AFRICAN INDIGENOUS SCIENCE IN HIGHER EDUCATION IN UGANDA

By

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A thesis submitted in conformity with the requirements
for the degree of Doctor of Philosophy

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Institute for Studies in Education University of Toronto

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ABSTRACT

This study examines African Indigenous Science (AIS) in higher education in Uganda. To achieve this, I use anticolonial theory and Indigenous knowledge discursive frameworks to situate the subjugation of Indigenous science from the education system within a colonial historical context. These theories allow for a critical examination of the intersection of power relations rooted in the politics of knowledge production, validation, and dissemination, and how this process has become a systemic and complex method of subjugating one knowledge system over the other. I also employ qualitative and autoethnographic research methodologies. Using a qualitative research method, I interviewed 10 students and 10 professors from two universities in Uganda. My research was guided by the following key questions: What is African Indigenous Science? What methodology would help us to indigenize science education in Uganda? How can we work with Indigenous knowledge and anticolonial theoretical discursive frameworks to understand and challenge the dominance of Eurocentric knowledge in mainstream education?

My research findings revealed that AIS can be defined in multiple ways, in other words, there is no universal definition of AIS. However, there were some common elements that my participants talked about such as: (a) knowledge by Indigenous communities developed over a
long period of time through a trial and error approach to respond to the social, economic and political challenges of their society. The science practices are generational and synergistic with other disciplines such as history, spirituality, sociology, anthropology, geography, and trade among others, (b) a cumulative practice of the use, interactions with and of biotic and abiotic organism in everyday life for the continued existence of a community in its’ totality. The research findings also indicate that Indigenous science is largely lacking from Uganda’s education curriculum because of the influence of colonial and post-colonial education. Graduates of the colonial education system who are manning education in the country have themselves come to disdain Indigenous knowledge. The major findings from the study were: 1) participants’ articulation of Indigenous science; 2) influence of organized religion on African Indigenous Science; 3) dominance of professors’ foreign experiences in determining curriculum content; 4) protection of intellectual property rights for Indigenous science; and 5) collaborative research between Indigenous and Western scholars to enhance attitude change toward Indigenous science.
Dedication

This academic achievement is devoted to three people: my late father, Raymond Atube Adyanga. It is painful that death grabbed you away from us prematurely. Nonetheless, your legacies of honesty, hard work, commitment and perseverance lives on and have contributed significantly to my scholarly success. In the absence of my Dad, his young brother – my uncle Dr. Onek C. Adyanga kept the family in unity and provided education to me, my siblings and cousins. It is because of his generosity that I am who and what I am today. This work is equally dedicated to him. Finally, to my mother, Ms. Lamaro Margret – there are no words to thank you enough for enduring hardships in the absence of my Dad to provide for me and my siblings. You are one in a million, a true feminist who has not been only a mother, but also a father throughout my educational expedition. Through this work, the fruit of your labour has paid off. God has listened and responded in the affirmative to your prayers. More women like you will make this world a better place to live in. I dedicate this thesis to your hardwork, determination and resilience.
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Chapter 1

Introduction

The motivation by scholars such as Smith (1999), Odora (2002), Wane (2008), Gupta (2009) in the 21st century to integrate Indigenous knowledge into the formal education system is driven by the relevance of Indigenous knowledge to the respective Indigenous communities. Accordingly, there is currently a global initiative of maintaining worldviews, languages, and environments to which Indigenous science belongs. This global initiative has been restricted to a few geographical locales that are still testing the initiative with some reservations. Mosha (2000), Wane (2002), Odora (2002), and Dei (2009) advance that for African societies Indigenous education is rooted in the everyday life of most rural communities. Indigenous science, which falls under the larger umbrella of Indigenous knowledge, is a community intellectual resource, often difficult to commoditize and privatize. In some cases practitioners with a specific skillset, such as herbal/medicinal practitioners, earn rewards for their specialization in aspects of Indigenous science. However, as much as Indigenous sciences has been—and still is—the foundational knowledge and livelihood of most rural communities, it is not being emphasized in the formal schooling systems. Most African governments are continuing with Eurocentric science on the assumption that it is the best method for modernizing their societies. The term Eurocentric, or Western, science is used loosely in this thesis to refer to science related subjects/disciplines brought to colonized societies and enforced through the formal education system.

The validation of Indigenous knowledge as legitimate knowledge in the global education system has been a constant source of contestation among scholars (Gupta, 2009; Kincheloe &
Steinberg, 2008; Odora, 2002; Sillitoe, 2009; Smith, 1999; Wane, 2008; this is despite the fact that most scholarly research has recognized its usefulness in different contexts. Scholars such as Kincheloe (2006, 2008), Dei (2007, 2009, 2010), Wane (2008, 2009), Castellano (2000), and Smith (1999) recognize that the existence of tension resulting from unequal power relations in the education system marginalizes Indigenous knowledge in most countries’ educational curriculum. As revolutions in technology and telecommunication systems have fostered globalization, the transfer of Western knowledge to non-Western societies has increased. However, the propagators of Western knowledge dismiss Indigenous knowledge as primitive, heathen, and unscientific, and impose monolithic Western knowledge as universal truth and science (Akena, 2012). However, Western science is itself a form of the Indigenous knowledge of Western society that was universalized through colonialism and evangelical Christian schools in former colonies. Accordingly, the scientific knowledge and the scientific enterprise have roots that stretch all the way back to antiquity. The dominant stream of modern science, the reductionist or mechanical paradigm, is the particular response of a particular group of people. It is a specific project of Western man which came into being during the 15th, 16th and 17th centuries as the much-acclaimed scientific revolution to respond to the challenges of Western societies (Goodstein, 1993; Vandana, 1997). Modern science therefore became a social and political project. Its founding fathers developed thinking that was parochial, masculine, white, deeply misogynistic, and dominating (Vandana, 1997). The Western/Eurocentric science project, however, was projected as a value-free system of knowledge which displaced all other knowledge systems with its universality.
1.1. Definition of Indigenous Science

In this thesis, Indigenous science is broadly defined as a form of traditional knowledge that is locally based, rooted in local cultures, and generally associated with long settled communities having strong ties to their natural environments (Orlove et al., 2009; Kapoor & Shizha, 2010). Defined this way, Western science can rightly be labelled as science Indigenous to Western society. Traditional knowledge is referred to as traditional ecological knowledge systems. These differing references convey the disciplinary orientation and focus of the respective scholars. Slightly parting ways with the above scholars, Dei et al. (2008) emphasize the context specificity of Indigenous knowledge by situating it in the long term occupancy of a place. Their definition includes traditional norms and social values of communities as well as mental constructs that guide, organize, and regulate the ways in which communities live and make sense of their immediate environment. This definition is broadened by Abdi et al. (2006, p. 54) who articulate Indigenous knowledge by tying it to Indigenous communities’ ways of knowing developed over generations as a result of their sustained occupation of a given place. They argued that “the result of generational experience allows communities to develop a good understanding of the relationship of their communities to their surrounding natural and social environments” (see also Gupta, 2009; Langdon, 2009; Sillitoe, 2007). African Indigenous people are people with a long history of ancestry in the African continent who identify themselves one way or another with rural communities. Indigeneity, within the context of Africa, is therefore not universal, as Shizha (2008) pointed out:

African indigeneity is not the universalized cultural representations that have been exported to non-African societies, but a cultural life embedded in authentic spiritual, ecological, economic, political, and holistic life experiences. It is a way of life that is embodied in existential authenticity that is required for Indigenous people to engage in self-defining and self-sustainable development projects. (p. 39)
Therefore, since indigeneity and Indigenous knowledge are broad and multifaceted, as seen from the different scholarly orientations above, I will focus on one of its aspects—Indigenous science. My definition of Indigenous science is derived from the broader Indigenous knowledge. Indigenous science thus refers to science practices by Indigenous communities developed over a long period of time through trial and error to respond to the social, economic, and political challenges of their context. These science practices are generational and synergistic with other disciplines such as history, geography, trade, and commerce. This position is reinforced by Castellano (2000), an Indigenous scholar who argued that:

Traditional knowledge has been handed down more or less intact from previous generations. With variations from nation to nation through Indigenous knowledge, communities get to know how the world was created. Also through it, people get to know the origin of clans, it records genealogies and ancestral rights to territory; and it memorializes battles, boundaries, and treaties and instils attitudes of wariness or trust toward neighbouring nations. Through heroic and cautionary tales, it reinforces values and beliefs; these in turn provide the structure for civil society. In some of its forms, it passes on technologies refined over generations. (p. 23)

Other forms of Indigenous knowledge include astronomy, reading of seasons/weather conditions to determine crops cultivations, interweaving of plants and animal fibres, ethno-medicinal practices, classifications of animals and plants species, rotational farming practices, and mixing of different crops in the same fields (intercropping). These community practices are the principal elements of Indigenous sciences which were deeply embedded in Ugandan societies, forming the foundations upon which the survival of traditional civilizations depended.

The Western-centric approach to education has affected Indigenous knowledge. Many Indigenous communities are losing their ways of knowing, planning, and organizing their livelihoods. Among the Embu rural women, for example, there was a disjuncture between traditional knowledge, spirituality, and planning community life. The Embu women in Wane’s (2000) study indicated that the ongoing destruction of the natural environment represents the
various stages of human self-destruction because the natural environment is intricately interrelated. Their concept of self-destruction is embedded in the debasing of the value of Indigenous knowledge within the community. The destruction dates back to colonial encounters when the colonizers’ knowledge was imposed at the expense of traditional knowledge and ways of understanding the world. Wane (2006) calls for appreciating knowledge that recreates a world that is habitable and meaningful for all. Most independent African societies continued the trend of undermining Indigenous knowledge, sometimes paying little attention to it, and or even demonizing it outright. In post-colonial Uganda, this trend is deeply rooted in the education sector.

The present Ugandan education system put more emphasis on Western science education with little to no consideration of the limitations of implementing such education. As a result, Indigenous science was regarded as out-dated and backward knowledge. To entrench Western/Eurocentric science education in the national curriculum, the Ministry of Education and Sports (MOES) made subjects in the science disciplines (physics, biology, chemistry, agriculture) compulsory for every student in the secondary stage of their education. Although the invention of multimedia technologies is improving teaching and learning techniques in some urban and city schools, Western/Eurocentric science education, without a doubt, is quite expensive to implement. Most Ugandan schools cannot afford multimedia capable classrooms. Furthermore, most parents/students are too poor to afford computers. Even those who can afford computers do not have them and if they did, the poor electrical connections would limit usage. The implication for students from low income backgrounds, who constitute the majority of students in the country, and students who cannot afford city schools with well-equipped science classes/laboratories, is that they end up dropping out of science classes and the schooling system.
The Ugandan government and other educational stakeholders like donor communities, NGOs, and other development partners have tried to make modern science equipment accessible to some schools in rural areas. However, the technical know-how related to the use of these facilities is often lacking. Besides, students find it hard to make meaning out of these science classes as they are not synchronized to their local settings. Sane (1999) draws examples from India to show that the mere availability of science laboratories, equipment, and literature describing their use is not enough; what is needed is an adaptation of this knowledge to suit local conditions. However, the interventions by different education stakeholders to reinforce the teaching and learning of sciences in the Ugandan schooling system do not deal with the multilayered questions regarding the Indigenous sciences and their role in the lives of learners. The marginalization of Indigenous knowledge from the education system of most developing societies dates back to the establishment of formal education (see Gupta, 2009; Langdon, 2009; Sillitoe, 2007).

The exclusion of learners’ Indigenous knowledge has impacted their identity, self-esteem, and creativity as they cannot relate what they learn at school to the teachings given by parents/elders or their community at home. The exclusion of Indigenous knowledge from the school curriculum has contributed to the difficulties being faced by many students who do not succeed in acquiring Western education. They have nowhere else to turn; they lack a second or third option. Among these challenges are the high rates of student dropout from primary and secondary education, low enrolment in university and other tertiary institutions, increasing crime rates, and social deviance. These challenges occur because students are forced to adopt a solitary way of knowing (dominant discourse) and those who cannot meet or fail to adjust to the demand of the solitary knowledge system in the education sector are left out.
Therefore, my suggestion to integrate Indigenous science education into the curriculum is a concerted redress strategy for the challenges facing the education sector. This endeavour must be taken regardless of oppositional forces because the campaign to integrate Indigenous science in formal education is a proactive step. Students who fail to meet the requirements of Western/Eurocentric science can identify with Indigenous science because it draws from their daily life, leading to equally enriching knowledge that advances human progress. For Indigenous people, equal rights and treatment form the basis of peace, harmony and progress in societies. Quigley (2009) asserts:

For Indigenous groups, what is often important in regards to “others” is [that] they are respected and live without threat to their language, culture, and resources but this gets even more complicated when involving education. They see education as important for preparing their children both locally and globally because of the dual environments they will live in......currently, their world is a combination of both local and global spaces and they recognize both spaces as a concurrent part in their everyday lives. (p. 79)

This worldview of Indigenous people is not shared by all people—especially the dominant groups whose interests have always been that of domination and unequal power relations by exalting their knowledge system above others. These groups have advanced the argument that poor performance in science in developing countries is not due to the worldviews of students in these countries but to the absence of supportive environments for science learning and the lack of scientists as role models for the youth. Riyad (2006) further argues that the dominant discourse within the Western academy does not reflect the diverse bodies, religions, ethnicities, histories, and values of the people that make up Canada and the world. Riyad continues to affirm this when stating, “I have come to realize that I am surrounded by Western ideas that do not affirm my way of life and instead negate my history, spiritual worldviews and ways of living” (p. 2). Clearly, imposed Western secular knowledge is a threat to the history, upbringing, and values of Indigenous people. There is a need to focus on the integration of Indigenous science education
into the current school curriculum as a redress strategy for the escalating school dropout problem in Uganda because learners can connect with and find their true identity in it.

The focus of my research was to explore the integration of Indigenous science into the school curriculum. This will draw from my personal experiences and engaging with diverse body of literatures. The study combined analysis of participants’ voices, personal reflections, and secondary sources, materials from newspapers (popular sources), articles, and dissertations, among others. Although this thesis is by no means an exhaustive investigation of the benefits of integrating Indigenous science into Uganda’s current education system, my hope is that the recommendations herein can be used to offset the claims associated with emphasizing only Western sciences. The study is significant because no systemic investigation focusing on the integration of Indigenous science into the school curriculum in Uganda has been conducted. This work is therefore of significance not only to the academy and schooling system, but also to the entire society. In addition, this work will contribute greatly to challenging the reductionist binary of Western science versus Indigenous science, instead having the two ways of understanding how the world co-exist and supplement each other. The argument for the integration of Indigenous science alongside Western/Eurocentric science in the education system for holistic learning is done with due considerations for context specific to Uganda’s society.

Future research projects will shed light on teaching and scholarship, focusing on the techniques of work and lesson plans that can be structured to include Indigenous science knowledge. Dei (2011) points out that a methodological implication is the development of a framework for professional development which is able to shift science instruction toward meaningful culture, place, and problem-based learning, relevant to environmental literacy and sustainability. However, as a scholar, I appreciate the challenge of including and sharing best
practices to reinforce Solomon and Wane’s (2005) observation. They observe that one of the problems with sharing practices is that Indigenous methodologies are not always respected for the integrity inherent in them. Scientific paradigms are often used to deny or refute Indigenous time-tested, reliable, valuable, and successful practices. This is not a critique of scientific testing to arrive at reliability and validity, but rather, a call for objectivity in conducting such endeavours. Champions of the dominant knowledge system can quickly dismiss the epistemological consequences of sharing practices as being simply apolitical with no ground. A critical ontology should enable societies to liberally choose what they want to impart to their learners. This is because societies make decisions on what epistemology is best for them, and the decisions are shaped by the context of their immediate surroundings. As Indigenous scholars advocate for the inclusion of Indigenous knowledge in the academy, linking it to educational reform is part of a larger social and political struggle. This in turn outlines the inseparability of academic reform, the reconceptualization of science, and struggle for justice and environmental protection (Kincheloe & Steinberg, 2008). Indigenizing the current science pedagogy in Uganda entails a critical scrutiny of the existing curriculum and science textbooks being used to determine their relevance to the present era. This is a starting point to sort out what is relevant and what is irrelevant within the education system. Curriculum reform is not an easy task as it requires skilled labors, time and financial resources. This could take years to accomplish, but with education, no undertaking is impossible provided there is commitment from stakeholders.

1.2. **Personal and Professional Context**

The motivation to examine the integration of Indigenous science education into the current school curriculum in Uganda is driven by the high number of students dropping out from
the schooling system. The school dropout problem has partly been due to the fact that many students in Uganda are required to take Western science subjects (biology, physics, chemistry, agriculture) because these subjects are mandatory for secondary schools. Compulsorization of Western science expands the base of students’ general education training and improves their comprehension of the world around them. However, the mandatory expansion of this western science worldview excludes students’ traditional learning and knowledge systems.

The shortcoming of this mandatory requirement partly contributes to low school retention rates and reduced number of students enrolling and graduating with science degrees from Uganda’s universities. It is against this background that the study focused on interviewing professors, lecturers, and students about their experiences and perspectives on integrating alternative science education—that is, Indigenous science into formal education. The purpose of exploring the inclusion of Indigenous science is to make education relevant to the challenges existing in the students’ communities. Growing up in northern Uganda, for instance, I was not privileged like the children from the other regions of the country because of a civil war. The civil war ravaged northern Uganda from 1986 to 2008; therefore, social services such as education and health care were inaccessible. In isolated places where such services existed, they were expensive and of low quality compared to the national standard; hence, most people resorted to alternative means of social service provision—Indigenous practices provided under insecure environments due to the civil war. This trend (lack of social services and a peaceful environment) destroyed the future of many children in the region where I grew up. For many, there was little to no hope for a bright future. In the absence of meaningful education (education that embraces students’ inherent knowledge), the younger generations become irresponsible citizens because they lack the skills to earn a living and seek gainful employment in the
competitive world economy. Wane and Gathenya (2003) noted that when children are denied basic education, their ability to support themselves as adults and to provide for their basic needs and the needs of their families is compromised.

I grew up during the northern Uganda civil war and suffered immensely. We were often running away from home fearing the marauding Lord Resistance Army (LRA), rebels who abduct children at night for the purpose of forceful enlistment into the rebels’ ranks. We would stay in the bushes and return home in the morning to pick up our scholastic materials to go to school. Often we would find some of our unfortunate friends abducted, killed, or too sick to attend classes. Furthermore, professional teachers would frequently run away to safer regions of the country to continue teaching, leaving us with unqualified teachers whose salaries were often paid by contributions from parents. The government army, the Uganda People’s Defence Forces (UPDF) counterinsurgency policy aggravated the problems of education in the north. The UPDF set their operation bases in schools and dug trenches in school compounds, an act that often attracted rebel attacks. Schools became battle zones and many were closed for fear of the UPDF-LRA conflicts. Families were herded to internally displaced people’s camps (IDPs) that lacked the basic amenities for survival. Sometimes, when government soldiers were defeated militarily, the rebels would pursue them and schools were turned into frontlines, shattering buildings, burning books and other scholastic materials (see also Akena, 2010). The school communities thus became victims of the war. In 1996, the government decided to move everyone to areas called “protected villages,” also known by many as Internally Displaced People’s camps (IDP), which numerous critics called “concentration camps.” A phenomenon born out of the IDP camps was called “night commuters,” whereby school children fearing abduction walked to urban centers studied under street lights and slept on verandas. In the morning they walked back to
their homes, which were several kilometres away, to freshen up and go to school. Children no
longer spent the evenings with their parents to acquire real Indigenous education. Both
Western/Eurocentric (formal) and Indigenous education were severely interrupted, leading to
high rates of school dropout.

Further, in the IDP camps, schools were overcrowded due to space constraints and
inadequate numbers of qualified teachers to traverse every classroom to deliver instruction to the
learners. This created a new concept called “amalgamated schools,” with some classes
accommodating 150 to 300 students per teacher. The turmoil in these classrooms—with students
lacking space, lacking proper communication gadgets, and studying under trees with other kids
sitting in the scorching sun—was unimaginable, yet real. With this kind of classroom scenario,
even the most innovative pedagogical strategy would fail on trial. In the camps, the children and
their families were fed on foodstuff distributed by the United Nations World Food Program
(WFP). Due to resource constraints matching overwhelming need, the WFP distributed about 20
kilograms of posho (maize/corn meal), 10 kilograms of beans, and 3 litres of cooking oil per
family once a month. In the context of the family system in Africa where most families had
between five to 10 children, plus additional dependent children from the extended family, this
allotment implied just about 250 kilocalories per person every day. Scientifically, this alone is
enough to malnourish children, keeping them away from schools and could systematically kill
them (Ryerson University School of Nutrition, 2007, p. 24). I was able to succeed because of
personal perseverance to achieve my long term goal of becoming a teacher. Though I wanted to
have the option to pursue science education, the lack of laboratories and exorbitant costs of lab
equipment, as well as the lack of school facilities and professional teachers closed that option.
Therefore, I had to pursue liberal arts education with a concentration on reading, writing, and research.

In the doctoral degree program, I have since realized that it was during this time that the community of this region reverted mostly to the use of the Indigenous knowledge system for their livelihoods. Reflecting back to my childhood, Indigenous knowledge surrounded me, and my parents returned to it during times of turmoil such as the ravaging civil war. It was the only knowledge most people knew, and that is what sustained them. According to Quigley (2009), a well-documented branch of Indigenous science, known to biologists and ecologists as traditional ecological knowledge (TEK), focuses on the science that is highly localized and socialized. It is localized and socialized because this knowledge system is within the local community and has been the foundation upon which the community existed for time immemorial—reinforcing its relationship with other communities and immediate environments. In relation to Indigenous science, the use of traditional herbs for purposes of treatment both of human and animals became a common practice in my own community as the civil war took its toll.

The awakening of my consciousness on Indigenous knowledge through graduate studies has enabled me to reflect on my experiences as a child going out in the bush to collect grass, leaves, plant roots, and stems for herbs with my mother and at times with my grandmother, and using these herbs for healing purposes. I was astonished at how I would be sent back to the forest the following day on my own to gather the same herbs which were still abundant in the house. At that time, this did not make sense to me, but I later realized that it was a way to help me master the practice and names of the herbs so that it would be carried on even in the absence of my parents. Note that, my primary and secondary teachers were deeply influenced by Western/Eurocentric science education and in turn influenced their learners to follow the same
path. In the same way, this greatly influenced my attitude (lukewarm) towards traditional knowledge.

It never crossed my mind that through the home experience of being sent to gather herbs, I was being familiarized with the practice of Indigenous science. My consciousness has been awakened by the graduate studies program that delved deep into my mind, hence empowering the liberation of my psyche into carrying out this research. Liberation of the psyche, according to Myers (1987), is the central pivot that sanctions someone to discover his or her true self. She argues that the consciousness of the person is totally changed and empowered when he/she establishes the conceptual system of the African culture’s deep structure. By reflecting on some of the practices (extraction and use of herbs, traditional agriculture, hybridization of cattle) that I came to terms with as constituting my comprehension of Indigenous sciences, I created a pattern of judgement and values that strengthened my convictions in traditional knowledge.

This traditional knowledge of science is replicable in the current Ugandan school curriculum to address the existing problem of school dropout. My inspiration in this project is driven by the realization that, as an African scholar, my research-based contribution to the challenges facing African populace is a tool and process of self-empowerment. It is also a decolonizing strategy to be embraced by communities still skirmishing with the effects of colonization. The continent of Africa needs scholars who will continually contribute to knowledge production in the schooling system and workplace through the advancement of different segments of African Traditional Knowledge (ATK) both in sciences, liberal arts, politics, spiritual/religious and economic disciplines. According to Kapoor and Shizha (2010), this is called emancipation. They asserted that Indigenous African Scholars can emancipate themselves fully by taking their place in global knowledge production and dissemination from
their own African perspective. They should distance themselves from dominant theories that devalue their Indigenous contributions to global knowledge (Kapoor & Shizha, 2010). As a member of the minority student body from the continent of Africa in the doctoral degree program in education, I struggle to understand how and why Indigenous knowledge and Indigenous science in particular, is left out of the school curriculum when this knowledge system forms the core of community existence and strengths.

From life experiences as well as through practice, I affirm that Indigenous science is the pivotal point around which rests the acquisition of suitable intellectual prowess. It contributes to the cultivation of physical skills and spiritual strength required for an individual to live as a responsible member of a community. This is crucial because different communities embrace diverse knowledge systems that are relevant for the continuity of their members. There are multiple levels of understanding the world scientifically but the Eurocentric scientific comprehension of the cosmos has been universalized at the expense of others. The universalization of Eurocentric science has resulted in the systemic exclusion of Indigenous science from the education system of Indigenous societies.

For specific context, the lack of Indigenous knowledge has been at the root of most social challenges in the current schooling system in Uganda. Different Indigenous sciences are rooted in different people’s life journeys, and these journeys either reflect an individual’s cultural/family history, environment, class, spiritual/religious connection, or are shaped by lived experiences in one’s life. For my part, I have a personal family history that is intensely embedded in the significance and principles of traditional Acholi spirituality, which is

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1 The Acholi, also spelled Acoli, are an ethnic group occupying most parts of northern Uganda and upper southern Sudan. According to oral historical traditions, they are the descendants of Luo speaking peoples who are believed to have migrated from the Bar el Ghazal region of Sudan before settling in northern
interwoven with Indigenous science. Specific to public health, herbs are a strong component of Indigenous science. However, spiritual practices are sometimes interwoven with herbal practices in the healing process, in other words interlacing spirituality with science.

1.3. Problem Statement
The current marginalization of Indigenous science knowledge in Uganda’s school curriculum has its roots in colonial education policy. During the colonial era, education was meant to train junior clerks to work as subordinates to the senior white administrators, and puppets in extending and sustaining colonial rule. Liberal arts education with a focus on reading and writing was promoted over practically relevant sciences such as pharmacology, animal husbandry, chemistry for economic development of the time. In the post-colonial era, formal education faced numerous difficulties that have dwarfed and sustained the low quality of education to the infant stage. In particular, formal education experienced massive internal damage from the turbulent years of 1971 to 1985. During this time, the status of education was pitiful with very limited government and donor community support. Kemp (2008) documented a decline in budgetary allocations to the education sector from 3.4% to 1.4% between 1971 and 1985 (p. 5). The material infrastructure of the education system had depreciated and/or was destroyed, and teachers’ remuneration had declined tremendously hence pushing professional teachers away from teaching. Between 1971/2 and 1975/6, the Government Educational Plan was almost not implemented due to a shortage of skilled and professional labour created by the expulsion of expatriate teachers and fleeing of local teachers. Even after the restoration of normalcy in the country, there was no access to quality education for most children.

Uganda about fifteen centuries ago.
Uganda’s education system continues to reflect the curriculum left by the colonial government at independence in 1962. Since then, some minor reforms have been introduced such as Universal Primary Education (UPE) in 1997, compulsory science subjects at the secondary level in 2005, and thematic curriculum in 2007, reducing the number of subject combinations for Advanced Level secondary education students in 2010. Despite these minor reforms, the curriculum has not been relevant to the needs of many students. For instance, a significant percentage of university and tertiary institution graduates continue to languish without acquiring their dream jobs. Consequently, by 2010, the unemployment rate stood at 4.20% for the overall population, 32.2% for youth, and 36% for university graduates (Daily Monitor, 2011). The responsibility for the irrelevance of the curriculum to students’ needs rests on successive post-colonial regimes that have failed to recognize human resource planning and human capital development as vital facets of and prerequisites for national development. Some of the education reform programs have created more problems than remedied the challenges for which they were intended. For example, the introduction of UPE in 2007 was intended to ensure mass school enrolment to address the low literacy rate in the country. Several reports based on assessments of UPE in Uganda showed that it produced failures rather than success stories.

Accordingly, the World Bank reported a typical characteristic of some of the UPE classes. A harsh, yet common scene in the Bweyale village in Northern Uganda is that of more than 100 students packed into one classroom, sitting on the floor due to the absence of desks, lacking reading and writing materials, and led by one teacher. In 1996, when the government of Uganda introduced the removal of primary school fees in what has been called the “big bang” for universal primary education, enrolment expansion was dramatic. Just in the Bweyale Primary

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2 http://www.tradingeconomics.com/uganda/indicators
3 Daily Monitor, 2011
School alone, enrolment increased from 573 to almost 3,000 children (World Bank, 2005). The report noted with concern that despite a decade of donor agency support to mitigate the negative effects of explosive enrolment due to the UPE, the basic conditions for effective learning were not present in many Ugandan rural schools. The average number of students per classroom, according to the report, was still 94. The same report also noted that three students were sharing a single textbook. The textbooks where they existed inadequately or rarely addressed Ugandan content such as local science, history, geography etc nor students’ learning needs. Besides being scarce, the textbooks were located far away from many students who might want to access them after school hours or during holidays. With this scenario in most UPE schools, coupled with the inadequacy or lack of textbooks in the majority of cases, the Western science subjects that the Ministry of Education made compulsory in secondary schools failed for many students due to a poor foundation at the primary level. It was not simply the lack of resources and infrastructure that led to failure, but the form of science (being taught in some cases by unqualified teachers) itself that contributed to these outcomes. At the initial stage, Uganda should have focused on supporting learning outcome enhancement while at the same time improving access and resisting the excitement of showing incremental gains in quantity at the neglect of quality. Doing so necessitated an advanced level of resources and political dedication which the country did not have. Due to a lack of resources and political dedication to promote education for human capital development, Uganda has largely promoted humanity subjects in the education system, producing large numbers of white-collar job seekers like lawyers, journalists, economists, clerks, accountants, and administrators among others. This policy is responsible for shortages of science teachers, doctors, engineers, chemists, agriculturalists, ecologists, and many others from the time the country obtained independence from Britain in 1962 to the present.
The few science professionals such as teachers, professors, doctors, chemists, biologists, agriculturalists that are in the country have been trained using the Eurocentric/Western education curriculum left by the colonial regime at independence. These teachers continue to advance the same type of curriculum that was given to them regardless of its significance to the local Ugandan context. The existence of these science professionals is good for the country but the extent to which they embrace Indigenous science is uncertain. They fail to see the dissension that this education system has been creating in the learners’ minds due to, in some aspect, its inapplicability to the local settings. In a similar tone, Wane (2009), a strong critic of the dominant curriculum asserted:

As a product of foreign curriculum that did not speak to my values, I have been wrestling with the question of why we are so intent on universalizing the curriculum when there is evidence of a negative impact on those whose values, backgrounds, histories are not Eurocentric. I have often wondered why educational planners cannot see the fragmentation and dissonance created in a child’s psyche when there is disconnect between what they are taught at school and their home experience. (p. 161)

This curriculum ignores Indigenous knowledge/science since such knowledge is viewed as a threat to Western education. Perhaps the colonial educators perceived that when learners acquired African Indigenous knowledge, it would encourage them to rebel since it teaches learners values that are incompatible with the content of colonial education.

The other factor for the exclusion of Indigenous science has been the need to keep up to the international standard for educational provision. Until recently, even international development organizations in education have not taken the issue of Indigenous knowledge/science seriously. Rather, most of the funding emphasis for developing countries has been on Western/Eurocentric science and technological education. This forced many developing economies to direct their efforts toward Eurocentric education with a focus on Western science and technology. The redirection toward Western centric education did not come with a new set
of curriculum for most African states, but rather with an extension or modification of the already existing curriculum, as pointed out by Woolman (2001):

Since independence, the role of African education has been inextricably interwoven with the quest for national development and modernisation. The inherited colonial systems were expanded and modified to serve new economic and social needs identified by African Governments. For the most part, educational policy decisions and implementation remained highly centralised and reflected the will of ruling elites. In many countries, results have not matched expectations and educational systems have, in some cases, caused new problems for nation-building. (p. 28)

To respond to the new trend (need to cope with the international standard); many developing societies adopted Universal Primary Education (UPE). The aim of UPE was to increase school enrolment for children who hitherto had no access to education. To ensure implementation, donor communities directed their funding toward countries implementing UPE. Donors and international financial institutions have argued that the pattern of spending which provides large amounts of support to a restricted group of beneficiaries rather than broad equality of opportunity at a basic level does not constitute a prudent use of scarce public resources. In Uganda’s case, the introduction of UPE led to a tremendous increase in student enrolment. By 1999, the influx of students as a result of UPE had resulted in low quality education and increased student–teacher ratios to the highest in the world (Deininger, 2003, p. 292); moreover, about one quarter of participating students failed to pass their final exams. This type of classroom scenario shifts the curriculum emphasis to rote learning (learning by memorization) as opposed to inquiry based learning for practical problem solving skills. This type of learning is teacher-centred and students are viewed as empty entities and mere recipients of knowledge (see also Freire 1970). Its end result is graduates who cannot apply theoretical knowledge into practice.
For the context of Uganda, this mental peculiarity influenced the elites and policy makers’ comprehension of how society should be modernised. To them, social, economic, and political development/modernisation can only be achieved by reliance on scientific knowledge produced and validated in the West regardless of the effect of that knowledge on individuals from a different social context. Owuor (2007) emphasized that the formal Western oriented education system inherited after independence not only cultivated among the elites a sense of denial of their Indigenous heritage but also impacted individuals’ sense of self-confidence in expressing and appreciating their native values and cultures.

To assert Western science education, subjects such as physics, chemistry, and biology were made compulsory for students both in primary and secondary stages of their education. Under the new policy approved in 2005, the Ugandan government has made science subjects like biology, chemistry, and physics compulsory for secondary school students and has required all first year university students to take some science courses. The government also preferentially funds university students taking science courses. For instance, science students are the major recipients of government scholarships (75%) to universities and other tertiary education institutions (Mugira, 2005). Although the prioritization of Western science is a positive step toward the production of cadres of technological experts to implement the vision of changing Uganda into an industrial economy, it carries the high potential of devaluing liberal arts education and Indigenous science. A healthy mix of Western and Indigenous science would be a positive move because Uganda lacks the resources to expedite the implementation of a robust Western science discipline. This lack of resources has affected the production and hiring of highly skilled professionals such as PhD graduates to teach university courses. According to the National Council for Higher Education (2010), universities need more highly qualified staff.
Nationally, those with PhDs were only 11% (858); Master’s 38% (2967), Bachelor’s 34% (2621), and the rest had various types of diplomas. Due to limited funds for making science facilities and resources available to all public schools in the country, most students in upcountry schools learn about the use of laboratory equipment theoretically. They only get to physically use laboratory equipment such as test tubes, Bunsen burners, microscopes, reagent bottles, calorimeters, and mixing chemicals on the national examination day when such equipment is rented or borrowed from city schools. It is not surprising that students fail to use the equipment accurately, leading to poor scores in science subjects and blocking them from obtaining government scholarships for their university education.

To comply with the Ministry of Education’s policy of making science subjects mandatory at the secondary school level, most schools introduced a very harsh policy called “elimination” at the end of each school year. Elimination is an intolerant policy that has seen many students drop out of school. Under this policy, students who fail to score above average in the mandatory science subjects are automatically purged from schools. In Kitgum High School, where I studied in the early 1990s, this system was already in place and many of my colleagues unfortunately became victims of this unsuitable policy. Hence, the doors to a better future through education were shut on their faces. With few secondary schools available to match the high demand for education, these students had their academic futures disrupted. Most of them could not gain admission to other schools as they were now considered “weak” students. It is ironic that formal education in the present century still continues to be discriminating to students and yet learning should be a process that students enjoy and find resonance in. I cannot understand why an education system would coerce students to study what does not interest them. The education stakeholders who framed this policy failed to appreciate the fact that, every culture has profound
and unique differences in its value, knowledge, and belief systems. They also failed to acknowledge that a culture’s values, knowledge, and belief systems transcend civilizations and time. The forceful imposition of values or knowledge of other cultures on learners from different cultural groups defeats the objectives of learning and injures the learners spiritually, emotionally, and psychologically, keeping them away from schools. Avoiding schools becomes a natural response strategy or coping mechanism when spiritual, psychological, and emotional torture is inflicted on the students.

However, it is not surprising that such an inappropriate policy is imposed on learners in Uganda because the policymakers themselves were trained using colonial curriculum. I have illustrated this phenomenon in a recent publication with the argument that the post-colonial elite in Uganda were educated in colonial schools or in schools whose curriculum was colonial. Even when some of the schools had an independent base, the inspection of these schools and control over the syllabus tied these independent schools to the British system of education. These schools graduated scholars whose identity was formed in two different worlds: Indigenous as a result of their birth and Western as a result of attending colonial modelled schools. The dual identity of these professionals causes conflict when it comes to the issues of Indigenous education and knowledge systems (Akena, 2011). It is common practice for many students who could not cope with the mandatory science subjects at secondary schools to drop out of school and take jobs as science teachers in primary and secondary schools in rural communities. The ineffectual teaching of Western modes of science by unqualified teachers in rural communities raises serious concerns about quality.

For meaningful science education, emphasizing a scientifically valid worldview among potential teachers in a predominantly traditional culture is imperative because learners’
perceptions are shaped by those of their teachers. Learners’ view of the cosmos is to a great degree determined by the acknowledgment of what their teachers construe to be valid. My educational experience offers a practical account attesting to the truth of this statement. Due to an inadequate number of professional science teachers to cover all the schools nationally and because of the insecurity in some parts of the country, some upcountry schools developed a policy of hiring un-trained ‘teachers’ and paying them using funds generated from Parent Teacher Association (PTA) collections. During my secondary education at Arch Bishop Janani Luwum Memorial College Mucwini, our chemistry teacher was an example of someone with a modest chemistry background and no teacher training at all since he was eliminated from Advanced Level education (higher secondary education) due to his poor performance in science. The school hired him to teach chemistry because he had basic chemistry knowledge. It was not surprising that most students from this school performed poorly in the subject at the national examination.

The inferiority complex created in many students after being eliminated from secondary schools is sufficient to close a final chapter on their educational course. Even worse, schools eliminating students on grounds of poor academic performance, especially in science subjects, would note the reasons for elimination in students’ report cards and publish their names on school announcement boards and in school newsmagazines. Thus, by the end of the school year, the poor academic performance of students purged from the school system was known throughout their community. This humiliation created fear in students and turned education into a persecution field instead of a place where they could acquire skills necessary for societal development and transformation. Education became an instrument of torment and competition as students and schools raced against each other for the best performance in the local and national
examinations. This environment strays from the concept of African Indigenous education where learners enjoy the entire learning process as they acquire new knowledge and skills.

Moreover, because the government prioritizes funding students doing science courses in university, the implication for students from rural schools that cannot afford science equipment for their students is that they miss out on university education. Even in urban areas, private as well as public, schools compete for the restricted university admission requirements by cheating on examinations for their students. The cheating involves school administrators conniving with corrupt officials at the Ministry of Education and Sports (MOES) to leak examination materials, hence giving the cheating schools an unfair advantage over others.

1.4. Conclusion
The pervasive trend toward inadequate science education in Uganda has become a causative factor leading students who survived the elimination policy and entered university education to drop science subjects at the university level where it is not mandatory. They concentrate instead on liberal arts and business education. Learning loses its meaning when learners are forced to study courses that are of less interest to them. As a result, taxpayers’ resources are wasted on the forced provision of such social services to dispirited learners/consumers. Any education policymakers should allow space for consumers/recipient in a traditional cultural background to assess and judge the value of educational policy and decide its relevancy. An in-depth assessment of any educational system or policy by recipients will help recipients form their worldviews using their existing values and knowledge systems alongside the new knowledge. This is lacking in Uganda’s education curriculum in which imposed knowledge and values reign
supreme in the academy at the expense of Indigenous knowledge and values. Multiple inaccuracies have thus led to the education sector’s failure to address the country’s social, economic, and political difficulties.

Uganda’s current science education curriculum is burdened with challenges such as the growth of the student population in excess of the available science resources, inadequate laboratory facilities and science equipment, insufficient professional human resources (teachers) to implement the mandatory science subjects, and above all, the exclusion of Indigenous science from formal education. Research in and implementation of alternative (Indigenous) science pedagogy alongside the dominant pedagogy to provide learners multiple options is necessary to address these problems. Accordingly, Ogunniyi (1988) argued that the aim of science education should not be to supplant or denigrate a traditional culture but to help the people meet modern challenges. If an African can grasp technological products without mental conflict, it is certainly not impossible to design ways and means to help him/her take up scientific interests, attitudes, thoughts and habits without destroying his/her identity or religious sentiments. This individual should not only be allowed to absorb new interests and values but should also be allowed to invest in other aspects of his/her culture. In a similar tone, Olugbemiro (1997) asserted that the second issue relates to the worldview that learners in traditional societies take into the science classroom. Each learner’s worldview acts as a framework within which mechanistic science concepts are assimilated. Wane (2006) stated the need for inclusion of Indigenous knowledge:

Current Western approaches to education do not acknowledge the richness of different approaches, instead choosing to perpetuate the homogeneity resultant from the dominance of the developed world…. Education may actually benefit from the sustainable practices inherent in Indigenous system of knowledge. (p. 195)
The suggestion is that the concepts to be learned must begin from what the learners already know in relation to their own society. In this regard, traditional science knowledge should be the foundation upon which the teaching of dominant science is anchored. In summary, chapter one provided the definition of Indigenous science by drawing it from the existing literatures. Such definitions laid the foundation for discussing the professional context of the study and problem statement. In chapter two, the discussion will focus on the history and context of Indigenous science.

1.5. **Thesis Structure**

The thesis is organized into nine chapters. The first chapter provides an introduction, personal and professional context of the study, and statement of the problem. The second chapter provides the history, literature review, and context of AIS in Uganda. The third chapter offers a theoretical framework with analysis of anticolonial, Indigenous knowledge discursive frameworks, and transformative learning theories. It discusses how the theories can be used as tools to situate the exclusion of Indigenous science from the education system within a historical context. The chapter also attempts to explain how the use of the different theories empowers Indigenous people to resist oppressive elements of mainstream science pedagogy that undermine AIS knowledge. Chapter four discusses the methodology of data collection and analysis. The fifth chapter reports the findings of the study. Chapter six analyzes data. The analysis engages participants’ perspectives, the literature, theories, and the researcher’s perspectives in the discursive process. Chapter seven discusses how formal education was used to entrench psychological violence. Chapter eight discusses the significance of the study. The last chapter offers recommendations and conclusions.
Chapter 2

History and Context of Science Education in Africa

2.1. Structure of Uganda’s Education

Uganda’s education system is comprised of seven years of primary education, four years of lower secondary education commonly known as Ordinary Level (O level), and two years of upper secondary education known as Advanced Level (A level). From there, students may complete four or five years of university education depending on the course or program of study. Post-secondary institutions of learning encompass technical colleges, colleges of commerce, teachers training colleges, and other tertiary institutions training students in different skill sets. The tertiary institutions normally consist of one to two years of study. Uganda’s first institution of higher learning, Makerere University, was established in 1922 (Macpherson, 1964) followed by Mbarara University of Science and Technology in 1989. More public universities were built in Uganda after these two, including Kyambogo University (2003), Gulu University (2002), Busitema University (2007), and Muni University (2012). In addition, Uganda has 23 private universities (National Council for Higher Education, 2013).

Post-secondary education in Uganda is regulated by the National Council for Higher Education, a statutory agency established under the Universities and Other Tertiary Institutions Act of 2001. Its core objectives are to regulate the establishment, management, and quality of higher education, equalize higher education qualifications, and advise the government on higher education issues. It also manages the post-secondary accreditation system (National Council for Higher Education, 2010).
2.2. Higher Education Admission Process

Higher education is offered at tertiary-level institutions and universities. At the postsecondary level, technical colleges, the Uganda College of Commerce, and the Community Polytechnic Instructors College offer two-year programs leading to a diploma or a Master Craftsman Certificate DIT. National teachers colleges offer two-year programs to UACE (or Grade III Teacher Certificate) holders leading to a Grade V Diploma, qualifying graduates for teaching in primary and secondary schools as well as primary teachers colleges. At the university level, short programs leading to an ordinary or higher diploma last two years. Bachelor’s degree programs usually last between three and four years (five years in the case of medicine and dental surgery). Postgraduate studies leading to a diploma normally last one year, while Master’s degree programs take from 18 months to two years to complete depending on the program a student is enrolled in.

2.3. Distribution of Higher Education Institutions and Admission Process

Regional inequality in distribution of higher education institutions has not changed. In 2010, 98 institutions (54%) were in the central region, 37 (20%) in the western region, 28 (15%) in the eastern region, and 18 (10%) in the northern region. More than half of the institutions in the country are in the central region. The northern region continues to be the most disadvantaged in terms of institutional locations with only 18 institutions, or 10% of the country’s institutions of higher learning (National Council for Higher Education, 2010).

Admission to higher education system is based on either government or privately sponsored schemes. Students join higher education after completion of the Advanced Level of secondary education. Prospective candidates who aspire to be admitted to public universities
under a government sponsorship scheme fill out the Public Universities Joint Admissions Board (PUJAB) application form. In the process, candidates rank their top six choices of degree programs at public universities and four choices of diploma programs at other public tertiary institutions. Entry into public and private universities requires a minimum of two principal passes obtained at the Uganda Advanced Certificate of Education Examination (UACE). Admission to universities on government sponsorship is based on scores in various subject combinations, which are then weighted based on individual programs at the faculty level. Generally, the best students are admitted under government sponsorship schemes while the rest are admitted under private sponsorship programs. Those who fail to get admitted into university under these two schemes then apply to join colleges and other tertiary institutions for certificate and diploma programs. In Uganda, tertiary institutions refer to the system of advanced education offered to students who have successfully completed secondary schools. Besides universities, there are many other tertiary institutions spread throughout the country. These include national teachers training colleges; the Law Development Centre in Kampala; the Agricultural College at Bukalasa and Arapai; Uganda College of Commerce in Kabale, Aduku, Soroti, Tororo, and Pakwach districts; the Land Survey School in Entebbe; the College of Forestry at Nyabyeya; and the Uganda Cooperative College in Kigumba district.

In weighing applicants for the two entry programs at public universities, students majoring in science subjects (such as chemistry, physics, biology, agriculture, mathematics, nutrition/food science) are given an advantage over their colleagues specializing in the arts. However, emphasis on science courses in university education is restricted to subjects in the dominant science disciplines at the expense of AIS. The National Council for Higher Education, working under section 5(i) of Universities and Other Tertiary Institutions Act 2001, sets
minimum standards for university courses of study. In arriving at minimum standards for courses of study, the Council works with lecturers and professors from universities who recommend to the Council what they think is the minimum body of knowledge for which a degree in a particular program can be awarded (National Council for Higher Education, 2010). Close examination of the summary of courses offered for a basic sciences program for undergraduate students at the university level reveals the absence of Indigenous science from the basic requirements. The absence of Indigenous science from the higher education curriculum is reiterated by the different bodies of literature.

2.4. Reviewing Literature on Indigenous Science

By engaging with the different literatures that centers Indigenous knowledge at the hub of knowledge production, the possibility for its integration into formal education is explored. In the modern era, Western oriented scientists are continually making new discoveries and advancements in the field of science and technology but the foundation of the advancements is embedded in Indigenous sciences. Dei et al. (2008) observed that the so-called modern science is in fact embedded in Indigenous knowledge (p. 72), and Indigenous knowledge is used for decision making at a local level on multiple community issues (Gupta, 2009). By expanding their enquiry into the timeless traditional knowledge and wisdom of long-resident and oral people, contemporary scientists have in effect moved the borders of scientific inquiry and formalized a branch of biological and ecological science that has become known as traditional ecological knowledge (TEK). TEK can either be thought of as knowledge itself, or as a documented ethno-science enriched with analysis and explication provided by natural science specialists (Snively & Corsiglia, 2000). It can thus be concluded that, the foundation of modern scientific knowledge is
Indigenous knowledge. The coexistence of Indigenous and modern sciences would provide the most enlightening pedagogue to learners in terms of diverse worldviews about science.

Exclusion of Indigenous science, a highly valuable cradle of modern science from the arena of knowledge production in the education system, undermines the ability to derive measures with which to tackle the multiplicity of challenges facing Indigenous societies. It hinders community members from depending on each other for societal transformation. Survival of African societies persists because every community member is obligated to contribute toward the existence of their society by producing relevant knowledge (of social and applied science) to their local milieu. Corsiglia and Snively (2000) suggested that scientists are using TEK to solve important biological and ecological problems; they are also using TEK because problems of sustainability are ubiquitous and of high interest to students and others. It has therefore become increasingly important for science educators to introduce students to the perspectives of both Western modern science and traditional ecological knowledge. The implication is that local practices may validate narrowly defined global or modern scientific knowledge (Sillitoe, 2007). A proper understanding of science can be effectively achieved when it is construed as a link between different ways of knowing where none is elevated over the others. Local and global sciences are often directly comparable.

During the colonial and post-colonial periods the world economy favoured knowledge and skills developed in modern laboratories. Thus it promoted knowledge and technology developed to meet local needs in different socio-economic contexts. Furthermore, global industrial and agricultural firms produced for the world market, including developing countries like Uganda. These trends put Indigenous knowledge and techniques at a great disadvantage (Kagoda, 2009; Langdon, 2009; Sillitoe, 2007). In the education system, the favouring of
Western modern science at the expense of Indigenous sciences was facilitated rather than hindered by the loopholes in the post-colonial education system where the curriculum became a means of expressing cultural hegemony. Until fairly recent times, any region outside of Western Europe learned modern science through direct contact with a Western European country. Through military conquest, colonization, imperial influence, commercial and political relations, and missionary activity, the nations of Western Europe were in a position to pass their scientific heritage on to a wider world (Basalla, 1967). This scientific heritage, however, conflicts with Indigenous people’s holistic concept of education and life, where no knowledge is placed over others.

In the book *Growing Up in East Africa*, Castle (1966) reiterated the significance of African traditional education. He argued that African customary education was a true education, for:

> Its aim was to conserve the cultural heritage of family, clan and tribe, to adapt children to their physical environment and teach them how to use it, to explain to them that their own future and that of their community depended on the perpetuation and understanding of their tribal institutions, on the laws, language and values they had inherited from the past. These aims were achieved, and most effectively, long before Europeans brought to Africa the other view that education necessarily involved the skills of writing and reading of books. (p. 39)

However, this outwardly holistic education system of the African people became distorted and subjugated as contact with formal education took place. The introduction of formal education inescapably resulted in the devaluation of the holistic African education because the new (Western) education displaced African scholars from their environments to one that was quite abstract and alien to them. Woolman (2001) upheld this view with the argument that:

> Several Africans who experienced colonial education report that it had the effect of undermining traditional societies; on the one hand, by introducing an individualistic Eurocentric value system that was alien to the African communal mores and, on the other hand, by isolating students from their local communities. (p. 28)
The marginalization of African traditional education involved a well-structured and hierarchical strategy in the form of curriculum and syllabuses. Ogunniyi (1986) stated that before the late 1950s and early 1960s, the science curriculum in most African states was in the form of the syllabuses of the different subjects set up primarily for examination purposes. The curriculum was left to grow by itself—a process akin to the evolutionary mechanism of natural selection. It was thought that the obsolete or irrelevant materials would die a natural death while new ideas would gain prominence. In view of the fact that formal education was introduced by the Europeans, the development of the curriculum was primarily their responsibility. They decided what was best for African learners to include in the curriculum. As a result, most African cultural values, knowledge, and traditions were excluded from the education system. This was a deviation from traditional African education in which educational content grew organically from the instructors’ and learners’ environmental circumstances. Evidently, in their view, Indigenous science and knowledge were of no value to the African ecological context. Ibikunle (1990) lamented that the curriculum for science education at the tertiary level in most post-colonial countries is noted for lack of relevance, inadequacy, and neglect toward national needs and concerns. His major concern was that most of the curricula are carbon-copies of those from Britain and American universities.

Formal education shifted teaching and learning in accordance with the Europeans’ knowledge system and the centre stage of this was the missionaries’ schooling. As pointed out by Mosha (2000), European educators demanded that African schoolchildren reject their own “primitive and pagan” customs in order to embrace the new, civilized ways of learning and living. This automatically meant that schoolchildren and anyone who desired the new, civilized way should cut themselves away from the Indigenous influence of families, elders and anything
that stood for, or promoted, Indigenous knowledge and wisdom. As a result, most African communities have embraced Western knowledge to the extent that unity among Indigenous people and organizations in Africa to resist domination and reclaim their traditional ecological knowledge has been difficult. There is also little networking among the various Indigenous groups in Africa. Unlike Asia and Latin America, no African regional Indigenous network or organization exists. Furthermore, some independent actors such as NGOs using the name Indigenous have no focused agenda and program activities that target the interests and education of Indigenous people. If they do, they are not comprehensive enough to target issues that are critical and of concern to Indigenous people in their territories (Kipuri, 2006). Unfortunately, it is the painful colonial legacy in which the seed of inferiority and unassertiveness were implanted into the colonized minds that makes it hard for them to form a united front in the struggle for recognition of their Indigenous values, belief systems, and ways of knowing. Some education stakeholders in Uganda argue that embracing foreign curriculum is important in maintaining international standards in education. However, the justification that upholding the Western outlook curriculum on the basis of keeping academic standards and aspirations to conventional levels of excellence is debatable. This reasoning amounts to validation of failures by post-colonial regimes to attain autonomy in the provision of education.

In his book, *The Heartbeat of Indigenous Africa*, Mosha reiterated that Indigenous people experience life holistically and integratively. Everything that is thought, said, and done is done in relationship to the whole of life and the world. Everything that is known is learned in the context of the entirety of life for the purpose of furthering physical, intellectual, and spiritual growth (Mosha, 2000). African Indigenous people’s concept of education is that of interrelationship and impulsivity which encompass a belief in mystical powers and supernatural beings, as well as
human to human and human to environment relationships. It also emphasizes the connectedness of the three worlds—womb world, universal world, and spiritual world—which form the essence of the everyday education of the traditional African society. Dismissing these worldviews as uncivilized, third world, or backward is gravely misleading and lays bare the unequal power relations in knowledge production between the dominant and minority groups. Subsequently, Dei (2009) cautioned against the tragic inheritance of colonial education with a strong plea for the decolonization of African education.

Dominant groups create and impose subjective knowledge. Semali and Kincheloe (1999) argue that the essence of Indigenous knowledge is found in the experience of the colonized, which is never restricted to the third world, the uncivilized, the unreligious, and other tribal contexts. In retrospect, science is not limited to the uncivilized country where European settlement is the object. It can also be found in regions already occupied by ancient civilizations, some with Indigenous scientific traditions (Basalla, 1967). Therefore it is ethically vague to argue, as some dominant groups do, that the experience of the colonized is in the domain of the third world only.

Although the holistic education or worldviews of Indigenous African people are marginalized from the education systems, their reclamation and existence in African societies prevails. In a global context where dominant discourses usually appropriate other knowledge and claim universality, there is a site for the politics of reclaiming the subjugated Indigenous identities and knowledge. This reclamation serves to unmask the process through which Western science knowledge becomes the hegemonic way of knowing by masquerading as universal knowledge (Abdi, Puplampu, & Dei, 2006). The reclamation in itself is a tool of resistance and decolonization that reinforces the dualism of the different ways of knowing in the Indigenous
societies and possibly in the academe. Embracing multiple ways of knowing in the academe is a process liberating African people from the mistakes ushered by universalizing Western science in the academe.

Acceptance of multiple knowledges in societies and in education systems provides the power and strength necessary to progress in the modern century so that the citizens can live responsible lives (Abdi et al., 2006). Scholars argued that, for Indigenous people, the dominant Western knowledge system is incomplete and hegemonic in nature, hence the need to have multiple knowledges (see Bicker, Sillitoe, & Pottier, 2004; Langdon, 2009; Sillitoe, 2007). Elsewhere, Indigenous leaders lament how difficult it is for their young generations to see any options for economic security without following the ecologically destructive ways of the industrialized world (Gupta, 2009; Posey, 2004). The objective of advocating for the existence of Indigenous knowledge alongside Western science is so that the holistic nature of combined knowledge systems can benefit wider sections of mankind.

Conversely, there is some optimism for Indigenous science since many scholars are increasingly researching the Indigenous knowledge system and its contributions to the modern era. The focus on Indigenous knowledge and its production heralds a long overdue move. It represents a shift from the centralized, technically oriented solutions of the past decades that failed to alter life prospects for a majority of the peasants and small farmers in the world (Agrawal, 1995). Indigenous knowledge is undoubtedly the foundation upon which stood numerous scientific/technical innovations in the field of medicine, as well as in poultry, animal, and crop husbandry. Agrawal (1995) further argued that multiple new international and national institutions sponsor inquiries into Indigenous knowledge. Funding agencies such as CIDA.4

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4 Canadian International Development Agency
IDRC, UNESCO, and the World Bank also attempt to incorporate issues related to Indigenous knowledge in their financial activities. In numerous conferences, scholars and development professionals discuss the merits of Indigenous knowledge and deploy a new populist rhetoric to assert the relevance of Indigenous knowledge in development (p. 415). The rising interest in Indigenous knowledge and Indigenous science represents a great shift in attitude by contemporary scholars. Moreover, it is a positive intellectual resistance to old-fashioned theorists who applaud only Western science, viewing Indigenous science as somehow deficient.

Integrating contemporary science curriculum into our education systems opens our awareness to the relevance of Indigenous science for many African societies. This is often reflected in many African communities where formal education is not deeply entrenched, and their survival and pattern of life continue undisturbed. In Uganda, the Batwa Indigenous group and Karimojong pastoral communities provide a good example by preserving a balance between human and societal needs despite formal education that is scanty or completely absent. Wane and Solomon (2005) are convinced that, over many centuries, Indigenous people have maintained a unique and judicious balance between human needs and the needs of nonhuman nature. They maintained that many Indigenous people have a growing interest in returning to their sacred teachings and ceremonies and will continue to follow their traditions to sustain themselves. Indigenous communities fully recognize that the ancient ways of the Ancestors are valuable, reliable, and more sustainable than the present-day methods of living in the universe. Posey (2004) upheld the debate for Indigenous science’s significance in sustainable development with the argument that:

5 International Development Research Centre
6 United Nations Educational, Scientific and Cultural Organization
Traditional knowledge of medicinal plants, natural insecticides and repellents, fertility regulating drugs, edible plants, animal behaviour, climatic and ecological seasonality, soils, forest and savannah management, skin and body treatments attest to but a few of the categories of knowledge that can contribute to new strategies for ecologically and socially sound sustained development. (p. 149)

A synthesis of Wane and Posey’s views typically illuminates the practicality and relevance of Indigenous science to the needs of the local society. It also suggests that the integration of Indigenous science into the formal education curriculum is significant for revitalizing education for sustainable social, economic, and political development.

The principal flaw of emphasizing only Western science in the education system, with its philosophy of social and economic progress, is that of un-sustainability. It is on this ground that a significant number of African people continue to embrace Indigenous science alongside Western science to create an ecologically sustainable society that gives broad satisfaction to its members. Perhaps based on this realization, Castle (1966) observed that about four-fifths of Africans still adhere to their traditional beliefs and practices. In a few areas of the African Christian world, the Christian gospel has been able to destroy the roots of ancient African tradition. However, he further observed that customary beliefs continue to condition the outlook of African Christians who seldom yield themselves completely to the Western world outlook. Castle, an American professor at Makerere University in the 60s, had an independent and opposing mindset to that of most Western educators of his time. He championed the cause of African education and repeatedly castigated Western conservative biases against African traditional education. To him, what the Western mind regards as superstition and attempts to purge from society remains a natural response for Africans to the physical and supernatural influences that surround them.

Although excluded from formal education, Indigenous African innovativeness in science and technology predates modern architecture and engineering works. For instance, pre-colonial
Africans used resources at their disposal to set up structures that kept them out of the reach of wild and perilous animals. In mountainous communities, stones were carefully carved into tools, weapons, protective gears, wall structures, and cooking stoves. Communities that lived in the tropical forests used wood for different purposes to meet the needs of their environment. In documenting ancient African architecture and engineering, Sertima (1983) argued:

People use materials available to them and where stone was available to Africans, they built in stones. When less sturdy materials lay at hand, the African was still able to place the stamp of technological ingenuity upon those materials. A British engineer has cited suspension bridges built with vines by the Kikuyu which equalled in engineering skill and potential durability any comparable bridges of wood he had seen in his own country. (p. 15)

Another architectural work by Indigenous Africans, Great Zimbabwe, is familiar to many in the academy and beyond. The ruins of this magnificent stone city (see Sertima, 1983) was perhaps the second greatest architectural work after the pyramids in Egypt, and is believed to be more than 800 years old.

The above literature is summed up by Wane (2011) who validated Indigenous knowledge and science with the argument that African systems of thought have been constructed to validate and legitimize the “dualism of knowing” and to show that there are multiple ways of seeing the world; these include physical and metaphysical, real and unreal, rational and irrational, objective and subjective, natural and spiritual, and finally scientific and superstitious. The celebration of this oxymoronic process of constructing Indigenous knowledge is grounded on the ontological, axiological, and epistemological foundations of Indigenous knowing. Intuitions, dreams, visions, proverbs, oral narratives, songs, fables, myths, and superstitions are all validated as legitimate means of knowing (p. 282). Authentic Indigenous science does not confine the field of invention/discoveries and distribution of scientific awareness to any specific areas as seen in Western conservative viewings of the cosmos. Indigenous science knowledge is produced by
Indigenous communities to respond to the challenges of their time and context. Certain practices of Western knowledge of science do not wholly apply to the context of Indigenous communities. The reverse is true of Indigenous science practices as testified by Hattersley (1972). He asserted that:

I have experienced the truth of these statements. I imported a large number of currant and gooseberry cuttings, which if cut in November or December in England, can be safely sent by post [to Uganda], without losing their vitality… In March, our wettest month, these were planted out in the open, and of seventy-six, seventy took root and threw their spring shoots of pale green which we know so well at home. Alas! In three weeks, all were dead, killed, no doubt by the light of the sun. (p. 59)

The testimony by Hattersley, a Church Missionary Society (CMS) missionary from the Anglican Church in Uganda in the late 19th and early 20th centuries signifies that attempts at cross cultural application of science knowledge (of plants/crops husbandry) and practices from the Western world may work or fail because of the differences in several factors such as climate, soil composition, alkalinity of the soil, people’s receptivity, and differences in cultural and belief systems.

Discursively, Indigenous and Western sciences have their own drawbacks and strengths. It would be beneficial to tap into the strengths of both sciences for solutions to global challenges. Western science does not need to be superior to Indigenous science; rather, both should be perceived as augmenting the other. With the unequal power relations in knowledge production and validation mentioned earlier, this appears to be an unattainable ideal. However, there is a possibility of conciliation that derives from appreciation of the complex relationship between traditional/Indigenous and modern science, leading to rational investigation or research that would focus on the method of integration. Such an investigation, Basalla (1967) articulated:

Would include comparative appraisal of the development of science in different national, cultural, and social settings and would mark the beginnings of truly comparative studies in the history and sociology of science. (p. 620)
Laying emphasis on comparative research and studies in science disciplines is instrumental if educators in the modern century are committed to establishing competency based education. With the rapid advance of globalization reaching all corners of the world, there is an increased demand for the use of scientific culture to the extent that education stakeholders/planners cannot afford to keep deaf ears on the discussion about the inclusion of other ways of knowing. Because globalization leads to an increased mobility of labour across the world facilitated by advancements in science and technology, it follows that increased scientific cultural diversity needs to be reflected in the curriculum.

With reference to Western academies, Dei (2002) offered possibilities for the integration of Indigenous science into the curriculum. He argued that integrating Indigenous knowledge into Western academies recognizes that different knowledges can co-exist and complement each other, but that these knowledges can be in conflict at the same time. Developing the understanding that traditional knowledge is not frozen in time and space would help in avoiding false, dichotomous thinking about Indigenous and non-Indigenous knowledge. The past continues to influence the present and vice versa. There is a continuity of cultural values from past experiences that helps shape the present. The present also influences the narration of the past. Wane (2008) supported this discussion with specific reference to Kenya. She argued that:

When we consider the human consequences of colonial education and the devastating impact that it can be expected to have on those who do not fit the Eurocentric norm, the agency to create room for Indigenous ways of knowing and teaching is clearly evident. (p. 193)

She proposed using anticolonial education as an instrument for opening up space for inclusivity/coexistence. Extending the debate for anticolonial education, Dei and Marlons (2009) posited that anticolonial thought exposes historic colonizing specificity, which informed the disciplines that gave Western academia institutions their “truth,” such as anthropology, political
science, and sociology. Anticolonial thoughts champion the co-existence of knowledge, which is a fundamental step toward decolonizing the African academy.

Conclusively, the literature review section demonstrates the importance of Indigenous science in the present society. It also strengthens the relentless debate for its inclusion as relevant knowledge in formal education. The literature points to the much anticipated determination to reform science education curriculum to mirror the knowledge and needs of Indigenous communities, because as Gupta (2009) noted:

Indigenous knowledge is a key element of the social capital of the poor….. Hence, [the] political contribution of Indigenous knowledge to locally manage sustainable and cost effective survival strategies should be promoted in [the] development process. (p. 34)

Realistically, Gupta’s analysis offers an embodied comprehension of Indigenous knowledge that surpasses a mere call for knowledge integration into the formal education curriculum. It stretches to other aspects such as practical development programs which must incorporate local knowledge for the objectives of such programs to materialize. It also lays the foundation for challenging the dominance of modern epistemological discourse in the education system.

2.5. Formal Education in Uganda

Initial development of missionary and colonial schools started in the southern region among the Baganda tribe of Bantu speaking people. The Baganda were perceived by the early European explorers/travelers to be more structured socially, politically, and economically than other tribes in Uganda. The missionaries found it convenient to begin intensive mission work and formal education there, and then move gradually to other parts of Uganda and East Africa. The real foundation of formal schooling focusing on literacy was established by the Church Missionary Society (CMS) of the Anglican Church in Buganda in 1895. Because the schools
were boarding (residential), children left their homes to attend and only returned during holidays. Reports indicate that in 1903, 22,000 children were attending the basic literacy education offered by the CMS schools in the Buganda region (see Adyanga, 2011; Goldthorpe, 1965; Macpherson, 1964; and McGregor, 1967). The Africans’ interest in formal education compelled the missionaries to set up secondary education for graduates of elementary classes; consequently, Mengo High School was opened in 1904 and was reserved for the sons of chiefs in Buganda. This was followed by Buddo High Schools for boys and later Gayaza High School for girls in 1905. The Mill Hill Fathers of the Roman Catholic Church also set up primary and secondary schools around the same time as the CMS: Namilyango College was opened in 1902, while Kisubi was established in 1905 (McGregor, 1967). The graduates from these schools later became missionaries and colonial administration agents to expand formal education to other parts of Uganda (east, west, central, and northern regions). Although the development of formal education started from one kingdom (Buganda), it later expanded to cover the whole of East Africa (Kenya and Tanganyika) by 1914. The demand for more skilled human resources to expand and sustain colonial administrative rule necessitated higher education institutions. This resulted in the establishment of Makerere College in 1922 as an institution of higher learning for East and Central Africa. After its founding, the central government of Uganda took full responsibility for the management of higher education. All students enrolled in higher education had their tuition fees, living allowances, and transport to and from their homes, stationery expenses, covered by the government. They also received extra allowances called “boom,” for incidental costs (Kajubi, 1992; Macpherson, 1964). However, the content of formal education curriculum did not include students’ prior knowledge. The introduction of formal education meant students continued to acquire two different and conflicting knowledge systems: the first
from their parents/community, and the second from the mission schools. The mission schools emphasized Christian virtues with African traditional education subjugated.

The schools were geared so much toward organized indoctrination that when the younger pupils completed their school term, the missionary educators were not eager to send them home for vacation. Among other considerations, missionaries often maintained that if African learners returned home, they would be exposed to the evil influences of African culture, thus diluting Christian teachings. With collaboration from leading royal chiefs in Buganda, they proposed two approaches to seclude African pupils from their culture and knowledge system. The first was for students to live with African chiefs chosen for their piety. The second was for students to go to camps. Both approaches were adopted because they allowed for close monitoring, supervision, and control of the daily lives of African learners (Akena, 2012) during their time at school.

Moving to the 1960s and onwards, Castle (1966) noted that formal education became an instrument of division in social relationships due to the scarcity of educational facilities and limited access for most learners. The inadequate provision of secondary and higher education facilities, Castle maintained, created educated elite who were completely detached from the majority of the population that did not acquire formal education. One of the manifestations of this division was a reasonable spirit of vanity mixed with arrogance that “School Certificates talk only to graduates, and graduates only to God!” (p. 28). The arrogance of educated elites was manifested in the post-colonial period when they took control of education in the country. At Makerere University, such elites failed to develop effective staff recruitment mechanisms for the implementation of science education. Traditionally, lecturers for universities and other institutions of higher learning were recruited from graduates with good first degrees who also had some post graduate qualifications and experience. In most cases, these academics, some of
whom are now Professors, had never been exposed to pedagogical training, particularly in science education, thus could not teach well (Ibikunle, 1990). Retrospectively, the poorly-trained lecturers not only failed to teach effectively but also became the means through which the exclusion of Indigenous knowledge from formal education was reproduced and sustained.

AIS practices were thus regarded as uncouth, uncivilized, and not worth teaching African children. The legacies of the few educational experts from the Western world who were mandated with determining the future of African education worked to the exclusion of Indigenous science from formal schooling. They set up curriculum that suited their interests but not those of the African learners whose interests they claimed to represent. For inflicting emotional and psychological injury by eliminating African traditional education from the lives of African children, the “expatriates” received enormous remuneration from the colonial government. Accordingly, they lived relatively better than most average Africans and enjoyed better goods and services as asserted by Michael (2005):

In Africa, many white expatriates enjoyed a good standard of living that they would never have dreamed of in their home countries. This view is not a generalization but rather a fact to which anyone who has lived in Africa can easily attest. And today, we see that many academic programs in African universities resulted from the input of some of these expatriate academics. Of course, it is not surprising that some academic programs were developed on the basis of the expatriates’ own view of the world and on the curricula of the universities where they studied. (p. 84)

However, despite the contemptuous feeling of formal education administrators toward traditional knowledge, the axiological nature of the latter has survived and native Africans continue using it in their daily lives. The proceeding analysis of traditional education in Uganda centers on Indigenous science and how it was/is practiced.

2.6. Science Education in Africa
This section generally shows that as much as Uganda and other African states lay more emphasis on Western science education, the initiative has, to some extent, failed to respond to the challenges facing by African people. This failure is due to poor planning, the irrelevance of the curriculum, and the exclusion of Indigenous communities in framing education policies. The section shows that, although Western science was introduced in African societies with the advent of formal education, it was a mediocre system that greatly failed to prepare learners for the challenges such as high rate of school drop, diseases, famine, droughts confronted by their societies. This state of science education continues to the present era, where several factors have prevented learners’ empowerment from the science instruction they receive at schools, as observed by Ajeyalemi (1990):

In practice, much of what is described as science and technology education in Africa today is nothing more than information-giving by teachers and the memorization of the presented information otherwise expected to be taught with emphasis on experimentation. Teaching/learning at all levels of education is neither practical or relevant nor appropriate. The theoretical approach is further encouraged by the emphasis it receives in public examination. (p. 12)

Ajeyalemi was concerned that the outcome of this science pedagogy would be graduates who could only read and remember scientific information but who lacked the ability to apply science principles to their societal needs as did learners from developed countries. Unfortunately, the poor foundation in science education for African learners dates back to the initiation of formal education as pointed out earlier. Of the many conferences that were held across Africa to ameliorate the pitfalls in science education, a 1964 conference made significant contributions for education reforms in Uganda.

The deliberations at the conference, held from July 28 to August 6 in Lagos, Nigeria laid the groundwork for motivation in science education in Uganda. The conference made recommendations on numerous strategies to be adopted which, among others, included
emphasizing practical and experimental works, introducing science at the primary stage of education for learners to have better grounding, and producing science textbooks that would be relevant to local contexts. In 1965, the notion of the African Primary Science Programme was introduced with some modifications to focus on the learners’ context. However, the introduction of the African Primary Science Curriculum was in name only. Examining it closely, it was an extension of the old colonial curriculum with minor modifications to the context of the local settings. Conversely, a meaningful reform in science education should include Indigenous knowledge that learners are taught by their parents at home.

2.7. Indigenous Science in Uganda

As mentioned in chapter one, the definition of Indigenous science is derived from the broader term Indigenous knowledge as articulated by different scholars (see Abdi, Puplampu, & Dei, 2006; Castellano, 2000; Dei, 2008; Gupta, 2009; and Odora, 2002). African people have a well-grounded Indigenous education system that encompasses the body, mind, and soul as the learners navigate the different stages of life. This education is holistically initiated to young people throughout different stages of growth, and it is the responsibility of the entire community to take on roles as educators without denigrating cultural knowledge. This education is intimately interdependent in that the learning of either liberal arts or applied science takes place harmoniously. The central axis of this education system is Indigenous knowledge, which is imparted to the learners through traditional/customary education. Mosha (2000) labelled African traditional education as education for a living and education for life, seen as one whole, not as a system consisting of two parts. The family and larger community have a central place in raising and educating a child holistically in Indigenous society. This observation absolutely rejects the
conservative views of early missionaries and some scholars in the present century who argue that education was brought to the African people by the Europeans. Critique of colonial mindsets regarding science education and its place in the transformation of African societies continues to carry weight because of the need to reform the education sector to be relevant to the learners’ surroundings.

AIS knowledge is rich and diverse in nature. It encompasses soil and plant taxonomy, cultural and genetic formation, animal husbandry, population control, medicine and pharmacology, ecology, architecture, and governance, among others (See Odora, 2002). AIS has made several positive contributions to the lives of African people, their animals, and plants; it also guides their ecosystem and is the foundation upon which their communities rest.

Though Indigenous science is denigrated as unsubstantiated by Western educators, it is widely practised by African people at home alongside the dominant science knowledge. Furthermore, although the formal science curriculum came with Western education during the colonial encounter, African societies were already practicing advanced science and technological innovations. This is evident in different facets of African societies and includes medical practices for curative purposes, community health care systems, agricultural civilization, iron smelting, astronomy, writing, mathematics, and architectural works.

Indigenous science practices and education in Uganda are a part of people’s lived experiences. The science is transferable across ethnic and cultural groups without charges levied on it. An example of the transfer of AIS knowledge is in the field of crop and animal husbandry. Among most Ugandan communities, farmers share knowledge of how to crossbreed animals and plants without charging money. A farmer from community “A” will travel several miles to community “B” to learn the practice of controlling soil erosion so as to replicate it when he/she
returns to the village. However, while away learning the most effective strategy to control soil erosion, this farmer also teaches host farmers in community “B” some farming techniques, like the preparation of liquid fertilizers, that he/she finds lacking in that community. The oral transfer of knowledge and skills ensures the transfer of best practices. In traditional African societies, orality is a central pillar around which knowledge is produced, validated, disseminated, and archived. Young learners are organized into age set systems in which every group has their own set of instructions passed on to them orally by different experts, mostly elders. In Uganda, Ocitti (1973) studied the Acholi people, who had a well-organized age set system in which the male children acquired skills and knowledge orally from male adults/elders in the family/community, while the girls received practical oral instructions involving life skills from female adults/elders. Oral transfer and sharing of best practices in science applies to crops, animal, and poultry husbandry. Additionally, in medicinal practices, oral sharing of science skills and knowledge ensures good health for community members, their livestock, and crops.

2.8. Healing and Health Care System

The health care system as an element of Indigenous science in Uganda is centered on the prevention and cure of diseases. In the curative domain, there exist two types of traditional doctors that specialize in different ailments. The first is herbal practitioners. These are medicine men or women who use local herbs for the healing or prevention of illness. They employ locally-centered approaches to physical healing and spiritual renewal. Herbal practitioners have been the cornerstone of community health and welfare for time immemorial. Their significance has been weakened, but not destroyed, by factors such as formal education and organized religion. By examining ethno-medicinal practices among Ugandan communities, the argument advanced is that medicinal practices have borrowed from nature or natural medical practices that
meet their needs within the cultural context of public health. This view is based on the community concept of health as including physical and spiritual balance. However, the community understanding of good health is undermined by Western education and colonization, which mischaracterize Indigenous science as backward. Ethno-medicinal practices also make significant contributions to our health. However, many times they are appropriated by outsiders who do not understand their importance, as elaborated by Wane (2011) below:

One must understand and appreciate the beliefs, values, symbols, myths, and the socio-cultural components that are associated with healing practices. This is because in many cases aspects of Indigenous practices are appropriated without acknowledgement through written text or media, and in the process their authenticity is lost. (p. 283)

The traditional doctors’ knowledge of ailments is derived either from physically examining the patient’s body for symptoms or from patients telling the doctors the invisible symptoms for internal ailments.

The second type of traditional healer, and probably the one maligned the most by colonial education and religions, is the spiritual healer/doctor. These doctors interweave spiritual powers with medicinal practices to dispel evil and provide holistic healing to patients. Ugandans have unique worldviews in which the spiritual and universal worlds exist in harmony. Most Ugandan communities have a profound belief in the existence of a Supreme Being called God, and in other supernatural powers called spirits (both good and evil). Evil spirits radiate ill-health that comes with varying degree of sufferings. Among the Acholi people for example, twoo Rubanga (hunchback) is believed to be cause by an evil spirit called jok Rubanga. It takes the expertise of the spiritual healers/doctors to dispel such ailments. There are many accounts and testimonies from people who have gained healing from hunchback after being treated by these doctors. A belief in the existence of God and holy spirits coexists with a belief in the presence of evil spirits and their ability to devastate mankind. Spiritual healing consequently requires the unity of
spirituality and herbal treatments to dispel evil from possessed patients. Castle (1966) observed that:

It is difficult for the Western observer to realize how deeply this influence penetrates into the daily life of the family. The spirits of a deceased grandparent or aunt may possess any member of the family who disturbed their rest. I have known a Makerere undergraduate deeply perturbed by the conviction that he was possessed by the spirit of his grandfather. Taylor cites the case of an educated girl suffering from what the European doctors diagnosed as acute hysteria for which lengthy treatment was advised. But her father thought otherwise, took her home under the conviction that ‘the sickness is from her aunt,’ and returned her to school cured in two weeks by the local practitioner in magic. (p. 31)

In Africa, one cannot rule out the existence of certain conditions that are related to a mystical causation, are beyond the scope of modern science, and thus require the intervention of African native doctors for remedies. However, this practice has been widely misunderstood and castigated by early European explorers and missionaries. They labeled it as witchcraft and sorcery, but to the African people, it is part of the way of life. The labeling and consequent dismissal of the works of spiritual healers/doctors by Western education renders their efforts futile and accounts for the contemporary low perceptions of these doctors among “educated” and “pious” Africans. Regardless, Sertima (1983) reminded readers that, Western-trained doctors who have studied the traditional medicine-man concede that the African doctors have a profound knowledge of the human body and anatomy. According to Sertima, the doctors usually give a careful diagnosis, beginning with a history of the disease, followed by a thorough physical examination.

Among the Acholi people, for example, several medicinal practices exist to cater to the well-being of the community. People consume specific wild fruits with conviction that doing so reinforces the body’s immunity against multiple ailments. The most common of the fruits are *Lantana trifolia* and *Ampelocissus Africana*. These fruits, known in Acholi language as *Bel-
winyo and olok, respectively, are known to have antioxidants which are a perfect deterrent of most liver diseases and cancer, and also help with weight loss. A recent study conducted on the toxicity of Lantana camara’s methanol extract on male and female mice at the University of Malaysia by Badakhshan, Lachimanan, and Sreenivasan (2011) provides some substantiation of the effectiveness of the plants’ species. After the administration of a single dose of leaf extract in the acute toxicity test, the female mice lost much of their body weight while the male mice lost organ mass, particularly kidney and heart weight. Although the study was conducted to determine the toxicity of the leaf, its effects on the male mice provided clues as to its toxicity. Other than losing organ—kidney and heart—weight, the mice were found to have developed minor liver damage after consuming the leaf. This suggests that the Lantana camara/trifolia have antioxidants which the Acholi people have long known to be able to increase the body’s immunity against cancer and other heart diseases. Perhaps this explains why occurrences of cancer among the Acholi people and other African groups are minimal.

Elsewhere, Sertima (1983) introduced us to Nigerian root bark Annona senegalensis which has been found to possess strong anti-cancer properties. He argued that the Nigerian root bark could provide a breakthrough in cancer treatment. In many Ugandan, as well as other African societies, the use of different herbs grew instinctively whenever there are outbreaks of ailments. In this event, certain individuals gained insight into the remedy through dreams or were intuitively guided to it. It was not apparent that every herb/s prescribed to the patient for specific ill-health derived cure since others were still in the trial stages. In the era when the existence of modern laboratories for testing medicinal effectiveness was unheard of, such experimentations were done directly on patients.
In Africa during the early centuries, there existed substantial numbers of doctors who were committed to finding curative measures for different diseases of their times. However, the lack of modern technology then as we now have in the 21st century centered their efforts on trial and error, which would either succeed or fail. For example, the sleeping sickness pandemic was rampant in Africa during the 18th and 19th centuries and native African doctors were already involved in the struggle to bring it to an end well before their European counterparts joined the struggle. Sleeping sickness is caused by two germs, *trypanosoma brucei rhodesiense* and *trypanosoma brucei gambiense*. Tsetse flies are known to be the major carries of these infectious germs. When an infected fly bites the victims, the infection spreads through the victims’ blood and develops into full blown sickness. Hattersley (1968) stated that European doctors joined the fight against sleeping sickness in 1906 after two Europeans succumbed to the disease in Uganda. One of them was Mr. Mahon, the head of the Botanical Department of the Uganda Administration, whose work in the Botanical Gardens at Entebbe lay in one of the most thickly infested districts, and the other was Lieutenant Tullock, a member of the sleeping-sickness commission (p. 133). According to Hattersley, following the death of these two Europeans, Professor Koch and two assistants were sent to Uganda in 1906 on a special mission financed by the German government at an estimated cost of £ 6,000 plus an offered reward of £ 8,000 from the King of Belgian for anyone who could discover the remedy for sleeping sickness.

Although African native doctors were, by that time, already heavily involved in searching curative measure for the pandemic, no mention was made of their efforts. Even the Sleeping Sickness Commission that was sent to Uganda from England paid no attention to the local

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initiatives that were already in place to combat the plague. Hattersley’s descriptions of the
treatment method used by Professor Koch depict a trial and error method that, while able to bring
short term relief to patients, largely failed to achieve total healing for the victims of sleeping
sickness. He asserted that:

His method of treatment was to inject hypodermically a preparation of atoxyl. Professor
Koch made an admixture of aniline with the preparation of arsenic, which enabled the
latter to be increased to several amount of ordinary dose. He found that this preparation
freed the blood temporarily from all trypanosomes. As he himself stated before the
German Emperor, when he injected 0.5 gramme of atoxyl he found trypanosomes in the
blood after five days; if he injected double doses…, he could not encounter any of the
parasites in the blood for a long time. They then endeavoured to obtain still better results
and increase the dose to 1 gramme injecting that quantity about every seventh day…..
After a while the doctors had a great surprise. More than twenty of their patients became
blind, and this was apparently not temporary but permanent…. Professor Koch himself
appear to agree that his treatment is open to grave doubts; but he believes that if it can be
adopted in the first stage, atoxyl can certainly cure. (p. 135)

It is evidently clear that Professor Koch and his team were investigating sleeping sickness cures
not for their care for the African victims suffering from the disease, but due to their natural desire
for scientific discovery, driven by the hefty financial reward from Professor Koch’s home
government (England) and Belgium. The trial and error strategy used was normal and logical;
therefore, the respective community had no problem with it. What was problematic, however,
was the deliberate predisposition to exaggerate the failure/futility of African native doctors’
efforts, terming them sorcery, satanic worship, and primitive. Then, as now, for fairness to reign
in society and the education system, African efforts in science and medicine must be given the
same treatment as the evolution of European science and medicinal practices.

In the domain of surgery, the Baghisu of eastern Uganda have long practised and still
continue to practise the lighter surgical procedure of imbalu (circumcision) on every male youth.
Although this is a cultural practice signifying initiation into adulthood, the scientific skills used
in the procedures are quite astonishing. Without any painkillers given to the candidate, the
surgeon is able to carefully place the edge of his surgical blade at the right spot to cut off the male foreskin without meting damage on the soft tissue. After the surgery, the surgeon then invites the herbal man/woman to apply medicines (usually extracted from plant fibres) on the wound. Therefore, imbalu signifies a well-organized principle of specialization encompassing expertise in different segments of science. Usually the patients’ healing time in these cases is equivalent to that of patients circumcised by Western trained medical doctors. Sertima’s (1983) account reminds us that overall, surgery seems to be an area in which African native doctors attained a level of skill comparable with, and in some respect superior to, that of Western surgeons up to the 20th century.

It was not until recently that the Ugandan government formally recognized the significance of this generational practice and adopted it into its health care system. Studies (some conducted in Rakai district—western Uganda) indicate that circumcised men have a 60% reduced risk of contracting HIV/AIDS. In 2008, the US government, under President Bush’s program for AIDS treatment and prevention, made circumcision free for every male Uganda. Also according to the New York Times (2011), male circumcision also appears to help protect a man’s sexual partners against cervical cancer. In an offshoot of a landmark study of 1,200 heterosexual couples in Uganda involving circumcision and AIDS, researchers reported in The Lancet that having a circumcised partner reduces a woman’s risk of catching human papillomaviruses by about 25 percent. Such viruses lead to genital warts and cervical cancer. Different studies in the present times have evidently validated some of the traditional science practices by African communities. As a result, massive campaigns have been launched by

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Uganda’s government for every male child, youth, and adult to be circumcised as a strategy to reduce HIV/AIDS.

Under the colonial rule that laid the foundation of traditional knowledge exclusion, many European nations considered traditional healers to be practitioners of witchcraft and outlawed them. In some areas of colonial Africa such as Zimbabwe (Waite, 2000), attempts were made to control the sale of traditional herbal medicine. More recently, however, there has been expressed interest in integrating traditional African medicine with the continent’s national health care system (Nakato & Kiwanuka, 2010; Sekagya, 2010). Despite the undermining of Indigenous African science, the practice has persevered and continues to be used by wide sections of African people both in the continent and in the diaspora because of its positive impact on the lives of African people. As Dei (2011) stated in support:

This knowledge goes way back into ancestral times, and they are continually subjected to daily improvements and adaptations. Such a body of knowledge about traditional pharmacology is often contextualized on the community’s historical experience with local health and illness situations and has been confirmed by their common usage and societal norms. In effect, it constitutes a collective traditional knowledge that cannot be conveniently dismissed. (p. 6)

This position calls for a comparative study of modern and traditional science in different national and cultural settings to ascertain the pros and cons of the coexistence of the two worldviews on pharmacology.

The practice of African traditional pharmacology goes hand in hand with the existence of specialists for different ailments. Finch (1983) reported that the Egyptians had quite an extensive knowledge of anatomy and physiology. They understood the importance of pulsation—4500 years before Harvey\(^\text{10}\)—and knew something of the structure and function of the cardiovascular

\(^{10}\) William Harvey, born in 1578 was an English physician who gave a detailed description of how
Moreover, they knew that the heart was the centre of this system, had names for all major vessels, knew the relation between the heart and lungs, and knew of the distribution of the vessels through the limbs. They were well versed in many pathological syndromes. Thus, if Africans already mastered the complex science of the human body years ago, the exclusion of this long-held tradition from formal schooling, as well as the monopoly of Western science in the curriculum proves a major detriment to African students’ educational journeys today. Students suffer when they are subjected to a mode of instruction differing so widely from the deeply rooted traditions learned in their cultural settings, as exemplified above. The end result is cultural border crossing. In examining cultural border crossing in terms of cognitive effects on students learning, Aikenhead and Jugede (1999) argued that when the culture of science is generally at odds with a student’s life-world, science instruction will tend to disrupt the student’s worldview. It does so by trying to force that student to abandon or marginalize his/her life world concepts and reconstruct in their place new (scientific) ways of conceptualizing (p. 274), a process called assimilation. However, assimilation or not, formal education in Uganda creates conflict by encouraging rote learning, or memorization, to pass national exams with little relevance to learners’ cultural values. Wane (2008, p. 194) challenged the subjective approach of viewing formal education. She postulated that it has been argued that formal education provides opportunities to be free of primitive ways and to embrace the fast-moving 21st century technological advancements. Such a position, which frames technological advancement as the sole means for improving one’s situation, reflects a narcissistic understanding that devalues ways of being in the world that are not consistent with the view being promoted by post-industrial world powers.

the heart pumps blood throughout the human body.
The continuous analysis of the formal education system that views the cosmos with one lens is significant in understanding the prevalence of African science practices such as pharmacology. According to Nakato and Kiwanuka (2010), the survival of African ethnomedical and epistemological tradition results in part from its capacity to deliver both physical cures as well as psychological solace to new world Africans. These authors found that plants native to the tropics and to Africa played a direct role in healing diseases whose origin are attributed to a physical and spiritual origin (p. 5). The realization of the invaluable role of AIS in modern times emerges parallel to advocacy for its inclusion in the education system. This realization is what Myers labelled adoption of an Afrocentric conceptual system which prompts us to re-evaluate every aspect of our being and empower our sensitivity to begin seeing an old world in a new way (Myers, 1978, p. 82). This new way is one that values and centers Indigenous science as the foundation of all scientific knowledge and situates this knowledge system at the nucleus of Indigenous people’s socio-economic and political wellbeing in the modern era.

2.9. Indigenous Agriculture

In the field of agriculture, the Indigenous agrarian communities of Uganda practiced unique and advanced farming and storage systems that in most cases endured different weather conditions of their time and region. Uganda has two major seasons, namely the wet season (March to late October) and the dry season (November to February). The wet season, equivalent to the spring of North America, is the period when all crop cultivation takes place with heavy rain in most parts of the country. Among the Acholi ethnic group of northern Uganda, farming took the strategy of rubu kodi, which is the planting of diverse crops simultaneously, or mixed
cropping/intercropping. Although all the crops would give a better yield due to proper season calculations, the objective of *rubu kodi* is that when one crop variety fails due to unforeseen causes, the others will succeed. Consequently, millet was intercropped with sorghum and pigeon peas, sweet potatoes with beans and cow peas, simsim with cassava and peas, okra with peas and tomatoes with peas, among others. Peas (pigeon and cow peas) are the variety most commonly intercropped because they contain legumes that are known to add food nutrients to the soil and hence sustain the fertility of the soil. Rotational farming is practiced among most farming communities. The aim is to allow a field ploughed in a given year to rest and regain its fertility before such a field can be reused in later years.

In terms of storage systems, the Acholi, Langi, and Alur people developed a unique food storage facility called *dero*, which means granaries. The *dero* was designed by professional craftsmen from reeds or bamboos and then smeared with cow dung, making it impenetrable by harvest-damaging pests like bean weevils and grain weevils. The mixture of cow dung and black soil for smearing the *dero* also provided resistance to fire. From my experience, *dero* stores grains for as long as a period of five years without going bad because it is designed to withstand any weather conditions (hot or cold), resist mild fire and above all, pest invasion. During times of plenty, every family dried their grains and stored them in *dero* in anticipation of a period of scarcity. Among the Acholi people, the different chiefs had central storage facilities called *dero miri*. All members of the community were expected to contribute some percentage of their yearly harvest for storage in *dero miri*. This would only be opened the following year when new harvests started coming in. The central storage facility acted as a reserve for starving orphans, families with poor harvests, and the entire community during times of scarcity (famine). Contributions to *dero miri* were mandatory and strictly enforced. The best craftsmen in the
community were selected to construct the central storage facilities in the courtyards of the ruling chiefs. The design of the dero required special skills, and the reeds/bamboos were carefully selected for maturity. They were split (in the case of bamboos) and mildly sun dried for ease of curving, and then carefully interwoven into a basket-like shape. After the full shape was woven, it was allowed to fully dry up and mounted on four stands usually made of wood or stones pillars. It was at this stage that the plastering of the interior and the exterior was done, creating three layers. The first thick layer had direct contact with the reeds and consisted only of cow dung, while the second and third layers were a mixture of cow dung and black soil. These layers were exposed to all natural and human factors. For these people, the development a complex food storage facility at a time when such innovations were rare in most societies demonstrated a multifaceted scientific and technological capability. This intrinsically provided a defensive deterrent against famine/starvation. It is unfortunate that such great accomplishments are slowly disappearing due to the forces of modernity that come with the deliberate marginalization of traditional values/structures from society.

In central Uganda, the Baganda have long mastered and practiced the skills of making backcloths. This unique skill required mastery of specific plants whose fibres could be smoothly blended with fibres from different species to produce soft linens that gained the admiration of most ethnic groups that came in contact with the Baganda. In crop husbandry, the Baganda practiced intercropping along the shores of Lake Victoria. In western Uganda, the Bachwezi were credited with smelting iron ore and curving tools that were also used as weapons in times of war. The Alur people of Northern Uganda were known for making canoes and large boats that crossed the Nile water with huge loads yet still maintaining balance. Like their counterparts along Lake Victoria, Kyoga, and Albert, the Alur had a well-developed sense of balancing
weight (modern day physics) and selected a fishing strategy that ensured the sustainability of resources for future usage. Among the Banyoro of Western Uganda, the Caesarean section practice surprised early European travelers to the region as discussed earlier (Sertima, 1983). This complex scientific practice is well documented and widely known among the Ugandan community.

Sex education among most Ugandan communities also provided a well-established science practice that controlled sexual misconduct and ensured that young people indulged in the act at the right age and time. Informal and continuous instructions were given to young people who had reached puberty, with the homestead as the central learning environment. Among the Baganda, for example, girls at puberty were guided and taught life skills by their aunties, while the boys were taken care of by their fathers and uncles. The role of the adults was to ensure that premarital sex was non-existent. During this training, young couples were taught child spacing and breast feeding. They were also given the names of people in the community who could treat impotence and barrenness. Sex education was sternly enforced, as described by Castle (1966):

Control over natural impulses, especially the control of sexual desire was governed by strict customary law with its prescribed rules and penalties, some of them very severe. To Western minds there would seem to have been much sexual freedom among adolescents, but it was a freedom within rules whose purpose was to regulate family life. [Citing Murray, Castle continued.] In the matter of continence alone, the restrain that the so called ‘savage’ can and does put upon his sexual impulses at certain seasons through loyalty to the tribal custom is one of the most remarkable things about the make-up of the primitive man. (p. 45)

The above discerning analysis, though partially derogatory, demonstrates that African practices were complex and not easily comprehensible to an outsider. The idea of sex education to control sexually transmitted diseases, population growth, and above all, ensure the existence of morality in a manner generally acceptable to the community, was a powerful social virtue that African societies mastered and applied rigorously.
Throughout the country and elsewhere in Africa, the existence of traditional midwifery was widespread. The midwives had specialized skills in the birthing process. Among some communities in Uganda, midwives were able to detect embryo defects and had herbs that could induce abortion in the first three months of pregnancy (Finch, 1983). In areas where there was a high incidence of dystocia (retarded labour), the midwives had preparations which stimulated uterine contractions (Finch, 1983). Interestingly, traditional birth attendants gained national, as well as international, recognition for their contributions to rural communities. At present, in Uganda, their knowledge is being improved with training by Western medical scientists, who are equipped with modern equipment to aid their work. However, midwifery is not formally taken up by the education curriculum. Failure to include traditional midwifery training in the school science curriculum can be equated to the unfair dismissal of past achievements. We cannot dismiss the achievements of the past in this way, partly because the past has a way of asserting its values in the present and because there are elements of real value in traditional education (Castle, 1966). The increasing interest of researchers (indigenous and non-Indigenous) in studying Indigenous science exposes the sacred elements of such knowledge to the risk of misappropriation. This is possible when research findings are labeled as “discoveries” or “innovations” and then patented, repackaged, and taken back to Indigenous communities in a new form. It reduces the need for recognition of the original knowledge. This is because Indigenous people themselves tend to favour “new” knowledge from the Western world, presumably developed in the laboratories with “modern” minds and technology.

Another significant scientific practice in Indigenous Ugandan society was an alcohol distillation process involving enormous knowledge of chemistry. Indigenous Ugandan societies distilled alcohols that were rich in food value with very low ethanol content. The brewing of
kwete (a brand of traditional beer brewed from sorghum and cassava flour) among the Acholi people required special skills, which mainly the women possessed. Their impressive brewing knowledge involved blending different cereals, grinding and mixing them with water, and allowing the mixtures to ferment. After fermentation, the product was then brewed using large clay pots. The drink had a mixture of sweet and sour tastes that delighted the consumer. It was the most favoured brand of alcoholic drink in the traditional Acholi society during major festivities as well as during leisure time. Enormous hygiene knowledge was demonstrated in the making of the pottery used in brewing. These pots were clearly different in design and separate from those used in food preparations. With colonial contact, Western alcohol/liquors and knowledge of alcoholic distillation became deeply entrenched in the Ugandan society that most people today no longer prefer the traditional alcoholic products. Fanon (1965) attested to this fact:

Colonialism obviously throws all the elements of native society into confusion. The dominant group arrives with its values and imposes them with such violence that the very life of the colonized can manifest itself only defensively, in a more or less clandestine way. Under these conditions, colonial domination distorts the relations that the colonized maintains with his own culture. (p. 130)

There is no doubt that Western educators have failed to understand and appreciate non-Western ways of life or the lived experiences of the people, condescendingly labelling them as primitive and inadequate. Some Indigenous people who maintain traditional values and science practices have strong reverence for the imposed dominant values. For example, it is not uncommon for the elites in Uganda today to seek treatment from traditional doctors under the cover of darkness, but go to modern hospitals for the same in broad daylight. Even when the patient is healed by using local herbs prescribed by traditional doctors/healers, she or he will not testify to it openly but
will attribute it to the “amazing efforts” of modern doctors or the “miraculous” intervention of the missionary gods.

Finally, the preceding discussions have dealt in depth with the significance of Indigenous science in the context of Ugandan communities. However, a one sided examination of AIS demonstrates intellectual biases and is akin to taking sides uncritically. This exposes the research to the reproduction of the status quo that the study aims to rupture. It is therefore important to engage in critical examination of AIS to identify associated challenges/risks with this knowledge. This is crucial for meaning knowledge hybridization to materialize.

2.10. Formal Science Education in Africa

Science is the broad interaction between living and nonliving thing. The intention of these interactions is the continuity of the environment and organisms therein. The practice and transfer of scientific knowledge in Africa is as old as the existence of African cultures/ethnic groups itself. The worldview of an African person is deeply interconnected with science, spiritual, political, and economic education as he/she interacts with the immediate environment. The aim of African traditional knowledge is to adapt the cultural heritage of the family, clan, and entire community; it also aims to teach the younger generation to preserve their environment with the realization that their survival resides in their local context.

With the imposition of formal education, however, the focus of education in Africa shifted from practical to more theoretically grounded learning with a concentration on faith. By quoting Taylor, McGregor (1967) reminds us that by 1927, the curriculum at King’s College Budo in Uganda was entirely academic. There was no attempt to relate school to life by any inclusion of agricultural, industrial, or health training. The primary objective of education was to
train learners to teach and preach the Christian religion or to take junior administrative works with colonial government. He pointed out that:

Boys on whose education time and money have been spent but who are incapable of becoming catechists, will either be sent away, or if their characters are good, will receive additional education to fit them for government clerkship. (p. 5)

The above view of education differs significantly from Ogunniyi’s (1988) proposition that science is largely a product of Western society and that the worldview held by modern science is strictly tied to Western culture. This linear way of viewing the different cultural practices and knowledge systems of the world is misleading and partly accounts for the imposition of dominant discourses in the education system of developing countries in the present age. This linearity in viewing different cultures is referenced to denote specific scientific inventions to mean “science” in its broadest sense, hence crediting it only to Western cultures. In any case, if we are to refer to scientific discoveries/innovations in any culture to mean science, then it is a documented fact that Africans made multiple scientific discoveries around the same time or before the Western civilization discovered and practiced them (see Sertima, 1983).

In pharmacology, as discussed in the first section of this chapter, several Western medicines were known to Africans before European discovery. For instance, Africans had their own aspirin. At present, the Bantu speaking people use the bark of the *Salix capensis* plant to treat musculoskeletal pains, and this family of plants yields *salicylic acid*, the active ingredient in aspirin (Sertima, 1983). The dates of some of the discoveries and medicinal practices among African communities cannot be accurately traced as some of the scientific civilizations are as old as the cultures that practice them. In terms of the pedagogy of science education, Indigenous science is highly sustainable since learners acquire the knowledge by practicing what they are being taught. This promotes the active participation that leads to critical observation, reflection,
and new discoveries/innovations corresponding to the challenges of the ever-changing societies. Because African societies are not static and are constantly evolving, pedagogical approaches in African education have also evolved continually depending on the society’s existing needs/challenges.

Technologically, African scientific and technological development dates back to the Stone Age in which the early hunters/fruit gatherers crafted stones into tools for hunting and weapons for defence purposes (Karim, 2003). In the present era, the study of pre-colonial Africa in Uganda’s education system evokes such topics. Sadly, however, this is mostly done with reference to the primitiveness of pre-colonial societies and their ways of living. Teachers/professors rarely mention these societies’ innovativeness to mould stones into shapes unearthed by archaeologists. Sertima (1983) reported that the earliest technological leap from hunting and gathering activities to the scientific cultivation of crops occurred in Africa at least 7,000 years before it did on any other continent. In 1979, Science Magazine reported the discovery by Fred Wendorf of agricultural sites near the Nile going back more than 10,000 years before the dynasties of Egypt. There, Africans were cultivating and harvesting barley and einkorn wheat. When grains of these cereals were carbon-dated at the Kubaniya site a few miles north of Aswan Dam, it gave a reading of 17,850 BC plus or minus 200 years, which is roughly 17,500 to 18,000 years ago (Sertima, 1983, p. 20). Civilization in agriculture along the Nile valley stretched from the source to the mouth; since the Nile is the longest river in the world, covering 6,853 kms (Wikipedia), agricultural advancement along the Nile basin was by far the greatest factor in the development of African societies throughout the Nile valley. Early European explorers were flabbergasted by the rate of technological and scientific development of some societies along the Nile valley. Scanlon (1964, p.3) stated that the famous British explorers
Speke and Grant had, in 1862, reached the court of Mutesa, the King of Buganda, and reported to an Africa-conscious Britain the discovery of a highly developed African Kingdom. Since the concept of development is tied to techno-scientific innovation and discoveries, the report of these early European explorers judiciously meant that the advanced African societies by then practiced sophisticated levels of Indigenous science. Such scientific and technological innovations appropriately addressed African societal needs and ensured sustainability.

Some of the scientific practices of African societies only came to the spotlight after early European explorers or traders came into physical contact with the community, witnessed, and documented it with astonishment. Africans were found to be using antiseptic surgery, which Lister had pioneered only two years earlier, at a time when the universal application of his methods in the operating rooms of Europe was still unheard of (Sertima, 1983). The literature illustrates the complex practices of science and informal administration of science education that existed in Africa long before Africans knew of the existence of other civilizations. The tendency of some African scholars, as well as scholars of other ancestries, to limit scientific innovations and discoveries to Western civilization is not only representative of these scholars’ illusionary perspectives; it also demonstrates the damaging effects of colonial inheritance.

In most of colonial Africa, meaningful science did not gain entry into the formal school system until the last half of the 19th century. This demonstrates the degree to which formal education did not fully address African challenges. Even when science entered the curriculum several years after, the focus was so narrow that only basic knowledge of scientific facts, often memorized, was taught to privileged students who had attended the few schools in existence (Olugbemiro, 1997). Science education started to take a more meaningful direction after most African states acquired their political independence in the 1950s and 60s. The focus of formal
education was on liberal arts. This was geared toward training a few Africans (mainly sons of “loyal” chiefs) to work as clerks, administrative assistants, and support staff in predominantly colonial administrative offices. Education for Africans—as provided by the colonial regimes—was not meant to invoke African learners’ critical, problem solving, and innovative skills. Even then, in the discipline of science, the few Africans who enrolled for applied science courses such as medicine were only trained in the basic principles of pharmacology. African graduates (commonly referred to as quack doctors at that time) were not permitted to treat European citizens living in Africa. In Uganda, they were only allowed to treat fellow Africans because the colonial administrations knew that these African graduates were ill-trained, with a mediocre science education. To show the degree to which African doctors were despised, Adyanga (2011) asserted that the African medical assistants of this time were prohibited from practicing medicine in racially segregated European areas. They were also prevented from treating other racial groups such as Asians and Arabs, but were required to practice medicine among the African population. It would seem that the African medical assistants were needed to maintain the basic health of African labourers, who would continue in agricultural production to benefit the colonial economy (p. 36). However, learning medicine in the formal education system as well as in the Indigenous African education is necessarily a complex process involving in-depth theoretical and practical comprehension and application of these principles. The ill-trained African medical assistants licensed by the colonial government to treat fellow African menial labourers would otherwise not practice their skills in the traditional African society due to their conscience as well as the societal rebuffing they would receive. However, the existence of a racially induced colonial society meant that anything opposing traditional values, customs, and education found its place in the hitherto inclusive African societies.
According to professional and ethical standards, the training of medical doctors normally takes five years of formal education while, in the case of Indigenous education, the training lasts until the learner has mastered all the medicinal skills and applications, thus is longer. For some communities, like the Acholi of northern Uganda, training can last until the medicine specialist/trainer passes on. When he/she is still alive, he/she mentors heir(s) to inherit the medicinal practices so that at death, the practice is not taken with him/her. During my informal conversation with a traditional doctor in Kitgum district who specializes in treating snake bites, he acknowledged that he had been training his first born son for 12 years. Although the boy had mastered most of the principles of his herbal practice, he felt that the trainee was not yet well prepared and was likely to remain in training for more years or until after his (father’s) death. This demonstrates the extent to which Africans have prepared specialists in areas related to public health. Among the Yoruba of Nigeria, the priests are also the traditional doctors and have to learn a great deal about plants, roots, and herbs. The training of diviners can be a long, highly specialized, and complicated process (Bray et al., 1986, p. 106). This explains why any ill-trained doctors, both in the African and Western formal education contexts, are not permitted to practice medicine—a principle clearly overlooked by the colonial administration in Uganda.

After African states broke loose from the colonial masters in the 1950s and early 1960s, most of them embarked on substantial science education to improve the wellbeing of their citizens. They realized that including only the basic sciences in the curriculum was producing graduates who were detached from real societal needs. To advance the acquisition and sharing of best practices in science education, several conferences were held both in Africa and outside in view of improving science education, as well as producing more skilled human labour like doctors, nurses, engineers, pharmacists, geologists, pilots, and teachers. Some of the ministerial
conferences held across Africa to discuss the improvement of science education in the 20th century include but are not limited to Tananarive (1962), Addis Ababa (1961), Lagos (1964), Yaoundé symposium (1967), Nairobi, Kenya seminar (1974), and Harare (1984). The Harare conference noted the existing loopholes in the science education. This was the Forum of African Science Educators (FASE) of 1982. Summarily, FASE delegates acknowledged the failure of science education in the African states, thus:

We are aware of the goal of education to produce human beings who are self-reliant. . . . We are aware of the failure in many ways of our current science education programmes to prepare learners, be it at the secondary school level or at the primary school level, for useful living. . . . We observe that most African governments have in no way positively supported and sustained action programmes to make science education functional with a view to replacing or complementing academic preparation.... We recognize that our curricula are rather deficient of technology, and in particular appropriate technology, for the transformation of rural life. We recognize that our examination system is inadequate, to say the least, and yet has its stranglehold on the educational system. We note with regret that governments often-times institute far-reaching changes in curricula or educational systems at relatively short notice and sometimes without cognizance of professional opinions. (FASE, 1982)

Although multiple efforts by African states were made toward science education, the science education curriculum in Uganda continued to mirror the ones left by the colonial masters at independence. The wave of science curriculum reforms in the West was felt in African countries. With technical and financial assistance from UNESCO and other organizations overseas, leading science educators in collaboration with the associations of science teachers embarked on curriculum reforms in line with development in the West (Ajeyalemi, 1990). The adaptation of Western curricula also came with its strength and weaknesses. Careful reviews of the deliberations of most of the conferences held across Africa to promote science education demonstrate that the focus of participants was on Western sciences with no mention of Indigenous science. Several international organizations such as UNESCO played a crucial role in sponsoring conferences that promote Western-centric science curriculum over the Indigenous
curriculum in Africa. In 1975, UNESCO sponsored a workshop on the teaching of Integrated Science in African secondary schools. In the same year, the International Institute for Education Planning (IEP) of UNESCO organized a workshop on curriculum development and evaluation in science and other school subjects (Ogunniyi, 1986). To match the need for the entrenchment of Western science education, which was the funding emphasis of the aforementioned International Organizations, most African universities and tertiary institutions (colleges of forestry, agriculture, education, technology) established strict admission policies that targeted students with specialities in Western science.

To further deepen the wound already inflicted on Indigenous science in Africa, up to the 1970s the East and West African examinations were manned by Cambridge University in England (Adyanga, 2011). With the control of examinations exercised by an education institution whose home government was the architect of the imposition of the colonial agenda on the colonized, it was obvious that both science and liberal arts curricula would be dictated according to the strong influence and interest of the colonizers. It is thus not surprising that many African states cried foul over the contents of the science curriculum because they were unsuitable to the society for which they were planned. The importation of science education curriculum into the continent was causing more problems than providing solutions. In retrospect, Ogunniyi (1986) argued that:

The experience of the past two decades has brought about a strong awareness all over Africa that the present form of science being taught in the schools does not prepare pupils to function well in society undergoing transition from a rural economy to a modern economy......which resulted into the production of ‘well-packed mind’ rather than ‘well formed-mind.’ (p. 118)
For transition into a modern society to be effective, a broad approach to science for sustainable societal transformation is required. In the context of Africa, this entails engaging with Indigenous African as well as Western science and technology.

During the Lagos ministerial conference of 1964, the African ministers in attendance acknowledged that African countries were handicapped by a lack of sufficient national policies on science and deprived of any national machinery for coordinating and preparing such a policy. According to a UNESCO report (1974), the Yaoundé symposium of 1967 showed some effort by several African countries in science planning, decision making, and coordination. Also, much had been done by then—in the spirit of the Lagos conference—toward preparing and implementing concrete national policies in science. By the late 1960s, many countries had begun to feel their way toward “a concerted science and technology policy” (Ogunniyi, 1986 p.112).

The conferences levelled ground for the improvement of science curriculum in African countries corresponding to the development needs of their societies. The coming together of different actors in education across Africa ushered in the realization that the science curriculum inherited from the colonial masters did not promote social stability in a socially heterogeneous context like Africa. Moreover, African traditional education was creditable for its consideration and tolerance of diversity and for African societies to progress, its inclusion into the education system was a vital and long overdue project.

Thoughtful analysis of the persistence, practice, and contribution of Indigenous science in African societies indicates that Indigenous science represents the people’s holistic way of life. With emerging mass of scholars gaining interests in traditional education and value system, the task of building a stable education system requires constant challenging of the dominant system as a method of reform. The emergence of interest by many African scholars in Indigenous
science suggests that the reformation of education based on traditional values as well as modern imported values is quite feasible. However, the bequests of colonial education in Africa also demonstrate that the coexistence of traditional science education in the school curriculum is a challenging undertaking because of the continued dominance of the education system by Eurocentric/Western education. African education stakeholders in the present era are confronted with the challenge of creating a versatile curriculum for the preservation of the societal fabric that functions as channels of cultural transmission and change.

The institution of such a curriculum is significant in recovering the multiplicity of African traditional education that was submerged under colonial and post-colonial arrangements, and subsequently dismissed from the school system. The abstract knowledge characterizing Western education as was practiced in colonial Uganda is contrary to the principle of applied skills and understanding, which is the emphasis of African traditional education. Indigenization of the curriculum is significant in positioning African learners in their specific context, which in turn influences their thoughts and attitudes toward science education. It empowers learners to adjust according to the challenges presented by contemporary times. In agreement, Wane (2008) postulated that we are in an era where we cannot live in isolation, nor can we claim to shelter our students in spaces where they will only be exposed to their own culture, knowledge, and traditions. The above observation presents indigenization of the science curriculum as an enterprise to have what is different and local taught concurrently; this duality will give students the option to explore what is different in relation to the science teaching they get from their community. We cannot afford to be quiet when there is looming danger that Western science will dislodge the remnants of Indigenous science from the local community that still practices it
and that the latter will totally disappear as its practitioners are dissuaded of its value and contributions to society.

The emphasis on Western science in the education system compounded by an inadequate investment of resources in alternative science is exacerbating the problem of learners failing to find meaning in what they study at school. When learners do not see the relevance in what is taught to them as “truth” intended to help them survive in their environment, they end up losing hope in formal education and consequently drop out. Such learners will find it extremely challenging to fit into their social context because the early and most important stages of their life were compromised by the education system that failed to prepare them holistically. From my experience growing up in northern Uganda, I witnessed such youth grow up committing numerous felonies (e.g., street kids/gangs, prostitutions, robbers, pickpockets, substance abuse, murders) and are easily exploited by greedy powerful/wealthy people into capital offenses like rebel movements to meet selfish and immediate goals. This is because their life goals are invested in the attainment of instant benefits since formal education has failed and disgruntled them. It is also because they missed out on traditional education, which empowers learners with its holistic goal structure and creates a space where their goals can be accomplished. Several scholars (e.g., Adyanga, 2011; Castle, 1966; Dei, 2010; Smith, 1999; Wane, 2010) agree that the exclusion of traditional education from the formal education curriculum has a close relationship to the social upheavals alarming developing societies in the present era.

Indigenous communities’ embrace of foreign cultures and education systems in their entirety, with the corresponding denunciation of traditional education, is presently contributing to a greater decay of Indigenous education, science, culture, and society than ever witnessed. This decay deviates from the central objective of education—the holistic development of
individual learners. In exploring the kind of education required for students’ development, Gaston (1979, p. 53) championed an education that enriches and does not mutilate, one that introduces a learner to universal cultural values without undervaluing the wealth and value of local cultures, one that fosters the self-fulfillment of individuals capable of playing an active part in the construction of the future through self-efficacy and creativity. These must be the overriding aims of the kind of education worth fighting for; one that really vindicates all our efforts to ensure that the learner’s rights to education are recognized, upheld, and applied in practice. The significance of Gaston’s philosophy on the type of education required resonates with Boydston (1990) articulation of education’s aims. Citing Dewey, Boydston (1990), asserted that:

> It is a sound education principle that students should be introduced to scientific subject-matter and initiated into its facts and laws through acquaintance with everyday social applications. Adherence to this method is not only the most direct avenue to understanding science itself, but as the pupil matures it is also the surest road to understanding the economic and industrial problems of the present society. (p. 53)

Although he presented his thoughts within the context of Western science, Boydston’s philosophies of science education are in no way divergent from the Indigenous African comprehension of science education.

### 2.11. Conclusion

The first section of this chapter offered a brief background to formal schooling in Uganda with the exploration of education structures. It was then followed by a detailed examination of Indigenous science in Uganda. The second section illustrated that although Indigenous science is excluded from the formal education curriculum due to imbalanced power relations in the politics of knowledge production and validation, the practice transcends time and geographical
boundaries among African people. It has survived amidst imported formal education and religious philosophies that aimed to subdue it. The last part shed light on the adverse side of some aspects of traditional science and argued that, although integrating AIS in the school curriculum is a worthy and long-overdue project, it has to be done with much scrutiny to avoid the inclusion of detrimental aspects. Romanticizing Indigenous science and advocating for its inclusion in the curriculum risks creating more problems than solutions if the desire for integration overwhelms the desire for scrutiny of what should and should not be integrated. The scrutinization process could involve institutional arrangements such as setting up a committee comprised of academicians on one hand and selected community elders who act as communal corporate bodies and are custodians of Indigenous knowledge on the other hand. This process is also crucial in ensuring the continuity of orality in the course of knowledge production, validation, and dissemination.

Overall, the literature review in this chapter explored the deliberate exclusion of Indigenous science from formal education. Then, it discussed its continued existence in Indigenous communities with associated benefits, possibilities, and limitations, which connects with the successive theoretical frameworks discussed in the following section. The theoretical frameworks chapter situates Indigenous science at the center of Indigenous people’s struggle for the acknowledgement of their scientific epistemology.
Chapter 3

Theoretical Framework

3.1. Introduction

Theory is an in-depth description of any phenomenon providing a more philosophical/thoughtful way to understand the reasons behind its occurrence; it produces an explanation that, ideally, can be supported, tested, or contested by evidence. This study is thus guided by three theoretical frameworks: Indigenous knowledge discursive frameworks, transformative education, and anticolonial theory. These theories allow for a critical examination of the convergence and divergence of power relations in the politics of knowledge production, validation, and dissemination. These theories also examine how this process becomes a systemic and complex method of subjugating other knowledge systems. With these theoretical frameworks handy, it is possible to situate the subjugation and denigration of Indigenous science knowledge from the schooling system within historical settings. Working with Indigenous knowledge and the relevant works of anticolonial theorists (Dei, 2002; Freire, 1994; Semali & Kincheloe, 1999; Smith, 1999; Wane, 2009) has enabled me to critically and objectively examine the marginalization of Indigenous science within the Ugandan education system.

For the purpose of this work, the three theories were selected because they particularly spoke to African Indigenous ways, colonial experience, and post-independent Uganda. The intersections between these theories offer a way to arrive at a more informed and critical analysis of the power relations and opposition rooted in contemporary societies through the forces of globalization. Together these frameworks offer a clear conception of how AIS knowledge and identity have been conceived and continuously represented as hedonistic and unsubstantiated practices via formal education. Specifically, Indigenous knowledge discursive frameworks empower scholars to theorize the ramifications of Western scientific and technological
advancements. Olugbemiro (1997) noted that as society begins to master the use of technology for human survival, the social fabric of the communities gradually degenerates into individuals who are physically and socially isolated from the community’s collective essence. In the present era, this comes in different forms such as the devaluation and misappropriation of original societal knowledge, values, and norms. One researcher, Smith (1999) expressed serious concern about the misappropriation of Indigenous knowledge by Western researchers. She noted that the collective memory of Western imperial projects has been perpetuated through the ways in which knowledge about Indigenous people was collected, classified, and represented in various ways to the West, and then, through the eyes of the West, back to those who had been colonized.

The three theories evoke a consciousness of how the denigration of Indigenous African identity is perpetuated, and how this vilification breeds disunity to weaken the social spirit of resistance. In other words, the theories are tools for the oppressed voices to reclaim their suppressed values and real identities from the painful brunt of colonization. Villaverde (2008) asserted that theory provides the keys to analysis and further inquiry by solidifying or challenging one’s mission or project. Anticolonial and Indigenous knowledge theories thus empower the colonized people to decolonize from the dominant knowledge in the academy as Wane (2009) argued:

Decolonization project[s] should address the complex systems of power and identity and how global curriculum has translated itself at local levels. The honouring of Indigenous education calls for [the] creation of a power context for each child and in our classroom. (p. 173)

Wane also defined decolonization as a project involving being aware of how we live our lives, and how our thoughts, beliefs, and interactions with others are shaped by systems that create universal norms. To critically engage with this discussion, the synthetic itemization of the three
theories will espouse ontological and epistemological paradigms by identifying points of convergence and divergence, possibilities and limitations.

3.2. Anticolonial Theory

To understand anticolonial theory, it is important to place it within a historical context. Situating anticolonial theory within a historical context evokes critical questions that take readers to the root of colonial contact in order to understand the initial relationship between the colonized and the colonizer, and how this relationship resulted in the hegemony that we currently experience. How did colonization start and how was it entrenched? Wane (2006) posited that colonization began as an imaginary idea—a thought that got translated into a philosophy, creed, and way of life. Implementation of this idea had tangible consequences for those deemed to need to change to fit into the new order. With colonization, people’s land was taken away from them, and their physical and mental capacities were controlled through forced indoctrination and exploitation of their vulnerabilities (p. 190). These events altered the social and cultural formation of the colonized subjects who were mandated to conform to the new order, hence resulting in a type of social and cultural revolution.

Certain structures and institutions were required for the social and cultural invasion to effectively materialize in non-European societies. According to Wane (2006), these structures and institutions, like formal schooling, facilitated rewriting the history of the colonized subjects to deny their existence, devaluing Indigenous knowledge, and debasing cultural beliefs and practices. The mechanism that enforced this was the Western system of education, texts, and literature, thereby making the business of education and knowledge production contested terrain.

In *The Wretched of the Earth*, Fanon (1963) pointed to the Christian churches as another
institution that permeated European hegemony in the colonized societies. He asserted, “The church in the colonies is a white man’s church, a foreigner’s church. It does not call the colonized to the ways of God, but to the ways of the white man, to the ways of the master, the ways of the oppressor (p. 7).” This postulation, however, does not negate the fact that some Indigenous communities responded with violent resistance against colonialists upon contact (Fanon, 1963). Fanon argued that the natives had the weight of force to bring about effective decolonization. The struggle for effective decolonization would necessarily be a violent process rendering the notion of a peaceful handover of power during formal independence an illusion. However, with reference to educational institutions in the present era, the decolonization of science education would require extensive dialogue.

How the idea of colonization was initially spread to the non-Western societies is extensively captured by anticolonial theorists. Such philosophers like Fanon (1959, 1963); Memmi (1965); Kabwegyere (1972); and Wa Thion’o (1986) remind us that the process involved both ideological and physical violence. Ideological violence was meted through formal education and Christian evangelical schools. Physical violence meted with impunity took root where ideological violence failed to permeate the colonized societies. At initial contact, the colonizers came as friends and portrayed a false image of their real face and intention. Wane (2006) attested to this proposition in a similar study. She stated that the colonial government managed to create doubt in people’s minds about who they were, to the point that parents advocated a colonial education for their children even after independence was attained (p. 91). The purpose of portraying a false image was to covertly assess the strengths and weaknesses of the colonized, and understand their philosophy, customs, and values. Because of the colonizers’ false humility at entry, the colonized opened their doors, giving a warm reception, showing as
much as they could to the guests of the possibilities as well as the limitations of their environment, people, and general cultural norms.

In the process of embracing the hospitality offered the colonizers generally start to show their true colours slowly, getting settled and turning the different groups against each other. The relationship between the colonizers and the colonized soon becomes a complex one that brews tensions because one cannot substitute the other. In *The Colonizer and the Colonized*, Memmi (1965) pointed out that colonial relations do not stem from individual goodwill or actions. Rather, they exist before his arrival or birth, and whether he accepts or rejects them does not matter. It is the colonizers, on the contrary, who, like any institution, determine their place and that of the colonized and, in the final analysis, their true relationship. Once the role of the guest (colonizer) is successfully switched with that of the host (colonized), colonial oppression and hegemony are normalized as the colonized that is turned into a guest in his/her own land develop “complacency” in the new relationship. At this stage, hegemony is firmly rooted. Subsequently, colonial violence (psychological and physical) is continuously regenerated and meted with impunity. In the midst of complacency, some of the colonized find themselves unconsciously trapped in perpetuating colonial violence, hence reproducing self-injury to stimulate colonial hegemony (see Kabwegyere, 1972; Wane, 2009). At some point, however, the colonized discover flaws in the complacency. This consciousness nurtures a rebellious approach, hence anticolonial resistance. Obviously, there is no way that anticolonial theory can effectively engage dominant discourses if we do not acknowledge that the struggle against neo-colonial identity in independent states is the struggle against fellow natives who reproduce the colonial status quo.

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11 Kwame N. (1965). Neocolonialism (also Neo-colonialism) is the geopolitical practice of using capitalism, business globalization, and cultural imperialism to influence a country, in lieu of either direct military control or indirect political control, i.e. imperialism and hegemony. The term neo-colonialism was coined by Ghanaian president Kwame Nkrumah, to describe the socio-economic and political control that can be exercised economically,
The Westernized African nationalists and bourgeoisie who took over power from former colonial masters have betrayed the cause of decolonization. They have protected the economic interests of the colonial masters, are weak, and lack the financial resources to boost their economy. Many African nationalists and bourgeoisie appear to want to belong to the colonial world, to monopolize commerce and dictate government policy. However, since they are not a dynamic group, they have failed to initiate economic growth and minimum prosperity. According to Fanon (1963), these groups are “only a sort of little greedy caste, avid and voracious with the mind of a hacker, only too glad to accept the dividends that the former colonial power hands over to” them (p. 45). Unfortunately, in the post-colonial era it was mostly this class of natives that gained employment in government and administration, and filled in the professional ranks and teaching posts in government and social services such as educational institutions. Their rule has sunk the country deeper into stagnation and crisis because they are merely interested in continuing the colonial status quo. The misery and retrogression of the masses is compounded with the apathy of the ruling class toward the people and the failure to commence meaningful national development. For the masses, independence means nothing substantial because it has brought inconsequential changes to their welfare.

The continued existence of the remnant of colonial legacies and institutions that reproduces and promotes them in the former colonies signifies the existence of counter forces against such legacies and institutions among the colonized subjects. Anticolonial theory is a counter force arising from the protracted violent and peaceful resistance against colonialism. Dei (2006) articulated anticolonial theory as an approach to theorizing colonial and re-colonial relations and the implications of imperial structures on the processes of knowledge production linguistically, and culturally, whereby promotion of the culture of the neo-colonist country facilitates the cultural assimilation of the colonized people and thus opens the national economy to the multinational corporations of the neo-colonial country.
and validation, the understanding of indigeneity, and the pursuit of agency, resistance, and subjective politics (p. 2). The adaption of this position situates anticolonial theory as reflecting an individual’s or a people’s ideas that illuminate different resistances against colonial/neo-colonial agencies. Wane (2011) argues that anticolonial thought is a search for ways of dismantling colonialism and neo-colonialism—visible and invisible—as well as finding ways of dealing with psychological traumas that have no name. She suggested that it is important for contemporary scholars to get back to the source and discover how colonialism as a theory, project, praxis, and discourse, managed to produce and reproduce itself. In what appears to be a response, Dei (2003) reminded readers that anticolonial thought consists of the decolonization of the mind working with resistant knowledge and claiming the power of local subjects’ intellectual agency. Resistance in this context is about fighting for survival and beyond. It is about resistance to the colonial domination of the past, the contamination of the present, and the stealing of the colonized people’s future. In the context of Indigenous science education, anticolonial thoughts empower Indigenous scholars to interrogate the rationale behind the exclusion of such a lived body of knowledge from the education system. This inquiry is in line with Fanon’s (1963) philosophy that challenges the current generation to liberate themselves from the stronghold of the colonial mentality. He said, “Each generation out of relative obscurity discover its mission, fulfil it, or betray it” (p. 206). This is a realization that the task of liberation must continue to be generational as different methods of colonial and neo-colonial control are developed and concealed under various guises. Generational vigilance for freedom of the colonized is critical to countering such colonial and neo-colonial machinations.

Anticolonial theory empowers the colonized to understand the complex process through which colonial structures interact in the Ugandan education system. This it does by challenging
the means by which the curriculum for science education is drawn and adopted. In some aspects, curriculum design still reflects the interests of former colonial masters. This, in essence, makes learning institutions foreign owned with Africans acting only as agents in maintaining the foreign enterprises (i.e., educational institutions). Okrah (2008) lamented this state of affairs with the argument that:

Universities in African countries are still not African universities. They are universities tied to the aprons of the foreign, [the] West, Europe and North America. Their conception, philosophy, orientation, and research, even their academic rituals and ceremonies, are copies of the ancient and modern colonial masters. (p.30)

Anticolonial perspective is about developing an awareness of the varied conditions under which hegemony and oppression function in colonial and post-colonial societies. It seeks to subvert the dominant relations of knowledge production that sustain hierarchies and systems of power (Dei & Kempf, 2006) in educational institutions. By subverting the dominant relations behind knowledge production, anticolonialism creates space for the integration of Indigenous science into the academe. Therefore, the inclusion of Indigenous science in the academy does not imply that the academy become isolated from current affairs. Rather, anticolonial theory creates awareness that educational institutions should open space for the multiple ideas of the world’s societies and nurture a deeper appreciation of the complex nature of global societal diversity.

In agreement, Dei and Asgharzadeh (2001) argued that the relevance of a theory should be seen in how it allows us to understand the complexity of human society and to offer a social and political corrective—that is, the power of theories and ideas to bring about change and transformation in social life (p. 298). However, this hypothesis sharply deviates from Fanon’s (1959) view on the importance of exerting a greater degree of violence to confront colonial violence and injustices. Conversely, a real solution to social problems would necessitate dialogue for it to be sustainable. Based on the premise that anticolonialism still prevails in the independent
states in Africa, anticolonial theory opens our eyes to critically see and identify the salient features through which colonialism permeates society. Such features may appear so trivial that labelling them as colonial invites denial from the perpetuators. According to Dei (2011), this denial can be seen in the process of producing and validating what is knowledge in the academe. He argued that rather than heralding knowledge that allows learners to develop a counter-culture, the colonial system can actually reward the knowledge that inserts learners within existing hegemonic structures and practices (p. 299). For instance, excelling in Western knowledge (science, social sciences, philosophy) in former colonies’ educational institutions is highly rewarded over excelling in local knowledges, which are often regarded as inferior. The complex process reinforcing Western knowledge is often internalized unconsciously by the education system. Albert Memmi (1965) referred to this complex process as colonial mimicry. Colonial mimicry within the context of a pluralistic science approach negates the very essence of local, traditional science knowledge.

Anticolonial theory supports a project of going back to our roots in traditional education to identify and pick the positive attributes/values that survived colonial destruction for integration into the education system. In a way, this is speaking back to the lived experiences of the African people since African traditional education is inseparable from their thoughts, action and believes. The use of transformative learning theory labels the emerging issues from colonial/colonized relations as cultural invasion as noted by Freire (1970). He asserted that, in cultural invasion, the invaders impose their own views of the world upon those whom they invade, and inhibit the creativity of the invaded by curbing their expression. Whether urbane or harsh, cultural invasion is thus always an act of violence against the person of the invaded culture (p. 133). Clearly, social, political and economic dangers are manifested on the colonized
when cultural invasion is inflicted. Cultural invasion permeated through formal education is very complex because it creates the false impression of self-satisfaction in the colonized to the point that they fail to see contradictions in the new culture but instead embrace it without scrutiny. Wa Thiong’o (1986) concisely asserted that:

The process annihilate(s) a peoples’ belief in their names, in their languages, in their environment, in their heritage of struggle, in their unity, in their capacities and ultimately in themselves. It makes them see their past as one wasteland of non-achievement and it makes them want to distance themselves from that wasteland. It makes them want to identify with that which is furthest removed from themselves. (p. 3)

Wa Thiong’o’s comparison of cultural invasion and domination of the colonized to infertile land perfectly illustrates the extent to which colonized subjects mimic and perpetuate the oppressors’ values through formal education. However, as some colonized citizens acquire formal education to better understand the colonizers, some level of consciousness that aggravates resistance arises, as evidenced by some African leaders’, activists’, and scholars’ agitation for independence in the 1950s and 1960s. The resistance took different forms, touching multifaceted levels of society.

In the education sector of the present era, the process of resistance evokes questions such as: who determines curriculum for learners in developing countries? What are the processes involved in the selection of materials to be taught to learners? To what extent does the local community get involved in the formulation of education curriculum? What is the relevance of involving local community in the formulation of education curriculum? To what extent do power relations play a role in curriculum development with regard to formal education? While Indigenous science has its roots in the long-held traditions of Indigenous people, its practice continues to evolve to meet the demands of the users. This realization is crucial in responding to some of the critical questions raised above.
Anticolonial resistance reinforces this consciousness and champions for equity and fairness in educational debates through inclusivity. Within the context of colonialism, any discussion related to equity and fairness is farfetched and limited by power. Cognisant of these limitations, the anticolonial stance requires that the knowledge producer be aware of the historical and institutional structures and contexts which sustain intellectualism and intellectual projects. Elsewhere, Dei and Kempf (2006) argued:

Within colonial relations there lies the individual and collective agency to resist subordination and domination. Agency emerges from the power of knowing and knowledge, and it is this that gives meaning to social and political action… Through the power and politics of resistance, the colonized are able to understand their social reality and work to change their condition. (p. 15)

By engaging anticolonial discursive framework as a dialogue, Dei and Asgharzadeh (2001) believed that power and discourse are not possessed by the colonizer only. Discursive agency and the power of resistance also reside among the marginalized and the colonized. Anti-colonial theory thus arises out of alternative, oppositional paradigms, which are in turn based on Indigenous concepts, analytical systems, and cultural frames of reference. Anticolonial frameworks offer broad, multifaceted interpretations of the inhuman decisive processes Indigenous people go through wherever colonization took place. Anticolonial scholars such as Freire (1970), wa Thiong’o (1986), and Dei (2003) offer a healthy interpretation of anticolonial theory, for they shift the focus away from the traditional emphasis of centering anticolonial struggle on violent resistance and instead introduce other forms of resistance as dialogue and knowledge production by Indigenous people. It is in this healthy shift away from the conservative scholarly comprehension of anticolonial theory that intellectuals in the present century engage with the theory in producing discourses that are parallel as well as contradictory to the dominant ones. Accommodation of the dominant science discourse in the education system
creates disillusionment when science is viewed as the foundation of the culture and way of life of Western scientists. When the masses are not accustomed to science, the scientific culture fails to permeate society, making the recipient community hostile to science and technology (Olugbemiro, 1997). In a different study, Gatson (1979) castigated the schooling system for teaching children with knowledge that was irrelevant to their context. He referred to it as alien knowledge with no continuity or relationship to knowledge to be found in the child’s environment. Alien knowledge removes children from their natural surroundings, which results in lack of motivation, artificial education unrelated to reality; these consequences block progress and lead to the child’s failure at school. The power of Indigenous knowledge discursive frameworks is that it takes into account the learner’s experience in designing educational programs. Gatson (1979) argued that “in building up the educational system we must take as our starting-point the situation of the child, his physical, experiential, family and social background, and we must encourage him to play a real part in his own education” (p.49). With reference to the developing world, however, this is not always the case because international bodies—such as the World Bank, that monitors and regulates educational programs—implement policies which exclude the interests of learners in designing educational policies. Bayliss and Dillon (2011) referred to the World Bank’s preconditions for globalized education as an ideological stance aimed at promoting an integrated world economic system along market lines. According to them, associated with this ideological bearing is a particular form of education managed by a centralized system or state government. The centralized education system allows limited room for flexibility that leads to effective learning; this highlights the need to use anticolonial theory as a discourse challenging inflexible education systems that fail to accommodate learners’ interests.
Using anticolonial theory acknowledges the continued existence of colonialism in the present age. The new form of colonialism is manifested in a different arena of former colonies with institutions that orchestrate hegemony at play. Therefore, it is imperative to adopt the stance of Dei and Kempf (2006), who asserted that colonialism has not ended because of various examples of colonial and neo-colonial relations produced within our educational institutions and the community. Accordingly, anticolonial discourse problematizes the marginalization of certain voices and ideas in the educational system, as well as the denigration—in the pedagogic and communicative practices of schools—of the knowledge and experiences of subordinate groups. Using the anticolonial discursive approach means affirming the pedagogic need to confront the challenge of social diversity and the urgency for creating an educational system that is inclusive and better able to respond to the multiple knowledges that students bring to formal learning spaces (Wane, 2008). Effective education must accommodate the learners in their totality, allowing them to share their lived experiences and how formal education curriculum content relates to such experiences.

One of the most damaging aspects of the colonized struggle is the internalization and acceptance of the dominant discourses that demean the culture of the colonized and exalt the colonizers’ cultural values as universal. Wane (2006) again reminds us that the processes of colonization involved re-writing history to deny the existence of the colonized, devaluing their knowledge, and debasing their cultural beliefs and practices (p.87). For any meaningful struggle to integrate Indigenous science in the school system, a detailed grasp of this history is instrumental. The challenges of the formal education system are so deeply engrained that the significance of these theoretical frameworks in providing remedies cannot simply be dismissed. The ethics of conduct upon which Indigenous people’s survival depends can only be instilled by
a comprehensive and concerted examination of the historical facts through the gaze of these theories in setting educational goals that are consistent with learners’ lived experiences.

Conclusively, anticolonial theorists such as Fanon (1963) have made important contributions to Africa in the struggle against colonialism and neo-colonialism. He articulated a theory of revolution which can free the oppressed and exploited native. Second, he exposed the colonial and neo-colonial nature of politics that have endured since the post-colonial period. Third, he reflected on the problem of revolutionary truth: “The native replies to the living lie of the colonial situation by an equal falsehood…Truth is… all that protects the native, and ruins the foreigners … The good is quite simply that which is evil for them” (p. 50). The reality of the situation and the truth of the conditions facing the natives is what is most harmful to the colonialists. Truth is the enemy of the colonialists and their native agents, for it awakens revolutionary impulses of the masses.

3.3. Transformative Learning Theory

Transformative learning theory, on the other hand, guides and challenges the way in which we receive and interrogate issues regarding Indigenous/oppressed people and their ways of knowing. This empowers us to critically analyze issues which are of pertinent concern to Indigenous/oppressed communities. It sanctions Indigenous people to resist oppression by holistically strengthening the individual. The underlying principle of transformative learning is that education should be able to resist oppression and domination by strengthening individual and collective souls to deal with the continued reproduction of colonial and re-colonial relations in the academy (Dei, 2002). Freire (1970), a strong proponent of transformative education, decried the colonial system of education which assumes that learners are mere recipients of
knowledge from teachers who know all. Accordingly, he referred to this as the “banking concept of education,” which regards learners as adaptable and manageable beings. According to Freire, the colonial education (banking education) that post-colonial societies inherited does not develop learners’ critical consciousness for the transformation of their society. In pointing out the biases inherent in the banking concept of education, he argued:

The capability of banking education to minimize or annul the students’ creative power and to stimulate their credulity serves the interests of the oppressors, who care neither to have the world revealed nor to see it transformed. The oppressors use this humanitarianism to preserve a profitable situation…the humanism of the banking approach masks the effort to turn women and men into automations—the very negation of their ontological vocation to be fully human. (p. 55)

By engaging with this line of debate, transformative education aligns with holistic education, which is meant to create a well-rounded individual equipped with the maturity to detect and resist unequal treatment; that is, an individual who can identify and challenge elements of inequality in society. Therefore, transformative education means an education that can empower the learners/recipient of knowledge to analytically review any new epistemology to determine its relevance to his/her context.

Engaging with transformative learning theory empowers Indigenous educators to interrogate the loopholes in existing science education and make recommendations for the inclusion of Indigenous knowledge. In agreement, Freire (1970, p. 65) referred to this as problem posing education which takes the people’s history as their starting point. Freire’s philosophy of education is one of a liberator, which situates learners and teachers as subjects of their own history and education process as they overcome authoritarianism and an alienating intellectualism to champion for the inclusion of the Indigenous way of knowing in their own education system. His philosophy is a call for realistic reform or modernisation in the education sector, as asserted by Gaston (1979) that:
Throughout the world, voices are heard calling for the ‘modernization’ of education. Presumably the essential feature of this modernization must be an approach which will give young people a training fitting them to live, work and be creative in a completely new socio-economic context. Long term planning of the education system is thus called for. This is true of developed countries and even so of developing countries, which are assimilating the achievement of scientific, technical, social and cultural progress and themselves becoming part of it at an unprecedented speed. (p. 91)

The application of Gaston’s ideas interweaves with the principles of transformative education and Indigenous knowledge discursive frameworks, vitally contributing to opening space for Indigenous worldviews to reign alongside the dominant discourses in the education system. Equipping the education curriculum with different worldviews strengthens the emergence of a packed array of skills offering huge potential that is not fully tapped among Indigenous communities in the present era. This is the introduction of innovations that propagate holistic education through the integration of best practices as elaborately captured by Wane (2008). She argued that our Eurocentric national education policies neglect and devalue Indigenous knowledges. An inclusive education would promote the flourishing of all ways of knowing, teaching, and learning via curriculum and language. This would be adapted to the needs of learners in that community because the education would be owned by its members. Accordingly, this can be rightly argued as a new orientation to science discourse, one that attempts to nurture the intellectual resourcefulness of learners to identify constructive community needs and challenges, and mobilize appropriate response strategies.

The exclusion of Indigenous knowledge from the education system is the greatest structure of social inequality that hurts Indigenous people globally and perpetuates the hegemony of dominant knowledge. Dei (2002) insisted that the exclusion of Indigenous knowledges from the academy within the Euro-American context of knowledge production leaves the space for the colonization of knowledges and cultures in local environments and context unchallenged. Such a
project becomes even more critical given the power imbalance between groups that own and have access to the technology of knowledge dissemination (p. 4). Therefore, using transformative learning theory and Indigenous knowledge discursive frameworks challenges the academy to take steps to include Indigenous science in the curriculum. This also entails the need to avoid essentializing the binary of Indigenous versus Western science but to instead celebrate the two worldviews complementarily.

The vision of transformative education encompasses the wonder and magnificence of the universe as well as humans’ extraordinary capacity to make meaning and create cultural and social structures. It is an education that commits itself to recreating human consciousness and structures in order to make real our dreams for justice, harmony, peace, and joy (Purpel, 1999). This framework allows for the internalization of Indigenous science from a wider perspective and not just science as a separate entity. It opens Indigenous people’s awareness to the values and importance of embracing and practising Indigenous science. In regard to the philosophical and sociological nature of education, transformative learning acknowledges traditional education as the epicentre upon which Indigenous communities owe adherence to persist in environments agreeable to coexistence. This view is maintained by Solomon and Wane (2005), with the following line of argument:

Indigenous people’s philosophy is the pivotal element of sustainability and balanced harmonious living, grounded in a spiritual relationship to the land…it is through this understanding that we are able to support each other with scared medicines, ceremonies, and the use of our Indigenous methods of traditional counselling. (p. 54)

The significance of this statement is that transformative education invokes awareness that propagates the development of policies toward science curriculum in the larger educational debates. In agreement, Gaskell (2003) aligned the development of science education policy with
the articulation of the place and value of various minority groups; this entails developing an understanding of what science is, and recognizing that minority people’s knowledge may have a place in school science. Transformative learning theory therefore places learners at the focal point of any education system, and acknowledges learners’ pre-acquired knowledge in relation to the new knowledge being given for their empowerment. This theory, as advanced by Freire (1970), conceives of learning as a dialectical process emerging from interactions between the learners and significant others (i.e., teachers, instructors, or professors).

The three theories (anticolonial, Indigenous knowledge and transformative education) harmonize with one another by furnishing the colonized psyche with the potential to defy, weaken, and oppose colonial hegemonic dogma, and instead view such dogma as local, imposed, dominating, and oppressive with egocentric motives. This ushers in the realization that Indigenous science is vastly relevant to the people and their locale, and is the substratum on which their existence revolves. Embracing this view offers an avenue for moving beyond the current denigration of Indigenous knowledge and for continuously viewing structures that reproduce colonial relations with the lens of suspicion. It also invites scholars engaged in the decolonization process to participate in the knowledge production that empowers Indigenous intellectual resources for the continued advancement of their community.

3.4. Indigenous Knowledge Discursive Frameworks

For the colonized bodies, Indigenous knowledge discursive frameworks situate Indigenous identity within a history different from colonial hegemonic constructs. It empowers Indigenous people to reclaim and hang onto their traditional histories as they navigate formal educational settings. According to proponents of Indigenous knowledge (Dei, 2008; Gupta,
the theory projects a cultural rebirth and revival, reflecting integrity and pride in self, culture, identity, history, land and heritage, as a commitment to the collective good and well-being of all people. The ideas and principles of Indigenous knowledge discursive frameworks are rooted in local/grassroots political organising and intellectual activism. The framework affirms a local, national, and international consciousness as well as an understanding of the politics of national cultural liberation that is matched with political sophistication and intricacies. In the education and development spectrum, Indigenous knowledge provides local people with an avenue for creativity and resourcefulness (Dei, 2000, 2008). This is because it centers key community virtues such as compassion, hospitality, generosity, forgiveness, reconciliation, and the collective, at the heart of community education.

As a colonized body who struggles to understand the fragmentation of my history by the formal education system, the use of the three theories has empowered me to evoke significant questions that should challenge my readers to critically explore ways of engaging with the struggle to break free from the bondage of ideological colonization. The question remains: how would one engage Indigenous knowledge discursive frameworks, anticolonial and transformative learning theory as tools for reclaiming subjugated Indigenous worldviews to resist domination in the academe and reform the curriculum for holistic learning?

To address this question, it is important to acknowledge that anticolonial theory, Indigenous knowledge discursive frameworks and transformative learning theory position the struggle against the denigration of Indigenous knowledge (science) at the centre of individual epistemological consciousness for the liberation of Indigenous lived experiences. These theories enable the psychologically/ideologically colonized to develop a sense of counter agency and entitlement concerning their knowledge systems and cultural values so as to positively alter
empirical insights into the socio-materiality of knowledge production dominant in the colonized society. According to Purpel (1999), this is a call for tragic and radical action; specifically, it calls for utopian energies and tragic actions that yield permanent and perennial revolutionary, reformist strategies opposing the status quo of our day. The opposition of biased status quo with reference to education and schooling system is a process that evokes the awareness of the colonized whose science knowledge is subjugated by the Eurocentric worldviews of science.

The prevalence and comprehension of these theoretical frameworks is central in determining what to include in the curriculum and what not to include since education is political. Education is “always already” political—who will choose what is taught, what is learned, and to what ends? Who will choose the “ideal type,” that is, form the model for which the educative exercise will be directed? Who will say if it is to be directed to the production of a “consumer” or “producer” (Peters, 2005)? As educators commit to seeing equity and fairness in the inclusion of Indigenous science knowledge in the curriculum, transformative learning is the key to open the doors of inclusion that embrace other knowledge systems in Uganda. Accordingly, Gaskell (2003) argues that the inclusion of students’ inherent knowledge of science in the curriculum provides a learning environment of respect for the student’s culture. The coherence and applicability of students’ traditional knowledge to their specific context enhances their self-efficacy for theoretical and experiential learning. In essence, this implies the diversification of the science curriculum in order to be relevant for the diverse social contexts in each society. According to Dei (2001), identities must be constructed outside of the identities that have been, and continue to be, built in Euro-American ideology and hegemonic ways of knowing. Transformative learning theory calls for developing a particular prism, one that frames issues and questions within a particular lens. For teachers, the pervasive question is: is this in the
best interest of our learners? At the very least, we can initiate our teaching practice by posing—at the start—the relevant questions that centre on the experiences of learners. Henceforth, transformative learning theory also seeks to empower learners through the use of relevant pedagogical practices.

Relevant pedagogical practices are instrumental in promoting critical thinking that raises responsiveness against any effort to dehumanize people by awakening the spirit of peaceful transformative resistance. Dehumanization, as imposed on the colonized during the colonial encounter, was a coup against their holistic spectrum of life, with their spirituality and Indigenous knowledge at the center of repression. In the book The Colonizer and the Colonized, Memmi (1965) concisely problematized this issue with a question: what is left of the colonized at the end of this stubborn effort to dehumanize him? He is surely no longer an alter ego of the colonizer. He is hardly a human being. As an end, in the colonizer’s supreme ambition, he should exist only as a function of the needs of the colonizer, i.e., be transformed into a purely colonized being. Fanon (1965) described this as psychological warfare against the colonized by the colonizers, which was met with stern protracted resistance. He asserted:

Behind these psychological reactions, beneath this immediate and almost unanimous response, we again see the overall attitude of rejection of the values of the occupier, even if these values objectively be worth choosing. It is because they fail to grasp this intellectual reality, this characteristic feature (the famous sensitivity of the colonized), that the colonizers rage at always ‘doing those good in spite of themselves.’ colonialism wants everything to come from it. (p. 63)

This is precisely what anticolonial theory aims at rupturing in the education system and in society at large in order to change the status quo of domination in knowledge production. The conception of knowledge production through Indigenous knowledge discursive frameworks is that knowledge is produced through relational interactions among people, as well as between people and their environment. This relational interaction is based on the transfer of established
historical practices centred on lived experiences, and such practice evolves depending on time and context.

On the other hand, the interrogation of power relations embedded in knowledge production is a central tenet of anticolonial theory. Anticolonial theory acknowledges the dual, and at times conflicting, roles of education in reproducing and counteracting racial, ethnic, religious, and linguistic, gender, sexual, and class-based inequalities in society (Wane & Gathenya, 2003). Acknowledgement of the role of education in producing inequality has corresponding implications of battling educational policy regarding the prevalence of fairness in knowledge production, validation, and dissemination. This intersects with the Indigenous knowledge discursive approach to education that urges Indigenous communities to take centre stage in the production and centring of Indigenous knowledges at the axis of education. Engaging with these theories harnesses Indigenous scholars and communities’ capacity to participate in maintaining control of the social, economic, and political aspects of their societies.

Finally, anticolonial, transformative learning theory and Indigenous knowledge discursive frameworks empower Indigenous people globally to develop Indigenous discursive discourses counter to the dominant Eurocentric science. This allows for the integration of such discourses into the academy and schooling system. One way that the theories allow for the development of counter discourses is through the establishment of Indigenous science research centres among Indigenous people worldwide. Such centres, as found in Africa, South and North America, Australia, Asia, entice Indigenous communities’ intellectuals and researchers to resolutely engage in demystifying the contemporary Western models of knowledge production and validation.
The theories also support the notion that universal knowledge/science does not exist since the credibility of knowledge is dependent on its relevance to the context in which it is produced. Gaskell (2003) shed more light on the credibility of knowledge systems, stating:

If credibility is based on the length and strength of networks, then it is possible to move away from the idea that some knowledge is right and others are wrong while arguing that some knowledge is more credible than others in particular contexts. Credibility will depend on the community and context within which people are operating, the human and non-human actors that must be taken into account. (p. 243)

Because anticolonial and Indigenous knowledge discursive frameworks are critical theories, never accepting and upholding any produced knowledge and always interrogating the personage and motives behind any produced knowledge, they constantly advocate for and engage with an epistemology that is alternative to the dominant ones in the present day educational system—an epistemology derived from the local environment. In terms of convergence, Dei (2002) broadened the discussion by postulating that anticolonial theory uses Indigenous knowledge as an entry point to interrogate the power imbalances in knowledge production. Engagements with Indigenous knowledge aids in deconstructing dominant viewpoints that are taken for granted, yet are destructive to local knowledges. In stressing the importance of Indigenous knowledge as a tool for decolonization, we should caution against expecting that it might be the only instrument, given that colonization is intrinsically complex and today exists in many forms. Moreover, attempts to determine the Indigenousness of knowledge should not blind us to the theoretical supremacy of the knowledge’s capacity to organize thoughts. Such processes only lead to socio-economic and political disengagement from the campaigns against dominance by Eurocentric knowledge in the education system (Akena, 2012).

The convergence among the three discursive frameworks in the Ugandan context can practically be illustrated by the exploration of concrete examples in the education system. The
power of the theories can be argued to have significantly contributed to the introduction of population and family life education (new curriculum content) in the primary education in 1988. The United Nations Family Planning Agency’s financial support as a donor agency led to the successful introduction of population and family life education. The addition of new contents in the curriculum came after the realization that the rate of population growth was disproportionate to the available resources in the country. Wild and Mutebi (1996) indicated that the population of Uganda had increased from 6.6 million in 1960 to 16.6 million in 1991. The old curriculum inherited from the colonial government had no place for demographic education. Within the Indigenous knowledge discursive approach, communities teach the young to sparingly use the environment and natural resources to match the growing population. The new curriculum further included birth control strategies varying from one context to another. Overall, the aim of population and family life education was to prepare young people to make informed decisions about family life as they came of age. To minimize costs, the new course was simply integrated into already existing subjects such as science and social studies, and teachers of these subjects were trained to integrate it in their pedagogy.

The continual challenging of the irrelevance of the colonial education curriculum is vested in the power of the three critical theories that do not take imposed knowledge for granted. The theories always seek reforms in crucial areas that exhibit disconformity with the needs of Indigenous learners. They fight the complacency by Indigenous educators in teaching the colonial education curriculum and call for the reorganization of a comprehensive Indigenous and Western education that resonates with Indigenous learners’ cultural and local contexts. Education reorganization, according to Gaskell (2003), is crucial in developing:

Students who have undergone a process in which a student borrows or adapts some content from modern science and technology because the content appears useful to him
or her. The new knowledge may replace some former Indigenous views or it may exist alongside them. Everyday thinking is an integrated combination of the common sense thinking and some science/technology thinking. (p. 244)

Educational reorganization engendered by transformative learning theory augments the conservation of positive traditional norms without the disruption of society’s social fabrics. In turn, anticolonial and Indigenous knowledge theories acknowledge that Ugandan/African people have mixed economies in which every activity (social, economic, and political) is intricately symbiotic. The corresponding implications of the synergy of mixed economies are twofold: first, educational reform should enhance the training and production of skilled labourers to be more comprehensive and reflective of the mixed economies. Second, the theories recognize the fact that we live in a globalized world where no society can strive in isolation. Therefore, they highlight the need for collaboration with other societies with respect to societal customs, ways of life, and epistemological bearings, in order to progress.

3.5. Conclusion

Although the three theories can be used by Indigenous communities as methodological tools to achieve all-inclusive education, we must understand and appreciate the nuances of each framework. While transformative learning theory champions education for individual liberation from the states of oppression, poverty, and hopelessness (Freire, 1968), this alone is inadequate for meaningful reform in the education sector. Indigenous knowledge discursive frameworks depart from this view because they center Indigenous people’s lived experiences as a starting point of any community activities (social, economic, and political). With the guiding principle of this framework, any debate about education reform in Indigenous society is incomplete if it lacks Indigenous worldviews. Indigenous knowledge constitutes the practical experiences of
Indigenous societies and is the foundation upon which modern knowledge rests. It is a diverse and complex body of ancestral wisdom arising from histories, customs, spirituality or religion, science, and cultures. Theorizing Indigenousness in the academy and local community gives birth to the framework. Theorists/scholars in the field (Dei, 2000; Gupta, 2009; Kincheloe & Steinberg, 2008; Langdon, 2009; Wane, 2006) have argued that theorizing that is oppositional to the dominance of Western discourses has populated the 21st century formal education system. For anticolonial theory, its path of departure from Indigenous knowledge and transformative education lies in its emphasis on resistance to colonial and re-colonial remnants. Theorizing anticolonial resistance as articulated by scholars (Fanon, 1963 & 1965; Kabwegyere, 1972; Memmi, 1965) projected counter resistance by Indigenous communities against colonial hegemonic tendencies. As colonization changes shape, theorizing resistance also changes. In the academy, as stated earlier in this chapter, scholars are shifting the analysis of colonial resistance to include dialogues and production, validation and dissemination of counter knowledge.

Finally, the theoretical frameworks weave through my research methodology by allowing participants’ narratives to take centre stage in data interpretation and validation. This is vital in working with the data where the lived experiences of participants are analyzed and interpreted objectively to avoid influencing the outcome. Examining the core elements of these theories, the research methodology that best aligns the three theories to the problem statement under scrutiny and also weaves them throughout my findings is a qualitative and auto ethnographic research methodology. While qualitative research focuses more on participants’ voices, the auto ethnographic research methodology integrates my (researcher) lived experiences to enrich the participants’ perspectives.
Chapter 4

Research Methodology

4.1. Introduction

This section examines the research methodology used to undertake the study. My understanding of research is that it is a logical inquiry or study intended to derive a detailed understanding of occurrences, conditions, or problems in a particular context. Although the study mainly uses qualitative research methodology, autoethnographic methodology is also used to reflect on my personal experiences with the colonial education system in Uganda. Autoethnography is an approach to research and writing that seeks to describe and systematically analyze (graphy) personal experience (auto) in order to understand cultural experience (ethno) (Holman Jones, 2005). This approach challenges canonical ways of doing research and representing others (Tami, 2001) and treats research as a political, socially-just and socially-conscious act (Adams & Holman Jones, 2008, as cited in Ellis, Adams, & Bochner, 2010). A researcher uses the tenets of autobiography and ethnography to complete and write an autoethnography. The rationale for using ethnographic methodology is that it gives the researcher the “liberty to produce meaningful, accessible, and evocative research grounded in personal experience, research that would sensitize readers to issues of identity politics, . . . to forms of representation that deepen our capacity to empathize with people who are different from us” (Ellis, Adams, & Bochner, 2010, p.275). For the context of this study, I used autoethnography to reflect on my personal experiences (i.e., researcher’s subject positionality) growing up and studying in Uganda from elementary schools through to higher education at Makerere university, Kampala. Readers may also remember that my personal narratives came
out in chapter one in the personal and professional context section where my multiple identities as a male, Christian by faith, IDP internee, and above all, African, were clearly articulated.

Qualitative research, on the other hand, involves the use and collection of a variety of empirical materials—case studies; personal experiences; introspective; life stories; interviews; observational, historical, interactional, and visual texts—that describe routine and problematic moments and meanings in individuals’ lives (Denzin & Lincoln, 1994, p. 2). Qualitative research is an umbrella concept covering several forms of inquiry that help us understand and explain the meaning of social phenomena with as little disruption of the natural setting as possible (Merriam, 1998, p. 5). This particular research project was best suited for a qualitative research approach. According to Merriam (1998), there are four major features that characterize qualitative research. The first is that the researcher is interested in understanding the meaning that people have constructed. In this study, the participants and I concentrated on the detailed comprehension of Indigenous science with examples from life experiences. This was in line with my original research goal, which was to understand participants’ views of Indigenous science and its integration into the school curriculum as well as how the community perceives and practices Indigenous science.

The second feature is that which views the researcher as the major instrument of data collection and analysis. The use of structured and unstructured data collection method centred me (researcher) at the axis of the study. From actively participating in the conceptualization of the study from OISEUT with my supervisor to conducting interviews with study samples, I became a central instrument in data collection. By working closely with my supervisor, the
interview questions were carefully identified and shaped in a language that would excite study participants and invite their creativity during the interview sessions.

Merriam (2009) also identified field work as a major feature of a qualitative study. For the purpose of this study, field work was achieved by going to Uganda, recruiting, and having direct interviews with participants. Finally, an inductive strategy was identified as another key feature of qualitative research. Although the validity of any theoretical approach was not tested in this study, the research heavily relied on Indigenous knowledge discursive frameworks of reference to understand participants’ articulation of issues regarding Indigenous science and its place in higher education in Uganda. Because the qualitative approach is flexible and allows researchers to do things in ways that makes sense to them, the issue of validity was addressed through the use of theoretical frameworks and engagement with literature in the analysis of findings (see chapter six) to substantiate the claims being made by the researcher and respondents. In agreement, Eisner (1998) asserted that:

Qualitative inquiry places a high premium on the idiosyncratic, on the exploitation of the researcher’s unique strengths rather than on the standardization and uniformity. Hence, investigators who study schools or classrooms and who engage in that craft called field work will do things in ways that make sense to them, given the problem in which they are interested, the aptitude they possess and the context in which they work. (p. 169)

The rationale for the selection of qualitative research is that it is valuable in gaining a detailed comprehension of policy formulation and implementation, value systems, a populace’s behaviour, community concerns, cultural values, and aspirations, among others, through descriptions and interpretation of interview excerpts. Accordingly, Merriam (2009, p. 16) explains that the product of qualitative inquiry is richly descriptive. There are likely to be descriptions of the context, the participants involved, and the activities of interest. In addition, data in the form of quotes from documents, field notes, and participants’ interviews, excerpts
from videos, electronic communications, or a combination of these are always included in support of the findings of the study. Accordingly, Miles (1979) argued that qualitative research data are attractive because they are rich, full, earthly, holistic, and real, with their face validity seemingly unimpeachable. Moreover, they preserve chronological flow where that is important and suffer minimally from retrospective distortion (p. 117).

4.2. Data Collection Methods

The data collection method consisted of structured and unstructured interviews. In appraising interviews as a data collection method, Merriam (2009) posited that, in all forms of qualitative research, some, and occasionally all, of the data are collected through interviews. Interviews are instrumental because they aid in the examination of the challenges of contemporary school science pedagogy and make clear the students and professors/lecturers’ attitudes toward the indigenization of science curriculum in the school system. For the purpose of studying Indigenous science’s integration into the curriculum, Mertens (1998) asserted that if researchers accept the ontological assumptions associated with interpretive/constructivist analysis, that multiple realities exist that are time and context dependent, they will choose to carry out a qualitative study so that they can gain an understanding of the constructions held by people in that context.

Prior to my field trip for this study, I took a course on mixed research methodology in the fall of 2011. This helped me streamline and enrich my consciousness of the tension that exists between the Western knowledge of science and Indigenous scientific epistemology. This tension was also clearly captured by interview participants as will be discussed later. The most significant one was the uneasiness of some participants to accept that Indigenous science is a
valid body of knowledge. One participant (a professor) even wondered why I was wasting my valuable time researching such “old fashioned knowledge” that has no merit to the community. To avoid losing track of my objectives as I navigated through the tensions, I held onto the two research methods that were stipulated in the proposal—structured and unstructured interview methods to allow free expression of opinions and, where necessary, engage with the tensions in the course of the interview. The study was also anchored my own beliefs in African Indigenous Knowledge and Transformative Learning, and my constructivist approach and critical inquiry.

4.3. Use of Structured and Unstructured Interview Methods

In a structured interview, the interviewer asks all respondents the same series of pre-established questions with a limited set of response categories (Fontana & Frey, 2003, p. 68). In its simplest form, structured interviews involve one person (interviewer) asking another person (respondent) a list of pre-determined questions about a carefully-selected topic. The interviewer is allowed to explain things the respondent does not understand or finds confusing. In engaging with this method, therefore, participants had some idea/s of what I expected from each question/s—for instance, questions like, “What is the status of Indigenous science in Uganda’s education curriculum?” In response, most of my participants responded by explaining their feelings on whether or not Indigenous science was reflected in Uganda’s curriculum. Some respondents were very thorough in that they gave a quick overview of education curriculum beginning from primary through secondary to university education before making a conclusion of whether or not Indigenous science exists in the education curriculum. Also, since the question was very straightforward, some respondents simply answered by saying there is no such thing as Indigenous science in our education curriculum. However, although it included direct questions,
the structured interview played a significant role in simplifying questions that would otherwise have appeared complicated for study samples to comprehend. It also gave them neutral ground to dig deep into the questions and even ask for clarity where necessary. For my part, working with this method allowed for a simplified angling of research questions in a clarified manner for the respondents to easily understand.

In unstructured interviews, respondents are seen to have their own agency and selfhood, thus are not simply “respondents” answering the questions posed by the interviewer. The interview style is generally unstructured and interviewees have the freedom to tell their biographical stories in their own way, although there may be some gentle guidance offered by the interviewer in order to keep the narrative going (Creswell, 2002). This interview strategy greatly helped in generating other questions that were not hitherto part of the original questioners and also solicited responses from participants in breadth and depth. This exemplified the criticality of the research by touching every detail that originally was not part of the research questions with elaboration for clarity in challenging the injustice of the exclusion of Indigenous science from the curriculum. Kincheloe and McLaren (2000) succinctly explained that critical inquiry must be connected to an attempt to confront the injustice of a particular society or public sphere within that society. According to them, research then becomes a transformative endeavour.

4.4. Sample Recruitment

I recruited participants from Lapani and Masomo University. Both universities are situated in Kampala city and about 15 km apart. The rationale for the selection of these two sites is that they are the oldest public universities in Uganda with long track records of training skilled
human labour for the social, economic, and political development of Uganda. Every region of Uganda was represented in the recruitment of participants. The table below shows participants’ profiles. Note that pseudonyms have been assigned to all participants and the two universities for confidentiality purposes.

## Participants’ Profiles

<table>
<thead>
<tr>
<th>Name</th>
<th>Place of origin</th>
<th>Program of study or teaching/research interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPK</td>
<td>Northern region</td>
<td>He teaches Biological science, entomology (productive entomology—bee keeping)</td>
</tr>
<tr>
<td>Albert</td>
<td>Western region</td>
<td>He is a second year graduate student, Master of Science in agriculture and applied economics</td>
</tr>
<tr>
<td>Fred</td>
<td>Western region</td>
<td>A second year graduate student, Master of Science in population and productive health</td>
</tr>
<tr>
<td>Birungi M.</td>
<td>Northern region</td>
<td>She is a third year undergraduate student in the Bachelor of Science program</td>
</tr>
<tr>
<td>Namutebi</td>
<td>Central region</td>
<td>She is a graduate student of Master of Science in agriculture (biology)</td>
</tr>
<tr>
<td>Birungi</td>
<td>Eastern Uganda</td>
<td>A first year graduate student, Master of Science in education, specializing in biology</td>
</tr>
<tr>
<td>Fred</td>
<td>Northern region</td>
<td>He is a professor of chemistry, Department of Chemistry</td>
</tr>
<tr>
<td>Kigundu Moses</td>
<td>Central region</td>
<td>A third year graduate student, Master of Science in chemistry</td>
</tr>
<tr>
<td>Dina</td>
<td>Eastern region</td>
<td>She is a professor of Biomedical laboratory technology</td>
</tr>
<tr>
<td>RDC</td>
<td>Central region</td>
<td>A second year graduate student, Master of Science in education</td>
</tr>
<tr>
<td>Michael</td>
<td>Central region</td>
<td>He is a professor from the Department of pharmacology</td>
</tr>
<tr>
<td>Peter</td>
<td>Western region</td>
<td>A professor from the department of Biomedical laboratory technology</td>
</tr>
<tr>
<td>Sarah</td>
<td>Northern region</td>
<td>She is a professor from the Engineering department, renewable energy</td>
</tr>
<tr>
<td>Nakato</td>
<td>Eastern region</td>
<td>She is an assistant professor from the Department of science</td>
</tr>
<tr>
<td>Amwine</td>
<td>Western Uganda</td>
<td>A professor from the Department of science, specializing in medicine</td>
</tr>
<tr>
<td>Maggie</td>
<td>Southern region</td>
<td>A second year graduate student, Master of science education in agriculture</td>
</tr>
<tr>
<td>Ondua</td>
<td>West Nile region</td>
<td>A first year graduate student, Master of Science in veterinary medicine</td>
</tr>
<tr>
<td>Name</td>
<td>Region</td>
<td>Profession</td>
</tr>
<tr>
<td>--------</td>
<td>------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Musinda</td>
<td>Eastern region</td>
<td>A professor in the Department of nutritional science</td>
</tr>
<tr>
<td>Nabirye</td>
<td>Southern region</td>
<td>She is a professor from Department of science, population and reproductive health</td>
</tr>
<tr>
<td>Mawanda</td>
<td>Southern region</td>
<td>He is a professor from the Department of Science, agricultural engineering</td>
</tr>
</tbody>
</table>

From the above table, five participants are from the northern region, four from the western region, three from the south, and four from the eastern and central region respectively. The representation from the different region is not even. This is because the study aimed to get participants from all over the country with no emphasis on equal regional distribution.

4.5. Lapani University’s teaching Staff and Students’ Demography

According to Lapani University’s 2012 annual report, the university students’ population stood at thirty-four thousand (34,000). The population of the teaching staff as of the 2011/2012 academic year was one thousand three hundred fifty-seven (1357). The bar graph provides a detailed breakdown of teaching staff. The breakdown is categorized into colleges and levels of appointment.
Figure 1
Teaching staff by colleges as of academic year 2011/2012


Guides

CAES—College of Agriculture and environmental science
CEDAT—College of Engineering, Design, Art and Technology
COCIS—College of Computing and Information science
CONAS—College of Natural Sciences
COVAB—College of Veterinary and Biosecurity
COBAMS—College of Business and Management sciences
CEES—College of Education and External Studies
LAW—School of Law
CHS—College of Health Sciences
CHUSS—College of Humanities and Social Sciences
4.6. Masomo University Faculty and Students’ Demography

For this university, acquiring detailed information regarding students’ enrolment and faculty demography was an uphill task. The institution was very protective of such information and none of the administrative staff was willing to openly speak on enrolment. However, based on their strategic plan for 2012 to 2015, student enrolment was ten thousand five hundred sixty six (10,566). Out of this, six thousand two hundred thirty-three (6,233) are males, and four thousand three hundred thirty-three (4,333) are females. The university also has five thousand nine hundred eighty-one (5,981) students in the distance education program. The total faculty comprised four hundred and two (402) academic staff spread over all the faculties.

In total, I recruited 20 participants for the study from the above universities. They consisted of five students and five professors/lecturers from Kampala University, and five students and five lecturers/professors from Lapani University. The student participants from Lapani University were mostly those doing their graduate studies (Master’s degrees) and were either in the first, second, third or last year of their programs. From Masomo University, all my participants were undergraduate students. As it was a relatively new university compared to Lapani, one of the professors from the department of science told me that Masomo University has a very low graduate student population and most of them are in the faulty of education. I used purposeful sampling to maximize the information being sought and as a result, out of the 25 participants recruited, only 20 were interviewed. In agreement, Merriam (1998) recommended that, if a researcher is submitting a proposal to a funding agency or dissertation committee, he or she can offer an approximate number of people to be investigated knowing well that this will be adjusted in the course of investigation. Besides, two students withdrew from the study (attrition) on the grounds of the interview questions being too complex. One of the students from Masomo
University offered to recruit a friend to fill her place, but I declined to take the recruit because that was not my method of recruitment. In this case, I went back to the list of potential participants and sent out emails to a few students. From the response, I selected two to replace those who had opted out.

Although the number of study participants is by no means an average representation of students’ and professors’ population in the two universities for which I could claim accuracy of the data, the participants come from all the five regions of Uganda (central, eastern, northern, western and southern region). Most of the participants had grown up in the villages (countryside) either for all or most of their educational journeys before joining the university. The implication is that they were exposed to a significant level of African traditional education as well as Western formal education. Besides, at Masomo University, most participants were already teachers in the primary (elementary) and secondary schools who had returned to school to acquire more professional development. Masomo University was in fact founded as a teacher training college before turning into a university in 2001.

Experience shows that since these two universities are the oldest public universities in Uganda, they are normally prioritized by students enrolling for university education from all over the country. This fact provided a diverse participant population. Participants from the two universities had origins from different regions/parts of Uganda. During my conversations with them, I noticed that most of them were raised in traditional home settings (villages, as most of them preferred to call it) while some were raised in purely urban settings with very limited introduction to traditional values/education during the course of their education through primary and secondary school, and university. Because of this, participants’ worldviews of Indigenous knowledge at large and Indigenous science specifically varied depending on the community of
their upbringing, types of schools (primary and secondary) attended and their levels of interactions with other societies/individuals during the course of their education.

The recruitment of participants occurred over the course of one month. Basically, after attaining ethical approval from the Ugandan National Council of Science and Technology (UNCST) and the President’s office (see list of appendices for the two approval letters), the only bodies responsible for the approval of research in Uganda, I communicated with the Department of Sciences at the two universities. In my correspondence, I requested the names and contact information of professors and students in their departments who might participate in my study. After the contacts were given, I sent out emails to the first batch of 20 would-be participants inviting them to be part of the study (refer to appendix B for letter of invitation to participate). From the 20 emails sent out for the first time, fifteen (15) replied and agreed to participate while two replied asking for a meeting with me to get the details of the interview before they could make a decision. Three contacted individuals did not reply to my emails.

After getting the desired numbers for my study, I set dates for interviews. The actual interviews with the 20 participants took one month and a half (6 weeks). I had two cases of attrition, where the participants (both female) decided to opt out of the study. One of them decided to exit the study before the set interview date, while the second dropped out in the course of the interview on the grounds that the questions were too complex for her to exhaustively respond to. In both cases, I did not hesitate to let them go. This is because there was room for attrition as stated in the ethical review form submitted to the University of Toronto’s Research Ethics Board.
4.7. Confidentiality of Participants and Informed Consent

To ensure that a safe space for free expression of ideas was created, I gave the participants the informed consent protocol form in which they read and signed the agreement that their participation in the study was voluntary. On my part, I reiterated the confidentiality of the information by using pseudonyms in the reporting. I made it clear to every participant that only I would know the names of the people who are being interviewed, and there would be only one copy of those names, which I would keep under lock in a secure file in accordance with university policy on privacy and confidentiality. Christians (2000) posited that research subjects have the right to be informed about the nature and consequences of the study in which they are involved. Proper respect for human freedom generally includes two necessary conditions: first, subjects must agree voluntarily to participate—that is, without physically or psychological coercion. In addition, their agreement must be based on full and open information. In line with this postulation, the information and consent forms that I sent out to potential participants gave detailed briefings about the research, their role and expectations as study participants, among other things.

4.7. Ethical Approval

I met the requirement for ethical approval from the two research ethic boards before the actual contact with study samples. From the departing institution, ethical approval was granted by the University of Toronto Office of the Vice-president, Research Protocol Reference Number 26619. While in the field, ethical approval was granted by the office of the President and the Uganda National Council of Science and Technology (UNCST) (see the two ethical approvals in appendices on page 279).
4.8. Data Collection Tools

To accurately capture the data from the participants, I designed the questions in clear and concise language and simplified them further where I noticed that participants were experiencing difficulties internalizing them. I used an electronic voice recorder to capture every detail that respondents were giving. The recorder was very instrumental in that it gave me time to focus on the conversations with interview participants without having to write down their responses. Also, the recorder allowed for ease in transcription since I could play it back and forth until I got the desired message. In lauding the importance of tapes and recorder, Silverman (2000, p. 829) asserted that tapes and transcripts are a public record, available to the scientific community in a way that field notes are not. They can be replayed and transcriptions can be improved, and analyses can take off on different tracks unlimited by the original transcript. In using the audio recording during face to face interviews, I felt that the enrichment of the data was complete since I could observe facial expressions during the interview, and also note the same in the transcription.

In addition, I reflected on my personal experiences growing up and studying in Uganda from elementary through secondary schools to university, where I completed my undergraduate studies in 2005. My personal experiences with the education system became key data for most of the chapters such as introduction/statement of the problem and data analysis, among others.

4.9. Interview Questions

After completing sample recruitment and fixing dates for the face to face encounter, I met with each participant at the agreed-upon site. Most of the respondents offered to meet on campus in the open grounds or in offices, while I met a few students in their private rooms. Each interview lasted between 45 minutes to 1:10 minutes. The question sheets were given out before
the interview dates along with the consent protocol forms, information letters, and introduction letters from the University of Toronto. The questions were 11 in total and basically sought participants’ comprehension of Indigenous African science, its status in Uganda’s national education curriculum, the constraints being faced by higher education at the two universities in the implementation of Indigenous science curriculum, respondents’ perceptions and attitudes to indigenization of the current curriculum, and factors influencing the direction of education policies in Uganda. However, in the course of the interviews, other questions that were not initially included in the question sheets were derived. Sometimes, additional questions were generated from participants’ responses. This was especially possible where the unstructured method was used. The matrix below gives a summary of the research questions, objectives of each question, participants, and data.

### 4.10. Metric with Research Questions

<table>
<thead>
<tr>
<th>Research questions</th>
<th>Objective of the questions</th>
<th>Participants</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is African Indigenous Science?</td>
<td>Get the definition of AIS from participants’ perspectives.</td>
<td>Professors and students</td>
<td>Unstructured interview</td>
</tr>
<tr>
<td>What is the status of African Indigenous Science in the curriculum?</td>
<td>Establish whether or not AIS is in the curriculum of higher education.</td>
<td>Professors and students</td>
<td>Unstructured interview</td>
</tr>
<tr>
<td>How and what elements of African Indigenous Science should be integrated in higher education curriculum?</td>
<td>Identify elements of the AIS that can be integrated in the curriculum. Where possible, find out the method of integration.</td>
<td>The “how” question targets professors and the rest, both professors and students.</td>
<td>Structured interview</td>
</tr>
<tr>
<td>What are the professors’ perceptions of African Indigenous Science curriculum?</td>
<td>Find out the opinions of professors toward AIS and its inclusion in the curriculum.</td>
<td>Professors</td>
<td>Unstructured interview</td>
</tr>
<tr>
<td>What are students’ perceptions of African Indigenous Science curriculum?</td>
<td>Find out the opinions of students toward AIS and its inclusion in the curriculum.</td>
<td>Students</td>
<td>Structured interview</td>
</tr>
<tr>
<td>What are the attitudes of professors and students to</td>
<td>To determine participants’ attitudes toward AIS and knowledge in general.</td>
<td>Professors and students</td>
<td>Structured interview</td>
</tr>
<tr>
<td>Question</td>
<td>Description</td>
<td>Participants</td>
<td>Interview Type</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>What are the constraints faced by the university’s faculty of science in implementing African Indigenous Science curriculum?</td>
<td>Find out the reasons why AIS is not in the curriculum and the impediments of incorporating it.</td>
<td>Professors</td>
<td>Unstructured interview</td>
</tr>
<tr>
<td>What are the social and cultural factors on the perception of professors and students regarding Indigenous knowledge curriculum?</td>
<td>This question seeks to establish how traditional beliefs play a role in the way participants understand and conceive AIS.</td>
<td>Professors and students</td>
<td>Structured interview</td>
</tr>
<tr>
<td>What are the historical and political changes influencing the direction of education policy in Uganda?</td>
<td>Find out how the historical tradition of the country impacted education policy and the contemporary curriculum.</td>
<td>Professors</td>
<td>Structured and unstructured interview</td>
</tr>
<tr>
<td>What is the status of professors in initiating national education curriculum?</td>
<td>Find out if professors have a voice in shaping curriculum they teach.</td>
<td>Professors</td>
<td>Unstructured interview</td>
</tr>
<tr>
<td>Is there space for Indigenous science in the curriculum? Please elaborate on your response.</td>
<td>Find out if education stakeholders are willing to open up space for Indigenous knowledges.</td>
<td>Professors and students</td>
<td>Unstructured interview</td>
</tr>
</tbody>
</table>

The use of the unstructured interview method to explore the above questions created an ideal environment for free expression of ideas through conversations between the participants and me. This was quite instrumental in nurturing a high degree of trust for free and honest exchange of views which allowed participants to engage with the flaws in the pedagogy of the science curriculum in the education system. In the book *Expanding the Boundaries of Transformative Learning*, Dei (2001) challenged educators to use pedagogical strategies that tell success stories as well as failures and disasters. He asserted:
We must challenge the academic attraction and fetish of focusing on “failures.” We must ask: what can we learn from success cases; the sites and sources of local people resisting and empowering themselves through their own creativity and resourcefulness? (p. 129)

By creating an environment of mutual trust and respect, the qualitative research strategy empowered my participants, as backed by Dei, to reveal what they conceived of as strengths and weaknesses in the current science education curriculum in Uganda, and the corresponding implications to critical pedagogy.

4.11. Interview Environment

For most students at Lapani University, interviews took place in different settings such as the residence halls, in the dining halls after lunch, under the trees within the university complex, and in the private rooms of respondents. Professors were interviewed in their offices during office hours. Since Lapani University had closed indefinitely for business due to a strike, there was no normal routine that students and professors were following such as attending classes, office hours, meetings, conferences, dealing with administrative issues. This created a free environment in which participants unreservedly expressed their views without fear of any consequences. Besides, for every interview, it was just the participant and me (interviewer). This further created a very relaxed atmosphere for participants to express their views.

Because it was normal business at Masomo University, I interviewed most student participants on campus. Like at Lapani University, I allowed participants to select safe and convenient places for the interviews. Most respondents opted to complete the interview on campus under the trees or in lecture rooms after classes. Since participants selected venues that were safe for both of us, there was free expression of opinions. Generally, the interviews were
conducted in neutral places that allowed for the participation of respondents in a free and fair manner.

4.12. Validity of the data

To ensure validity of the data collected, I sent the transcribed texts by email to three participants who had expressed a willingness to review it. Of the three participants, one was a professor from Masomo University, while the other two were graduate students from Masomo and Lapani University, respectively. The three participants agreed with the transcribed data and said they would be honoured to read the completed dissertation. However, the 17 other participants did not express interest in reviewing the transcript. Instead, most of them requested that I send them the final electronic copy of the approved thesis.
Table 2
Theorizing Research
The above research approach is summarized in the matrix below

<table>
<thead>
<tr>
<th>Research purpose</th>
<th>Theoretical framework</th>
</tr>
</thead>
</table>
| To investigate how syllabus and curriculum designs targeting integration of Indigenous science in higher education curriculum can revitalize science education in Uganda. | 1. Anticolonial theory  
2. Indigenous knowledge discursive frameworks  
3. Transformative learning theory. |

<table>
<thead>
<tr>
<th>Key research questions</th>
<th>Methodology</th>
</tr>
</thead>
</table>
| 1. What is African Indigenous Science?  
2. What is the status of African Indigenous science in higher education curriculum in Uganda?  
3. What elements of Indigenous science can be integrated in higher education in Uganda?  
4. How can these elements be integrated (what are the strategies?) | 1. Qualitative research methodology  
2. Autoethnographic research methodology |

<table>
<thead>
<tr>
<th>Key Claims</th>
</tr>
</thead>
</table>
| 1. Indigenous science is lacking in Uganda’s education curriculum.  
2. Integration of African Indigenous Science into the curriculum will improve the quality of science education in the country.  
3. Indigenous science education is cost effective to implement. |
Source: adopted and modified from Maxwell and Loomis (2003, p.246) as an interactive module of research design.

From the above diagram, conceptualization of research is based on five stages. Stage one concerns research purpose. This entails problem statement and the rationale for conducting the study. Stage two looks at the methodology used to achieve the study objectives. Stage three examines different theories and how they speak to the research study while stage four presents the key claims. Stage five is very significant because it is here that participants’ voices are heard.

4.13. Brief Closure of Lapani University: Implication for my Research

After gaining ethical approval from the research board in Uganda, I successfully wrapped up the recruitment of my research participants from the two universities. I made contact with the first batch of participants from Lapani University and set dates for the first meeting. However, before I could engage with them in one-on-one interviews, the university professors and lecturers went on strike. The lecturers and professors had demanded that their financial contribution with the National Insurance Corporation (NIC), amounting to approximately US$ 5,693,950, be paid to them in full. They also wanted a 300% salary increment. Their demands were tabled before the government for consideration but were not met. The lecturers’/professors’ grievances were that they were over worked and the cost of living had gone up, yet their salaries had remained static. They were also concerned that the leaders in government were amassing excessive wealth through rampant theft from the national treasury while they, who trained the country’s skilled human resources, remained the least paid. My conversations with two of the senior lecturers indicated that there were long standing issues that the government had suppressed. It was therefore a matter of time before something could trigger their grievances to full explosion and the climax came into force during my research period at the university.
The strike came barely two weeks after the university had opened in August and most students from upcountry had just returned to school in the second week. When the lecturers/professors refused to teach, the students’ body threatened to join the strike in support of their professors/lecturers. To avoid a violent strike by students who had already begun gathering and drawing strategies, the university council announced the closure of the university on September 2, 2011, and gave the students four hours to vacate the university campus with all their belongings. Immediately, military police and other security personnel flooded the university to ensure that students left without destroying property or causing chaos in the city; students’ strikes have always ended up disrupting businesses and causing unrest in the city. With the closure of the university and departure of the students, I was concerned that my research would be greatly affected. However, as luck would have it, only undergraduate students left the residence halls and hostels as the police carefully monitored them. In the graduate students’ hall of residence, students remained on campus and continued accessing the libraries although lessons were not being conducted while the professors’ and lecturers’ strikes continued. With this development, some lecturers and professors who had initially agreed to participate in the study opted out for reason that they had travelled upcountry to spend the strike period with their extended families. Therefore, I had to contact other participants from my initial list.

It was evident that my research in the country was taking place at a time of crisis in the education sector, which also gives a hint as to the educational tribulations in the country. One month prior to the lecturers’ and professors’ strike, the teachers in the public elementary schools throughout the country went on peaceful strike for several weeks demanding a pay raise from the eighty ($ 80.00) US dollars per month. The government remained adamant in its refusal and instead threatened to expel all teachers who continued with the strike beyond the set dateline. It
took the intervention of parliament for the teachers to be given a 15% pay raise to be effected in the new financial year (2012).

Although the closure of the university slightly disrupted my research, it also enabled me to obtain rich information that would otherwise not have been captured. Participants talked in depth about the negligence of education by the government and the government’s prioritizing of other sectors like the country’s defense. According to most participants, this neglect has contributed to an enormous drop in the quality of education because professional teachers/educators leave the education sector for other jobs with NGOs, civil society organizations, and other government departments. There has also been a high brain drain where professional teachers leave the country to teach in foreign countries such as Kenya, Rwanda, Tanzania, and beyond East African boarders.

At Masomo University, I was confronted with bureaucratic administrative procedures that momentarily hindered the recruitment of participants. Unlike at Lapani University, where only ethical approval from the Uganda National Council of Science and Technology (UNCST) was required, Masomo University had its own requirements. In additional to ethical approval from UNCST, the highest ethical research board in the country, the university required foreign researchers to get ethical approval from their (Masomo University) research ethic board. It is typically a long process that could take about four weeks before one could start recruiting participants. This is because after submission of the proposal to conduct research, the researcher has to wait for the university research ethics board to convene a meeting and make a decision. This meeting takes place once every two months depending on the volume of application received. What helped my work was that the Dean of the faculty of science did not see the relevance of the internal approval application to my study since I had already gained ethical
approval from the UNCST and the President’s office. Thus he provided permission for my research to begin while waiting for the long approval process by the university’s research ethic review board. Fortunately, ethics approval was granted two weeks after I started my research.


The central objective of this study was to explore ways through which Indigenous African science can be brought on board the school curriculum for coexistence with the dominant science discourse. Because this is the first exploratory study to be conducted in this context, the selection of qualitative research approach allowed for interaction between the researcher and diverse participants in sub-identity groups like gender, ethnic groups, educational levels, professions, and faith, among others. The interaction changed my earlier assumptions that the participants had related experiences, and that many had closely related views on the subject of study and would be very willing to participate in the study. This assumption was based on the fact that I was going to interview Ugandan participants and most of them had acquired formal education in the country. Kamenou (2007) reminds us that we should avoid essentializing ethnic groups by assuming they have specific traits and behaviours. Ethnic minority or dominant groups occupying the same geographical locale may have unique and completely different experiences and views on a particular issue. For instance, in the course of recruiting participants, a professor in the department of veterinary medicine asked me what Indigenous science was and what its value was to society.

My response to him was that the question he was asking was part of the broad questions that I would love to hear him articulate during the actual interview. It was at that point that he responded by revealing his concealed identity and why he might not be the right participant in
the study. His faith-based identity, coupled with a high level of formal education attained partly outside Africa, had displaced him from his original identity. In the professor’s mind, the mention of African Indigenous knowledge implied engaging in conversations involving non-Christian principles and evil practices, as well as scientifically unsubstantiated traditions. Against this backdrop, my original assumption that participants in this context would be receptive to conversations on the subject of study was significantly altered. This particular prospective participant had a negative view of the subject of study and was, in a way, trying to dissuade me from pursuing it.

As a researcher, I conceived my subject location as objectivity while the professor’s view was that of subjectivity. These two divergent locations significantly influenced the participants’ recruitment and interview. I never approached the other participants in the same way again. The process in which the researcher and the research participants’ points of view influence the outcome of the study has been referred to as double subjectivity (Lewis & Meredith, 1988, as cited in Kamenou, 2007, p.203). In regard to the tension that developed between the researcher and the prospective participant in this case, the term conflicting double subjectivity was coined to illustrate the degree of tension and mistrust that was brewing between the researcher and participant. To avoid biasing the outcome of the study, I chose to allow the will of the professor to reign supreme by removing his name from the list of potential participants. Interestingly, I later learned from the student participants that this professor did not agree with most aspects of traditional knowledge and was known to question the authenticity of most traditional practices and the sanity of those who embrace it. This statement was reiterated by some participants in the process of explaining how some of their professors ridiculed traditional knowledge. For the purpose of confidentiality, I left out the professors’ names. In a recent work, Wane (2008)
attributed the denial of Indigenous knowledge and cultures by some elites to formal education, she argued:

Indigenous peoples often view the knowledge they inherit and construct as unworthy of recognition or value. Current Western approaches do not acknowledge the richness of different approaches, instead choosing to perpetuate the homogeneity resultant from the dominance of the developed world. However, we can no longer justify the ongoing oppression of nations of people. The current system of education alienates many from their cultural traditions and as such, is often perceived as a dehumanizing process. Education may actually benefit from the sustainable practices inherent in Indigenous systems of knowledge. (p. 195)

In agreement with Wane, the different types of literature archived in global educational libraries are instrumental in understanding how inferiority permeated the mind of Indigenous elites through psychological violence. This involved a well-planned indoctrination strategy disguised under religion and formal schooling to intensify the marginalization of traditional knowledge from formal education and greater society. Such groups of elites have become gatekeepers in educational institutions. They continuously challenge and question the authenticity of Indigenous knowledge.

In conclusion, the methodological chapter examined key activities that transpired in the course of data collection (seeking ethical approval from the researched area, participants’ recruitment, and actual interview process). Since no research has been conducted on the integration of African Indigenous Science into Uganda’s formal education before, the use of qualitative research methodology became very central in providing a safe space for participants’ expressions of ideas on the subject. The interviews conducted generated rich data that have been reported in chapter five below.
Chapter 5

Research Findings

5.1. Introduction

This chapter presents the results from the study designed to investigate the integration of AIS in higher education in Uganda. From the interview, one of the major findings was respondents' articulation of Indigenous science. Some of the participants had not previously thought about Indigenous science. However, upon reflection, they were able to articulate what it meant, its importance in daily life, and why it should be introduced in formal schooling. Additionally, they reflected on the status of Indigenous science in Uganda’s education curriculum, and concluded that it is not formally recognized. What was amazing with my participants was that they did not speculate about the state of things but preferred not to answer questions they were unsure of. They also provided strategies on how Indigenous science could be integrated into formal education; this was another one of the major themes that dominated my conversations with participants. In addition, participants offered their perceptions and attitudes toward AIS. The lukewarm perceptions of AIS pointed out by some participants were not surprising because, as articulated earlier, the Eurocentric schooling system has conditioned them to view traditional cultural practices with skepticism. It was deeply refreshing to hear professors and students take up the discussions on AIS enthusiastically; they knew that the implementation of AIS in the formal education system would be an uphill task. In the body of this chapter, I will also be sharing what participants argued or felt would impede the implementation of AIS in the curriculum. With the interview proceedings electronically recorded, the transcribed responses generated sixty-five (65) pages of written texts that are reported in order of the interview
questions. Since the interview proceedings were being recorded, I devoted more time to asking questions and listening.

5.2. Participants’ Understanding of AIS

Participants provided a definition of African Indigenous Science: how it is accumulated, applied, and passed on. They also provided examples of AIS, the details of which will be provided in this section. In many cases, participants had a closely related understanding of the subject. Of the 20 participants, 14 (70%) defined AIS as a traditional knowledge of science that was dominant before the introduction of formal education and continues to be practised mostly by people in rural communities in the present era. They gave examples of the use of herbal medicine, bone settlers, the traditional birthing process, and animal and crop husbandry as components of Indigenous science still being practiced. Participants stated that the practice of these components is passed on from one generation to another. Following are some of the main points participants brought up in their definitions.

1) Cumulative practice. Peter gave a succinctly cutting-edge elaboration by emphasizing the orality and cumulative practices of the knowledge in his articulation. According to him:

   Indigenous science is a cumulative practice of the use, interactions with and of biotic and abiotic organism in our everyday life for the continued existence of a community in its totality. This interaction and practice is carried from generation to generation through oral transmission and is stored in the minds, hearts, and souls of the community that practices this science to improve their wellbeing. The central organism in this interaction is human being.

By pulling out the key pieces of the transmittable nature of this knowledge and its storage system, Peter’s articulation is closely linked to that of most participants. Another participant named JPK emphasized the locality of the science knowledge in terms of the settings and resources, and its adaptability to community needs.
2) Innovation from local environment to improve living conditions. This point was specifically asserted by JPK, who argued that:

Indigenous science is innovation by the Indigenous people using local environments for sustainability to improve or change their ways of living. In summary, this is a practice developed by the Indigenous people using local resources and is sustainable for community wellbeing. Indigenous science education embraces aspects of teaching and learning, focusing on the use of local resources to educate the community to bring them up so that the knowledge can be transformed to fit into the local settings for the wellbeing of the local community.

3) Practical education for nurturing responsible citizens. Slightly differing from JPK and other participants, Albert brought up the practical dimension in his definition. He stated:

Indigenous science refers to that practical education that was mainly passed on informally by African parents to teach their children and has no time definition. The focus is on the practical and not only on theory. The education is conducted from childhood through to adulthood.

Although this was by no means very dissimilar from other participants’ responses, few participants had mentioned the practicality of the subject. Practical education is the emphasis of African traditional teaching where learning takes place concurrently with doing. In the same vein, JPK reiterated this by rationalizing his motivation toward traditional entomology. He stated that his enthusiasm in traditional bee keeping dates back to childhood experiences when he used to harvest wild bee honey with peers. The learning process involved was exciting. His emphasis is now on cross fertilization of the local and non-local approach to bee keeping with a focus on using Indigenous materials such as log hives, clay bee hives (clay modeled into bee hives), and bee hives made from reeds. In a different tone, Fred provided examples of Indigenous scientific orientation in his definition. He stated that:

Indigenous sciences are those traditional aspects and practices by the community that were scientific in nature, those practices that were giving scientific orientation—for instance, and traditional birth attendant practices. Their practices and skills are highly scientific in nature and acquired organically without having to go through formal education. Learners are trained to carry out scientific practices basing on traditionally
inherent knowledge. Traditional medicine is another example. This is where herbal practices are used for preventative or curative measures.

4) How this knowledge is passed on. In a closely related response, Namutebi asserted how this knowledge is passed on to learners by the teachers in a practical, unconventional method:

It is generally the way of interaction that our parents, grandparents, and ancestors developed with their environment without going through formal education. The science knowledge is passed down from one generation to another with the main focus on the scientific aspects such as medicinal practices, animal keeping, sex education, and the health care system, among others.

By expressing the informality in the process of Indigenous science knowledge dissemination, Fred and Namutebi pointed to the absence of standard practices or settings such as curriculum through which this knowledge can be disseminated. Therefore, orality, as discussed earlier, was the main medium of producing, validating, transmitting, and storing traditional knowledge.

Finally, Fred added the aspect of inheritance in the acquisition process of Indigenous knowledge. This means that one can acquire it by right of birth in a specific family or community. Although this dimension was not directly mentioned by other participants, most of them seem to suggest that AIS knowledge is community generated to meet the challenges of their immediate environmental milieu. Therefore, by being born in a specific community, one is expected to learn the knowledge or even inherit it from his/her parents or community elders. An example given was the knowledge of traditional medicinal practices. In most cases, the practitioners passed this knowledge on to one of the children they confided in.

The section below gives participants’ articulation of the status of AIS in the formal education curriculum. Although participants were asked to give their views on the status of AIS in Uganda’s higher education, most of them broadened their responses to the entire formal education curriculum beginning from elementary education to the university level.
5.3. Participants’ Articulation of AIS Status in the Curriculum

The responses to the question on the status of Indigenous science in Uganda’s education varied from one participant to another. Forty percent of the participants (Fred, Musinda, Ondua, Maggie, Amwine, Nakato, Mawanda, and Peter) mentioned the absence of this knowledge from the country’s education system. They stated that Uganda’s Ministry of Education has not clearly embraced Indigenous science. What is being emphasized instead is the modern dominant science discourse. The key points raised herein includes: 1) very few AIS aspects in the curriculum, 2) some elements of Indigenous science found in elementary schools’ curriculum, 3) existence of foreign materials in the curriculum, and 4) consultation with elders for clarification of local scientific practices. Evidently, some of the participants were more aware of this gap as articulated by JPK:

There are very few aspects of Indigenous science in Uganda’s curriculum. I have been teaching for 13 years and realized that the curriculum is mostly foreign in nature with a very limited focus on Indigenous people and their environment. It appears that our traditional knowledge has no space in the curriculum that we teach students in schools. Most of our teaching focuses on content that is alien to our lived experiences and Uganda’s history, and as a result, leaves out Indigenous science.

Albert and Dina, however, noted some areas on the grade level where such knowledge exists on a small scale. In particular, Albert posited that:

From my experience, there are elements of Indigenous science in lower primary school level. For example, sending kids to collect cow dung and black soils for smearing/plastering classroom floors and walls\(^\text{12}\) is teaching them Indigenous science. Kids are also taught in their native tongues about the traditional health care system. However, as the kids progress through the middle to upper level of elementary education, the focus shifts to Eurocentric science since the kids focus on the marks they want to get for their national examinations. High school upper secondary levels like S.5 and S.6, where field trips are taken in biology and agriculture courses, are opportunities for

\(^{12}\) Blend of the chemical properties in cow dung and black soil provide fine mortars for plastering walls and floors. This is commonly used by people who can’t afford exorbitant costs of cements. The mixtures are strong and can endure rough weather.
students to get practical experience with Indigenous science. However, this is during field trips only and not in the classrooms. The trend is that the more advanced with study the students get, the more likely that they drop Indigenous science and focus on Western science to pass national exams and plan for their careers.

Black soil is normally collected from the village pond and mixed with cow dung to get strong mud mortar for plastering the house floor or wall units. Due to the chemical properties in the cow dung and black soil, the mud mortar provides solid layers on the wall or floor that cannot easily be eroded or infested by termites. The above views were, however, contrasted by Michael (2005), who argued that Indigenous science exists informally in the curriculum of some higher education institutions. He declared:

> It has not been adopted in educational structures in as far as policies are concerned. We in the teaching field do not have a provision or guideline that specify[ies] incorporating Indigenous science into the modern curriculum. However, in my field of pharmacology, we borrow what the Indigenous people use in managing certain ailments and expose our students to the properties found in herbs and their efficacy. The department of pharmacology is taking a lead in this.

Dina also submitted that elementary school songs, riddles, stories, folklores are used to teach the young learners about their family history, the environment, plants, the animal kingdom, food productivity, medicinal practices, religion. For universities, she stated that:

> At the university level, though not officially mentioned in the curriculum, there are times when we consult with the Indigenous communities on their medicinal practices. For example, in the biomedical lab technology program, when we identify new bacterial infection, we consult with the local herbalists to understand how they treat such infections. This allows us to compare it with the modern approach to fighting such infections. However, it is not officially specified in the curriculum, so it is an informal practice.

The above views were supported by Fred, who suggested that there has been a significant move away from Indigenous science recently to something more unusual. He stated that:

> Lately, there has been a very wide shift from the traditional science orientations to something which is very unusual in nature. In the process, it has affected us grossly because we have left the training that was traditionally acquired from the elders. Health education that used to be given by the specialists at the community level has been
excluded. For instance, you will be surprised today that if you ask a child where mangoes come from, the child will likely tell you that it comes from the refrigerator. All the teachings that our parents used to give us explaining where different thing come from have disappeared. The system now is shifting to impractical science. We are simply copying innovative science of the Western society which does not fully apply to our environment. The science is simply theoretical and meant to follow other people’s discoveries/innovations.

Because of this shift, Fred reported that education curriculum today has made learning very complex as students are not given time to conceptualize what they study in class. They simply cram foreign loaded curriculum to pass examinations. Fred, Dina, and JPK called for creating space for Indigenous science in the curriculum so that learners can get hands on experiences with whatever they study. They also suggested the need for decongestion of the curriculum. Other participants, such as Birungi, think that professors are responsible for the unclear status of Indigenous science in the education system. Her position targets professors’ pedagogical practices. She argued that:

It’s difficult to tell whether there are elements of Indigenous science in the curriculum that we receive today. However, the way the curriculum is packaged, it appears like it’s loaded with only Western science without any Indigenous component. Even if there are elements of traditional science, the professors try to model it in modern ways. They integrate traditional science with modern science and label their teaching as modern science with no mention of traditional science. Their pedagogical practices seem to be biased toward traditional knowledge which leaves a lot to be desired in as much as the value of traditional knowledge is concerned.

Participants have varying views on the status of Indigenous science in the country’s education system. However, despite this, it is evident from their perspectives that a lot needs to be done in terms of knowledge integration as a process of curriculum reform.

The next section echoes participants’ voices by providing a discussion on elements of AIS that should be included in formal education.
5.4. Elements of Indigenous Science Identified by Participants

Participants gave many examples of Indigenous science elements for integration into the school curriculum. These included:

1) **Alternative medicines** were identified because with Indigenous medicinal practices there is enormous potential for improving health. They argued that modern medicines are expensive and most rural community members cannot afford them. Therefore, alternative medicine used for curative measures need to be acknowledged by its formal integration into the education curriculum.

2) **The practice of circumcision** was also identified as an element of Indigenous science for inclusion in the curriculum. Participants argued that circumcision is an important element of AIS for it reduces the rate of sexual transmitted infections (STI).

3) **The African food storage system.** Participants stated that, this is a reliable technological innovation that ensures the preservation of food for a long period of time. This can be integrated into the national curriculum as well.

4) Africans also have a very effective **pest management system** that can be integrated into higher education curriculum.

5) **Water conservation** can improve sanitation and provide safe drinking water for the community, thus is an important element of traditional science for consideration in the formal education curriculum.

5) **Indigenous entomology** was identified as another element of AIS for integration because it produces organic honey with no chemical contamination.
6) The Indigenous alcohol distillation process was seen as valuable because the alcoholic drinks produced are healthy with no ethanol that destroys human cells.

7) Finally, Albert and JPK lauded marriage and sex education as elements of traditional science that control population growth. JPK asserted that:

   Sex and family education within the traditional society is an element of Indigenous science that needs to be integrated into formal education. Take, for example, the Karimojong pastoral community that lives in rural areas. They have not been influenced much by the modern family planning method and yet they have managed to control population growth through strict sex education to match the available resources. These people have established wisdom rooted in traditional customs related to marriage, sex education, and childbirth, which are strong elements of Indigenous science.

   In agreement, Albert extended that line of thought to include the values of marriage education in controlling sexually transmitted diseases. Because of the existence of marriage education in traditional African societies, early involvement in sex is unheard of.

   The traditional African food storage system also came highly recommended by participants. They argued that the food storage and preservation method has stood the test of time and uses no destructive chemicals since they are acquired from organically planted grown plants. Maggie emphasized that:

   I have seen our people preserve foods using locally-made pesticides such as banana juice, red pepper, and lemon leaves to control varieties of pests such as maize and bean weevils in storage facilities. This is despite the fact that there exist modern storage devices like refrigerators in the present era. If this traditional storage method has lived the test of time, then we should consider teaching it to the younger generation. The only way we can make the younger generation interested in this knowledge is by officially integrating it in the education system. But most elements of Indigenous science cannot find a way into formal education because if it was of value, the Ministry of Education and Sports would have included it in the curriculum.

Eighteen participants (90%) of the 20 interviewed mentioned traditional medicinal practices as a relevant component of traditional science. In emphasizing the importance of traditional
medicinal practices and the reason for integration into the formal education curriculum, Fred cited the example of herbs that have been used to treat numerous cases of measles in his local community at no cost to the patients. Further, he stated that some researchers from the Center for Disease Control in Entebbe District have traversed his community to collect specimens of the local measles herbs for further research. He stated that:

> When we talk of the aspects of medicine, contemporary scientists are getting back to the African roots. They are bringing those traditional ways of using medicines back to life. Today it’s a highly emphasized and marketable area in the field of medicine. African Indigenous medicines should be given unprecedented attention because their benefits have been proven beyond reasonable doubts. They only need a little bit of improvement, for example when it comes to preservations, packaging.

The above participant, however, did not elaborate on why packaging needs to be improved.

Herbal medicinal practitioners have unique ways of preserving and storing their medicines. Dried herbs extracted from trees/crops can be stored and transported for years without going bad.

The traditional health care system was also identified alongside medicinal practices. Further, Musinda presented a powerful rationale for the identification of traditional medicines. He stated that:

> The introduction of Indigenous medicines in the country’s curriculum is crucial not only in protecting this practice from extinction but also in drawing a cross cultural comparison of the different medicinal practices from other societies beyond the confines of our context.

Along similar lines, participants also identified the traditional health care system such as birth attendants as a key element of Indigenous science that should be integrated into the higher education curriculum. Indigenous birthing practice involves the use of local herbs to induce labour and reduce pain during the birthing process. It seems Sarah came to the interview with lots of passion about traditional birth attendants for she carried a copy of an old government
newspaper that highly rated this practice. After handing over the newspaper (which will be discussed in chapter seven) to me, Sarah stated:

The traditional birth attendant is a very important element of Indigenous science to be integrated in the curriculum. After skimming through the interview questions yesterday, I decided to bring this newspaper article…please take a look. It is an old New Vision newspaper published in October 2010. The paper explains the significance of traditional birth attendants from rural women’s perspectives. Some of the traditional health care practices are very important and we need to hear from the real beneficiaries at the grassroots level to appreciate their value (participant handed over a copy of an old newspaper article to me).

In the same way, Moses emphasized this view by exploring why most expectant women from rural areas prefer the services of traditional birth attendants. He asserted:

Although many hospitals and health centers have been constructed by the government to help expectant mothers, there are not enough compared to the growing demand. Even where hospitals and health centers exist, some of the midwives handle patients unprofessionally and this discourages many prospective patients. It is against this background that most expectant women go to traditional birth attendants with whom they have a personal relationship since they are members of their community.

Traditional agriculture also came vastly recommended as an element of Indigenous science that should be integrated into the formal education curriculum. According to Fred, the traditional agricultural formula is highly sustainable. It gives good productions/yields that are free of unhealthy chemical components, nutritious, and good for the health of the community. Moreover, African traditional agricultural practices are good for maintaining soil fertility.

Namutebi passionately made a case for inclusion of this element into the education system:

As a student of agriculture, I have come to realize that there are many components of traditional science that can be taught interchangeably in the education system. Some of them are mixed cropping, soil conservation, hybridization of animals and plants for better quality. There is also the element of mulching which deals with improving soil fertility through the use of animal and plant residue. These are long time practices by traditional African farmers which have been modified, repackaged, and brought into the curriculum as modern agricultural science. There are, however, traces of these practices among our parents, elders who have not acquired any formal education. This means modern science borrowed from the traditional knowledge of farming or there are similarities in practices. It therefore follows that the same way traditional societies practiced these agricultural
elements can find a way and relevance in the curriculum. This is one way of documenting and preserving such science practices in their raw form.

The above view was reinforced by Ondua, who argued that the traditional African agricultural system provides high productivity and organic foods that are very healthy for a community’s wellbeing. One area of this type of agricultural practice is intercropping, which is basically growing more than one crop in the same field in a given season. The aim of intercropping is to ensure that when one crop fails, the other gives yield to the farmer or both crops give double yield to improve food security.

Another component, the alcohol distillation process, was identified by Fred and Moses, who argued that the process produces very low ethanol in the drink and therefore presents low risk to human health. Fred reinforced the argument by stating that:

I think the alcohol distillation process by African women is a rich element of practical Indigenous science that can be included in the school curriculum. If you look at the way the Luo people of Uganda, Kenya, and South Sudan distil kwete (local brews); it is very rich in practical science. The kwete drink is very nutritious and healthy for the diet. So we need to collaborate with communities that are practicing the distillation process and learn from them.

Extending a similar line of thinking regarding a different element, Moses identified the technique of extracting cooking oil from simsim as an Indigenous science. His view was that cooking oil from simsim has the low level of cholesterol necessary for reducing the risk of several diseases that we face these days. Further, he stated that:

The process of extracting cooking oil from simsim involves complex science skills that are not easily accessible in the academy. In most cases, women are the experts and key custodians of this scientific knowledge.

Participants’ emphasis on the technological processes of alcohol distillation and extraction of cooking oil from simsim (sesame) sharply deviates from the scaffolding belief system toward Indigenous science upheld by other sections of scholars who still associate this knowledge with
out-dated practices. As a researcher, my view is that such elements of science need to be given more study as discussions about knowledge integration take place. How can we implement all of the above elements? The following section provides strategies that were identified by participants for the integration of AIS into formal education.

5.5. Suggested Strategies for Integration of the Identified Elements of Indigenous Science

This section presents findings on the participants’ perspectives regarding the technical, methodological, and epistemological approach that can be used to integrate Indigenous science into the formal education system. The findings from the interviews also reveal that participants’ perspectives are context relevant and that there are no correct or linear strategies for integration.

Most participants identified the need for joint research and publication in both Indigenous and dominant science as the first positive step toward knowledge integration. They stated that joint research and publications are important in validating the values of both types of scientific knowledge and in this way one would not dominate the other. JPK called for African scholars to take the lead in Indigenous knowledge integration. His remarks in the following statement directly admonished African scholars for developing complacency in regard to the current education curriculum. He stated:

There are so many learned scholars (teachers, professors, doctors, lawyers) in the country who can be used to ingrate these elements but they are in their own cocoon. They are detached from reality. They still embrace only the Western science curriculum. How do you embrace something that vanquishes your own values and elevates values that are alien to your context? I think something is terribly wrong with some of our scholars. These fellows could be used to influence policy change toward Indigenous knowledge. For example, the forestry department at our university is planted right in the heart of Kampala city where there are no forests. So, one of the strategies for integration is to convince the learned people who have real power to influence policy to move the department of forestry and agriculture from the city to rural areas.
Such a view emphasizes a strong collaboration between the rural communities and educational institutions by bringing certain aspect of formal education closer to the community. This will make it possible for science students to gain hands on experience in different categories of traditional knowledge as they learn and interact with Indigenous people. In the long run, JPK continued, “the specialists of traditional science knowledge can start to work collaboratively with students with the aim of establishing joint research team.” Advancing a similar line of thinking, Nakato asserted that:

I think Indigenous knowledge generally needs to be integrated into the curriculum at all stages of formal education in Uganda. By this I mean beginning from the lowest level (primary) to the top most level (university) of education. The question of how to integrate can come later but I would suggest the focus now should be to influence policy change toward acceptance of Indigenous knowledge. The debate about local knowledge integration in formal education is long overdue and it’s high time we start exploring radical means to deliberately bring this knowledge right at the heart of the education system. Why would we deliberate on whether or not to integrate?

In agreement, Amwine poignantly argued for the involvement of leaders with real power to influence policy change. He called for fundamental change in all stages of the education system in Uganda with a focus on traditional knowledge integration:

To begin with, this is not the right place for you to conduct this study. An important study like yours should have started right from the primary (elementary) school level, then gradually proceed to secondary education and other tertiary institutions before coming to the university. Your recommendations for integration of Indigenous science would then start right from elementary through secondary education to the university level. Policy reform with the context of African society can only be effective if it’s tackled from a bottom to top approach, rather than top to bottom, which is resonant with the same colonial approach that you are trying to change.

By suggesting a bottom to top approach in knowledge integration, Amwine did not only seek to deconstruct the dominant model of policy formulation and implementation in society; he was also envisioning the sustainability of such a policy since the community would have a sense of
ownership. However, Dina disagreed with this view. She argued that Indigenous knowledge should be introduced at the higher education level, saying:

At the higher level, there is space for Indigenous science because at that level, learners are mature [enough] to select what they want to do/be. So if a course has been designed in Indigenous science, learners who enrol for it will do so wilfully with an objective of acquiring something out of it.

Many participants called for the involvement of religious leaders in any debate about knowledge integration. They believed that the leaders of organized religions such as Christianity have been at the center of disparaging traditional knowledge. Such religious bodies have large numbers of followers in the country who also denigrate traditional knowledge. To reiterate this point, Musinda stated that one of the major players in undermining African Indigenous Science is religion. Christian religious organizations continuously preach against African cultural practices, calling them demonic and satanic. Therefore, any serious debate about knowledge integration must involve leaders of religious organizations in order to be fruitful.

Reiterating this view, Fred criticized religion for its condescending teachings against some science practices which economically can lead to someone attaining self-reliance in society. He asserted that:

Also, if you want to teach learners how to ferment alcohol or grow tobacco using an Indigenous approach, they will say that their faith does not allow them to consume any alcoholic and tobacco products because this would lead them to hell. If we are to successfully integrate Indigenous science, then this factor needs to be harmonized.

The general picture from this finding in relation to the role of religion in undermining traditional values is worrying, and yet religion should be the means through which believers become more spiritual. Spirituality is all-encompassing and embraces people’s relationship with their creator, God, fellow humans, and their surroundings. Participants therefore strongly emphasized that, for
traditional knowledge integration to be meaningful, religious leaders and their flocks have to change their mindset and attitude toward such knowledge systems.

Participants also emphasized the need for extensive consultations with the community, specifically elderly people who are authority figures and custodians of local knowledge.

Involving the local community, according to Michael, is imperative because:

Documenting the various ways of managing ailments using local herbs would then be brought to the discussion table. This would lead to its formal entry into teacher training curriculum. After training a critical mass of teachers, we could seek policy to get legal backing and a formulation process to guide us in integration. This could start all the way from primary education through secondary to colleges and universities.

Moses expanded on community involvement with the argument that Western and Indigenous sciences have a lot in common and should be taught concurrently. He stated that when you critically look at modern science, it seem to have a bearing on Indigenous science. Further, it seems to have developed from Indigenous science. The Indigenous science integration process must thus begin with this realization. At elementary schools, students should be taught more Indigenous science as a foundation. Then, when they go to higher level, Western science can be introduced in detail in order to refine their grasp of science. In order for them to understand the concepts of modern science, science instruction has to be based directly on Indigenous science.

Many participants called for the harmonization of the language used in Western science instruction to reflect Indigenous language. Failure to interpret and analyse complex scientific and botanical terminologies in the local languages by students can be a deterrent leading to lack of motivation toward Indigenous knowledge. To reiterate this point, JPK argued that:

There is a need to harmonize the language we use as well. There are some scientific words that are so complex, without direct meaning in local language, that there is a need to know the meaning in the local language as well as in English. This can be done by
involving the local community in modern science conferences/workshops so that we get their perspectives. In the process, they would also be sensitized to the value of Indigenous science. Among the Acholi people, for example, the emphasis of Indigenous medicine is to ensure the good health of human beings and their surroundings, and to maintain good relations with the spiritual world through communal ritual practices aimed at preventing ill-health and misfortune.

However, Sarah and Dina thought that harmonization of language alone was inadequate because Uganda has many ethnic groups with different cultural knowledge. The bigger question when it comes to knowledge integration is whose cultural knowledge will be integrated. Dina succinctly stated that:

Uganda has very many cultures. To come up with knowledge from a specific culture that we are going to follow is hard because what could be adopted in one culture may be a taboo in another culture. So, the Ministry [of Education] thinks that it’s better to just keep it off the curriculum than have it bring confusion/tension. Harmonization is quite difficult.

Other participants suggested involving activists to sensitize the community to the value of this knowledge. They argued that there are many activists in Ugandan society but they are mainly focusing on human rights and political related issues. It is time they start venturing into Indigenous knowledge and its place in formal education. Birungi, RDC, and Musinda emphasized the need for scholars to go back to the local community and learn from its members. Local community members need to be told that their ideas are vital for the survival of the economy through the preservation of traditional knowledge.

Participants also pointed out that such knowledge needs to be packaged in a way that is attractive, professional, and available to all people. This would help deconstruct the false belief among most elites that Indigenous knowledge is for the poor and those without formal education. Ondua argued for involving the media houses in raising the community’s awareness about Indigenous knowledge. He stated that:
If you look at the message that the public media brings out to our community on a daily basis, you will realize that, they belittle the Indigenous culture and knowledge system. It’s common to hear derogatory phrases such as witchcraft, sorcerers, villagers, and out-aged practices, among others in the media when commenting on Indigenous cultures. This is stereotypical, and a child growing up hearing such negativity will automatically end up desiring the foreign knowledge systems that are glorified by the same public media houses. So I think the media houses will be a good starting point. They need to send out positive messages about Indigenous knowledge.

This is an important process in changing people’s attitude toward such knowledge. Participants further suggested that knowledge integration has to go hand in hand with local language inclusion at all levels of the education system. They endorsed the thematic curriculum—curriculum based on the local language—but said it is inadequate because its catchment areas are limited to lower primary schools. This was poignantly echoed by JPK when asked whether or not the thematic curriculum would have a meaningful impact on knowledge integration:

I think yes, because if you look at most developed industrialized countries like China, Russia, and Europe, they are using their local language. The use of local language in Uganda’s case will enrich the learners’ ability to understand the concepts of what they are taught. This is because the instruction is being given in a language that they understand better. However, if it stops at lower primary, will it create an impact? It is not enough because by the time learners reach university, they will have lost track of the Indigenous language. But if you go to Tanzania, for example, a learner can name the body parts in Kiswahili. On the contrary, in Uganda, learners in the higher level of their academic pursuit can’t name most body parts in the local language. They can only do this in English—the language of instruction. Besides, at the secondary level, students cannot dissect a frog and name the parts in their local language but they can accurately do so in English. So the scope of thematic curriculum needs to be expanded to every level of education for it to have real impact. But it’s a good foundation for the inclusion of Indigenous science in the school curriculum.

The need to include the local language in the integration process cannot be emphasized enough since nearly 70% of study participants echoed it. Thematic curriculum, they argued, has greatly improved students’ comprehension of concepts taught. However, their concern is that this will not have much impact since most levels of education are monopolized by English as the sole medium of instruction.
Finally, the documentation of Indigenous trees, plants, and animal species was identified by participants as a very crucial strategy for the sustainability of traditional knowledge integration. Maggie stated that there is a need for research and documentation of Indigenous trees, plants, which is lacking in the public education system. For example, if you go to secondary or even primary schools, our students know about forestry in British Columbia, the best seasons for lumbering there, and even the types of trees and specific timbers they produce as well as the use of these timbers. However, the students will fail to have the same knowledge about the trees in Uganda’s Mabira forest simply because we have not taken the responsibility to document what makes up our local environment.

In applauding the above view, Peter called for joint research by Indigenous and non-Indigenous scholars so that their findings reflect both perspectives. He stated:

Also, document the common names of local medicinal innovations, plants, herbs, alongside the names given by Western science. This will promote the practices. For example, me, I come from Teso region and I know that we have tamarind, which is used for treating typhoid. I also know that tamarind does not decay however long it’s left in an open space. So this means there is/are some chemical components that deter it from decaying. As an Indigenous researcher, I have to find out what this chemical component is and how it can be applied to treat other diseases. Therefore, it is beneficial to conduct collaborative research with professionals in the field of modern science so that we give the name of this herb from the Indigenous and modern science perspectives. Collaborative research would help in changing people’s perceptions.

In light of the above summary, joint research and publication is critical in any knowledge production, validation, and dissemination. Extensively published knowledge reaches a wider audience to gain acceptance as well as criticism, which lead to significant changes in attitude and perception. With this in mind, the section below presents participants’ perspectives on students and professors’ attitudes/perceptions regarding AIS.

5.6. Participants’ Articulations of Professors’ and Students’ Perceptions/Attitudes toward AIS
The question regarding the perceptions and attitudes of professors and students toward Indigenous science received mixed reactions. Most participants responded with enthusiasm and credited this knowledge. They embraced it because it informed their identity. According to this group of participants, this knowledge has proved very significant because, as Albert asserted, “people who live in urban centers with ease of access to modern science products, facilities, and services suffer from many [more] ailments such as diabetes, cancer, pressure, than their counterparts who live in the villages without ease of access to such products.” Further, Albert elaborated on the reasons why he embraces this knowledge. His perspective was premised on a recollection of teachings from home by his parents, thus:

During all my educational journeys, I reflected on the African education teachings that my parents/community gave me. My perception in particular is that of relativity, originality, reality, and comfort. This is because Indigenous science is the original science knowledge that is as old as the human race. This science defines who and what we are and how we came into being, and shapes our understanding of the world. It is the science knowledge that provides real meaning to life since it transcends both the physical and the metaphysical world.

Drawing examples from practical classroom experience, Fred, who is also a high school teacher and graduate student, stated that some students get very enthusiastic about traditional knowledge. This is because they easily connect with it. He stated:

Students are excited about Indigenous science. Their excitement increases when you teach science and bring examples from what transpires in their respective community. For example, when I teach them about the process of alcohol distillation (malwa/ajono) where I bring a live example of what happens at home to class, the students greatly connect with it and improve their understanding. If they could also do the hands on activity, this would greatly improve learning as well as teaching.

Although many participants embraced this knowledge system, others expressed negative feelings toward it. Those who did not embrace it stated that the existence of their low perceptions was attributed to the way students are brought up by some parents. Most elite parents despise
Indigenous science and, as a result, influence their students. The role of organized religion such as Christianity was singled out as a key factor for the low perceptions and attitudes toward Indigenous knowledge. According to Fred, this has made many students think that such knowledge is rooted in primitive traditionalism. He noted:

It [brings about] mixed feelings from the students. This is partly due to the negativity clouding the minds of many students toward African education. They look at it as primitive practices rooted in myths and superstitions. This is because of the focus of the Ministry of Education policymakers—they have left out this science from the school curriculum. Students hence think it is substandard and valueless.

Fred implored the government to appreciate the value of African traditional knowledge. His view is that even the World Health Organization is now acknowledging the contributions of traditional birth attendants and herbal practices. They are being given further training and user friendly equipment to be able to identify that a certain antenatal condition requires a C-section for quick referrals to be made. These attendants are empowered to help their communities using their traditional scientific knowledge coupled with additional skills from modern science. This is an illustration that the two sciences can co-exist in the formal education system.

Maggie was very open in expressing disapproval for most elements of traditional science. She held such hard feelings against the subject, which was explicitly visible on her face and tone. She asserted that:

First of all, although I know that people in the community practice this science, my own view about it is negative. I personally think that Indigenous science was useful to society in the days before formal education was introduced. With the new and complex knowledge coming from formal education, what makes one want to go back to traditional knowledge? If we are talking about integration of this science into the school curriculum, then I think not very many aspects can be taken up. Most of it cannot fit now, though a few aspects are still relevant. Things have changed and society is developing.
Another participant named Birungi tailored her response to the marketability and career significance of such science knowledge. According to her, it is economically less valuable to study traditional knowledge. She stated:

Students’ attitudes are poor because they feel that the core reasons for coming to formal schooling are being compromised. They consider embracing Indigenous science as taking them back to those who didn’t acquire formal education in the rural areas. [Regarding] traditional science knowledge, they feel that they can get it without coming to school. So they have come to acquire modern knowledge which can make them attain a higher socio-economic status in life beyond where their parents stopped—be professors, doctors, lawyers, and travel to foreign countries, unlike most of their parents who have not travelled widely.

Participants stated that attitudes and perceptions depend on exposure. Those who are exposed to traditional science feel that it is of help to Indigenous communities. Those who are not exposed to it still associate it with witchcraft or primitiveness. Ondua extended the line of thinking in terms of low perceptions with the argument that:

The perception is low because of the way society views practitioners of this science. If one decides to use herbal medicines to treat a sickness, people look at this person as uncivilized because the general perception created is that traditional medicines are for those who haven’t encountered modern civilization.

This view was stressed by Moses and Michael, who argued in terms of professors’ areas of speciality in their research and teaching field. Specifically, Michael proclaimed that:

Being a professor means having super specialized skills. People have various perceptions depending on their areas of specialization. In the department of pharmacology, college of health science, most of the professors focus their research on traditional medicines. So they have positive perceptions. However, the perceptions are not uniform. People’s mindsets are shifting toward alternative medicines because of the challenges with modern medicines. As lecturers and professors at the college of medicine, we are now exploring hybridization of traditional medicines with modern medicines to meet the challenges of some ailments developing immunity to modern medicines.

Pushing the frontiers of the argument differently, Peter stated that students’ perceptions are dictated by the community/public opinion regarding Indigenous science. He declared that:
Students have less-than-positive attitude because they think they will be looked down upon. You will be looked at as someone who settled for the lowest in life. For example, look at students doing agriculture or botany. They are perceived as those who settled for the least in life because they will be working with unskilled people (peasant farmers) who have not acquired formal education. They are seen as those who failed to enrol in medicine or engineering courses, hence settled for the least. This is the same reception that students will get if they specialize in Indigenous knowledge.

Conversely, Moses, Michael, Peter, and other participants noted that there is a problem with the education system and with most urban societies because they tend to discourage students from anything traditional. They stated that professors and other stakeholders have an enormous responsibility to change the education system and the general public opinions. The low perception of traditional knowledge, according to RDC, is also attributed to a lack of funding. Indigenous knowledge is heavily underfunded, and if there were bodies or organizations with research funding in those areas, the perception would quickly change. Much as participants saw the potential for a change of attitude concerning knowledge integration, they identified several challenges that would hamper the implementation of AIS as expressed in the section below.

5.7. Identified Challenges in the Implementation of Indigenous Science

Participants identified varying degrees of challenges that could hinder the implementation of this knowledge in the formal school curriculum; these arose from social, economic, and political factors. For meaningful integration to take place, these challenges would have to be addressed first. These factors include:

1) **Language of communication.** Many participants noted that English is the dominant language of instruction and communication right from elementary schools. It is difficult to emphasize Indigenous knowledge while leaving out local languages or what has commonly come to be known as vernacular. In local knowledge integration, vernacular should take central stage.
Also, the focus of our education needs to change from producing white collar jobs and workers to producing job creators. Graduates no longer want to associate with the Indigenous community, let alone Indigenous knowledge. The learners are detached from their villages. They associate life in the villages with backwardness and poverty. These days many graduates are in the city where the white collar jobs they are looking for are scarce or nonexistent.

2) **Financial resource constraints.** This has been identified as a major barrier for the implementation of new programs. This factor was mentioned by 80% of the participants and is said to be common among most public and private universities across the country. To emphasize the depth of this factor, Sarah specified that:

> The university generates lots of revenue from tuition fees paid by private students. However, the university is not directly in charge of the generated revenue. It passes the money to the government that then decides the percentage to be given back to the university. This has hampered the initiation and implementation of new progressive programs such as Indigenous science. For any programs to be successfully implemented in an educational system there have to be enough financial resources to support them.

Echoing resource constraints as a challenge, Peter stated that:

> Resource constraints—for example, we are doing a course called herbarium and we are required to use a dryer machine in the experimentation of certain plants’ species. Now that the machine has broken down, we are forced to dry our specimens by sun and this affects the process when it rains. There is no skilled manpower within the university to fix this machine, and due to resource constraints the university has not hired one from outside.

3) **Lack of professors’ motivation.** The above view is reiterated by Dina, Fred and Moses, who brought in a new dimension such as the lack of motivation of professors. Professors are poorly remunerated and this limits their ability to research in areas such as traditional knowledge which itself is underfunded. Research requires funding in order for it to be successful.
Research is important in the implementation of Indigenous science where elements of the science get validated through empirical observations and laboratory tests.

4) **Government interest.** A number of participants also stated that the government has not expressed enough interest in improving the quality of education by integrating new programs. As a result, public universities across the country still have some old fashioned colonial courses that are not necessarily relevant in the present time. According to Fred:

> This has hampered the promotion of an alternative type of education. The government has left the education system to “To Whom It May Concern.” Because of that, a lot of pressure has been exerted on primary and secondary schools where national examinations take place. With the high admission requirements into the universities and the business inclination attributed to education today, focus is tailored more to passing exams than to understanding the principles taught. This is threatening at a broader level because today the schools of law and medicine, for example, are saying that they are not going to admit students based on examination results at the national level. Instead, potential candidates will have to sit special exams set by those schools. This is because of government negligence in maintaining standards at the secondary and primary levels of education.

Further pointing fingers at the government, JPK argued that:

> The current regime promoted education for students in the western and central region, leaving northern Uganda, in particular, without educational benefit. A very fraudulent system of education was coined. Select schools in western, central and eastern Uganda leaked exam questions prior to the national examination day. [Students at these schools] would perform so well and gain exclusive admission into the state universities under government merit based admission with full scholarships. For the students from other regions of the country, especially north, this meant automatic exclusion from university education. Education became divisive.

Narrowing the responsibility on the Ministry of Education, Fred stated that:

> It does not demonstrate that it has concern about education in the country. Concerns have been brought up to the Ministry of Education before to make education relevant by improving its standard so that it ceases to be one attached to passing without knowledge and becomes one where knowledge comprehension is the basis. You would be surprised [to find] that somebody who studied physics up to senior six, wrote exams, and passed with distinction can’t even replace a light bulb, can’t fix a socket. What science were they studying? The science in the present curriculum is too theoretical.
Participants also pointed out that there is too much politicking and gimmicking which has affected the way education is being managed. This is because lots of good programs have been ushered in prematurely and end up being non-functional. For example, UPE is a good program but it was brought up haphazardly at the time when there was not enough structural development to support it, inadequate human resources. Students ended up studying under trees. Coupled with the above-mentioned challenges is the lack of professional backing in integrating traditional knowledge. Most of the professors and doctors have lost interest in this knowledge and see going back to Indigenous science as regressing to the Dark Ages. Thus, it is considered the last option should the dominant science fail to deliver.

5) Lack of compatibility with the job market. Participants mentioned the challenge of employability for graduates of Indigenous science. According to Michael, the lack of workplace environments to absorb such graduates is a serious barrier to its integration. He noted that:

We don’t have an environment that will absorb the graduates of Indigenous science. Now there is a course in the university which teaches alternative medicine. It’s called ethno botany. Ethno botany generally teaches purely alternative ways of managing ill-health traditionally. In that line, we have the chemotherapeutic laboratory at the Ministry of Health in Wandegeya. It takes research on traditional medicine to see how it can be used by the community. Other than this lab, there is nowhere that graduates of Indigenous science can be employed.

Other participants noted with discomfort the destruction of traditional Indigenous species, which has become a common and serious problem in the country. They argued that the fact that some of these species become extinct limits our ability to apply theory to practice.

Furthermore, Sarah and other participants claimed that there is a general feeling of phobia among university leadership that the program may not attract interest. There is fear that students
may not enrol for it thinking it is for people who did not acquire formal education. This fear is due to the way that the education system and religions have influenced society.

In discussing possible challenges to knowledge integration, participants pointed out that professors play a key role in curriculum design and implementation at the higher education level. However, their level of participation in curriculum design varies from one institution to another, as voiced in the section below.

5.7. Status of Professors in Initiating Curriculum Design

The finding has shown that professors’ involvement in curriculum design varies from one university to another. For some universities, curriculum design is centralized, while in others, it is decentralized to the departmental level. For the centralized universities, few professors participate in curriculum design. But for the decentralized ones, most professors sit in the curriculum design rooms and contribute ideas. In the university where Michael works, curriculum design is decentralized and most professors participate in the exercise. He affirmed that:

The college of health science has been going through changes in curriculum design to adopt traditional science. Professors have been actively involved in this process. In the same vein, new universities that are opening up, for example, Busitema University, have lecturers and professors participate in curriculum design. However, this is only for higher institutions of learning. At the lower level, the curriculum is basically designed by experts at the National Curriculum Development Centre (NCDC) with the main focus being on Western education.

Sarah also acknowledged that professors participate in curriculum design and implementation since they know what is best for their faculties, colleges, and the university. However, she lamented the influence of foreign trained professors. She argued that every professor brings their experiences of the courses they studied from foreign countries, especially Europe and America,
and imposes them in the curriculum without examining the relevance of those courses to African society.

In a similar tone, JPK and Moses argued that professors play a great role in determining the curriculum of their institution of learning. However, much as they participate in curriculum design, their participation is mainly geared toward the modern curriculum at the neglect of the traditional one. JPK succinctly declared:

Professors are the technocrats in initiating curriculum design. A professor knows the curriculum in-depth. However, many professors have no detailed knowledge of Indigenous curriculum. They don’t even think there is anything such as Indigenous curriculum. There is a saying in the local language that ‘once a tree has bent, it can’t be straightened.’ This applies to professors because they were trained using the European model of education. So they have no interest in traditional knowledge. Although the current curriculum of higher education is determined by the professors, it needs to be overhauled to integrate Indigenous knowledge.

Participants’ articulation of the status of professors in initiating curriculum design was evoked from the professional experiences of respondents. As pointed out by participants, curriculum in higher education is largely determined by professors. However, the absence of Indigenous knowledge in higher education curriculum leaves a lot to be desired from these professors. It appears that most of them are not walking the talk. That is, they talk about the value of traditional knowledge and even informally teach it to their students, but are not making a conscious effort to formally integrate it into the curriculum.

The above realization therefore introduces us to some of the social, historical, economic, and political factors that have been influencing the direction of education in Uganda. Some of the identified factors also pose threats to knowledge integration, as articulated by study participants in the section below.

5.8. Participants’ Perspectives on Factors Influencing the Direction of Education
Several factors influencing education were identified by participants. Their responses were anchored on lived experiences, historical events, articles, newspaper reports, and oral tradition, among others. Generally, at least 90% of participants mentioned all of the following:

a) Colonization and the Christian religion as the architects of formal education.

b) Political factors such as the birth of the multiparty system following political independence in 1962.

c) Civil wars that have marred the country since the rise and fall of President Idi Amin in 1972 and 1979 respectively.

d) Socially—the existence of many cultural groupings and different knowledge systems.

e) The abolishing of traditional institutions such as kingdoms and chiefdoms by 1966.

f) The uncontrolled liberalization of the education sector.

g) The deplorable conditions under which teachers are working with irregular pay, which have affected their input, hence their teaching quality.

h) The introduction of UPE which was politically motivated. From every indication, UPE has completely failed.

The intention behind UPE was good but the timing was poor. Among other concerns, the high enrolment does not match the available resources and infrastructure. As a result, participants noted that education has become politicized. Sarah argued that, students gain admission to the university based on “where they come [disparity basing on regional admission] from and who they know. Admission is no longer based on merit.” There is a lot of cheating exams in the
schooling system because education has proven to be focused on exams rather than on knowledge and skills acquisition.

Socially, RDC reflected on the influence of colonization and Christianity on formal education. He specified that:

The British colonial system of governance was adopted. The governance system of divide and rule was partly adopted in education where formal education was used as a vehicle of disunity in the country. Select parts of the country, such as the central region, were given formal education while the rest were deprived. Even when formal education later spread to the rest of the country, it was denominational in that only Anglican converts would attend Anglican school; likewise with the Catholic schools. The implication is that formal education became a tool for disunity since those who could not acquire it due to different belief systems viewed those privileged to acquire formal education with contempt.

He further argued that originally schools were for the sons and daughters of kings and chiefs. This influenced education immensely because the primary aim of formal education shifted away from preparing an individual to take a responsible role in society to focusing on extending monarchs who were loyal to colonial agents.

Basing on his personal experiences, Michael identified changes in government policies due to regime changes as another factor influencing education. He said:

In the post-independent era, the first government that came into power introduced its own education policy, although it was similar to that of the colonial regime. Within that policy, civic education/subject was introduced at the lower level of education. This helped to teach people about the way they were being governed. Due to changes in government, civic education was abandoned under the current regime. We lost it with changes in the political leadership of the country. People are now advocating for the return of civic education. This is because it kept people informed on how government structures work, how the community handles common things or policies.

The above observation was reinforced by Birungi, who said that each time there is change in government, education policies have to change to meet the ideologies of new leadership. Mild reforms are made in the curriculum to favour the interests of the new regime. For instance, political education in lower secondary education is being phased out because it reminds people
of the past, yet the government is emphasizing that we move forward. But this is not all; the real motive is that political and civic education creates consciousness in the citizens to hold the government accountable.

Natural factors such as rain, drought, landslides, have been identified by Peter as factors influencing education policy. He stated that in areas where such factors occur with severity, education is greatly affected and sometimes policies have to be re-designed to accommodate learning and teaching. Drawing from Eastern Uganda as an example, he indicated that this affects both Indigenous and formal education:

For example, in our land in Teso, we sometimes experience flooding throughout the year and then the following year, we get drought throughout the year. This has affected people’s attitude toward both Indigenous and modern science in the interaction with their communities for survival. So people try to find alternative ways to live and hence many end up along the lake side fishing or hunting wild game. Although people use the Indigenous approach to fishing, their activities are highly regulated by the government. That rotational traditional fishing and hunting mechanism was an innovative method to ensure that the animals in a given hunting ground were not depleted.

Natural factors, as stated by the above participants, have indeed influenced government policy over the past years. In the semi-arid areas of north eastern Uganda among the Karimojong pastoral communities, education policy had to change from stationary classroom settings to mobile ones to allow nomadic children looking after cattle to attend class.

Sarah argued that although the current partial existence of traditional knowledge in the education system is good for the country, it is contributing to students’ exploitation by some faculty. This is a negative influence for education because exploitation equals academic dishonesty. She posited that African Indigenous Science engenders creativity in students, research, thinking, teaching, and application of theory to practice.
Sarah put the responsibility for the exploitation of students squarely on the shoulders of professors who consciously engage in this act. Because of this, many participants have suggested pragmatic reforms that would formally see Indigenous knowledge in the formal education curriculum. The above postulation is shared in part by Nakato, who championed knowledge integration as a strategy for community intellectual property rights’ protection. She asserted that:

Indigenous science needs urgent protection from ongoing exploitation by researchers. The most efficient way to protect this knowledge is by formally planting it in the school curriculum so that researchers will recognize the knowledge when they explore it.

This belief is shared by a section of participants who think knowledge integration would bolster formal education since learners would see their own identity reflected. Specifically, Amwine maintained that:

There is a need to excite learners in traditional science. Take for instance, the Karimojong pastoral groups of north-eastern Uganda who have long shunned modern medicines with strong conviction that these medicines (especially those for immunization) were brought by the white people to make them barren/impotent so that with time, they would be extinct and their land and cattle would be taken away. So, for their children to embrace formal education, they need to see some of their traditional education reflected in it.

Historically, the invitation of missionaries by the King (Kabaka) of Buganda was argued to have influenced education greatly. According to participants, the missionaries introduced formal education. The introduction of formal education brought with it a new dimension of reading and writing. This highly affected Indigenous education, which was the central focus of schooling in pre-colonial Uganda.

Finally, external factors were identified by a section of participants as influencing education changes in the country. One was the IMF and the World Bank Structural Adjustment Policy (SAP) imposed on Uganda in the late 1980s. Under this policy, the government was forced to reduce public deficit through cuts in public spending, including in the education sector,
as a condition for acquiring new loans. This policy affected education by causing the number of
students per class (student-teacher ratio) to balloon and lowering standards of public education
due to poor facilities. At this time, many teachers also lost their jobs due to the retrenchment of
civil servants, low school enrolment since the majority of parents could not afford to pay tuition
fees, and an increased number of private schools for the few wealthy. Many participants also
stated that, as a result of external influence, the government introduced Universal Primary
Education (UPE) in 1997 to achieve the objectives of the United Nations’ Millennium
Development Goals (MDGs), signed by 189 UN member states in the year 2000. However,
without assessing the impact of this mass education policy, the government again introduced
Universal Secondary Education (USE) in 2007. This policy is furthering some of the problems
ushered in by SAP on education.

In concluding remarks, when participants were asked to give final comments, those who
responded geared their perspectives to the possibilities of knowledge integration, distinction
between Indigenous and Western science, interdependence of learning. Some of their comments
are reported below:

Sarah stated that there is the potential to change people’s perspectives toward traditional
knowledge; this is being done by some professors in the department of engineering. She argued
that:

In the field of engineering we try to improve on the traditional science of the local
community. For example, these days’ people say that when you eat food cooked from the
local cooking pots and three stones fire place, the flavour tastes better than food cooked
on gas or electricity. So as engineers, we try to improve this cooking style of the
Indigenous community and make it more users friendly. We improve it to change people’s
practices so that they don’t take inhale too much carbon monoxide from the smoke to
reduce their risk of acquiring diseases. It’s not easy to change people perspectives on
using three stones fire place for cooking. They believe that food cooked using this style
taste better, yet this process releases too much carbon monoxide. So, we improve the
three stones fire place to make it emit as little carbon monoxide as possible to reduce its
risk of causing diseases. We do this through community groups, and go on the radio to raise awareness.

Sarah also specified that:

I castigate making subjects mandatory because it takes the fun out of learning. For instance, I remember at some point while I was in high school, my school made CRE [Christian Religious Education] mandatory. We hated it so much but the school brought in a white priest to teach it. This again changed our attitude and we also always looked forward to the one hour period when the white priest would come to teach CRE. So with the African Indigenous Science, it could be taught in a different form to attract the interest of learners.

Peter reinforced the significance of knowledge integration by arguing that it would contribute to program sustainability. He stated:

I think Western science can’t exist without Indigenous science. In particular, Western pharmaceutical companies will collapse without Indigenous communities/science. The problem is that Western science has a bias in not recognizing the source of their innovations, which is Indigenous communities and their science knowledge. This realization is important in changing peoples’ perceptions.

Fred argued that space can be created in the current education system to accommodate traditional science knowledge. According to him, the evolution of society would eventually contribute to an attitudinal change by members.

I believe that there is room for Indigenous science in the school curriculum that will, in the long run. Change the perception of students because there is no single society that is static. Societies are constantly evolving. Even in the traditional cultures, no single culture is static. All systems are dynamic. The challenge is the attention that we attach to the nature of evolution. It is at this that as a people we have made mistakes. At this, when Western science came around, we embraced it entirely, thinking that we had got it all, that it would provide solutions to what we need in life as a people.

Albert drew his ending remarks by suggesting that there is a need to draw a line between Indigenous and Western science. In espousing this notion, he stressed:

Indigenous science is practical and can be executed any time without being classified for example that these experiments can only be practiced by students in a specific class/grade level. Science of the Western world is highly specialized; for instance, a student who specializes in chemistry may have little to no basic knowledge of biology, agriculture, and pharmacology. Indigenous science is so broad, and learners could learn and practice
medicinal principles, crop/animal husbandry, pottery, alcohol distillation, food
preservations, simultaneously. There is interdependence in learning.

The above closing statement by Albert is very profound and stood out because none of the other
participants made any effort to distinguish between Indigenous and Western science. There is,
however, a need to carry out more research to try and validate the difference between modern
and traditional science.

5.9. Conclusion

Conclusively, participants’ articulation of AIS demonstrated the richness of the broader
Indigenous knowledge. From the different strands engaged throughout the interviews,
Indigenous knowledge clearly remains a central pillar of African society that guides the everyday
activities of the community. It is the foundation upon which the social fabric of society resides.
The interdependence of the authentic African traditions as well as their views of the physical and
metaphysical world constitutes the foundation of African Indigenous Science.
Chapter 6

Data Analysis

6.1. Introduction

In the previous chapter, I thematized my data, while in this chapter, I will engage in discussions with the voices of participants concerning key themes. Going to the field and listening to the stories of participants have been the most informative and interesting part of this study. However, interpreting participants’ stories was a very challenging part of the research. At the same time, it was the most fulfilling aspect of the writing process as I got the opportunity to analyze the collected qualitative data.

Analysis of data involved a detailed reading of findings, reflection on the interview questions, and the jotting down of memos that guided the analysis process. Memos, according to Emerson, Fretz, and Shaw (2001) are instrumental in capturing analytical thinking. They also facilitate thoughts that stimulate analytical insights. In the process of data analysis, I paid enormous attention to the key aspects of the original interview questions such as participants’ comprehension of Indigenous science, its status in the school curriculum, and the elements of such science suitable for inclusion in the curriculum. Critical reflection became quite significant in the analysis of data because it helped in interpolating my lived experiences with participants’ perspectives, the literature, and the theoretical frameworks. In agreement with this view, Bloom (1998) reminds us to engage in critical analysis of our roles as researchers with regard to our social identities or positioning. My hitherto acquired experiences and knowledge from a combination of Indigenous and formal education developed my sensitivity to the themes generated and how I engaged with the themes.
Because qualitative inquiry places a high premium on the exploitation of the researcher’s unique strengths rather than on standardization and uniformity (Eisner, 1998), I utilized this backdrop to analyze the data organically without using any specific analytical tools. Again, Eisner (1998) justified this action with the argument that researchers who study schools or classrooms (educational institutions) and who engage in field work will do things in ways that make sense to them. This is partly due to the nature of the problem under investigation, the aptitude that a researcher possesses, and the context in which the study is being conducted. As pointed out in the confidentiality clause (see appendix B), pseudonyms have been used to engage with participants’ perspectives so that their identity is protected. In the analysis, two major themes have emerged, thus major and minor themes.

I developed the themes through generating patterns. There were many connections (similarities) in the patterns generated and this was crucial in developing themes. In trying to maintain the factual information articulated, participants are quoted verbatim (direct quote) in the analysis process. For instance, when I asked participants what their understanding of Indigenous science was, there were varied responses. But I found some to be very powerful and to bridge gaps in the definitions of Indigenous knowledge in the existing literature.

Synthesization of data was also based on key themes incorporated with the literature, theoretical frameworks, and participants’ and my own perspectives. A growing body of literature on Indigenous knowledge was used to engage the analysis of participants’ voices objectively. This is reinforced by the use of theoretical frames of reference to validate the outcomes of the study. As mentioned earlier, this chapter will provide a synopsis of all the major and minor findings from the research project. The key themes will be interwoven in the discussion to
understand the commonalities as well as differences in participants’ responses in relation to the literature and my own perspectives.

The articulation of AIS by participants as expressed in the preceding chapter constituted a key theme because all respondents, including those who value this knowledge and those who do not express a closely related understanding. Their views incorporate hypothetical and practical orientations, as seen in the theme below.

6.2. Participants’ Articulation of AIS

In response to the question, “what is Indigenous science?” participants gave elaborate and varying definitions of the subject of study. Most of them responded to the question through reflections on their personal experiences. The following are some of the given definitions:

Michael articulated Indigenous science as:

The local knowledge that Indigenous communities have had from time immemorial, being passed on from their forefathers to them insofar as knowledge of living and nonliving things is concerned. Indigenous science education therefore refers to how we teach our children this science knowledge, that is, how we handle the issues of ailments, health, births, crops growing, environmental sustainability, food processing and preservation, and alcoholic distillation, among others.

Michael’s comprehension of Indigenous science is all encompassing. It is closely tied with the broader definition of Indigenous knowledge examined in the literature (Gupta, 2009; Kapoor & Shizha, 2010; Snively & Corsiglia, 2000). With the in-depth comprehension of AIS and the inadequacies of employing only dominant science in solving societal challenges, Michael’s definition gravitates toward unconventional science to supplement the dominant one in Uganda’s education curriculum. This promotes an understanding of Indigenous science as a dominated knowledge, and reminds us of the existence of multilogicality of science knowledge, that there are multiple perspectives of human and physical phenomena (Kincheloe & Steinberg, 2008).
Such postulations in the literature and by participants are a critique of the dominant discourses that offer only linear ways of viewing and comprehending society.

Peter had a definition closely linked to that of Michael but varying slightly in the sense that he emphasized orality as a means of educating the younger generation about the traditional science knowledge, and the existence of community as the central purpose of this knowledge. He asserted that:

Indigenous science is a cumulative practice of the use, interactions with and of biotic and abiotic organisms in everyday life for the continued existence of a community in its totality. These interactions and practice are carried from generation to generation through oral transmission and are stored in the minds, hearts, and souls of the community that practices this science to improve their wellbeing. The central organism in this interaction is human beings.

This participant’s expression is closely linked to the literature (Dei, et al., 2008; Gupta, 2009; Kapoor and Shiza, 2010; Langdon, 2009; Sillitoe, 2007), which emphasizes the context specificity of Indigenous knowledge by situating it in the community’s long term occupancy of a place. The researchers’ definition includes traditional norms and social values of communities as well as mental constructs that guide, organize, and regulate the people’s way of living and making sense of their world. In extending the debate, Abdi et al. (2006) strengthened the definition by asserting that:

Indigenous knowledge is a way of knowing developed by Indigenous peoples over generations as a result of sustained occupation of, or attachment to, a place, location, or space. The result of [this] generational experience allows communities to develop a good understanding of the relationship of their communities to their surrounding natural and social environments. (p. 54)

According to other participants, Indigenous science refers to a human being’s use of materials from the environment with the belief that they work, based on historical experimentation. These may include the mixing of herbal medicines, spiritual power in healing, study of stars and their meanings, circumcision, treatment of diseases, superstition in some cases, and heredity issues, as
shown by clan formations. Slightly deviating from this articulation, Nakato added the educational component. She declared that:

Indigenous science is a practice by a group of people who have got their particular lifestyle, the way they deal with issues, handle certain situations, and have belief that it work. They pass these practices from one generation to another. The process of passing these practices from one generation to another is called Indigenous science education.

In linking the participants’ understanding of Indigenous science to other scholars’ orientations in the literature (Abdi et al., 2006; Dei et al., 2008; Orlove et al., 2009), it can be argued broadly as a form of Indigenous knowledge that is locally based, rooted in the local cultures, and generally associated with long settled communities having strong ties to their natural environment. Such communities have devised Indigenous education as a mechanism of imparting their knowledge from one generation to another. The imparting of the knowledge is done through oral traditions where learners critically listen and partake in educational activities (see Makokha, Kabaji, & Dipio, 2011). To adopt a functionalist standpoint in which orality is the foundation of knowledge production, validation, storage, and transmission for the stability of the entire society, the fluidity (flexibility) of such knowledge must be affirmed. In African traditional society, every system/sub-system of society functions interdependently to ensure the stability and social order of the entire society. Among the Acholi people, for example, knowledge was for training younger generations to be responsible citizens; responsible citizens ensured continuity of peaceful society; peaceful society provided safe space for reproduction and sustainability of the human race, animals, and plants (environment); in peaceful society, the younger generation cared for and also buried the elderly at death; the elders continuously imparted knowledge. In sum, if the cyclical order of interdependence is well aligned, stability, social cohesion, sustainability, harmony will be achieved, maintained, and promoted. In the event that any of the systems/sub-
systems’ interdependence is interrupted, society must find out where the interruption occurred and address it accordingly to prevent serious consequences.

From the above diverse responses, it is clear that participants approaches to the way they viewed Indigenous science. But despite this diversity, there was a strong emphasis on AIS as locally derived by the people who use this knowledge. Participants’ articulation of Indigenous science implied that this knowledge is typical and belongs/applies to a specific context. Consumers of the knowledge have a common cultural identity, social ties, histories, spirituality, and economic interests, and engage this knowledge for their wellbeing and environmental sustainability. The science is sustained through traditional education as pointed out by participants, and the education milieu varies from family, clan, community, and cultural groupings. Evidently, the understanding of Indigenous science does not depart from that of the broader Indigenous knowledge as articulated in the literature review (Abdi et al., 2006; Castellano, 2000; Dei et al., 2008; Odora, 2002; Orlove et al., 2009; Wane, 2000). Conclusively, participants’ articulation of AIS demonstrated the richness and thickness of the broader Indigenous knowledge (IK). From the different strands engaged throughout the interviews, IK remains a central pillar of African society that guides the community’s daily activities. The oral nature of its transmission accounts for the malleability of the knowledge in different environmental settings.

With critical dissections of this knowledge, participants presented varying views on its status in the formal education system. Most participants agreed that there are very few aspects of Indigenous science in the curriculum. They argued that even the few aspects exist in mediocre form. They acknowledged that Eurocentric focused content dominates the curriculum with very limited room for Indigenous knowledge. Some participants were able to identify elements of
Indigenous science being taught at the elementary level but were quick to argue that it is not being labelled as such. They cited the use of cow dung in smearing classroom floors, herbal/medicinal practices, personal hygiene, and use of songs, stories, and riddles to impart scientific knowledge to children. These are elements of AIS being taught in elementary education but there is no formal label assigned to them. With much focus on Western science, which sometimes does not resonate with students’ lived experiences, participants noted that Uganda’s education curriculum has made learning very complex because students are not given time to conceptualize and relate what they study in class to their local contexts. Students therefore memorize and recite concepts to pass examinations.

In a similar tone, some professors who responded to this question acknowledged that though no provisions are formally made for AIS in the curriculum, there are times when they consult with Indigenous communities on their medicinal practices. An example was given by Dina from the department of biomedical lab technology. She stated that sometimes they collaborate with the local community herbalists to identify and treat infectious diseases. In some cases, the local herbalists lack common names for specific worms or bacterial infections although they may have remedies. The names may vary from one herbalist to another, but the interesting thing is the commonality in terms of the herbs used for treating symptoms. She stated that:

We take samples of the herbs, run laboratories tests on them to determine their effectiveness and once proven positive for treating the worms/bacterial infection, we teach our students this therapeutic approach alongside the mainstream method. The reason why we first verify through laboratory tests is because: with herbal medicines, it’s difficult to determine their authenticity based on word of mouth. This is because most herbal medicinal practitioners claim to treat every sickness and some are quack practitioners who are out there to falsely extort money from unsuspecting patients.
However, the participant was quick to note that the practice is not formally specified in the curriculum. So Indigenous science exists in small dosage but is not laid down in the curriculum with pedagogical guidelines for its implementation as is Western science.

The above views, however, were not supported by Birungi, a graduate student in the department of agriculture. She argued that it is not easy to tell whether or not there are elements of AIS in the curriculum. Her argument was that the curriculum is packaged in a way that makes it appear like it is loaded with only Western knowledge. Even if there are elements of traditional science, the professors try to model them to appear modern, hence losing their originality. That is, they try to modernize traditional knowledge to make it appear different. The participant illustrated her point with an example, thus:

In agriculture, a professor would talk about the process of millet cultivation beginning from stage one to the last when it’s harvested and stored. Clearly, as someone who grew up in the village (upcountry) observing my parents, who did not acquire formal education, cultivate millet, I failed to see much discrepancy in the professor’s descriptions of the process during the formal lessons with the process that my parents used informally. The slight difference is that the professor used complex botanical names, added the ingredients of fertilizers for quick yield, talked about the use of heavy machinery for large productivity, and above all, failed to credit traditional modes of production.

Tying this to the literature, this participant’s view is in line with Corsiglia and Snively’s (2000) point of view. They argued that traditional ecological knowledge is being used by scientists to solve important biological and ecological problems. Then, because problems of sustainability are prevalent and of very high interest to students and others, educators are left with no option but to introduce students to the perspectives of both Western modern science and traditional ecological knowledge. Birungi added that at Lapani University, Indigenous science is being introduced into the faculty of pharmacology but it is still insignificant since the courses have not yet attracted much attention.
To substantiate the above claims, Michael, from the department of pharmacology, said that this knowledge has not been adopted in educational structures insofar as policies are concerned. He argued:

In the teaching field, we do not have a provision or guideline that specifies incorporating Indigenous science into the modern curriculum. However, in the field of pharmacology, we borrow what the Indigenous people use in managing certain ailments to teach our students although this is not laid down in the curriculum and text books that we use. We call it alternative medicine.

In agreement, Barnes (2005) argues that pedagogical decision making is complex in regard to Indigenous knowledge. Many challenges confront the teachers attempting to share Indigenous knowledge in the classroom due to a mandated curriculum that does not provide for Indigenous content. In terms of language, Michael, Peter, and Birungi believe that the adoption of Indigenous languages at the primary (elementary) school level by the Ministry of Education is a positive step toward indigenization of the curriculum to mirror the needs and aspirations of the local people. Birungi argued that it took Uganda over four decades to realize that emphasizing solely the colonial language was a disservice to learners. According to her, the introduction of the thematic curriculum is a good departure from the colonial education system. In a similar tone, former Education Minister, Hon. Namirembe Bitamazire (2006) decried the failure by a high proportion of Ugandan children to attain acceptable levels of proficiency in reading and writing at Primary Three (3) level. Bitamazire (2006) asserted that:

Sector-wide reflection on this phenomenon has led to identification of challenges which need urgent attention to make schooling more beneficial to the children. The Ministry commissioned a study which carried out a situational analysis which showed that one of the factors causing poor learner performance in literacy, numeracy, and life skills was the structure of the Primary School Curriculum. The Curriculum’s emphasis on the acquisition of facts in various subjects at Primary Schools influenced teaching to focus mainly on recall and other low order cognitive skills. This orientation was further reinforced by learner assessment techniques that aimed at grading learners rather than discovering variety in talents to be nurtured and weaknesses to be remedied. (p. 4)
Linking the education minister’s remarks to the literature, Ajeyalemi (1990) expressed frustration with the teaching of science in Africa. According to him, teaching/learning at all levels of education is neither practical nor appropriate. The theoretical approach is further reinforced by the emphasis it receives in the national examinations, which encourage rote learning. In Uganda, the aim of the thematic curriculum is said to improve the quality of education. Specifically, it increases the achievement levels of students in literacy, numeracy, and life skills. The new curriculum stipulates that wherever possible, the child should learn in the home language or at least in a language that is familiar to the child. It is based on the conviction that higher achievement levels are reached in literacy when children study in a language in which they already have a strong oral command.

Under the thematic curriculum, therefore, all learning materials used in the first three years of primary education will be provided in the child’s own language or in a language familiar to the child. In addition, all written tests that are used for assessment purposes will be administered in the local language except for the assessment of English language competence. The policy also takes into consideration schools in which there is no predominant local language or area language, and recommends English as the official language of instruction for all grades in such schools (National Curriculum Development Centre, 2006a). Because the introduction of local language is also geared toward the teaching of modern science with very limited aspects of Indigenous science, some participants think this will not be very beneficial to the learners. According to respondents with such views, curriculum reform needs to focus on content and not merely the language being used to deliver the content. In fact, a participant named Amwine challenged me to also carry out this type of research at the elementary school level and make recommendations for the integration of Indigenous science right from elementary through
secondary education to the university level. According to him, policy reforms within the context of African society can only be effective if tackled from a bottom to top approach rather than top to bottom, which is resonant with the same colonial approach that my research seeks to rupture.

Another participant, Sarah, acknowledged that Indigenous communities possess robust engineering skills that need modification for integration into the curriculum of higher education. To improve on the local science of the community, she cited an example in which the department of engineering is partnering with local people to identify some of their engineering skills such as the use of cooking stoves and how to modify them to be user friendly. She asserted:

There is a myth among local people that when you eat food cooked from the cooking pots and three stones fire place, the food tastes better than food cooked on gas or electricity (modern engineering). So as professors of engineering, we try to improve this cooking style of the community to make it user friendly. We improve it to reduce the quantity of carbon monoxide that users inhale from the smoke to reduce the risk of diseases. It’s not easy to change people’s perspectives on using the three stones fire place for cooking.

The above participant expressed concern that the traditional cooking stoves release too much carbon monoxide, which is responsible for numerous sicknesses when inhaled. According to her, studies have indicated that carbon monoxide, in the long run, can be very fatal. It causes heart problems, organs malfunction, cognitive problems—specifically memory loss, brain damage, and several other fatal medical problems.

Sarah noted that many deaths in Uganda are associated with this problem and that is why her department is working with the locals to improve on their traditional engineering skill of stove making. The aim is to have it emit the lowest carbon monoxide levels possible to reduce people’s risk of acquiring and spreading diseases. They do this through making manual ovens. These types of oven are cemented all over and one can use fire woods with a chimney built to take the smoke out. They educate people to these ovens through community groups and go on the radio to raise awareness. Undoubtedly, people’s perspectives are not easy to change due to
the influence of modern science and formal education. However, as articulated by Sarah, it is most effective to improve what is already in existence through integration with what is new (modern science). The idea of manual stoves is being embraced by many rural households across the country. In northern Uganda, during the course of conducting this study, I witnessed the local engineering skill of making mud stoves thriving. The mud stoves’ only difference from manual stoves is that they are made purely of thick mud while the manual ones are built using cement. Users told me that the mud stoves are not only easy and cheap to make, but they also absorb heat for a long time; this leads to reduced use of fire woods, hence saving trees. In terms of comparative advantage, both stoves have a chimney that takes the smoke out of the house. Both are also easy to make and environmentally friendly.

Consequently, the integration of modern and traditional engineering skills for the local communities and education system is necessary to promote environmental sustainability and community health. Some scholars (Abdi et al., 2006; Kagoda, 2009; Yashon, 1996) have noted that, in the face of entrenched hegemonic relations and global economic and ecological threat, knowledge is relevant only if it strengthens people’s capacity to live well. Strengthening people’s capacity to be self-reliant involves analyzing and discussing priority areas in which knowledge integration is more beneficial to the local context. This has more advantage than reliance on imposed models and approaches that are designed for different contexts such as highly industrial societies with different historical, social, and ecological conditions. For the Indigenous people, the Western dominant knowledge system is incomplete and hegemonic in nature hence the need for having multiple knowledges. Much as participants pointed out that the place of Indigenous science is not formally articulated in the Uganda’s education curriculum, they generally acknowledged that the knowledge is being informally practiced in elementary schools, high
schools, tertiary institutions, and universities, either consciously or unconsciously. Listening to the participants’ articulation of AIS, I could not help but wonder how the community lost such valuable knowledge. However, participants provided some answers to this amputation of Indigenous science. The section below examines the extensive influence of organized religion such as Christianity on AIS. The role of religion has undoubtedly painted a dark cloud over AIS as expressed by participants.

6.3. Influence of Organized Religion on AIS

The influence of organized religion on Indigenous science was a key theme identified under the social factors for low perceptions/attitudes toward traditional science. Although this view was not directly shared by all participants, the revelation from the literature suggests harmony. For instance, few respondents identified the existence of good will regarding Indigenous knowledge by politicians. This good will, however, is argued to be endangered due to lack of commitment from policymakers for which religion plays a role. While many participants criticized organized religion, the line between religion and policymaking process is blurry. For the context of Uganda, many religious leaders sit on key educational policy making committees. It thus becomes difficult to objectively make a conclusive argument that conflict of interest can be entirely avoided in the decision making process. In espousing the role of religion in denigrating traditional knowledge, Musinda stated that:

When you look at the major players in undermining African Indigenous Science, religion is at the forefront. For example, the Pentecostal churches continuously preach against African cultural practice calling it satanic and saying that it cannot take believers to the kingdom of heaven. For any serious debate about knowledge integration, these religious leaders must be involved. Otherwise, their masses may not embrace the debate about Indigenous science integration. For example, the Pentecostal Churches have openly supported the use of condoms as a strategy to combat HIV/AIDS hence promoting government prevention strategies against the pandemic. But other conservatives like the
Roman Catholics church do not support the use of condoms and emphasize only abstinence and faithfulness as a way of combatting HIV. Because of this, the use of condoms receives mix reactions among the youth of these religious affiliations. This is the same for African Indigenous Science. For it to be embraced by a wider section of the population, we need to involve religious leaders.

According to the literature, prior to the government takeover of formal schooling management, education was highly denominational (Adyanga, 2011; Goldthorpe, 1965; McGregor, 1967; Macpherson, 1964). Each Christian religious sect (i.e., Roman Catholic and Protestant Church) managed their own school system and determined policy such as curricula for learners. Denominational manning of formal education, as discussed in chapter two, ensured that traditional knowledge was historically excluded from the curriculum. In the present era, religious bodies, especially Christianity still have a strong influence on the education system despite the secularization of public schools. Christian religious holidays are given unprecedented attention; for most schools, Christian Religious Education (CRE) is planted in the curricula of public schools as a major subject. Therefore, a critical examination of the historical foundation of formal education and its trends up until the present era objectively harmonizes participants’ perspectives with the literature.

Other participants proclaimed that, alongside the religious factor, Indigenous science output is low and therefore not sufficient for the growing population. If it is to be adopted for use in the school system, then there is a need to modify it for increased productivity. This may involve addressing some positive genuine critiques being raised by religious bodies against such knowledge. In addition, some participants attributed students’ low perceptions of Indigenous science to public opinion and university graduates’ expectations. In extending this line of thinking, Peter posited that even if AIS was formally in the curriculum, students would hesitate to enrol for it because, “you will be viewed as someone who settled for the lowest in life if you
embrace this common science knowledge because society expects graduates from formal schooling to demonstrate modern knowledge.” Interestingly, although the above were given as reasons for devaluing Indigenous science by some sections of the population, most participants believed that the education system can reap significant benefits from the integration of this knowledge.

Further, religion was recurrently mentioned by participants when articulating the elements of Indigenous science for integration into the formal education curriculum. Although participants responded passionately, they expressed concern that integrating such elements would be challenging, given the influence of religion that undermines traditional knowledge. Undermining Indigenous knowledge by organized religion and education system prompted participants to identify elements of AIS such as entomology, Indigenous alcohol distillation process, African Indigenous medicines, for integration into traditional education as discussed in the section below.

6.4. Elements of AIS Identified by Participants for Integration into Formal Education

Participants gave many examples of traditional science practices. JPK identified Indigenous entomology as a unique element of traditional science that learners must be taught. He argued that Indigenous entomology is a complex process of bee keeping and harvesting whereby the natural environment is entirely relied upon for the provision of bee hives and the protection of the bees’ colonies. The process of harvesting the honey is scientific and social in nature. The honey harvester has to tame the bees naturally without the use of chemicals to sedate them. In comparison with modern entomology processes, JPK argued that:

With the advent of modern science, we teach our students how to use chemicals to sedate bees before one can harvest the honey. However, the use of chemicals sometimes has
adverse effects. It reduces the quality of the honey because the bees directly inhale the chemicals, hence passing them into the honey.

The above participant castigated the modern process of honey storage where chemicals that are mixed with the honey neutralize the organic components in the honey. He therefore called for Indigenous entomology to be introduced in the curriculum for learners to appreciate both the modern and traditional approaches. According to him, the African system of honey storage is known to last for over ten years before the honey can go bad. This is because organic honey has strong antimicrobial compounds that enable it to prevent any bacterial infection when properly sealed in clay pots or gourds. Reflecting on my personal experience as a researcher, I have observed women in northern Uganda practicing this system of honey and shear butter storage. They store honey and shear butter for years, and when the seals are broken and clay pots or gourds opened, the content is fresh. The suggestion offered by participants for this element of AIS to be integrated therefore embraces the positive values of local knowledge with complete negation of the stereotypical demeaning attitude that formal education and religion have expressed against traditional knowledge.

JPK, Mawanda, Birungi, Nabirye, and Fred identified the Indigenous alcohol distillation process, a pragmatic chemistry, as an important element for integration. They posited that the drinks produced are healthy, with no ethanol that destroys human cells. Fred identified the kwete alcoholic distillation process among the Luo people of Uganda, Kenya, and Sudan as a perfect example of a locally distilled drink that is mild and nutritious. Contrasting it with the modern alcohol drinks that most youth prefer in the present era, these participants argued that post-mortem (autopsy) results for several deaths in the community have been linked to excessive consumption of alcoholic substances such as vodka, whiskey, spirits, wine, and Uganda waragi (Uganda’s brand of whiskey). This, they argued, is known not only to have a very high alcoholic
percentage but also considerable content of ethanol. Although the claims by participants cannot be independently verified, they corroborate with the massive campaigns by the health ministry against excessive consumption of alcoholic beverages and resultant health implications.

In agreement with the participants, I remember that because of the adverse effects of some alcoholic drinks, towns like the Pader district had in 2004 banned the importation of Lira-Lira brew (equivalent of whiskey) into the district. Many young people were dying from the consumption of this industrial alcoholic product. Because of its high concentration of alcoholic content and ethanol, JPK pointed out that many young boys consuming such drinks become impotent, which poses a serious threat to population growth. On this basis, this study’s participants think that the integration of the Indigenous alcohol production process into the curriculum will promote the consumption of local brew, broaden its markets, and subsequently reduce the use of the fatal industrial alcohol substances that are dominant in the local markets.

About 80% of participants said that African Indigenous medicines should be given unprecedented attention because its effectiveness has been proven beyond reasonable doubt. But they were quick to add that, besides being castigated by religious teachings, traditional herbal practices need to make some improvements especially when it comes to preservations, packaging. They also posited that traditional medicines are very cheap and easily accessible by the local communities. With the current insufficiency of medicines in most government hospitals and health units in the country, as well as insufficient medical personnel to match the need, traditional medicines would play a valuable supplementary role. In agreement, Anyinam (1987) suggested that availability, accessibility, acceptability, and adaptability are the key attributes of African ethno-medicine that have ensured its persistence in contemporary African society. Eight participants (Namutebi, Mawanda, Fred, Birungi, Michael, Peter, JPK, and Nabirye) also argued
that the positive contributions of traditional medicine in Ugandan society need to be recognized by having it included in the school curriculum so that the practice is not lost. Its inclusion would contribute to ameliorating the problem of misappropriation of this native medicine knowledge as pointed out by Wane (2011). She suggested that one must understand and appreciate the beliefs, values, and socio-cultural components that are associated with traditional healing practices. This is because in many cases, aspects of Indigenous practices are appropriated without acknowledgement through written text or media, and in the process their authenticity is lost (Dei, 2009; Gupta, 2009; Sillitoe, 2009). Introducing Indigenous medicinal practices in the formal education curriculum will engender the learners to appreciate alternative healing and guard it from misappropriation. This postulation is supported by another participant, Nakato, who stated that Indigenous knowledge generally needs to be integrated into the curriculum of all stages of formal education in Uganda. According to her, the integration should begin from elementary to the university level of education.

From personal experience through my graduate educational journey in Canada, I have realized that professors/researchers are continually studying Indigenous medicines and designing undergraduate and graduate courses on its value to society. For instance, OISE offered a course: "Sociology of Indigenous and Alternative Approaches to Health and Healing Practices: Implications for Education" for the first time in 2011. The course attracted a large and diverse student population. Consequently, students from diverse cultural backgrounds are gaining interest in traditional medicines and beginning to understand it in comparison with medicinal practices from across the globe. In drawing cross herbal comparisons, there is an abiding call for good practices that emphasize social relations and a universal order in Native American herbal practices. The primary aim is the broader maintenance of balance and harmonious relations in a
community (Johnston, 2002), and not only in terms of community health. In African traditional society, likewise, the focus of medicinal practice is rooted in the whole notion of community health, social cohesion, and continuity of society, among others. All these are tied to the principle of the interdependence of systems as discussed earlier in the section.

The above view was substantiated by three participants: Musinda, Nabirye, and JPK. They posited that introducing courses on Indigenous medicine in the country’s curriculum is crucial not only to protecting this practice from extinction but also in drawing cross cultural comparisons of the different medicinal practices from other societies beyond the confines of our context. JPK expanded on the group’s view with an example. He argued:

> Among most African societies such as Baganda, Alur, Banyankole, Karimojong, Langi, Indigenous medicines is highly regarded for it sustain good health of the community. It also maintains good relations with the spiritual world through communal ritual practices aimed at preventing misfortune.

Drawing literature from different contexts, Wane (2008) concurred with this view when she articulated the depth of African Indigenous healing practices among the Kenyan communities. She stated:

> If there was sickness in the family, the rituals performed entailed looking at the individual, the family, and the community as well as the clan members. In order to make proper diagnoses of the disease, it was not enough to treat the visible symptoms, it was also necessary to look for the root cause. In most instances, the sickness could be traced to emotional disequilibrium caused by acts such as taking away a people’s land through uncustomary manner. The healing rituals that followed such acts were both educational and prayerful. (p. 192)

The validation of Indigenous African healing and medicinal practices by scholars in the present era illustrates the urgent need to unpack the false dichotomy between dominant and Indigenous knowledge. This calls for new conversations that focus on multiple knowledge systems. The breadth of Indigenous healing and medicinal practices demonstrate the bulk of multidisciplinary and multi-contextual science knowledge that Indigenous African societies possess. The aim as
pointed out by participants and the literature is prevention of ill-health through maintenance of balance with the physical and metaphysical world. A respondent, Michael, poignantly affirmed that:

Our forefathers in the traditional environment practiced Indigenous science and there was too much knowledge at their possession. They could predict season, treat diseases, train kids for the way of societal life. For the medical field, we could adopt ways of treating ailments. In the contemporary times, [modern] medicines are very expensive. So, alternative medicines, when adopted, would help our medical practitioners to recommend traditional medicines alongside modern ones.

Michael’s declaration connected the medicinal practices of ancient times with the present in a powerful way that situated the present knowledge of medicine with the medicinal practices of the forefathers. In essence, the respondent is arguing that Indigenous medicinal practice has sustained Indigenous societies for years before modern medicines existed, and therefore, we cannot simply dismiss it from the formal education curriculum. Discursively, the arguments presented by participants deconstruct the conventional and domineering colonial/neo-colonial worldviews that monopolize formal education system. The hybrid and sacred nature of herbal medicinal knowledge plays a crucial role in reaffirming the fluid identities and persistence of AIS in the present era, and reinvigorating debates for its validation as legitimate knowledge. The validation and inclusion of AIS, however, should not be misconstrued as an attempt to return to unpolluted pre-colonial societies (Semali & Kincheloe, 1999) in which African culture was intact. Rather, as pointed out by Semali and Kincheloe, the use of this knowledge as a basis for local problem solving strategies will always have to deal with the reality of colonization and the effect of economic globalization.

Participants also argued that the detrimental teachings of religions against traditional medicines should be mitigated. The multiple understandings and practices of medicine should be accommodated in the formal education system for traditional medicine to be more significant
and gain mass acceptance. In illustrating the significance of including traditional medicinal practices in the school system, Amwine drew upon the example of the Karimojong pastoral communities of north eastern Uganda that have rejected formal education because of their suspicions. He stated that:

These people have long shunned modern medicines with strong convictions that the medicines (especially immunization) were brought by the white people to make them barren/impotent so that with time, they would be extinct and their land and cattle taken away.

With this, Amwine argued that when learners from this pastoral community see their native medicinal practices taught in schools alongside Western medicines, they will be excited to embrace both practices. The absence of local knowledge in the lessons their children receive from formal education is a great source of suspicion that is never taken lightly by the Karimojong ethnic group. Applauding Amwine’s argument, JPK wondered, “How do you embrace something that vanquishes your own values and elevates values that are alien to your context?” These participants’ perspectives suggest that for formal education to be fully embraced by African society, the approach to its implementation should allow learners to use their histories, cultures, religion, spirituality, sociology, as a foundation to teaching and learning by adopting the Indigenous knowledge system in the curriculum. An Indigenously informed curriculum, according to Semali and Kincheloe (1999), enables educators and students to appreciate the significance of analyzing what they know, how they come to know it, why they believe or reject it, and how the credibility of their evidence is determined.

Participants identified the traditional birthing procedure (traditional birth attendants) as another important element of Indigenous health science that needs to be integrated into the education curriculum. Although the role of religion was not mentioned in this, a significant number of participants argued that practitioners of traditional birthing process are highly
respected by the communities in which they serve because of their invaluable services. The respect accorded them is also due in part to the scarcity of Western trained birth attendants.

Another participant, Sarah, stated that every sub county/village has traditional birth attendants who are known to the members of that community. Note that in Uganda, expectant women have the choice to either access the services of traditional birth attendants or see midwives in hospitals and health centers. To illustrate her point on the importance of having traditional birth attendants, Sarah pulled out a copy of the *New Vision* newspaper published in October 2010. The paper gave detailed narratives on why women in Mityana district have embraced the services of traditional birth attendants over midwives. The following is the report captured by the newspaper (government owned) in preparation for safe motherhood day celebration:

> Although the Government has established health centers across the country, many expectant mothers still prefer the services of traditional birth attendants. As we mark the Safe Motherhood Day today, Mityana women have a sad story to tell. Out of an old mud house, roofed with old iron sheets, Kevina Nakato, 70, emerges. A few minutes later, a woman comes out of the ramshackle house carrying her newborn baby. A few feet away is a similar house where Nakato’s twin sister, Deziranta Babirye, resides. These two women and their younger sister, Kotilda Nalugya, are traditional birth attendants. Their grandsons and granddaughters help them do the house chores. The three birth attendants did not go to school because their parents were poor. So their grandmother trained them to attend to expectant mothers in the 1950s. ‘Since then, attending to pregnant women has been our source of income,’ says Babirye. Surrounded by banana and coffee plantations, the two ‘maternity homes’ in Kiriga village, Butayunja Sub-county in Mityana District are the pride of many women. Commonly referred to as *zaliro* (equivalent of maternity home), hundreds of Mityana women flock to this place to have their babies. Inside the zaliro are three beds with tiny mattresses. The beds, which look 50 years old, were locally made using tree stems. The three attendants say they received some training in 1992. ‘Since then, we have never had a refresher course, but we try on our own to learn new things on our own. Worse still, government health workers do not recognise our role,’ Nakato laments. As I interview the three women, hundreds of villagers are gathering at the home for a village meeting. Top on their agenda is to find a way forward for their zaliro. ‘We get support from our visitors, some of whom were born in this house,’ says Nakato. Like modern midwives, these traditional attendants keep records. They have books where they write the names of the mothers they attend to. They also record the names of the children born here. However, Nalugya notes that they lost some records and
cannot ascertain the number of women they’ve attended to. ‘I cannot remember the exact year we started practising here, but some of these gray-haired people here and their children were born in this house,’ Nalugya says. As the meeting starts, parents narrate their experiences with the zaliro. ‘When my labour pains started, I came to the maternity home. The attendants gave me tea and after drinking it, they told me to walk around. Two hours later, I lay on the bed and had my baby. This was my first baby in 1984. Now I have over 10, all safely delivered here,’ Mary Nagoya of Kane village says.

The paper then went on to explain the reasons why women prefer the traditional birthing process at the expense of modern birthing facilities established by the government in many counties/sub counties. Clearly, the attitude and unprofessionalism of some modern midwives at the government health centers are factors for embracing the traditional birthing process within local communities. Although this was a serious concern for Sarah, she also considered it a blessing in disguise. She argued that the provision of health services in this country can be equated to doing competitive business where the best business person takes all the customers. If you do not offer quality services, clients/customers will seek alternatives, which is why traditional birth attendants in most rural communities in Uganda are popular. The newspaper continues:

In this meeting, women narrate the pain and suffering they undergo when they visit government health facilities in the area. They say whenever they go to Kitongo Health Centre, especially at night, they are not helped. Christine Nakawooya narrates how she endured the wrath of medical attendants when she took her baby for immunisation. They blamed her for delivering her baby with the help of traditional birth attendants. I successfully delivered 11 children in this zaliro, but whenever I took them for immunisation, the nurses blamed me. So with my last pregnancy, I went to the health unit. I got many complications and the nurses told me to go for a scan in Mityana because the baby was not lying in a good position. They said the baby was very big and I would have to deliver by caesarian section, she ignored the nurses’ advice and went back to the traditional attendants. ‘They checked me and confirmed that the baby was fine and I would deliver normally. When my labour pains started, I returned to the zaliro and had a normal delivery. Another mother narrates how she went to the health center at night and pleaded with the nurses to open for her in vain. A patient later opened the door and we got a bed. I attended to my daughter myself and she delivered normally. The following day, the nurses came and asked me to pay the bill.

The inadequate medical facilities in the country account for the preference of traditional or alternative healings by a wider section of people in Uganda (see also Anyinam, 1987).
Participants pointed this out in their articulation of elements of Indigenous science for inclusion in the education curriculum. Sarah amplified this point, saying that the provision of health services is a serious challenge in this country. There are several instances when the health workers blame local communities for seeking alternative healing or seeing untrained traditional birth attendants; however, these people have no options available to them. In fact, Sarah’s statement is corroborated by the same newspaper article about the inadequate health facilities in Butayunja Sub-county/Mityana district of central Uganda. It says:

Kitongo-Ngandwe Health Centre is serving over 100,000 people from Butayunja Sub-county, but the unit has only four staff, of which two are midwives, another is a clinical officer, and the fourth a nurse. My Saturday visit to the centre is fruitless as I find no medical worker there. After waiting for hours, a passerby tells me it is a weekend and I will not see any staff. I insist and return on Sunday, but it is the same story. On Monday, I arrive at the unit at 10:30am and find two people in the waiting room, which also serves as the immunisation room. One of them is waiting for antenatal services and the other, a student, is revising his books. He advises me to look for the nurses in their quarters, but luckily, a midwife arrives. She says only two women deliver their babies at the centre in a week. Most women go to traditional birth attendants, she says. “This is bad and it demoralises. Sometimes, a woman comes with labour pains. We tell her the time she will deliver, then she runs out, saying she is going to pick up items like the baby’s clothes. The following day you see her passing by with a baby she delivered at a traditional birth attendant’s place,” she laments, adding, “I do not know why they go there. Here we do not charge them, but the traditional attendants charge them shs 20,000 [about $ 10.00 US].”

The implication of this for my study is that, the newspaper reporter describes a sharp contrast with what transpires at the local traditional birth attendants’ maternity home in comparison with the health center. It appears that expectant mothers enjoy a cordial patient to traditional birth attendant relationship. They also have an enormous level of experience with the birthing process. This is cultivated through several antenatal visits to the maternity home with regular checkups monitoring the foetus’s position as noted by the newspaper:

A traditional birth attendant in Mityana, Kotilda Nalugya, says she gives herbs to expectant mothers in the first few weeks of the pregnancy. ‘We give them herbs, which they mix in water and bathe daily. We also have herbs for drinking,’ Naluggya explains. In the fifth month of the pregnancy, she changes the dosage. She gives them emmumbwa
(herbs made of clay), which they mix in water and drink for two months. ‘In the meantime, we keep on checking on the status of the child,’ she adds. They can tell the size and the position of the baby. They don’t need a scan to tell that a woman is expecting twins. In the seventh month, they can judge whether a woman can have a normal delivery or a caesarian section birth. Nalugya says the last dose makes the mother’s body flexible enough to guarantee a normal delivery. The last hour of labour pains is always a critical time for both the mother and the attendant, Nalugya says. When a pregnant woman arrives at her maternity home in Mityana, Nalugya can tell how long her labour process will last. ‘We give her a cup of tea without sugar in order to warm up the body as we prepare her bed, cotton and gloves.’ After a successful delivery, the baby has to be immunised. But some women are skipping this critical exercise, which is only done in health centres. ‘When you take the baby for immunisation at the health centre, nurses ask you where you delivered from. If you gave birth from the zaliro (traditional maternity home), they will only attend to you after insulting you,’ says one mother.

Sarah therefore suggested that the education system needs to integrate the training of traditional birth attendants into the education curriculum so that trained midwives will appreciate and work collaboratively with the traditional midwives to promote community health. This integration will also help in achieving the government’s developing plan to make health care services accessible to all Ugandan citizens. It will also play an archival role so that the practice is not lost as modern scientific innovations take course. This would address the present state of the education system in Uganda in which the curriculum is still reflective of the colonial type that belittles African scientific knowledge.

The traditional family planning method was identified by participants as an important element of African Indigenous Science to be integrated into the school curriculum. Although the method of family planning varied from one Ugandan community to another, participants argued that studies need to be conducted for the identification of commonalities that would be modified and taught to learners. The use of herbal medicines and abstinence were very important methods that many participants mentioned as examples of the traditional family planning method. For example, among the Acholi and Langi people, mothers took the responsibility for teaching the daughters at the puberty stage of the right time to engage in sexual activity as well as how to
manage their sexuality. Boys who had reached the puberty stage were taken through sex education by their fathers and/or uncles. Giving the example of the Karimojong pastoral community, JPK posited that most of them live in rural areas, have not been influenced by the modern family planning method, and yet have managed to control the population growth to match the available resources. He argued that “these people have established wisdom rooted in traditional customs related to marriage, sex education, and childbirth.” A UNICEF (2004) report recognized that when Indigenous knowledge is made visible in the science curriculum, students’ participation takes a special dimension in the area of education. It brings students’ school experiences closer to their home lives and gives them the opportunity to develop their talents and abilities to their full potential, gain confidence and self-esteem, use their initiative and creativity, gain life skills and make informed decisions, understand and experience pluralism and democratic coexistence.

In the same vein, another participant named Albert identified marriage education as an important element of Indigenous science that the education system cannot afford to leave out. His argument was that:

It used to be a curse for kids to marry before the right age because there was marriage education. There is sex education today but marriage education, which is part of African Indigenous Science, isn’t in the curriculum and should be introduced. For example, the sengas and kojas (aunties and uncles) in Buganda were specialists in imparting marriage education.

Marriage education, Albert continued, also controls not only sexually transmitted infections but population growth as well. Given the fact that we have scarce resources to match the growing demand of the population, marriage education regulates the population growth rate to reduce excessive pressure on natural resources.
Two participants, Birungi and RDC, identified circumcision as an element of Indigenous surgical science that needs to be integrated into the curriculum. They argued that circumcision, initially castigated as a barbaric practice by most sections of Ugandans and foreigners, is now being embraced because research has shown that it greatly reduces the risk of acquiring STDs. In covenant with participants’ hypotheses, The New York Times (2011) revealed that male circumcision appears to help protect sexual partners against cervical cancer. As stated earlier in this thesis, a landmark study of 1,200 heterosexual couples in Uganda involving circumcision and AIDS revealed that having a circumcised partner reduced a woman’s risk of catching human papillomaviruses by about 25 percent. The viruses lead to genital warts and cervical cancer. With the validation of circumcision by modern scientists, massive campaigns have been launched by Uganda’s government for every male child, youth, and adult to be circumcised as a strategy to reduce HIV/AIDS and other sexually transmitted diseases. This campaign has witnessed millions of male adults, youth, and children flocking to designated hospitals throughout the country for free circumcisions.

Since circumcision has been validated by modern scientists, its formal integration into the education curriculum should follow suit and not just be subjected to rhetorical debate as if this aspect of AIS is not important to African people. In pointing to the importance of African surgery skills, Sertima (1983) as stated in the literature review chapter argued that surgery was a significant area in which African doctors attained a level of skill comparable with, and in some respect superior to, that of Western surgeons up to the 20th century. The male circumcision practiced by the Bagishu of Eastern Uganda needs to be carefully improved and integrated into the education curriculum so that other Ugandans may embrace and adopt the practice. Learners also need to be taught the benefits of circumcision and why they should embrace it.
Wane (2000) stated that, among Embu elderly women of eastern Kenya, circumcision was identified as bearing not only scientific but also social reputation with strong historical significance and educational purpose. Drawing from Kenyatta, Wane expressed the social importance that most African communities attach to male circumcision, an element of Indigenous science that my research participants identified for inclusion in the education curriculum.

Circumcision as a rite of passage cannot be discussed intelligently unless we understand the emotional attitudes of those for and against this practice... The rite has enormous educational, social, moral, and religious implications that are quite far removed from the operation itself (Kenyatta, 1965, as cited in Wane, 2000, p. 59).

Indigenous ecological knowledge is important in conserving our ecosystem. Participants identified several Indigenous environmental practices aimed at preserving the soils, plants and animals for future generations. Some of the identified traditional ecological aspects include controlled clearance and burning of vegetation for agriculture, establishment of settlements away from swampy areas, rotational farming, controlled/coordinated hunting, and fishing. Regarding controlled hunting and fishing, Peter argued that this was an innovative method to ensure that the animals in a given hunting grounds are not depleted. He pointed out that:

Our people used to have gazetted hunting grounds. When the population of the gazetted grounds dropped down, the hunters would abandon such areas for a long period of time to allow the animals to reproduce and multiply. This was also true with fishing. With the fishing communities, nets/fishing baskets for trapping fish were designed in such a way that small fish would not easily be trapped. Besides, if small fish were caught, it was a common habit to cast them back into the water.

Michael and Namutebi identified the Indigenous skills of maintaining soil fertility and water levels. They presented closely related lines of argument that traditional Ugandan society had knowledge of plants that were very instrumental in enriching soil fertility, and such plants were carefully guarded. Michael cited examples of groundnuts and simsim/sesame (leguminous
plants) mostly grown in the greater northern Uganda region as crops used to enhance soil fertility. Such crops, he argued, “have legumes that inject nutrients to regenerate fertility of the soil and they are also excellent source of proteins to mankind.” Soil fertility enhancement among Indigenous people also involved the use of cow dung, chicken manures, goat waste, and coffee husks. These manures have been very effective in improving soil productivity, crop and plant yields. Drawing from participants’ perspectives, therefore, integrating these traditional soil conservation techniques in education curriculum will enable students to draw a comparative analysis of traditional soil conservation with the modern methods currently dominant in the education system.

Food storage to improve food security was also identified by participants as an element of Indigenous science that should be integrated into the education curriculum. The African people have instrumental ways of managing pests and conserving water to improve sanitation and provide safe drinking water for the community. Maggie cited the example of the Buganda region where Indigenous communities preserve foods using locally-made pesticides such as banana juice, red pepper, and lemon leaves to control varieties of pests such as maize and bean weevils in storage facilities like granaries. She argued that even in the present era when modern storage devices such as refrigerators exist, most Ugandans still use traditional storage devices like granaries, clay pots, and wooden storage, store houses, because of the exorbitant cost of acquiring and maintaining refrigerators. In a recent study conducted in the Masaka district of central Uganda, Lugangwa et al. (2008) reported similar findings that reinforce participants’ views in this study:

The use of local knowledge in enhancing food security and improved agricultural productivity is increasingly becoming important in the sub-county, Masaka district. Many households do mulch their crops using local materials and use locally concocted pesticides to control pests both in the field and in the storehouse. The use of locally made
mortars and pestles pound and curved large stones to grind foods like groundnuts is popular. Some households have developed a technique of burying certain foods like fresh cassava tubers in moistened soil to increase its storage life. (p. 70)

However, these Indigenous food storage and food security technologies are not well documented due to the oral nature of African ways of knowledge production, validation, and dissemination; hence, they risk being lost with many members of the younger generation shunning them in the present age. Formal integration of this knowledge into the education curriculum as suggested by participants is thus an entry point for these practices not only to gain appreciation and acknowledgement through publications, but also through their preservation. In a closely related study conducted in Kenya, Owuor (2007) considered integration of Indigenous knowledge into the formal education system as recognition of the power of the role of both the individual and collective agency of change found in the potential of using multiple forms of knowledge in solving contemporary community problems.

Traditional agriculture is another element of Indigenous science that participants said should be integrated into the schooling system. Specifically, participants identified intercropping as a unique African agricultural practice that improves yields while maintaining soil fertility levels. Essentially, intercropping is the practice of growing two or more crops in the same garden and at the same time. This is done with the aim that when it comes to cultivation, there will be double or triple yields from the same garden.

According to Ondua, Mawanda, and Fred, the aim of intercropping is to ensure that when one crop failed, the other would give a good yield to the farmer, or both crops would give double yield for food security. Intercropping has been/is being practiced throughout Uganda. The crop mixing varies from one ethnic group/geographical region to another. For instance, crops that are commonly mixed includes beans with bananas, sorghum with millet, beans with potatoes,
pumpkin with beans and maize, red pepper with okra, tomatoes, and cowpeas to enhance yield and maintain soil fertility. In amplifying the significance of intercropping, Peter posited that the practice not only improves crops’ yield and soil fertility, but Indigenous farmers also use it as a pest control method. For example, red pepper is believed to produce an odor that keeps pests off of beans and other crops; indeed, due to its antibacterial/antifungal chemical component, people use red pepper juice for prolonging storage of cereals. Integration of traditional agricultural science into the education curriculum is a step closely linked to the African developmental needs of the majority of the people, and in the words of Shizha (2012), meant to exclude commercial enterprise that dehumanizes learning experiences.

Although participants overwhelmingly identified elements of this knowledge for integration, they were conscious that the integration process would be hampered by mixed perceptions toward the knowledge. Asked about professors’ perceptions, Michael responded that being a professor means having specialized skills and exposure which may then influence perceptions. He argued that:

Professors have various perceptions depending on their areas of specialization and also, their knowledge and religious orientation. The attitudes and perceptions depend on exposure. Those who are exposed to it feel that it’s of help to the Indigenous communities. Those who are not exposed to it still associate it with witch craft. It also depends on their areas of specialization. Those who specialize in natural products like chemistry seem to have more attachment to Indigenous medicines because they are safe and easy to acquire. They have been used over time without any serious negative effects. For the professors who are not specialized in that area, they tend to have low perceptions. In the department of pharmacology, college of health science, most of the professors focused their research on traditional/alternative medicines.

However, RDC thought that most professors generally have poor attitudes and perceptions toward Indigenous science. He posited that the poor attitude explains why it is not included in the school curriculum. According to JPK and Nabirye, these low perceptions are caused by the professors’ education foundation—formal education that disparages African traditional
knowledge. The trio—Nabirye, RDC, and JPK—therefore argued that more work needs to be done to improve the condition of educational institutions in Uganda by establishing centers of distinction with a principal focus on harnessing Indigenous knowledge.

In linking the conversation about perceptions to the community, Michael argued that “people’s thoughts are shifting toward traditional medicines because of the challenges with modern medicines. The college of medicine and pharmacology is exploring hybridization of traditional medicines with modern medicines to meet the challenges of some diseases that are developing immunity to modern medicines.” According to Shizha (2007) and Wane (2011), hybridization of knowledge has the potential to reduce or deconstruct old prejudices and foster positive attitudes toward the multidimensional and multicultural world of science. It has the potential to give both teachers and students an enriched understanding of science (Indigenous knowledge) and its role in promoting sustainable communities through the valuing of such benefits as Indigenous health practices, environmental protection, and cultivation of medicinal herbs, among others.

Six participants (30%) out of the 20 thought that perceptions of Indigenous science among students and professors were poor. They argued that this is due to many factors such as marketability issues, stereotypical labels attached to it (e.g., primitive practices, witchcraft), rooted in myths and superstitions. However, the six participants (Fred, Kigundu, RDC, Peter, JPK and Birungi) stated that although other people undermine this knowledge, it is valuable to society and to the education system. In sharp contrast, participants like Maggie think that if it was anything of value, there is no way the Ministry of Education and Sports would exclude it from formal education. Maggie further said that Indigenous science was once useful to society prior to the introduction of formal education. She wondered what would make learners relapse to
the “old fashioned” knowledge system since there is new and complex knowledge being produced through formal education.

However, scholars who are strong proponents of Indigenous knowledge strongly disagree with this study participant’s view. They argue that Indigenous knowledge is a decolonizing project to challenge the colonial hegemonic and patronizing nature of Eurocentric knowledge base (Dei, 2009; Kincheloe & Steinberg 2008; Mosha, 2000; Wane, 2003) that has dominated the colonized society and education system. According to these scholars, such knowledge is not claimed necessarily as a reaction to Western dominance. Rather, it is meant to challenge the epistemic selfishness by which some western scholars ascribe stereotypical status to Indigenous knowledge. To understand and respond to some of the participant’s devaluation of Indigenous science requires critical appreciation of the intellectual arrogance of some Indigenous scholars who are ideologically rooted in dominant linear views of the world that undermine other knowledge systems as valueless.

Another participant, Dina, said that students have low opinions of Indigenous science because of the kind of knowledge/teachings they are exposed to from childhood. This is exacerbated by the media and religion that play a detrimental role insofar as Indigenous science and its transfer to the younger generation is concerned. Students prefer to adopt the Western lifestyle and education because of the negative portrayal and placement of traditional science at the lowest level of knowledge production. In addition, very few laboratory studies have been conducted to prove the validity of Indigenous science. To respond to this, other participants who value Indigenous science called for parents to change their attitudes so that children get this qualifying knowledge right from the onset at home. This can be done through civic education, sensitization, and community meetings. In affirmation, Dina maintained that:
The ways of our ancestors are not bad as formal education and foreign religion have made us to believe. Even the Western education and religion that we embrace are ways of the ancestors of the Western world which they followed for many years before their grandchildren brought and imposed it on us.

Conclusively, Albert used three terms—originality, reality, and comfort—to describe positivity in perceptions and attitudes toward Indigenous science. His argument situated Indigenous science in antiquity. The knowledge provides meaning to life because it pre-existed and sustained all traditional societies prior to colonial disruption.

Through this knowledge, traditional society devised mechanisms that made life easy in their environment. Amplifying this fact, Albert also pointed out that “anybody’s identity is his/her originality; it’s more like an innate or an inborn mechanism that operates somebody. This is where somebody first gets his/her orientation to the world. This identity guides our discipline, it guides progress, and it guides morals.” Albert asserted that, for the students whose attitudes towards Indigenous science are unenthusiastic, there is likely to be significant change in attitude because of the trends in community health. His rationale was that people who live in urban centers with ease of access to modern science products such as processed foods and drinks suffer from many more sicknesses such as diabetes, cancer, high blood pressure than their counterparts who live in rural areas with limited access to these products. This situation indicates that there is likely to be a change of attitude in the long run. Furthermore, this claim is supported by a UN (2006) report which states that:

23% of all deaths in Africa are due to chronic disease…an estimated 28 million people will die in the next ten years due to these conditions. The major causes are linked to poverty, globalization, the adoption of Western dietary patterns, facilitated by advertising for the consumption of unhealthy foods. (p. 6)

For the requisite attitudinal change to materialize, however, educators and professors need to play a critical role in consciously sensitizing the community about the relevance of AIS.
To what extent do professors participate in curriculum design and what are the implications of their participation for AIS? The following theme will address this question by discussing the role of professors in curriculum design as articulated by the participants.

6.5. Dominance of Professors’ Foreign Experiences in Curriculum Design

Professors’ foreign education and experiences prevailing in curriculum design in higher education emerged as a key theme. Although this view was expressed by a few study participants, it is so relevant that one cannot simply ignore. To illustrate this point, Sarah stated that professors participate in curriculum design because they know what is best for their faculties, colleges, and the university. However, she expressed concern over the influence of foreign trained professors. She stated:

Professors participate in curriculum design/review. The other problem is that every professor brings their experiences of the courses they studied from foreign countries, especially Europe and America. If they find the foreign course/s missing in our country’s curriculum, they then bring it in the curriculum regardless of its relevance to the society. Those of us who acquired our education system in Uganda or other African countries do not challenge them since we believe that they are trying to diversify the curriculum. But this is not right because they do not bring any Indigenous courses to our land.

Expansively, growing bodies of literature suggest that African countries give much weight to academic credentials and skills from foreign countries (especially Western) over the local ones. In the economic development field, development ideas are engineered from foreign countries, imposed and accepted by African countries (see Tucker, 1999; Yash; 2008) without a comprehensive examination of their relevance. This is true in the education sector, where African scholars have argued that the curriculum content reflects the British and American (Ibikunle, 1990; Michael, 2005; Okrah, 2008) education systems with limited relevance to the local context. It is therefore not surprising, as argued by study participants, that professors who
received their training from Western countries influence curriculum design significantly. On this basis, relevant curriculum content debates must be based on reconstructed educational and community socio-economic needs identified through extensive consultations between scholars and the local community. Such curriculum debates place the lived experiences of the local population and their aspirations at the forefront; this is deeply mirrored on the key principle of traditional education that emphasizes communalism as the benchmark for community progress.

The notion of communalism in education is also in conformity with the ideas of the Indigenous knowledge discursive frameworks (Dei, 2008; Gupta, 2009; Langdon, 2009) that projects a cultural rebirth and revival reflecting the integrity and pride in culture, identity, history, land and heritage, as a commitment to the collective good and well-being of all Indigenous people. Since the ideas of Indigenous knowledge are rooted in local community organizing and a form of intellectual activism, the importance of engaging such ideas as a foundation for curriculum design for learners is unquestionable.

Applying curriculum design to the question of power and privilege, participants clearly pointed out where the real power resides among Indigenous societies. In knowledge production and validation, elders have long been the custodians and fountains of community knowledge. Their knowledge surpasses generational boundaries, having been developed over time with long occupancy of their contexts (Abdi, 2006; Dei, 2008; Gupta, 2009; Langdon 2009; Wane, 2006) and subjected to critical empirical investigations. The sole custody rights of traditional knowledge passed on to them by virtue of their age and experiences provide a practical corporate body for the protection, modification, and validation of this knowledge. Indigenous science knowledge is constantly evolving with time, with a growing demography and climatic change, to address community needs. It is therefore not surprising that 35% of the study sample urgently
called for the need to involve community elders as a strategy for the integration of Indigenous science into formal education. This call goes hand in hand with the establishment of joint research between Indigenous and Western scholars to engender attitude change related to Indigenous science knowledge.

Participants also reported that professors contribute to the curriculum design of their respective universities and/or departments. According to Michael, the college of health science has been going through changes in curriculum design to adopt traditional science. Professors have been actively involved in this process. Kigundu however, thinks that professors’ involvement in curriculum design depends on the level of development in that particular university. He stated, “At Busitema (this university was not studied but the participant invoked its name as an example) University, professors are involved in curriculum design but the focus is on modern science.”

Participants noted, however, that it is only at the higher institutions of learning that professors have a stake in curriculum design. At the lower levels of education, such as colleges, high schools, and elementary schools, the curriculum is basically designed by experts at the National Curriculum Development Centre (NCDC) with the main focus on the Western knowledge system. The notion of the professors’ foreign educational experience influencing curriculum design is very critical in this study. This is reiterated by the literature in which the formal education curriculum in Uganda and Africa was said to have been influenced by foreign education stakeholders or expatriates (Adyanga, 2011; Michael, 2005). In other words, it is an extension of neo-colonialism in the present era in which the colonized subjects mechanically take on the role of the colonizer in reproducing the colonial status quo. Reproduction of the
status quo by the colonized facilitates misappropriation of Indigenous knowledge by Western scholars as pointed out by Dei (2002):

Indigenous thoughts and knowledges have long been appropriated by Western scientific knowledge and other knowledge that Westerners acquired in contact with Indigenous societies and peoples but without acknowledging the collectivity and ongoing collaborative nature of knowledge creation in dialectic exchange. Western researchers often integrated Indigenous knowledges into theories as their own innovations. (p. 10)

Finally, understanding and appreciating the context relevant specificity of different knowledge systems is integral to this discussion. This is because having this awareness demonstrates the unique traditional trans-humane practice among pastoral communities like the Karimojong. When grazing land was being depleted, these groups would leave their settlement and migrate to new areas, allowing the depleting grazing rangeland to fallow and renew itself naturally. Soil erosion would be avoided as the roots of most of the vegetation remained intact. This offered a natural barrier to strong winds that would take off the top soil and contribute to desertification. However, the new resource managers that branded these practices as primitive and backward wanted these pastoralists to lead a sedentary life. Sedentarizing the people of the cattle culture like the Karimojong of Uganda or the Maasai of Kenya led to more pressure on the rangeland and led to soil erosion, hence interfering with sustainability.

Based on the above realization, participants suggested proactive strategies for the integration of traditional knowledge into the education system. They unreservedly emphasized that integrating Indigenous science is significant in reviving the current curriculum, which they argued is too abstract, with partial applicability to local contexts. Accordingly, they suggested numerous methods for integration, described below.

Seven participants (35%) said that there is a need for education stakeholders and policymakers to go back to members of the local community and learn from them. They should
consult with the community to document the various ways for managing ailments using local herbs, improving crop and animal production, making weather predictions. After consultation, the knowledge acquired should then be studied further and attractively packaged for inclusion in the curriculum. After training a critical mass of teachers, the university needs to seek legal backing and a formulation process to guide all involved concerning the integration of Indigenous knowledge. This could start all the way from primary education through secondary to university and college levels. JPK asserted that:

We need to tell the local community that the knowledge they have is very vital for the survival of the economy and [for] lifting the quality of formal education.

According to JPK, Sarah, Peter, Michael, Dina, Fred, and Birung, this can be done by building spaces where members of different communities across the country meet with professors, researchers, and other stakeholders from the Ministry of Education and National Curriculum Development Centre (NCDC) to consult and find means of inclusion.

Creating space for discussion will lead to asking critical questions and engaging more with scholars on issues of colonial education and its outcome, along with the role of Indigenous science in knowledge production and validation. Again drawing from the literature, the pluralistic approach to the knowledge system requires all education stakeholders to respect diverse knowledge systems, embracing their logic and epistemological foundations. This involves acknowledging the value, reciprocal relations, and contributions of all forms of knowledge (Owuor, 2007; Wane, 2008). Such recognition can only be achieved in spaces that allow for free dialogue on diverse knowledge forms and the possible strategies for integration by different knowledge practitioners.

For the repositories of subjugated knowledge such as Indigenous science to willingly open up, it is imperative that the value of their knowledge and how its absence makes
educational institutions incomplete be clearly explained. Anticolonial theory and Indigenous knowledge discursive frameworks translate participants’ suggestions of learning the principles of Indigenous science from the elders for inclusion in formal education into a decolonizing project. Such epistemologies (also see Dei & Marлон, 2009) emerging from the colonized can challenge the institutionalized narrative that has upheld Western othering (Memmi, 1965) of knowledge and subjects. The alternative epistemological science discourse propagated by participants is, indeed, an empowering anticolonial tool that engages with local peoples’ experiences as the benchmark of knowledge. Learning from elders, according to Dei (2000), is significant as it:

Cultivates respect for the authority of elderly person (gerontocracy), for their wisdom, their knowledge of community affairs, and their closeness to the ancestors. Many people believe that with old age, comes wisdom and an understanding of the world. It is the duty of the aged to instruct the young and the duty of the young to respect the knowledge of the elders. (p. 76)

The close relationship between the elderly and the younger generation in knowledge production in traditional African society has ensured the preservation and continuity of Indigenous science, history, sociology, anthropology, spirituality, and geography, among others. In the words of Indigenous scholars like Dei (2000), this relationship gives moral and spiritual authority to African people because knowledge production is the result of a dynamic, interactive, and reflexive process involving the individual, social groups, and nature.

Participants suggested the pressing need to document the practices of Indigenous science by creating a database to employ and promote this science knowledge on equal balance with the dominant science discourse. This documentation is not only significant for the sustenance of this knowledge but also acts as a bridge between consumers/practitioners of local science and of dominant Western science. When we talk of integration of any knowledge into the education curriculum, the entry point is documentation of that knowledge. According to Kagoda (2009), the
creation of data on the available Indigenous knowledge system would inform policy and influence practice in a sustainable and self-reliant manner by guiding local knowledge’s integration into formal education. Clearly, all learners come to institutions of education not as empty entities to be filled by the teachers/instructors/professors but with inherent knowledge from their families. Learning, therefore, can become exciting and beneficial if learners find their inherent knowledge reflected in the content they are given at school and if they are given space to contribute to what they feel should be taught to them. In agreement, Egan (1978) plainly argued that:

> The belief that children are naturally good, and will [be] naturally incline[d] to the good if not prevented by social and institutional constraints, leads one to believe that educational methods which allow the freedom to attain this goodness will by definition be beneficial. … if children will naturally choose the good given freedom of choice, then children’s own interests should be allowed to decide at least some part of what their curriculum should contain. (p. 68)

The idea that what children learn in their traditional education system take into consideration the different stages of growth associated with the physical, psychological, emotional, and spiritual ability of the learners constitutes the richness of Indigenous education. The informality of the entire process is one strand that participants argued should be changed through documentation as a strategy for integration of the knowledge system.

The Indigenous knowledge and anticolonial discursive frameworks that focus on developing awareness of ways in which hegemony and oppression are reproduced through the education curriculum are important tools in this venture. The theories seek to subvert the dominant relations of knowledge production that sustain hierarchies and systems of power (Dei & Kempf, 2006) in education institutions. By subverting the dominant relations of knowledge production, anti-colonialism opens space for the integration of Indigenous science into the academe. With the inclusion of Indigenous science, the academy becomes directly bridged to the
local community. Therefore, the theories create awareness that educational institutions should open space for the multiple ideas of global societies and nurture a deeper appreciation of the complex nature of knowledge production in different societies.

Of the 20 participants interviewed, five (25%) identified the need to involve religious leaders in any move toward the integration of Indigenous science into formal education. Their rationale was that leaders of organized religious orders such as Christianity label some elements of Indigenous knowledge as satanic worship. Also, traditional science practice among the wider section of Ugandan society has been undergoing a steady decline because of a broader configuration of social and economic transformation. In the process, religion is playing a detrimental role coupled with access to formal education and the societal views of modernity.

Tying this to the literature, Anyima (1987) noted that:

> The introduction of Christianity, Western forms of education, and the integration of African peasant economies into the world capitalist system brought new values, tastes, and behavior patterns which led to the breakdown of African traditional cosmology and culture. Since the collapse of colonialism, Africans have witnessed a gradual revival of their self-image and socio-cultural identity, though for most people, ‘ritualistic’ admiration of Western culture continues. (p. 807)

Linking this to the views of the five participants (Fred, Birungi, Michael, Musinda, and JPK), they argued that the involvement of religious leaders would immensely contribute to changing the mindset of their congregation to embrace Indigenous science. This is a difficult but not impossible task because most of the religious leaders have themselves denounced traditional practices including Indigenous science in favor of the modern Western ways and customs. Musinda cited the example of Pentecostal Churches, which have openly supported the use of condoms as a strategy to combat HIV/AIDS, and contrasted it with other conservative religious orders like the Roman Catholic Church that did not support the contraceptive but strictly emphasizes abstinence and faithfulness as a way of combating HIV. For this reason, the use of
condoms received mixed reactions among the followers of these religious groupings. Considering most African traditional teachings on sex education, abstinence was the main focus for the youth who were not married. Among some Ugandan cultural groups like the Acholi, this teaching was strengthened with the practice that a virgin girl would fetch a higher bride price than one who was not.

For the married couples, sexually transmitted diseases were controlled by fostering faithfulness in marriage. Although a man could be allowed to marry more than one wife, adultery/extramarital sexual affairs were not tolerated. In fact, the teachings of African traditional society supplement those of imposed religious orders, yet the leaders of these religions continue to shun traditional practices and knowledge. Thus, if religious leaders’ consciousness can be awakened from their misinterpretation of traditional practices and they have a change of heart, their followers will embrace Indigenous knowledge as suggested by participants. In the case of Uganda, this will be a substantial accomplishment because the majority of the population subscribe to the Christian faith and are strong followers of what their religious leaders preach. Therefore, one avenue for the promotion of Indigenous knowledge would be the establishment and reinforcement of a partnership with leaders of organized religious orders.

Engaging the media as a strategy for the integration of Indigenous science knowledge into the formal school curriculum was identified by three participants. These three participants, Diana, Nabirye, and Ondua, called for the increased dissemination of information about the values and ethos of Indigenous cultural practices and knowledge systems through the media houses. Ondua pointed out that:

If you look at the message that the public media brings out on regular basis to the community, you will realize that they belittle Indigenous cultures and knowledge systems. It’s common to hear derogatory phrases such as witchcraft, sorcerers, villagers (referring to inhabitants of the countryside), and out-dated practices, among others, in the
media when [they are] commenting on Indigenous cultures. This is stereotypical and a child growing up hearing such negativity will automatically end up craving foreign knowledge systems that are glorified by the same media houses.

In applying anticolonial theorists’ perspectives (Fanon, 1959 & 1963; Kabwegyere, 1972; Memmi, 1965; wa Thiong’o, 1986), this phenomenon is psychological violence aimed at prolonging mental indoctrination. Discursively, Indigenous cultures and knowledge systems are not rigid, but undergo continuous evolution together with the society. The evolution of societies, climatic conditions, nature of diseases and pests implies changes of this knowledge system and cultural practices by Indigenous communities to cultivate from the possibilities as well as respond to the limitations ushered in by ecological changes. To dismantle the foundation of knowledge domination rooted in colonialism and its continuous production and reproduction through neo-colonialism, Odora (2002) suggested that there must be a clear principle of integration. She asserted:

> We need to generate and present debates and analyses on internal and external characters of both ISK [Indigenous Science Knowledge] and Western knowledge systems, separately and in relation to one another, with the objective of promoting strategies and terms under which their integration can be achieved. The contributions that Western knowledge has made to the development of science and technology is acknowledged. (p. 17)

To reiterate the importance of knowledge integration, the above author went on to argue that despite internal fragmentation, the Western knowledge system has obtained world hegemony and subjugated the Indigenous knowledge system which, despite its mutation, has continued to provide potential for development.

Of the 20 respondents, eight (40%) identified the need to carry out research and produce publications to get people excited about African Indigenous Science. Specifically, eight participants (Kigundu, Maggie, JPK, Fred, Dina, Mawanda, Peter, and Sarah) noted with great
concern the lack of research and publications on Indigenous science and its relevance to society and formal education. When you draw comparisons with modern science, multiple books, articles, newsletters, magazines, and pamphlets have been published. These materials are more easily accessible, even in developing societies, than materials on Indigenous science. Participants therefore called for collaborative research in Indigenous and modern science. They argued that, through joint research, the right elements of Indigenous science and the right strategy for integration into the curriculum can be consensually identified and agreed upon. Reiterating the importance of joint research, Peter stated that:

In Eastern Uganda, tamarinds are used for treating typhoid and tamarinds do not rot however long they’re left in an open space. This means there are some chemical components that deter it from rotting. As an Indigenous researcher, I think it is important to find out what this chemical component is and how it can be applied to treat other diseases. Identification of the chemical component in tamarind can therefore be carried out through collaborative research with professionals in the field of modern science because they have the technology while the Indigenous science practitioners have the physical resources/raw materials.

Participants identified the need to get the management of higher education sensitized to the value of Indigenous science education. They argued that programs cannot be introduced into an education system without support from the governing structure of that system. As a researcher, I found that the management of the education system plays a crucial role in policymaking and implementation because the largest responsibility of policy formulation and implementation rests squarely on their shoulders. Musinda stated that this study should have started from the governing council of the university as well as the National Council of Higher Education (NCHE) because that is where the power to make meaningful curriculum reform resides. As stated by participants, Indigenous science is a valid community knowledge that should be integrated into the education system for formal recognition. Connecting this viewpoint with the literature, Dei et al. (2000) asserted that:
It must be recognized that these knowledges are valid in their own right and that the process of bringing them into the academy should not itself constitute the measure of validation. Closely tied to the question of validation is the issue of legitimation. The legitimacy of Indigenous knowledges is based on the right of peoples to define and articulate their own accounts of what is happening to them and how they intend to deal with pressing problems. In other words, an acknowledgement of the varied ways, options, and strategies through which people continually make sense of their world and act within it. (p. 47)

The concerns by participants and the literature about misappropriation of Indigenous science reinforce the need to get technical and moral support from policymakers/governing councils/the management of education systems to methodologically approve and integrate this knowledge into the curriculum.

To place Indigenous science in educational corridors, we need policymakers and curriculum planners who are conscious of the vitality of creating a hybrid of Indigenous and dominant science and transforming pedagogies that help students examine important values, assumptions, and information embedded in other cultural perspectives (Aikenhead, 1996). Its formal acknowledgment and integration into the curriculum will reverse the mindset of most elites who think that embracing Indigenous knowledge is for the less- or non-educated. Respondents also said that there is a need to get structures such as a faculty/department of Indigenous knowledge. Moses noted that “when you look at modern science, it seems to have a bearing on Indigenous science; it seems to have developed from Indigenous science.” This perspective centers on the hybridization of knowledge.

With the present excitement about the notion of globalization, documentation of words or educational practices becomes a momentous aspect if that practice is to be sustained. This is because through the written word, Indigenous as well as non-Indigenous knowledge gets codified in the curriculum that the younger generation will inherit. In the context of African society, oral transmission of information/teachings and learnings were exceptional ways of
descending into the thoughts or the invisible (inner) world of the transmitter. With the shift in
knowledge storage and transmission, this knowledge requires documentation for ease of access
for Indigenous and non-Indigenous learners who cannot easily access the custodians of such
knowledge. For this science knowledge to be exciting to learners, guest lectures by experts in
African Indigenous Science should be encouraged. Even in a history or agriculture class,
educators can get somebody from the community to talk about their experiences and have these
experiences documented for future generation. This is because, as a section of respondents
believe, African science is a strong component of Western science. Fred painted an illustrative
picture by drawing a comparison between the modern scientific innovation of the steam bath and
the traditional steam bathing process. He succinctly stated that:

We have a steam bath in the present era that is believed to play significant role in healing
of ailments such as cold, fever and flu. However, steam bathing is also practiced by the
African traditional society. There are herbs that can be mixed and boiled in water to
produce results closely related with those of the ultra-modern facilities. A veranda and/or
room is properly sealed so that the steam is generated and contained, then the patient
enters into the sealed room, sweats and complete recovery would be registered depending
on the sickness.

This is a complex Indigenous science that African societies practiced prior to any contact with
formal education. It can therefore be rightly argued that contemporary scientists got the idea of
the modern steam bath from Indigenous societies among the numerous Indigenous peoples
scattered throughout the world. Seeing or reading about the steam bath today makes many
African students who value their traditional knowledge reflect on the African system of steam
baths with admiration, pride, and positivity in their attitude toward Indigenous science.

Participants therefore called for the decisive initiation of programs where guest
lecturers/speakers are invited into classrooms to share their knowledge of Indigenous science.
They also suggested visitations to model farms that are using traditional farming modules as
crucial strategies in the integration and teaching of Indigenous science education. The rich local science knowledge that the Indigenous community possesses is generated locally to respond to challenges in specific contexts (refer to discussions in chapter two). This cannot be learned at school, hence the reason to physically invite repositories of such knowledge into the educational space. Tying this to the literature, the observation was reiterated by Wanja (2003), who argued that:

Knowledges and skills that people use in everyday problem solving are, for the most part, not learned in school. Rather, they are carved out of the day-to-day experiences of the natural world and the need effectively to explain, understand, and survive, both intellectually and emotionally. (p. 198)

Some participants were hesitant to respond to the question on the strategies for inclusion of Indigenous science in the curriculum. They posited that Indigenous science knowledge’s inclusion should not be subjected to the whether or not, how, or why questions as if its significance to the community is questionable. Rather, the way it is being practiced should be holistically adopted in the formal education curriculum. All that needs to be done is for education policymakers to learn from the practitioners/repositories of such knowledge some of the key elements for inclusion. Maintaining the same line of debate, Egan (1978) suggested that the problem for curriculum as a distinctive field of inquiry within education over the centuries is that once it is opened up to how questions, it loses any comprehensible boundaries. His argument is that even with formal education, curriculum inquiry is educational inquiry; and both curriculum and educational inquiry address what to include and how to include questions together. They collectively deal with all the ramifications of trying to answer concerns about what content children should learn, by what method and sequence.
In conclusion, AIS is experiential knowledge that has been, and is still being, used to respond to different complex conditions of African society for livelihoods and environmental sustainability. The interdependence of the different elements of AIS ensures that diverse human and environmental needs are met (See Castellano, 2000) at all times. However, debate about knowledge integration in formal education must happen concurrently with the need to protect that knowledge’s intellectual property rights. Accordingly, it emerged from the study that a lack of intellectual property (IP) for AIS has contributed to the legitimization of the theft and misappropriation of traditional medicinal knowledge. The section below, therefore, provides an in-depth discussion on IP for Indigenous science.

6.6. Intellectual Property Rights (IPR) for AIS

The issue of intellectual property rights for Indigenous science emerged as another key theme in the study. Although this was stated by only one participant (5%) out of the entire sample, it is a very crucial element for any discussion about Indigenous knowledge given its contestation in the present era. Indigenous knowledge has broadly been misappropriated by both Indigenous and non-Indigenous researchers and scholars, either consciously or unconsciously. Most of the scientific and technological discoveries in the present era have direct or indirect linkages to Indigenous communities (see Sertima, 1983), but the discoveries have often fallen short of giving due acknowledgement to such communities. Specifically, as articulated by some study participants, modern pharmaceutical companies could not survive if Indigenous communities closed their doors. Tying this to the literature, Indigenous communities are known for technological innovativeness via a trial and error method (Gupta, 2009) to respond to the challenges of their evolving environment. It is this innovativeness that participants termed as
practicality of African Indigenous Science. Knowledge integration is important for nurturing a critical mass of students who are equipped with the skills to synthesize ideas from diverse disciplinary orientations in addressing their community’s challenges and coming up with new innovations. It is also crucial in studying the relationships between different countries, regions, and continents’ education systems and drawing cross-cultural, cross-continental, and cross-system analyses which lead to the copying and replication of best practices. For example, there are significant populations of Indigenous communities in Canada and the USA. Integration of these communities’ traditional knowledge systems into formal education would induce interest in the methodological and theoretical strategies used in the integration as well as its impact on education. African culture and Ubuntu philosophy that is rhetorically evoked both in Africa and globally must be the key foundation upon which knowledge integration is anchored. For Uganda and the entire continent of Africa, knowledge integration is significant not only for protection from appropriation, but also for pulling together the ancestral knowledge system and spirituality for the advancement of science and technology in the 21st century, and for balanced regional development. Extending a similar line of thought, Sarah was concerned that the creativity of African Indigenous Science could be compromised if this knowledge is not protected from appropriation. She argued that:

African Indigenous Science enhances creativity in students, our research, thinking, teaching, and application of theory to practice. For example, here at the university, some of my colleagues who are professors train students to go and research Indigenous medicinal practices or disease prevention in their community. When these students go to the community, the doors to acquire the community rich knowledge of herbal practices and disease preventions are opened to them because they are from that community. In the process, the student researcher is connecting theory to practice to enrich his/her theoretical Western knowledge acquired from the school. However, the irony is that, the source of the rich knowledge that the student researcher brings back from his/her community is never acknowledged when the professor decides to publish the research findings into books or articles in Western journals. In most cases, even the students who conducted the study from their community are not mentioned as co-researchers but the
only recompense given to them is the grade in the transcript. So, although AIS is contributing enormously in the professors’ academic growth, there is no mechanism to safeguard it from intellectual property rights invasions.

The participant expressed serious concerns that are not exclusive to African society in the present era. The literature has shown that the rationalization of the process of misappropriation of Indigenous knowledge of plants, seeds, and medicines by intellectual property right regimes with the claim of sharing the profits with all people, is fraudulent (Mander & Tauli-Corpuz, 2005).

Paying attention to the intellectual property rights of Indigenous knowledge according to Odora (2002) is significant because it:

- Enables the Indigenous authorities and communities to publicly and legally lay claim to IPRs, and copy right to the wide range of artistic, pharmacological, and other products currently being extracted largely without recompense. The development of new protocols for benefit sharing, value addition, and new ethics of extraction, will further lead to strategic revisiting of the adequacy of existing legal, educational, industrial, commercial, and other sectoral provisions currently under implementation, with a view to questioning the extent to which they are oriented to serving, promoting, developing and protecting all sources of knowledge, and putting them to use for the benefit of all. (p. 11)

Specifically, the above views take into consideration the fact that the concepts of medicinal plants in Africa are not just a collection of genetic traits that modern scientists can re-invent but there are also essential cultural and spiritual dimensions to their usage in the healing and cleansing process. These essential components need IPRs. Therefore, critical examination of the complex AIS system must be given intellectual property rights which elevate traditional society from being mere custodians of such medicinal plants. Its formal integration into the education curriculum is a practical step for the conservation and protection of this knowledge from appropriation.
6.7. Conclusion

In summary, this chapter has demonstrated that with the introduction of formal education, local languages and Indigenous knowledge were sidelined. The imposition of Western science through the education system became possible in the Ugandan context. However, this also meant that such knowledge, which was local to European contexts, lost its localness by embracing universality and dominating identity. In agreement, Purcell (1998) argued that “as colonialism uprooted Indigenous peoples it also uprooted their knowledge systems” (p. 266). However, the uprooting of traditional knowledge has not totally dislodged it from society. The knowledge has continued over centuries to persist and adapt to new challenges. Therefore, any study of Indigenous science and its relevance to the community must involve an examination of epistemic and cultural clashes, power relationships, and questions of new geographies of knowledge. As pointed out in the literature, scholars (such as: Fanon, 1965; Wa Thion’o, 1986; Smith, 1999; Wane, 2006) have affirmed that Eurocentric epistemology, and sometimes organized religion, has by coercive default become mechanisms that the colonized continue to use in daily experiences to reproduce colonial hegemonic discourse. Unfortunately, the colonized use this mechanism consciously and/or unconsciously to understand their colonial familiarization and construct new identities centered on their liberty. It follows that an important challenge to break the chain of colonial dominance in the education system continues to linger around the quest for effective decolonization tools. Religion, as pointed out by the participants, is the most expanded social spectrum of society that continues to obstruct the ability of the colonized to constructively unite and theorize their liberation.

Finally, the discussions in this thesis have greatly contributed to reinvigorating and expanding on debates about the significance of incorporating broader Indigenous knowledge in
the education system. The key aspect that has been at the axis of debate for integration is Indigenous science. Indigenous science, as articulated by study participants, receives mixed reactions from the general public. The work presented herein is unique because of its specific emphasis on the validation of AIS. This field of study remains highly under-researched by scholars in the present era. The use of methodological and theoretical orientations has therefore traced and situated the absence of AIS from formal education within a historical context. As stated in chapter two, formal education became a vehicle through which the exclusion of Indigenous science was institutionalized. Therefore, for the institutionalization to materialize, complex ideological, as well as physical, violence was used by the colonial administration as discussed below.
Chapter 7

Examining the Entrenchment of Psychological Violence through Formal Education

7.0. Introduction

Within the context of formal education in colonial Uganda, power relations were unequal, social identities were reconstructed and societal institutions (such as the role and place of traditional education) changed. Changes in the role of formal and informal institutions at various echelons of society altered how different ethnic groups related to each other. The root of this was in colonial violence perpetuated physically through colonial state machinations, and ideologically through formal education and religious orders. This section examines the extent to which formal education induced psychological violence in the minds of Ugandans, making them believe that their inherent customs were insignificant in the course of societal civilization.

European cultural hegemony and values systems were forcefully imposed on Indigenous people to liberate them from the “bondage” of their traditions that was considered unprogressive. Fanon (1963) reminded readers that the supremacy of white values is sated with violence. The victorious confrontation of these values with the life-styles and beliefs of the colonized is thus impregnated with aggressiveness. Fanon continued, as a counter measure, by saying that the colonized rightly make a mockery of white values whenever they are mentioned. The application of Fanon finds relevance in most colonized societies in Africa. Wane (2008) would agree with the assertion that what the colonizers succeeded in doing, therefore, was destroying and undervaluing the ways of knowing and teaching of all Indigenous peoples of the world.

For the colonized societies, psychological violence was prioritized as an entry strategy to destabilize existing social fabrics, create disunity and confusion as entry channels of values alien to Indigenous people. Citing Galtung, Kabwegyere (1972) stated that psychological violence is
aggression inflicted on the human psyche. Several forms of violence fall under these categories which include lies, brainwashing, indoctrination of various kinds, and threats. Because indoctrination can be institutionalised, it becomes a powerful instrument of psychological violence within the context of cultural transmission. For instance, psychological violence inflicted on colonial Ugandans through formal schooling was a powerful tool of cultural decomposition that aimed at re-producing subjects loyal to colonial administration. To achieve this, it was necessary for the brainwashed to abandon their own identity that would breed the spirit of revolt, and adopt new ones alien to them but easy for the colonial order to control. This would effectively be achieved by an isolation policy entrenched through formal schoolings. The isolation policy involved a system where young children were taken away from the influence of their society and kept in boarding schools until such time when the schools’ authorities deemed fit for them to go back into their society. It presented a sophisticated degree of mental violence because the children, upon returning to their communities, became resentful to their old customs, knowledge, and belief systems.

Psychological violence, Kabwegyere (1972) contended, aimed to alienate the native from his own values, from his pre-contact self, to force him/her to fit in the alien implanted organization. According to Heise (1967), this was “diffusion or system oriented strategy” where the missionary, in advancing colonial education, operated from a minimal, perhaps temporary, station and circulated widely among the population, distributing his attention over a large group of people with a particular focus on the leaders. By so doing, the missionary targeted the social system to effectively disrupt a group’s equilibrium. In the case of Uganda, the implication of diffusion or system oriented strategy was twofold. First, it entrenched ideological violence through formal education by removing pious Africans from their society and confining them in
one place (seminaries) where propaganda was deeply implanted in their minds. The converts, mostly sons of chiefs, later became instruments through which colonial hegemony would be reproduced and sustained. In societies where ideological violence failed to materialize, the strategy involved physical violence to achieve the desired objectives. This successful strategy, according to Heise (1967), seemed to produce steadfast congregations intimately tied to the mission and larger church community. To illustrate this, Hattersley (1968) gave the example of a young convert from Kisumu, Kenya studying at an Anglican mission school in Buganda. Through a bitter exchange of letters with his father, the fellow denounced his family and old tradition for the sake of the “truth” purportedly found in missionary teachings.

Hattersley (1968) further demonstrated the example of another young chief from the Busoga district in eastern Uganda who returned home for the Christmas holiday and was given a warm reception by his parents. To the parents’ surprise, the young chief quickly condemned the old style traditional dances performed in his honour, labeling them obscene and satanic. To Heise (ibid), such condemnation was achieved through the use of a diffusion strategy where focus was geared toward dislodging the sociocultural system of a people with the expectation of mass movements sweeping through the affected population. The mass movement, in the case of missionary work in Uganda, is interpreted to mean denunciations of their traditional customs in favor of the “absolute truth” acquired from missionary teachings. Heise (1967) further stated that the use of concentration strategy centered the works of the missionary in the community, opening missions’ stations outside the original point of contacts to widen their support and achieve colonial agenda by undermining native institutions. Although this is a complex strategy in stable societies, it succeeds because there are always some estranged individuals available for conversion. Moreover, concentration strategy provides more control over changes in character.
This control therefore becomes the underlying rationale for physical violence when ideological violence collapses. In the case of African colonization, when acts of opposition were exhibited by the colonized, the colonial authorities reacted with violent rapidity to subdue the colonized uprising with unmatched martial force. Regardless of the method used to supress acts of defiance, the motive was to keep the colonized African in a state of submission where control over their land, natural resources, education, cultural norms, and human resources was left in the hands of colonial authorities.

Transformative educators like Freire (1970), in the book *Pedagogy of the Oppressed*, termed this inhuman process as cultural invasion. Cultural invasion, according to Freire, is always an act of violence against the persons of the invaded culture. He asserted that “in the phenomenon of cultural invasion, the invaders penetrate the cultural context of another group, in disrespect of the latter’s potentialities; they impose their own view of the world upon those they invade and inhibit the creativity of the invaded by curbing their expression” (p. 133). This resulted in the hybridization of two diverse cultures—the Indigenous and the imposed culture—entrenched through indoctrination or violence where applicable.

The permeation of psychological violence in schools in most colonial African societies was carefully planned so that Africans were not wholly empowered to question colonial economic, social, and political hegemony of the time. Within the Ugandan context, Adyanga (2011) argued that throughout the 1920s and 1930s, a vocal and influential white European commercial interest ensured the subordination of African education. The subordination later meant that African elites were ill-trained and cannot take important jobs in government which would mean good remuneration. The mediocre education for the natives in Uganda resulted in structural violence and social-economic injustice. Kabwegyere (1972) argued that the context of
colonial justice or injustice assumed a standard of judgement against which one could view 
people’s behavior and actions, and see to what extent they conformed or deviated. Everything 
that made up and accompanied colonialism was violent. Violence was a tool to create new order 
of control totally alien to the natives. In *The Wretched of the Earth* (1963), Fanon constructed a 
revolutionary theory for decolonization which fits Africa and Asia with remarkable accuracy. The 
colonial world, he argued, was conceived and implanted with violence and its existence was 
maintained by “din of a great array of bayonets and cannons” (p. 36). From birth, the colonial 
world was compartmentalized and strewn with prohibitions (p. 37) against the natives. Its 
beneficiaries were white settlers who thrived on the exploitation of the natives and owed their 
very existence to the colonial world. And it was in the interests of white settlers to perpetuate the 
colonial world because of the dependence and benefits that accrued from the status quo. Fanon 
observed that colonial violence cannot be met with reason alone since colonialism was conceived 
in violence and maintained by violence.

The ramifications of structural violence rooted through formal education were later 
translated to mean that native Ugandans, deliberately sidelined from acquiring quality education, 
were not well equipped to take up lucrative jobs. Such jobs were primarily preserved for their 
white European counterparts as articulated by Hattersley (1968).

It is generally accepted as a correct statement that a Negro can go so far and no farther, 
and that he very soon reaches the high-water mark. My personal experience being limited 
to the Baganda, and the nations immediately surrounding them, I cannot speak for the 
whole of the Negro races…the Baganda can learn anything that they are taught. The crux 
of the whole matter is this; the Negro rarely gets a chance to show what he is made of. 
When he becomes sufficiently educated to take an important government post he is 
rarely, if ever, allowed to hold it; because important work means lucrative positions, those 
lucrative positions are always given to white men. (p. 156 - 157)

Clearly, working in the colonial bureaucracy did not guarantee Africans equal treatment to that of 
their white European counterparts but only disseminated psychological stress. For example, from
the mid-1920s onward, native Ugandans who were as qualified as Europeans were paid three-fifths the total amount earned by their white counterparts. The colonial administration, according to Adyanga (2011), rationalized the pay disparities as fair and necessary because the white Europeans were expatriates who deserved higher income. Adyanga further argued that when the native Ugandans petitioned the colonial government regarding the injustice in salary structure, their petition was rejected with the point that their European and Asian counterparts needed more pay because they consumed imported goods that cost more money. Adyanga, a native Ugandan scholar, and Hattersley, a white European who lived in colonial Uganda for over a decade, decried the colonial mentality that the Africans were inferior intellectually and were unfit for equal treatment in colonial economy. By asserting that we “we need more real Christianity to make us realize that African is of one flesh and of one blood with us all, and has every right to be taught, trained, and allowed to take his position in the world” (p. 157), Hattersley disdained the colonial and missionary education of the time. It is ironic that Africans were encouraged to send their children to schools so as to civilize and improve their living conditions, yet after completion of their education, their dreams never came to pass. By so doing, the missionary’s strategy to educate Africans was equated to the efforts of evangelists working in their own culture: it stressed isolation of the individual from normal social influences, exaggeration of personal conflicts and anxieties, and psychological dominance of the individual by the missionary (Heise, 1967, p. 53). The outcome, as we have seen with educated Africans in Uganda who complained against the maltreatment, was punishment for challenging colonial authority. Lower salary in public service and threat of expulsion from work was one form of a punitive measure to silence educated Africans.
Graduates of formal education were therefore placed in hierarchies (pyramid) depending on their racial groupings. The hierarchical arrangement and psychological violence of formal education introduced refined racial differences that relegated Indigenous Africans to the lower class. In Kenya, the education curricula were designed based on the racial classifications within a philosophy of education for one’s station in life. Africans were educated for manual labour and religious disciplines, Asians for middle-level technical labour, and Europeans for management and governorship of the colonial territory (Wane, 2003). The curricula bred injustices against Africans to the extent that resistance (both peaceful and violent, like the Mau-Mau movement for the case of Kenya) took place to seek redress. Wa Thiong’o (1987) captured African frustrations in the predicament of an elusive Kenyan patriot, Matigari, who, in search for explanations to the injustices against native Africans in Kenya engaged the colonial Justice Minister with metaphorical inquests. He asserted:

This is my question:
The builder builds a house.
The one who watched while it was being built moves into it.
The builder sleeps in the open air,
No roof over his head.
The tailor makes the clothes.
The one who does not even know how to thread a needle wears the clothes.
The tailor walks in rags.
The tiller tends crops in the fields.
The one who reaps-where-he-never-sowed yawns for having eaten too much.
The tiller yawns for not having eaten at all.
The worker produces goods.
Foreigners and parasites dispose of them.
The worker is left empty handed.
Where are truth and justice on this earth? (p. 3)

Matigari’s critical analysis of the social, economic, and political injustices of his time demonstrated the level of frustration that most Kenyan Africans had against British colonial rule.

For Matigari, colonial injustice was dispensed through doses of psychological as well as physical
violence to subdue Kenyans. By confronting the Justice Minister, Matigari became the mouthpiece of millions of his country-folks who were petrified to speak against colonial injustices. His conviction was that fear bred misery in the land and hence must be confronted regardless of the cost. Matigari was also concerned that as African patriotism grew and challenged colonial injustices, the existence of colonial collaborators and institutions (such as formal education and organized religion) frustrated such nationalists’ efforts. Formal educational institutions in particular became the greatest fountain of agony and desolation to the African ways of life, knowledge, and belief systems.

It was their mediocre education that left native Ugandan graduates dissatisfied with their state of relegation, and consequently heckled the whole system. The castigation of colonial education was due to the stakeholders’ (missionaries’) close association with the state that directed education toward the fulfilment of the state’s objectives. Failure to make a separation between the state and missionary activities left the mission work in a state of confusion and led to resentment by the natives and some colonized sympathizers/allies like Hattersley. In colonial Uganda, there were missionary activities in the villages centered on promoting Christian religion but achieved through state coercion. For example, if an African was not baptised, his tax was refused by the state departments responsible for tax collection. However, at the same time, he was pressured to pay his due tax (Kabweyere, 1972). The only option left was to accept the Christian baptism and have all his paraphernalia of Indigenous spirituality burned—because they were satanic—before his tax could be accepted to avoid physical violence inflicted through torture.

Tax collection for the colonial regime was strictly enforced by loyal local chiefs who oversaw the interests of the state at sub-county/county levels. The appointment of the chiefs was
dependent on several factors: one had to be christened with a European name, a graduate from one of the few missionary schools in the country, and had to swear allegiance to her majesty, the Queen of England, through her representatives in Uganda (Adyanga, 2011; Kabwegyere, 1972). With the tight psychological, structural, and physical violence that captured all corners of colonial Uganda, the natives found themselves confronted with two contradictory systems—alien and traditional—with the former taking its toll on their society coercively to the extent that some natives were forced to abandon their traditions and sympathized with the alien ones. Dei (2006, p. 3) argued that colonialism is not simply complicit in how we come to know ourselves and its politics. It also establishes sustainable hierarchies and systems of power. Colonial images continually uphold the colonizer’s sense of reason, authority and control. It scripts and violates the colonized as the violent “other,” while, in contrast, the colonizer is pitted as an innocent, benevolent, and [imperial] savior.

Confronted with the contradictory state of affairs, Hattersley noted that the natives who denounced traditionalism for Western treatment of sleeping sickness found the high dosage very painful, unbearable, and they deserted. Although Hattersley’s narrative did not give details as to where the deserters went for medical attention, the obvious assumption was that they went back to the traditional doctors who were already fighting the deadly pandemic before the arrival of the European medical team. This was because temporary relief provided by the Western medicinal injections was not sustainable as victims relapsed back to the problem. For native Ugandans, there have always been relentless efforts to find solutions to all adversaries that befell the community and every condition must be dealt with. It is interesting that some natives who had scorned traditionalism due to psychological violence returned to the very old practices. Fanon (1965) gave a similar situation in which the operation of the complex psychological laws that
govern colonial society left the traditional doctors in a difficult position as far as their medicinal practices were concerned. Although colonial policy conditioned native Africans to boycott traditional doctors, they (native doctors) continued receiving native patients who failed to find cures in colonial health care system.

The psychological control over native Africans was perhaps the primary reason why the Governor of Uganda by 1919, Sir Robert Coryndon, in his short response to the committee mandated with the selection of sites for the establishment of training institution, made the site choice based on long-term objectives. When the idea to set a training institution was developed, where to build the site was the next question, and an advisory board was appointed to examine possible sites. There were five men on the board: the Provincial Commissioner, the Land Officer, the Director of Transport, the Commissioner, and the Provincial medical Officer. They were to find a site within 50 miles of Kampala, and preferably within 20. In a later report, the Provincial Medical Officer, Rev. Dr. C. A. Wiggins recalled asking the Governor if they were to look for five, ten or fifty years ahead, in which the Governor replied fifty years (Macpherson, 1964). The Governor’s response depicted the long term colonial agenda to maintain hold of the natives through formal education that would coordinate ideological control. Clearly, the Governor’s assumption was that once ideological control was achieved and sustained through all means including formal education and state coercion where necessary, other modes of control would follow with ease. To achieve ideological violence and control, the colonial regime controlled educational subsidies through grants-in aid, and school inspections, allowing the dictation and enforcement of the type of education desired for Africans (Adyanga, 2011). Psychological control, however, faced stiff resistance from African nationalists in the early 20th century. The
nationalists, Adyanga argued, challenged the colonial authorities’ reliance on the missionary schools to train labourers who could only perform basic tasks for the colonial administration.

In cases where ideological violence and control failed, the colonial administration used “loyal” African chiefs of the time to orchestrate physical violence through indirect rule policy. Under indirect rule, loyal chiefs mostly from Buganda kingdom were used to extend colonial rule to outlying sphere of the country. Since the British colonial rule was well established in the Buganda Kingdom, the appointment of the Buganda King, the Kabaka, his cabinets and chiefs were reservedly determined by the British. Adyanga (2011) declared that:

The British government maintained its control of the Buganda monarchy by reserving the final right to approve any successor of the Kabaka of Buganda before he would assume power. This undermined the tradition of Buganda, according to which the Council of Elders selected the next Kabaka. The implications of this arrangement for the Bugandan social, economic, and political life were enormous. The protectorate governor assumed control over all appointments, promotion, and dismissals of the Kabaka and his administration, including minor county chiefs. (p. 59)

To show their resolve that control over Buganda could not be left in the hands of the Kabaka (king) in the event of failed ideological control, the colonial administration captured and exiled Kabaka Mwanga to Seychelles Island when he rebelled against them. His two year old son, Daudi Chwa, was enthroned as a new king with appointed regents loyal to colonial authority (Adyanga, 2011; Kabwegyere 1972).

With the Buganda Kingdom firmly in the hands of colonial administration, expansion to territories at the periphery of Buganda necessitated the cooperation of the loyal Buganda chiefs appointed to office by the colonial authorities. However, expansion of colonial rule to other provinces in Uganda by the use of “loyal” Baganda chiefs was met with stiff resistance that resulted in physical violence in the case of Bunyoro and Acholiland. In Bunyoro, Adyanga asserted that the discontent of the Banyoro over the mode of British colonial control through
Baganda chiefs erupted into bloodless riots called *Nyagire* (meaning “I refuse”) in 1907 and 1908. To quell the riot and establish British indirect rule, excessive use of violence was meted onto the Banyoro. The colonial administration sent an expeditionary force that captured and removed from office the Banyoro nationalist chiefs who were believed to be the instigators of the riots. The chiefs were replaced by the Baganda local chiefs reigning on behalf of the British under the indirect rule arrangement. When physical violence was used against Bunyoro, the kingdom paid heavily for resisting colonial indirect rule. In one incident during the attack, a British military officer, Grant, applying the brutal scorched earth policy, destroyed 1,000 villages, gardens, and food crops with the aim of creating food shortages for at least three months (see Adyanga, p. 63). Several incidences of destruction of wealth and sources of livelihood owing to the scorched earth policy were used in different attacks to ensure that the Banyoro would never again emerge as an independent state to pose any threat to colonial authority. It is based on such incidences of violence that Fanon concluded that the colonial and neo-colonial question could only be challenged by violence. His emphasis was that “colonialism is not a thinking machine or body endowed with reasoning faculties. It is violence in its natural state, and it will yield only when confronted with greater violence” (p. 51). Drawing on his experience treating Algerian mental patients, he lauded the therapeutic effect of revolutionary violence on the brainwashed mind of the colonized.

In the Acholi region of northern Uganda, efforts to implement colonial rule were resisted, leading to violent confrontation in a popular uprising known as the Lamogi rebellion. Different theories have been advanced for the outbreak of the 1911-1912 Lamogi rebellion. One account has it that the rebellion broke out when Acholi young men refused to comply with the British and Nubian troops’ directive to work as potters carrying supplies to military posts at
Wadelai and Nimule in Sudan. After a violent confrontation, the Lamogi rebellion ended with disastrous defeat for the Acholi: 1,070 taken prisoners including 413 fighters, with Lamogi causalities estimated to be between 600 to 700 fighters. The colonial government causalities included two policemen killed and eight wounded. The physical violence was exerted with such viciousness that death and destruction marred the outcome as described by Kabwegyere (1972):

Going ahead in time to 1914, we still see constant occurrence of violence in many parts of Uganda. In Chua District (now East Acholi), a police attempt was made to defeat a village which had presented resistance to the advancing colonial forces. What followed was almost a case of guerrilla warfare. The people took shelter in caves in a nearby mountain. They hid ‘amongst boulders of rocks, of which the mountains entirely consists and from behind which they hurled down rocks and spears.’ The troops were forced to retire; and on the second day, the troops divided into two groups after discovering another path to the caves. In the ‘sharpest fight’ 20 head of cattle were captured. The remainder were driven into caves and ‘the entrance closed with large rocks’. Six people were killed in the operation. In the same area, three chiefs committed an act of defiance. They murdered the Baganda agents, whom they saw as agents of colonial domination. The colonial troops pounced on them; 30 natives were killed, 28 taken prisoner, and all their villages burned down. In another operation, 131 head of cattle were captured, 75 of which were distributed to the loyal chiefs who had assisted the British in the battle. The remainders were taken as reserve to feed the soldiers on active service. (p. 306)

These two incidences demonstrate the extent to which colonialism exercised different forms of violence to entrench colonial domination regardless of the cost. For pre-colonial societies that were already warriors in nature, psychological violence categorically did not work, hence the need for physical violence. Overturning colonialism and neo-colonialism requires people to engage in violent struggles in order to move toward some meaningful advances, as Fanon (1963) observed:

Violence alone, violence committed by the people, organized and educated by its leaders, makes it possible for the masses to understand social truths and gives the key to them. Without that struggle, without the knowledge of the practice of action, there is nothing but a fancy-dress parade and the blare of trumpets. There is nothing to save a minimum of readaptation, a few reforms at the top, a flag waving; and down there at the bottom an individual mass, still living in the middle ages, endlessly marking time. (p. 118)
Fanon’s insightful analysis clearly illuminates the conditions for peasantry in Uganda and other African countries. He stated that it is the peasantry and not the urban workers who are the most revolutionary class. They are the real “Wretched of the Earth,” and the disinherited who have nothing to lose but everything to gain in a bloody struggle to overthrow the colonialist and neo-colonialist states. The peasants are in a state of destitution that can trigger a revolution to stop their economic, social, and political marginalization and servitude. Irrespective of the type of violence used, the establishment of colonial authority in Uganda aimed to achieve long term colonial hegemony.

Psychological violence was just the first stage of the real character of the colonial authority and its objectives in the colonies. The method of indirect rule in which loyal chiefs from Buganda stretched colonial rule to other parts of the country with the assistance of missionary schools has left a damaging legacy that is manifested in Uganda to date. Interestingly, ideological violence has taken a new colonial face in the post-independence societies. The new colonial face beneath which ideological violence resides is so highly institutionalized that the victims and perpetrators cannot easily identify and admit its existence, but instead contribute unconsciously to reproducing it. By asserting that the physical violence of the battle field was followed by the psychological violence of the classroom, wa Thiong’o (1986) suggested that the manifestation of psychological violence is rooted in formal education. Therefore, as educators, there is a need to counter the negative effects of oppressive education and address areas where critical work is wanting. This is not an easy task but is one that will require a great deal of sensitivity and knowledge to address the intersecting issues of equity in the education system (Wane, 2003). The exertion of varying degrees of psychological violence through formal education and the resulting exclusion of African traditional knowledge have proved
counterproductive and retarded the socio-economic and political progress of African societies. The different literature indicates that the exclusion of Indigenous worldviews from formal education amounts to psychological violence that propagates Western dominant discourses and oppressions over Indigenous communities.

In summary, this chapter examined how psychological violence was inflicted on African people by the colonial administration in Uganda. The strategy through which violence was inflicted included formal education and Christian religion. Psychological violence involved denying Africans the right to embrace and practice traditional education and the traditional belief system. The chapter stated that, where violence through formal education and religion did not achieve the desired objectives, direct use of military force (physical violence) was exercised with profound viciousness.
Chapter 8

Significance of the Study and Future Direction for Research

8.1. Development and Science Education

A dominant theme in African development policy since the 1960s has been that without a minimum scientific and technological base, there would not be development (OAU, 1987; UNESCO, 1987). Many African countries invested in the department of sciences in higher educational facilities, technical colleges, and vocational institutes to train qualified science students. The graduates of these schools were grounded in Western science disciplines that perpetuated colonial education at the expense of traditional sciences as discussed in depth in chapters two and seven. Insofar as the foundation of Western science was widened and entrenched in post-colonial curricula, innovations in the sciences of traditional societies were not promoted.

In the 1980s, the African governments continued to build their development policy on the neglect of traditional sciences in their attempt to increase the pace of African development. The aim was to improve the welfare of their population based on the important contribution of the dominant science. The African heads of state and government called their program the Lagos Plan of Action (1980) and the African Priority Program for Economic Recovery. These declarations recognized that sustainable development based on self-reliance is possible through the application of the knowledge of science. Their understanding of sustainable development policy was influenced by the World Bank and the International Monetary Fund as balancing the use of resources without compromising the future of generations to come. The means to attain
sustainable development did not consider the contribution of traditional science in African development and social welfare improvements.

The CASTAFRICA II summit that was held in Tanzania in 1987 at the auspices of UNESCO attempted to promote science education in the direction of relevant traditional technologies for African development. However, it also noted that debt, high infant mortality, economic shocks of the World Bank and International Monetary Fund’s Structural Adjustment Program (SAPs), diseases including malaria, HIV/AIDS, and tuberculosis, and increasing poverty had negative effects on sustainable development, self-reliance, and social welfare improvement. The realization that African Indigenous Science could offer a solid foundation for development was not taken seriously. Improving Indigenous science could widen the knowledge base of ethno-botany, ethno-medicine, as well as the reliance on relevant prophylactics that were traditionally used to remedy malaria, improve infants, community health, and welfare. It could also lead to general technological innovation in marine, plant and animal genetics re-engineering, tools, practices, and other aspects of sciences that had been well-developed in Africa before colonial encounter. Thus AIS remains an important component of African socioeconomic development and welfare improvement for several reasons. The significance of the study is categorized into two themes: cross cultural use and application of science knowledge, and context relevant development functions.

**Cross Cultural Use and Application of Science Knowledge**

Ethnic medicine that Indigenous communities in Uganda use for treating different diseases is a practical body of knowledge that concerns therapeutically active properties of plant ingredients. This knowledge is gradually gaining entry into the regime of modern scientific cultures.
However, many educated African doctors still carry the binary of Western science being in competition with African “witchcraft or superstitious” practices of medicine. A study like this is important in creating dialogue and space for the entry of African medicinal practices into the mainstream health care system in Uganda. Traditional African medical knowledge gained significant attention and interest from the European colonialists in the late 20th century. This was after the emergence of resistance to antimalarial drug like chloroquine (Webb & James, 2012). In the modern era, formal adoption and application of this study signified a momentous cross-cultural application of medical knowledge for community health.

For community health, the significance of plants such as papaws (papayas) and avocados that have medicinal and food elements is a strong testimony for the need to conserve such plants to help with ameliorating a myriad of health related issues in rural communities. The quick rate at which some of these plants are disappearing from Uganda’s rain forests due to human activities will dispossess scientists of the chance to study the plants’ possible medicinal properties and also expose the local community to only a singular way of treating diseases – modern medicines. This would deal a serious blow to rural communities who have been using the plants as herbal treatments for generations. The significance of the conservation of traditional herbal plants through integration into the formal education system is that of protecting the legacy of this Indigenous scientific knowledge as the foundation of modern pharmaceutical industries.

Integration would also guide the government to set up programs that aim to preserve and promote plants that have medicinal and food elements. This is a practical step in improving food security by recognizing local community knowledge. The African community uses environmental resources sparingly with the realization that food security at the grassroots level has direct linkage to biodiversity conservation. However, with the advent of modern science and
technology, coupled with the enormous demand on the existing resources and exclusion of traditional biodiversity conservation techniques, the need to go back to the drawing board and invoke traditional knowledge in improving food security is inevitable. According to Sarkar (2009), this process would entail relying on a holistic approach to transcend the walls of the nations’ boundaries. This, he argued, would be more achievable if proper cataloguing and inventory of plant genetic resources of medicinal importance were assured and the conservation of their wild relatives (species) were promoted at the same time.

This study is important in critiquing the argument that an overemphasis on Indigenous knowledge constitutes a mere romanticization of the past, which, in a pragmatic world, is untenable. Instead, the study demonstrates that the recognition of Indigenous scientific knowledge illustrates the sophistication of local people’s creativity in responding to the challenges of their context. It also shows that the integration of Indigenous scientific skills into the modern science epistemology does not comprehensively provide permanent remedies to the myriad of challenges in the present. Rather, the study is a call for more methodological and theoretical research to be conducted by think thanks from these two scientific ways of knowing to search for lasting solutions to global challenges. Basu et al. (2009) elaborately argued that it does not matter whether or not a practice is really Indigenous or mixed up with introduced knowledge. It is important that instead of looking only for technologies and solutions from outside of the community, we first look at what is in the community. Indigenous knowledge and Western knowledge need to fuse in terms of knowledge, practice, and an internationally accessible knowledge pool for community wellbeing.

In agriculture, Ugandan Indigenous communities possess multilayered scientific knowledge that evolves in response to the intricate ecological challenges of their localities. This
knowledge, as articulated by study participants, was developed over an extended period of occupancy of a place and accumulated through trial and error. Subsistence farmers constitute the bulk of the farming community in Uganda and predominantly produce for household consumption using traditional agricultural knowledge. Their efforts are, however, being hindered by many adversities like droughts, insufficient funds for mass production, poor road networks on which to transport their produce to the market, and soil infertility, among others. To respond to these adversities, Uganda’s government introduced the Plan for Modernization of Agriculture (PMA). Subsistence farmers were the primary target under this program, which focuses on enhancing their capacity through increased food productivity to eradicate poverty. The PMA program was implemented through university graduates, which implies a dominant knowledge approach. The Makerere University, through the College of Agriculture, Forestry and Nature Conservation, Veterinary Medicine, and Science, produces agricultural graduates, conducts agricultural research, and runs outreach programs with rural communities. This contribution has been expanded with the introduction of the Makerere University Agricultural Research Institute Kabanyolo and the Continuing Agricultural Education Centre, which offer demand-driven short-term courses for farmers, policymakers, and other agro-based stakeholders (Government of Uganda, 2003). For rural farmers, who are the target beneficiaries of this program, application of the knowledge gained from PMA training is interwoven with their traditional agricultural knowledge. For the local communities, the use of Western scientific farming is predicated upon their traditional knowledge. This is because the key mastery of their traditional eco-systems provides the basis upon which their survival resides.

As pointed by participants, the study is fundamental in unpacking the stereotype that traditional knowledge systems are rooted in old beliefs and practices (see also Abdi et al., 2012; Vandana, 1997), and are insignificant in the modern era. Even key educational theorists in a
dominant society like North America believe that learners’ first knowledge is very significant for successful teaching and learning. In the book *Experience and Education*, legendary educational theorist, John Dewey (1938), articulated the cardinal values of the learners’ first knowledge and experience as the foundation of learning any new concepts. Dewey explicitly stated that:

> It is a cardinal percept of the newer school of education that the beginning of instruction shall be made with the experience learners already have; that this experience and the capacities that have been developed during its course provide the starting point for further learning. (p. 74)

Dewey’s opinion is relevant in understanding the importance of traditional knowledge among Indigenous societies. In Uganda, where the majority of children first learn the knowledge and native language of their local environment before beginning formal education, such knowledge must be the foundation upon which teaching and learning is anchored.

### 8.2. Indigenous Science and its Contextual Relevance

Traditional knowledge plays a major role through medicines, community health, and ecological sustainability, among others, to offset the devastating cycle of destruction that industrialization has inflicted on the planet. Agro-biodiversity was practiced by African traditional societies for years before colonial contact. Agro-biodiversity includes all forms of life directly relevant to agriculture—rare seed varieties and animal breeds (farm biodiversity)—as well as many other organisms such as soil fauna, weeds, pests, predators, and all of the native plants and animals (wild biodiversity). Agro-biodiversity helped communities to develop context relevant practices for sustainable living.

Pre-colonialism, care for rangeland was also a collective responsibility among Indigenous pastoral communities. In Uganda, the Karimojong provide a good example of a setting where this traditional scientific practice has been preserved. Although the Karimojong live in a semiarid
region of north eastern Uganda, grazing land is considered an important asset that everybody guards. Male adults and youth take the primary responsibility of rotating animal grazing so that specific rangelands are not completely depleted. These age groups form corporate bodies that protect the rangeland and cattle, and also provide security from external negative forces. When the rangeland is completely depleted due to prolonged drought, the pastoralists migrate to neighboring communities, leaving their land to rest and regain fertility.

Among the Karimojong, collective decision making is taken to protect resources to ensure that the decisions are binding as a product of legitimate community education and observation over a long period of time. Decision making on resources that are collectively owned, such as land, water source, education, and knowledge, is vested in the hands of the entire community under the guidance of elders. Each community devotedly respects the decisions of the elderly since they are considered wise and knowledgeable (see also Dei, 2009). Although decision making is a collective responsibility, certain aspects, such as community health, medicinal practices require the guidance and expertise of specialists in those fields. For example, foreseers have the intuitive ability to predict possible tribulations that are about to befall the community. In such instances, the foreseers, in collaboration with the chief priests, perform some rituals or offer sacrifices to offset the pending dangers.

To preserve the knowledge of groups like the Karimojong, we should codify their best practices and integrate them into the national school curricula along with that of other cultural groupings. This would make the cross-national fertilization of ideas possible. The stock of knowledge that is abundant in other parts of the country would not cost anything if communities exchanged their expertise freely and in the spirit of cooperation, not commerce and profit. For example, whereas modern science depends on gene bank collection to support diversity,
traditional farmers combine both, select, and screen planting materials to maintain agro-biodiversity (Mander & Tauli-Corpuz, 2005). African traditional society is known to integrate farming with fishing and hunting/fruit gathering, which promotes environmental sustainability.

Government policymakers would also employ the graduates of Indigenous science, hence creating employment. To improve quality and promote research, these individuals would be asked to bring their passion into learning and research so that ways to improve these practices could be realized. Comparatively, the education sector and business world are closely interconnected. In the business world it has long been understood that the inclusion of diverse cultures and ideas increases organizations’ ability to nurture and benefit from diverse talents, often resulting in increased financial profits. This is true for the education sector, wherein the benefits of Indigenous knowledge integration would enhance students’ grasp of concepts and levels of achievement, creativity, and critical thinking, enabling students to gain pride in, and a feeling of ownership of, the education system.

Negative ideology associated with Indigenous science would be addressed if traditional knowledge were given recognition proportional to the dominant knowledge. There has to be a clear focus on teaching people that their way of knowing is beneficial. We live in a complex era of great advances in science and technology where creating hybridity between and among different worldviews of science is imperative. Again, Mander and Tauli-Corpuz (2005) remind us that science and industry must begin to respect local diversity and the delicate balance between life, land, and society.

Knowledge integration for sustainable ecosystem will empower students to become innovative. They could be the next generation to innovate in local context-related technology that meets the needs of the population. For instance, NBC News (2012) ran a story of a unique
innovation by a 13 year old Kenyan boy named Richard Turere whose family lives on the border of Nairobi National Park in Kenya. The media house detailed the elaborate innovation as:

Lion kills don’t just cost Nairobi families, however. To dissuade herders from killing protected predators, the Kenyan government pays market price for every cow, sheep or goat a predator eats. One study found that one compensation program pays for about 765 livestock animals a year. When he turned 9, Turere started caring for the family cattle. Over time, he noticed lions avoided ranches where someone woke up at night and walked around with a flashlight. So he designed a lighting system to mimic the irregular flashes of a herder checking on his cattle. He took LED bulbs from broken flashlights and gathered them together in round arrays. He put four or five arrays around the outside of his family’s livestock enclosure, pointing outward. Then he wired the lights to the solar-powered car battery that also powers his family’s TV. A switch lets them turn on the lights whenever they like. Turere invented his lion-repelling lights in spite of having no access to books or technical information.

Although the reporter mentioned that a lack of formal education was not a hindrance to this technological innovation, it is clear that at 13 years old, Turere had extensive traditional knowledge regarding livestock rearing, cross breeding, milking, and protection of animals and humans from danger. Such knowledge is usually imparted to young children by their parents throughout their growth process. The innovation also signifies the cross-fertilization of ideas for lasting solutions to local challenges. For instance, Indigenous pastoral communities light natural fires at night to keep off wild game such as lions, tigers, leopards from human settlements. The hybridization of traditional knowledge with the use of modern science and technological inventions (LED bulbs and solar-powered car battery) was the foundation upon which Turere derived a solution to protect the family cattle.

Indigenous knowledge integration will reduce reliance on foreign experts whose services are sometimes irrelevant to the needs of the people. The implementation of Indigenous knowledge in the formal education system calls for the urgent need to tap into the local communities’ expertise in areas such as contributing ideas for local development. For most developing societies, development programs have often been coined from the outside world and
imposed on them. As such, key human resources for the implementation of the programs are also foreign originated. However, in regard to the use of traditional knowledge for development, both the custodians and the expertise live within the local communities. In most cases, they are cost effective and sometimes offer their services at no cost to the community.

Involving local people in their development challenges changes the definition of these problems from elite-centered to village level-centered. The relevance of the re-definition could be the basis for generating practices that include community perspectives. The integration of community knowledge will increase a sense of nationhood and collective responsibility of citizens. This is because the integration of different knowledge comes with the implementation of culturally sensitive programs, ideas, and use of materials that are closely linked to the target community.

In conclusion, AIS constitutes a field of knowledge that is closely interrelated to the Western dominant science in many aspects, and distinct in other aspects. The similarities and distinctions enrich the debate for knowledge integration from an environmental and ecological sustainability point of view. Knowledge integration is inescapably crucial in dismantling the dichotomy between modern and traditional economies. With the extensive discussions on the contextual relevance of AIS, the last chapter offers recommendations for traditional knowledge integration, and its sustainability in society through technical, theoretical, and methodological frameworks.
Chapter 9

Recommendations and Conclusion

9.1. Introduction

The following key recommendations are intended to guide Uganda’s Ministry of Education, educational stakeholders, and educational institutions in the gradual removal of structural and systemic barriers to the integration of AIS into higher education. Specifically, the recommendations are intended to ensure that the education system in Uganda introduce culturally relevant programs that enhance students’ creativity, achievement, and well-being. Indigenous knowledge plays an integral role in meeting the needs of students from diverse communities across Uganda, Africa, and globally. For Indigenous science to be integrated into the country’s curriculum, the government—through the Ministry of Education and Sports—should consider the following recommendations.

The needs of Indigenous communities must be met through the formalization of traditional knowledge in the schooling system. As expressed by the study’s participants, the use of local languages in all education levels as a way of promoting Indigenous knowledge is instrumental. This is because a detailed grasp of the link between Indigenous education for ecological and cultural sustainability will be reinforced for Indigenous learners who struggle with understanding the dominant pedagogical language but who have a good grasp or articulation in their local language. Within the context of Uganda, where the majority of the rural population uses ethnic languages, dissemination of ethno-botanical knowledge (plants and their uses, herbal practices) is better transmitted through the heterogeneous languages of different communities. The implication for education is that use of local language will evoke interest in the arena of bio/eco-culturally relevant research by Indigenous and non-Indigenous scholars.
This is important for documentation and dissemination of traditional science in local languages for local audiences.

The Ministry of Education should set policies that deliberately aim to popularize and integrate local knowledge for the challenges of local contexts. As discussed in the last two chapters, there are significant stereotypes associated with the use of traditional knowledge. Through enactment of appropriate policies, the government should aim to change the mindset of the population to embrace local knowledge alongside the dominant knowledge in education and society. To achieve this, the principle of active participation by Indigenous people in different social, economic, and political projects that target their communities has to be promoted. According to Mander and Tauli-Corpuz (2005), the active participation principle recognizes the crucial importance of Indigenous peoples vigorously partaking in all stages of any projects in their communities from the beginning to completion.

Clear mechanisms to review, monitor, and report the progress of Indigenous knowledge in formal education should be established. The aim is to ensure that its implementation is consistent with the standard requirements of the National Council for Higher Education (NCHE). These mechanisms would check for biased personnel with adverse motives toward traditional knowledge. In brief, there should be checks and balances to monitor the integration of local knowledge into the formal education curriculum. The monitoring mechanism would also be used to compare how different institutions of higher learning have performed in the knowledge integration process. Practices of excelling institutions would also be contrasted with those that have not done well to encourage comparing and copying best practices.
A large percentage of study participants identified a teaching staff shortage as a hindrance to the implementation of Indigenous science. Also, as seen in the methodology section on staff composition, there is evidence of a shortage of academic staff that greatly undermines the quality and output of education. The few academic staff available are continuously looking for better opportunities in different sectors such as NGOs, business, and outside countries (brain drain). Concerted efforts should be undertaken to train and retain professional staff both in AIS and dominant science. This may entail giving better remuneration for their services and additional incentives such as housing, health care benefits, and tuition fee subsidies for their children to ensure retention.

The preservation and promotion of traditional knowledge, history, customs, and belief systems is a collective responsibility. The entire community, state, and donor agencies are all stakeholders in the provision of quality and relevant education. The contest surrounding which knowledge is included or excluded in the curriculum can be addressed when all stakeholders make a commitment. Understanding the historical context under which Indigenous science was subjugated is a crucial step in integration. Apportioning blame on any specific education stakeholders is not the way forward; we are all complicit and we all have a role to play for a culturally relevant curriculum to be adopted in the education sector.

Inadequate funding for the education sector overall has been identified by study participants as a major factor hampering the integration of Indigenous science into the formal education curriculum. For meaningful integration of Indigenous science to take place, the government and the donor community funding the education sector must allocate funding for this long overdue project. We live in an era where we cannot afford to bury our heads in the sand and
negate the marginalization of Indigenous knowledge from the curriculum. For knowledge integration to materialize, its own department or faculty should be established in the different institutions of learning across the country. This also calls for diversified sources of funding for sustainability. Reliance solely on fees paid by privately sponsored students is not sustainable. Institutions of learning should engage in income generating activities to supplement financial contributions from students, donor communities, and the government.

Still, regarding the financial resource base for higher education, there is an urgent need by government and donor agencies to increase research grants to higher education. This is because research and publications constitute the pinnacle of university education. In the present era, most famous universities have gained international reputation and higher global ranking because of the quality of their research output. For Indigenous science, its integration into the formal education curriculum must be followed by an emphasis on critical research in the discipline. The field of Indigenous knowledge generally is under researched, which accounts for the scarcity of publications in that respect. For learners to gain more interest in the discipline, publications in the field must increase and be made easily accessible to both Indigenous and non-Indigenous learners.

9.2. Curriculum Development and Teacher Training

Proactive steps should be taken by the Ministry of Education and Sports to integrate Indigenous knowledge in formal education. The teachers training institutions and vocational schools should also contain a strong component of local knowledge. To achieve this, financial resources should be earmarked for the development of curriculum for traditional education programs. Such resources would be dispensed through the National Curriculum Development
Centre. The center would then be required to consult and involve respected members of the community in the selection of traditional knowledge with a focus on elements worthy of integration into institutional training programs and manuals.

Once school inspectors are trained on the significance of AIS, they must familiarize the community of the need to preserve Indigenous sciences in their jurisdiction. Some members of the community have been conditioned to think that their community knowledge regarding health and wellness, marriage education, animal husbandry, food security is worthless. For this reason, many parents send their children to school to acquire only dominant knowledge. It is therefore imperative that extensive community sensitization begin right from the grassroots level on the importance of traditional knowledge for the integration program to be sustainable.

As a long term goal, head teachers (principals) of primary and secondary schools should receive periodic trainings on Indigenous knowledge. Such training should focus on ways to integrate and sustain this body of knowledge in the public school system; this training should then be replicated by the head teachers at their respective schools. Accordingly, when actual implementation of Indigenous science at the lower level of public education is started, the program would not take them by surprise. This measure would augment the relationship between local communities and schools/educational institutions since the teachers would be locally recruited.

Teaching aids and tools kits that increase student creativity and new ways of thinking should be part of teacher curriculum and training. As stated by the study participants, Indigenous science learning is highly participatory as learners acquire skills while it is practically implemented (learn by doing). On this note, the Ministry of Education and Sports should acquire
enough equipment (teaching aids and tool kits) for the practical teaching and application of the discipline. In this way, the traditional method of learning by doing would not only be sustained, it would also be applied to other disciplines such as modern science. This would result in the development of integrated science necessary for radically changing the linear and dominant comprehension of science by the education system.

It is also imperative to invite community elders, teachers, and curriculum developers to network at conferences and workshops, and strategize on the elements of Indigenous science to be included in the curriculum. Where appropriate, establish Indigenous knowledge centers where different elements of Indigenous education, such as science, arts, cultures, music, language, geography, and history, will be taught. Such centers should be managed by community elders and experts of Indigenous knowledge. Also, the elders would be remunerated for their services at the different centres. Hammersmith (2007) echoed the significance of establishing such programs/centers under Indigenous leadership with the assertion that:

The recommended initiative, under Indigenous leadership, would aim at fostering understanding of the interfaces among language, culture, values, science, technology, and sustainable human development. It would also aim at fostering understanding of the comprehensive development of human, material and scientific resources. It would identify these in a manner that gives cognizance to the wisdom and authenticity of traditional Indigenous practices, institutions, and knowledge. (p. 225)

It will also be helpful for universities in collaboration with the ministry of education to organize periodic conferences/seminars/symposium on Indigenous sciences for educators, students, and scholars nationally and internationally to network and share experiences and best practices. In such conferences, bring elders from the community and scholars to interact and learn from one another. According to Yash (1996), this is a deliberate policy aimed at digging deep into Africa’s culture and spirituality to bring forth the energy of its ancestors for social, economic, and political empowerment.
The integration of the Indigenous science curriculum will necessitate a review of all the professional development programs at educational and training institutions. Specifically, the government should establish formal training and professional development courses for faculty, administrators and other stakeholders of higher education such as the board of trustees; this is critical because these bodies constitute the policy making organs. This training would be followed by mandatory, periodic reviews to monitor the implementation of traditional knowledge. The role of policymakers, according to Odora (2002), is to interrogate the epistemological parameters of current and emergent policies with reference to relations between knowledge and power and perceived limits to policy within the existing parameters.

Decisively encourage the formation of Indigenous organizations and research centers at sub-county levels throughout the country. Such organizations would have membership from all spectrums of society, such as government departments, religious bodies, cultural groups, peasant farmers, youth groups. The formation of these organizations and research centers would be significant in opening dialogue at the local level about the value of Indigenous science in their community and education space. It would also be from the community dialogue initiated by such centers and organizations that locals could unpack the stereotypical labels against traditional knowledge and appreciate such knowledge for what it has to offer.

The formation of Indigenous community research centers and organizations would also act as a Community Research Ethics Board (CREB). Such centers would allow the local community to establish mechanisms and requirements for external researchers to meet before being granted permission to carry out research in their community. This would not only provide protection to the wealthy body of community knowledge (intellectual property rights for Indigenous science), but would also act as a source of income for the community in question. All
external researchers would be required to pay a fee agreed upon by members of the of Indigenous community research center for CREB Approval to be granted. The fee collection would be used for sustaining such centers and other archives of published community knowledge. This measure would also support Indigenous societies in undertaking their own research and publication, hence creating data bases for community knowledge.

The government and development partners should support the Community Research Ethics Board with funding and staff professional training. This body would then act as central custodian for the protection of AIS intellectual property rights from misappropriation and ensure sacred Indigenous knowledge/sites are respected. This would promote the principle of respect which, according to Mander and Tauli-Corpuz (2005), recognizes the need for researchers to respect the integrity, morality, and spirituality of the culture, traditions, and relationships of Indigenous peoples to avoid the imposition of external conceptions and values. Promoting the principle of respect is instrumental in addressing the issue of power for knowledge integration to be sustainable and beneficial. According to Odora (2002), knowledge integration means going beyond finding middle ground upon which the two knowledge systems can enter into a historical dialogue. Instead, it introduces the power and knowledge critique and analysis of the supremacy of mainstream knowledges in terms of their silencing effects, while paying attention to their nature, potential, omissions, and consequences.

The government should provide an extensive market catchment for the products of Indigenous knowledge both locally and internationally. This is an important strategy to attract people whose opinions on Indigenous knowledge are negative. For instance, Indigenous health and healing practices are not extensively advertised as compared to the modern health care system, yet both approaches are contributing to community health. Media houses producing
programs for promotion of Indigenous science should be required to offer subsidies for advertising products and services locally generated. Finally, it is critical to identify and benchmark Indigenous knowledge’s axiological and ontological principles in Uganda’s Ministry of Education and Sports Improvement Plans with structured hiring targeting teaching staff (professors, lecturers, teachers, and tutors) with rooted research interest and publications in Indigenous knowledge.

The key recommendations from this study are intended to ensure that Uganda’s education system taps into diverse knowledge systems for enhancing students’ achievement and community development. The integration of diverse knowledge in formal education is integral in meeting the needs of the constantly evolving local and global communities. By fostering a culturally sensitive pedagogy that is premised on the principle of inclusive education enshrined in African traditional education, Uganda will be able to attract and retain a critical mass of highly motivated students with keen interest in science disciplines, and skilled, diverse employees who will find their experiences to be meaningful and relevant to local and global contexts.

9.3. Conclusion

Throughout this thesis, African Indigenous Science has been articulated identically with traditional or local science to refer to the practice of science developed locally by the African community. Modern or Western/Eurocentric science has been used to imply dominant science discourses in most African formal education systems. It is projected as a universal system of knowledge that has displaced other belief and knowledge systems with its universality (Vandana, 1997). Western science is also acknowledged as the local science of the Western societies. This epistemology was, however, projected as a value free system of knowledge. Such science
discourse, as pointed out in chapter two, was introduced in Africa through formal education. The introduction of formal education, however, had an adverse impact on traditional education that had maintained African societies for years prior. In the absence of African traditional education, formal education became a vehicle for inculcating values and belief systems that are alien to African learners, and produced a dependency syndrome and admiration for the foreign lifestyle that comes with formal education.

Based on the above, fundamental reform is required in the education sector with a central focus on the inclusion of the African Indigenous knowledge system in formal education so that the two worldviews offer varying solutions to the disruptions of the means of survival currently being experienced. The whole notion of Western hegemonic discourse prevalent in developing societies’ education system is disrupting progress and encouraging the subordination of African people. Besides, the current policy that champions universal primary and secondary education with equal access for all learners cannot achieve its objectives as long as traditional knowledge continues to be sidelined. This is because of the policy’s emphasis on dominant western knowledge. The continuous exclusion of relevant Indigenous science that resonates with the lived experiences of African people can best be described as persistent intellectual control that only promotes ideological as well as physical dependency on Western countries.

Finally, it is important to note that various scholarly research with a Eurocentric lens in Africa has focused on governance, natural and human calamities, epidemics such as the HIV scourge, and the positive contributions of foreign interventions. Absent from the research is information on the efforts by Africans to provide practical, locally generated remedies to the challenges of their societies. The participants’ voices in authenticating AIS knowledge have been anchored on lived experiences growing in Uganda and on their witnessing how traditional
knowledge empowers the local community with concrete solutions to the challenges confronting them. In the words of Molefi (1990), it is the true meaning of Africalogical. He states that “an exploration, to be Africalogical, must be based on sound intellectual and philosophical foundations which maintain the centrality of the African experience and primacy of classical traditions” (p. 169). In methodological and theoretical terms, Odora (2002, p. 11) reminds us that “engaging with Indigenous knowledge implies sensitization, empowerment, and restoration of holism and ethical practices, including spirituality for individual systems” which in essence is validating lived experiences. Validating and centering my own experiences in analyzing data and interlinking with participants’ voices and the literature, I have come to terms with the fact that African traditional knowledge plays a vital role in offering contextually relevant solutions to community challenges - thus its integration in the education curriculum is imperative for the progress of Ugandans and all Africans societies.
Bibliography


UNICEF


PROTOCOL REFERENCE # 26619

July 25, 2011

Professor Njoki Wane
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Mr. Francis Aduanya Akena
Sociology and Equity Studies in Education
OISE/University of Toronto
252 Riel St. West
Toronto, ON M5S 1V6

Dear Professor Wane and Mr. Aduanya Akena:

Re: Your research protocol entitled, "Integrating African Indigenous Science in Faculties of Higher Education in Uganda"

ETHICS APPROVAL

Original Approval Date: July 25, 2011
Expiry Date: July 24, 2012
Continuing Review Level: 1

We are writing to advise you that the Social Sciences, Humanities and Education Research Ethics Board has granted approval to the above-named research study under the REB's delegated review process. Your study has been approved for a period of one year and ongoing projects must be renewed prior to the expiry date.

All your most recently submitted documents have been approved for use in this study.

Any changes to the approved protocol or consent materials must be reviewed and approved through the amendment process prior to its implementation. Any adverse or unanticipated events should be reported to the Office of Research Ethics as soon as possible.

Please ensure that you submit an Annual Renewal Form or a Study Completion Report 15 to 30 days prior to the expiry date of your study. Note that annual renewals for studies cannot be accepted more than 30 days prior to the date of expiry, as per federal and international policies.

If your research has funding attached, please contact the relevant Research Funding Officer in Research Services to ensure that your funds are released.

Best wishes for the successful completion of your project.

Yours sincerely,

Dean Sharpe, Ph.D.
Research Ethics Board Manager—Social Sciences and Humanities
June 13th, 2011

APPENDIX A

Dear Madam/Sir,

Information Letter for Potential Interviewees

I am PhD candidate in Sociology and Equity Studies at the Ontario Institute for Studies in Education, University of Toronto (OISE/UT). I am doing a research on Integration of African Indigenous Science in Faculties Higher Education in Uganda. The main aim of this study is to examine how African Indigenous Science can be integrated in the national school curriculum to improve teaching and students’ comprehension and application of science principles to their immediate environment.

The reason that I would like to speak with you is that, as a student, your perspective is quite significant in contributing to policy reform of science educational for our students.

I would like to invite you to participate in an interview about your experiences with subjects in the science discipline and how you feel about indigenizing the contemporary science curriculum.

Your estimated participation time will be about 45 minutes and this shall take place either in the university or a place that is reasonably convenient to you and safe for both of us. All information derived from the interviews will be used for research and academic purposes only. Your identity will be kept entirely confidential. Of course, please feel free to say if you are not interested in participating, or are unable to participate at this time.

If you do not want to make a decision at this time, please let me know when I should contact you again. You may also reach me at the following telephone number/email in Uganda at a convenient time: Tel: 0774 803 508, e-mail: francis.akenaadyanga@utoronto.ca, adyanga_frank@yahoo.com.

Please read the enclosed consent protocol, and let me know if it is acceptable, and if you would like to participate in this study. If you have any further questions, please do not hesitate to contact me. I look forward to hearing from you.

Yours sincerely,

Francis Akena Adyanga,
APPENDIX B

Consent Protocol for individual interviews

Research topic: *Integrating African Indigenous Science in Faculties of Higher Education in Uganda*

The aim of this study is to examine how African Indigenous Science can be integrated in the national school curriculum to improve teaching and students' comprehension and application of science principles to their immediate environment. The information will be used for my PhD thesis and will also be presented in the form of conference presentations, journal articles, working papers and book chapters. The reason that I would like to speak with you is because of your wealth of theoretical as well as practical experiences working in the classroom setting as a lecturer/professor and seeing the challenges that students grapple with as far as science pedagogy is concerned.

I would like to confirm your agreement to participate in this research. If you do not wish to take part, please feel free to say so. If you agree, and there are any topics that come up during the course of the interview that you do not want to discuss, please just say so. If at any point attention arise (you decide that you do not wish to continue with the interview), please let me know and we will stop immediately. In that case I will not use any of the information you have provided. All the data you have given to me will be deleted and not used any more in the study. However, I request that you give rationale for withdrawal from the study.

Participation in this study may involve answering/addressing the attached questions/topics.

I would like to have your permission to record the interview. The audio file will not have your name attached to it, and will only be listened to and transcribed by myself. If you wish, I will provide you with a copy of the audio recording and/or the transcript. I will keep the audio files for three years after the study is completed; they will then be deleted. Transcripts with no name attached may be kept for five years after the study is completed (in case a follow up study is warranted). If you are in any way uncomfortable with the interview being recorded, please just say so, in that case I will just take notes during the interview.

All information contained in this interview is confidential and anonymous. Only I know the names of the people who are being interviewed, and there will be only one copy of these names, which I will keep under lock and key/saved as an encrypted file.

Any reports I write for this study will ensure that you are kept anonymous. For example I might speak in a general way, saying that a particular issue was reported by several of the people interviewed. Or I might quote you by saying that one individual interviewed said...... In no...
APPENDIX C

RESEARCH QUESTIONS

My preliminary questions to research will include some of these enquiries:

1. What is African Indigenous science?
2. What is the status of Indigenous science in Higher education?
3. How and what elements of African Indigenous science should be integrated in higher education curriculum?
4. What are professors’ perceptions of African indigenous science?
5. What are students’ perceptions of African indigenous science?
6. What are the attitudes of professors and students to indigenous science curriculum?
7. What are the dilemmas faced by Lapani University in implementing African indigenous science curriculum?
8. What are the constraints faced by Masomo University faculty of science in implementing African indigenous science curriculum?
9. What is the status of professors in initiating syllabus national education curriculum?
10. What are the social and cultural factors on the perception of professors and students regarding indigenous knowledge curriculum?
11. What are the historical and political changes influencing the direction of education policy in Uganda?