not break things apart. This prompted lively and energetic conversation; the members emphasized that storytelling is a tradition in Crow culture and an essential way of generating knowledge (Simonds & Christopher, 2013).

They elaborated that all Crow Nation activities are underpinned by a story as an essential means of teaching others. For them, stories lose meaning and understanding if they are broken apart into scattered themes. In addition, a story has more impact the more experienced and knowledgeable the storyteller is in the tribe’s cultural practices. An example is an elder who is respected in the community – the story will have a significant impact on the audience at large based on the elder’s position. In this vein, the relevance of anonymity in Western scientific tradition comes into question. When an elder’s identity is not made known, the connection of the story in relation to the elder is severed; therefore, a vital part of the story’s impact is

lost. In this light, narrative analysis was considered; however, the data collection technique would only be the interpretation of the researcher and not the interpretation of the storyteller (Simonds & Christopher, 2013).

In the end, the university partners conceptualized a culturally representative metaphor, the Crow tipi (cf. Figure 4). The Crow tipi, a symbol of home, is sacred to Crow people with many stories and traditions. The four base poles represent four main themes from the data – a patient's visit context, expectations, history, and time. The poles connecting at the top are metaphorical to the primary theme, 'trust'. Members' stories were not kept as part of the model; however, they did affirm that the model resonates their experience and expresses excitement about the use of the tipi as a symbol of trust in medical encounters. For some members, the strength of the tipi structure also symbolizes the strength of trust during medical encounters. In retrospect, Simonds and Christopher (2013) state that there is no 'how-to' roadmap for collecting data in indigenous communities, hence their inference that a method applied in one indigenous context might not be successful in another indigenous context. The lessons learned from these decolonization studies follow below. We contextualize these lessons within ethnocomputing (Simonds & Christopher, 2013).

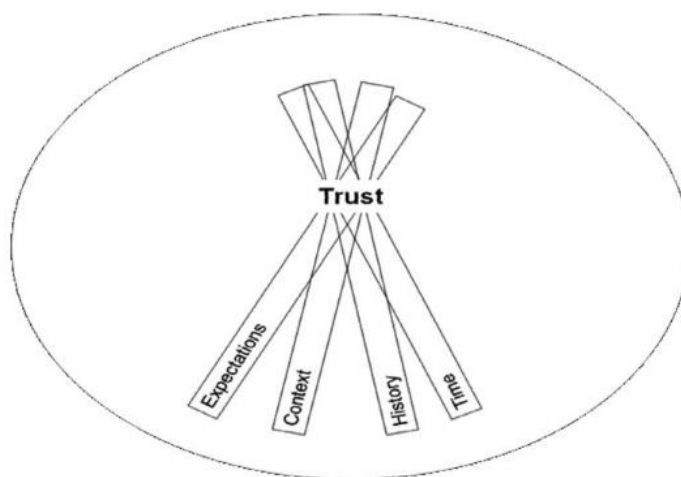


Figure 4. A Culturally Significant Symbol used as a Model of Patient-provider Interaction

Lesson 1: Clarify worldviews from the start. Partners need to deliberate and articulate assumptions regarding the role of indigenous epistemologies in research on decolonization. The level of trust within the collaboration space determines the extent to which community members will share indigenous knowledge with outsiders. Thus, researchers should explicitly acknowledge that they are committed to generating culturally focused research methods. In indigenous communities, knowledge is considered sacred, and to access it, respect must be earned; conversely, Western knowledge is often open to anyone (Simonds & Christopher, 2013). To gain access to such knowledge, researchers must respect the knowledge of elders as well as acknowledge the position they hold in their community. But according to Simonds and Christopher (2013), the history of social science shows that indigenous epistemologies have not been respected.

In the context of decolonizing South African Higher Education curricula, Kaya and Seleti (2013) echo the sentiments expressed above. According to the authors, Western approaches to decolonizing South African higher education are 'too academic'. The authors are furthermore critical regarding the lack of confidence and respect for indigenous ways of knowing. Consequently, the bias for Western methods leads to its uncritical adoption and use in African communities. By respecting indigenous knowledge, researchers do not only gain access to productive and valuable data that community members will feel free to share; they also equip universities with agency for transferring indigenous socioculturalism and epistemologies from one generation to the next.

On account of promoting mutual respect and epistemic pluralism from the African experience perspective, Gyekye (1997) encourages transfer of technology from the technologically developed world to indigenous settings. For practitioners of indigenous knowledge to gain because of their weak 'scientific' base. If one considers Berry's (2008) presupposition that ICT is inherently a neoliberal construct imbued with colonial tenets, it can be argued that technology transfer to indigenous settings is paradoxical. Such a presupposition would also explain the uncritical adoption of ICT (Kaya & Seleti, 2013). Gyekye (1997), however, expresses confidence in an epistemic pluralistic approach to overcome such a paradox. To achieve this, Gyekye states

that the assumption that indigenous societies are desperately in need of Western technology needs to be rejected.

Gyekye's 'organ transplant' metaphor explains the respect-based concern for indigenous knowledge that arises in the way the notion of technology transfer is executed. The 'foreign' cultural artefact cannot simply be transferred to the recipients (what Gyekye refers to as 'cultural borrowing'), for what is transferred may not be adequately assimilated – a notion he metaphorized as 'transplanted'. Such an approach simply verges on passivism on the part of the receiver who thus has little say regarding 'quality' of "the foreign body to be sewn into his body, and that there is no knowing whether the physical constitution of the recipients will accept or reject the new body tissue" (Gyekye, 1997). Analogically, a technological artefact would be guided by the goals and needs of the indigenous group whereby they are decision-makers on which technological tools of foreign origin they wish to acquire as well as becoming active participants who positively and willingly engage with the process of appropriating such tools.

Lesson 2: Decolonizing research is a process. CBPR approaches facilitate ideal conditions for community engagement; however, it is no indication of the appropriate use of an indigenous method. In contexts where indigenous epistemologies are not sufficient, Western theories and methods can be useful. Attaining respect, in order to establish trust, is vital to allow indigenous members to speak out in case Western epistemologies are not working or the research process reaches an impasse. Respect and trust are therefore crucial to cultural pluralism as the partnership can identify common ground where Western and non-Western methodologies complement each other (Simonds & Christopher, 2013).

In an ethnocomputing context, Dalvit et al. (2008) suggest that decolonization researchers identify intellectuals from both a Computing and indigenous background to help facilitate a process of reaching common epistemological ground. The authors observe that such individuals in an African context might be hard to come by since Africans who are knowledgeable in the Computing domain typically form part of the elite and internalized Western worldviews. In his seminal *Decolonizing the Mind*, Ngugi wa Thiong'o (1986) articulated concern extensively about the unquestioning internalization of Western worldviews. Decolonizing the mind requires a change of mindset since indigenous means of knowledge production should not be viewed as an alternative epistemology, but an epistemology in its own right (Wa Thiong'o, 1986). In related vein, researchers should distance themselves from assumptions that the 'traditional' must be replaced by the 'modern' – African researchers and collaborators must value knowledge of their indigenous ancestry as the foundation of community development (Kaya & Seleti, 2013).

Lesson 3: Critically assess methods to be used. Storytelling as a traditional custom appears to be a popular teaching and knowledge creation method in both African (Kaya & Seleti, 2013) and American indigenous communities (Simonds & Christopher, 2013). While researchers might think that narrative analysis is perhaps a suitable method in relation to storytelling, they would essentially speak for indigenous people. As mentioned, this is problematic since the re-interpretation in all likelihood loses meaning and impact as it was not received directly from a valued and respected indigenous 'source' such as an elder. There are, however, Western methods that could potentially be congruent with indigenous storytelling. Simonds and Christopher (2013) identify and espouse qualitative artistic methods such as the use of photographs as compatible across paradigms.

The deployment of photos as a participatory visual methodological tool uses visual images to elicit social and cultural meaning (Akther, 2015; Dolezal, 2013). Simonds and Christopher (2013) argue that these methods are powerful to equip collaborators as authors of their own stories instead of being spoken for. Akther (2015) used photo-voice to examine how ICT can be appropriated as instruments for indigenous community development in rural Bangladesh; Dolezal (Dolezal, 2013) used photo-voice to investigate how cultural assumptions regarding ICT impact the role of ICT for heritage preservation in a Native American community – the Choctaw Nation. Photo-voice involves collaborators taking photographs of sociocultural artefacts and customs in order to enhance, represent, and identify their socioculturalism through photos (Akther, 2015; Dolezal, 2013).

Both studies concluded that participatory visual methodologies provide great explanatory power of the potential of ICT for cultural depiction and empowerment. Similar to Simonds and Christopher (2013), Akther (2015) reported how difficult it was for participants to initially share their experiences. But when viewpoints, experiences and perspectives were elucidated via photos – e.g., 'please explain the context of this photo?' – participants actively engaged in discussion. The positive claims of photo-voice in decolonization research seem consistent with the use of images in ethnocomputing research. According to Sutinen and Vesisenaho (2006), ethnocomputing's use of imagery derived from students' socioeconomic context allows students to

easily grasp computing concepts. Combining images with verbal explanations can strengthen this teaching or learning method further, especially for students from a predominantly oral indigenous group. In this vein, photo-voice is a relevant and appropriate methodology for those who seek to advance cultural pluralism in Computing education.

A final major obstacle Simonds and Christopher (2013) highlight is the issue of rendering indigenous methods acceptable to Western-based paper reviewers. The authors recommend that universities train academics in indigenous theory and methods. This will allow academics to produce conceptual instruments to determine how sociocultural value systems underpin theories and methods, as well as value non-Western epistemology.

7.2 Cultural Pluralism in Computing Education: The Whole and the Parts

Throughout this paper, we used hermeneutics to advance the Africanization of Computing education. We adapted Gummesson's (2000) explanation of the hermeneutic circle to illustrate our understanding of the 'whole' of Africanizing Computing education. According to Gummesson, researchers approach an investigation with certain preunderstanding (preliminary understanding of the whole). By analyzing and interpreting the experiences of others, researchers gain understanding and insights (at least partially) of their own about the research problem. New understanding gives rise to new avenues of research to explore, thus possibly triggering a succession of hermeneutic cycles. New understanding acquired during a cycle essentially represents 'preunderstanding' when furthering investigation with each consecutive cycle (cf. Figure 5).

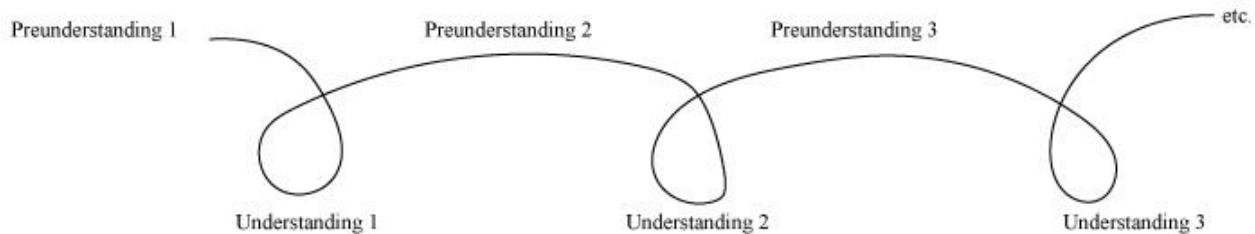


Figure 5. Gummesson's (2000) hermeneutic loop

Figure 6 illustrates our concluding hermeneutic interpretation of Africanizing Computing curricula. We have shown that the call for decolonization in South Africa stems from the slow rate of transformation away from colonial-era policies, and by extension, Western academic tradition. Consequently, Computing education is viewed by indigenous students as hegemonic insofar as it lacks epistemic diversity and disregards other knowledge traditions. Moreover, students struggle to grasp Western theory, epistemology, symbolism and metaphor that inform Computing education. Paradoxically, decolonizing Computing education is not possible without Western knowledge given the fact that ICT is a Western invention. Notwithstanding this reality, we espouse the view that it is possible to develop, in concurrence with Western tradition, indigenous knowledge in Computing education.

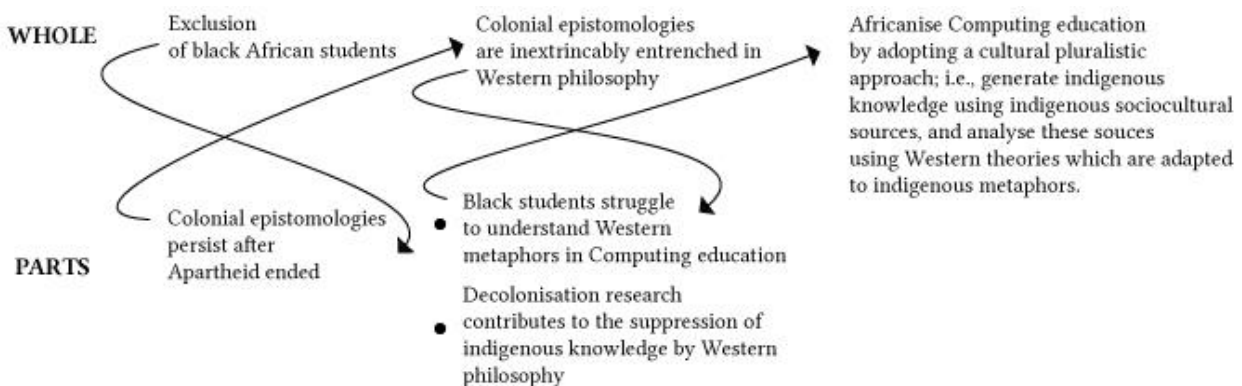


Figure 6. Hermeneutic interpretation of Africanization of Computing Education (based on Gummesson, 2000 – see Figure 5)

We found that it is indeed possible to generate indigenous knowledge in Computing using indigenous sociocultural sources. However, decolonization has yet to produce an alternative, non-Western paradigm to validate indigenous 'data' (Naudé, 2015). Naudé (2015) points out how the 'credibility criteria' of Ubuntu – generally exalted as a distinct African theory to interpret indigenous knowledge – remains contested. Simonds and Christopher (2013) show, however, that indigenous generated data can be validated within Western paradigms without abandoning its epistemic authenticity. Earlier, we illustrated how the authors, in collaboration with their indigenous participants, developed a conceptual, culturally metaphorized model (a form of thematic analysis) to make sense of participants' views (revert to Figure 4).

8 Concluding Thoughts

This paper sought to examine the decolonization of Computing Science in South African higher education. The motivation for this paper stems from discourses criticizing universities' slow rate of transformation away from colonial policies. The consequence is that black students feel excluded in academic spaces, which student activists argue, remain entrenched in colonial-era policies. We pointed out how black students' frustration culminated in the #FeesMustFall and the #RhodesMustFall student protests. And despite efforts by post-Apartheid government to redress past inequalities through ICT and funding policy frameworks, students felt the culture of apartheid and colonialism persists on university campuses.

We examined empirical evidence from previous research that contributed to attempts of decolonizing Computing education. These studies share one sentiment: inquiries to decolonize Computing education are not possible without Western epistemologies. Thus, decolonization researchers are left with adopting non-Western and Western philosophical pluralism. These studies – especially the ones using ethnocomputing as an approach – seemingly achieved significant gains to indigenize Computer knowledge. A primary concern Naudé (2015) expresses towards such studies represents the universal approach insofar as generalizations regarding the indigenous experience. These generalizations, filtered through Western epistemological lenses, distort the lived experience of indigenous people and paradoxically center around expressing Western truth in indigenous sociocultural forms. In this light, Naudé (Naudé, 2015) asserts that decolonization research, in fact, illuminates the value of Western epistemologies at the expense of interiorizing indigenous knowledge.

Naudé's (Naudé, 2015) concerns manifested in a decolonization case study by Simonds and Christopher's (2013). The Western epistemological ethical principle of anonymity, for example, is not pertinent in some instances such as with the case of a Native American tribe (Naudé, 2015). Indeed, the lived experience of the Native American community, from which indigenous knowledge emanates, is concurrent with the African philosophical views of Gyekye (1988). For Gyekye, the fundamental argument is that "truth" (a philosophical question) of indigenous ways of knowing cannot necessarily be answered through Western science, but rather through feedback from indigenous people who participate in their own everyday experiences. As we showed, these everyday experiences embody sociocultural sources such as imagery, storytelling, song, and dance. To follow a congruent cultural pluralistic approach, Dolezal (2013) suggests, for example, that visual methodologies such as photo-voice can effectively complement and combine indigenous epistemic sources such as storytelling and imagery.

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