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Examination of Traditional Medicine and Herbal Pharmacology and the Implications for Teaching and Education: A Ghanaian Case Study

This article presents the preliminary findings of a pilot study of the practice, uses, and effectiveness of traditional medicine in Ghana. Based on in-depth interviews with local key practitioners and users of traditional medicine, the article points to some of the educational significance of local cultural knowledge on the environment and the relevance of such knowledge for science education in Ghana. In the discussion the authors briefly highlight general themes relating to local understandings of traditional medicine, the distinctions between traditional and plant medicine, contestations between traditional medicine and orthodox medicine, local conceptions of health and a healthy individual, the economics of health, and the lessons of science and public education. Although the findings of the study are preliminary, the article argues that much is to be gained for educational purposes through the critical study of traditional medicine, particularly in terms of the promotion of science and community education in Ghana.

Cet article présente les résultats préliminaires d'une étude pilote portant sur la pratique, les usages et l'efficacité de la médecine traditionnelle au Ghana. Reposant sur des entrevues détaillées auprès de figures locales importantes en médecine traditionnelle (praticiens et patients), l'article souligne la signification pédagogique des connaissances culturelles locales relatives à l'environnement et évoque leur pertinence en enseignement des sciences au Ghana. Les auteurs font brièvement ressortir les thèmes généraux relatifs aux connaissances locales de la médecine traditionnelle, aux différences entre la médecine traditionnelle et la médecine basée sur les plantes, les points contentieux entre la médecine traditionnelle et la médecine orthodoxe, les conceptions locales relatives à la santé et à une personne en santé, la santé et l'économie, et les leçons de la science et l'éducation publique. Même si les résultats de l'étude sont préliminaires, nous affirmons avoir beaucoup à gagner sur le plan éducationnel en étudiant de façon approfondie la médecine traditionnelle, notamment quant à la promotion de l'enseignement communautaire et des sciences au Ghana.

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Introduction

In addressing the issue of teaching and education for teaching, we find ourselves also asking questions about education and the content of what we teach how and why we teach. Many would define education as the ways, strategies, and options through which we come to know our world and act in it to transform and change ourselves (Dei, 2004). Education means knowing and understanding our social and physical environments and the interactions required to be informed citizenry. Teaching education, then, can be conceptualized broadly as helping all learners acquire knowledge to help improve their living conditions and those of society. So there exists much information to be taught to learners. We intervene in this publication with an examination of teaching local cultural knowledge.

Throughout local communities, plant medicines are used for a variety of ailments including the treatment of common colds, malaria, and controlling hypertension and cholesterol levels. Yet to our knowledge, no cross-national study in Ghana (or indeed Africa) has focused on the users of plant herbal medicine to understand local conceptions of their effectiveness, why the use of such medications, the epistemological and philosophical groundings of herbal pharmacology as an Indigenous knowledge system, the pedagogical and instructional relevance of such knowledge, and the implications for teaching science education.

The role of traditional medicine to community health care needs and national development as a whole is often simply assumed. However, the linkage needs to be theorized and operationalized, and as well, the sociological and educational dimensions fleshed out for the understanding of society-nature-culture nexus. By identifying some key questions, we hope to broach the challenges and possibilities of educational research in providing relevant knowledge for theorization of Indigeneity and local cultural resources as valid ways of knowing.

It is widely recognized in Africa that there is the need for the integration of traditional medicinal knowledge into school science and social studies curriculum. Knowledge about plant medicines could be helpful in developing appropriate instructional and pedagogic approaches to the teaching of Indigenous science. An understanding of the traditional ways of knowledge transfer in communities including intergenerational communication, gendered dimensions of traditional knowledge, and working with traditional cultural custodians and herbalists and medical practitioners points to the sociocultural and political context of Indigenous science education.

The knowledge systems of traditional medicine and herbal medicine are not so distinct from each other. The differences are increasingly becoming blurred in our communities today. In fact traditional medicine is inclusive of herbal medicine. They both constitute Indigenous forms of knowledge dealing specifically with the health and social well-being of a community. Many herbalists and traditional medicine practitioners embrace the social, cultural, natural, spiritual, and physical realms of everyday existence. They depend on the material and non-material, physical and metaphysical meanings of everyday life and the interface of such knowledge in their communities. There is no doubt that such distinction and the coordination of such knowledge

systems [traditional medicine and plant medicine] mean a lot for teaching school and community science and technology.

Among the conceptual and methodological issues to be noted, one can point to the documentation of these knowledge systems for wider educative purposes in communities, not just at health clinics. There is also the challenge of archiving information for future reference and education. This will entail knowing who and what are the appropriate sources in the acquisition of these knowledge. This in itself is helpful in dealing with the question of ownership of (cultural) knowledge (e.g., intellectual property rights). In some communities, secrecy and rituals surrounding traditional medicine practice and who has such knowledge constitute a gate-keeping process. In fact the observed secrecy and rituals surrounding traditional medicine practice and the way such knowledges manifests a gate-keeping process reveal similarities to, as well as differences from, medical schools in the formal educational system regarding the protocols necessary to be followed to allow seekers of plant medicinal knowledge entry into this Indigenous knowledge and its associated practices. Traditional herbalists recruit members into the inner circle of knowledge usually, but not exclusively, from close kin, and these recruits as apprentices undergo training under the stewardship and tutelage of elder herbalists before becoming licenced practitioners. Thus information about plant medicine is not necessarily passed on to everyone. All recruits into the plant medicinal cycle have to undergo specific initiation rituals that serve to solidify their entry into the traditional health profession. Once in the profession there are certain protocols to be followed, and they show broad similarities to the training of Western physicians (e.g., serving for a required number of years to gain certification in the traditional health practice; working as an apprentice under a supervisor; being attached to a health/herbal clinic for internship; and dispensing medication under the supervision of the elder herbalists). But in order to grapple with these issues, we must obtain an in-depth understanding of local perceptions of the uses, effectiveness, and relevance of traditional medicine in the everyday health and community development practices of local people.

Although there is a wide body of African literature on herbal medicine, particularly medicinal plants, the information is scattered, descriptive, and largely focused on community case studies. Addae-Mensah (1989, 1991), Amo (2007, 2008), Oku-Ampofo (1976), Anfom (1986), Bonsu (1994), Mensah-Dapaah (1968), Twumasi (1978, 1979), and Acheampong (1989) in their extensive studies have long demonstrated the relevance of Indigenous health medicine in Ghana. Pioneering studies in the West African region by Harley (1941, 1970), Okiy (1960), Taylor-Smith (1966), Adegoke, Akisanya, and Naqvi (1968), Adansi (1970), Ampofo (1977), Lawson (1986), and Oku-Easmon (1891) point to the medicinal uses of herbs in the treatment of common and severe ailments in local communities. Many of these works through surveys document local plant pharmacological knowledge for informational and educational purposes and in a few cases touch on the local conservation efforts on wildlands and medicinal plants. Relatively recent works such as Mshana et al. (1999) have followed this trend with an ethnobotanical survey of Ghana medicinal flora. Similarly, Dokosi (1998) is an interesting read on the uses of herbaceous plants in Ghana. Working with traditional herbalists, the study

documents Indigenous wild plants and their medicinal uses in selected communities in Ghana drawing on similar groundbreaking studies in Africa and beyond (Basu & Pabrai, 1948; Lyon, 1990; Morton, 1968; Usher, 1962; Watt & Breyer-Brandwijk, 1962; Williams, 1955; Xavier, 1977). A recent publication in the local vernacular (Bonsu, 2007) also documents Ghanaian traditional herbal knowledge with a focus on the genesis, prevention, and cure of about 50 diseases. In general, however, the sociological, ecological, and political complexities of plant medicine as an Indigenous knowledge system underpinning the society-culture-nature nexus in rural communities has been largely underexplored. There is no cross-national comparative study of plant medicine, its practice and uses in varied ethnic groups and across varying vegetational zones in the country. It is this gap that the current study fills by understanding local perceptions about traditional herbal medicine, their uses and applications, and their fit with the cultural, social, political, spiritual, and physical [natural] realms of society.

Context

Ghanaians come from six main ethnic groups: the Akan (Ashanti and Fanti), the Ewe, the Ga-Adangbe, the Mole-Dagbani, the Guan, and the Gurma most of whom are rural-dwellers. They are religious people with about 60% being Christians, 15% Muslim, and 25% traditional African religions.

Ghanaian traditional healers work either as priest/priestess or the herbalist. The priest or priestess in most cases owes divine allegiance to a local deity from whom they derive divine powers for healing. The priest or priestess is a highly respected member of the community whose word is truth because it is believed that such a person is selected by the god and ancestral spirits to be a healer. In traditional medicine practice, most diseases are a consequence of supernatural causes like taboo violation, punishing ancestral spirits, envy, jealousy, and witchcraft. There is, however, no clear distinction between the traditional healer as a priest/priestess and the herbalist because they both use herbs as the main base for their treatment.

Patrons of traditional medicine are mostly people who believe in the traditional African religion or in Islam. The Ghanaian Christians, who are in the majority, avoid herbal treatment as much as possible because they see it as fetish that is practiced by "nonbelievers."

In recent times, however, the herbalist and the traditional medicine practitioners have become the last stop of health care services. Apart from the cost effectiveness of their treatments, their medications have been seen as potent as they have been able to treat people with all kinds of fractures, spiritual ailments, mental problems, sexually transmitted diseases, sexual weaknesses and barrenness, and so forth.

Methodology

The study began with an important premise that an appropriate evaluation of traditional plant medicine as local cultural resource knowledge must take into account subjective knowing, particularly those local voices that are directly engaged in the use, application, and transmission of this knowledge as students and practitioners. Consequently, we used multiple data sources and research designs: quantitative studies through administering a cross-national

field questionnaire and a cross-national qualitative research methodology that included in-depth individual and focus-group interviews with a select number of key informants as users/practitioners of traditional plant medicine. The goal was to explore how such cultural knowledge from diverse groups in Ghana informs everyday practice and social action about national health prevention, diagnosis, and cure of ailments.

The data reported here are the preliminary findings of the pilot study conducted as Phase One of a larger project. The main project was designed with three main research phases, each consisting of a number of specific research activities: pilot study, extensive field research and data analysis, and dissemination of findings. We began Phase One, which is the focus of this article, by training student researchers to help the principal investigators to conduct a pilot study. This was intended to field test the survey and in-depth interview research questions in two metropolitan cities/centers where we hoped to secure a full representation of the diverse Ghanaian ethnic groups. We administered field questionnaires to a total of 29 local participants and six key practitioners to conduct in-depth interviews.

A list of survey questions was prepared to ascertain the nature, extent, and use of traditional plant medicines in Ghanaian communities. The questionnaire sought responses to simple open-ended questions. For the in-depth qualitative studies with selected key participants, five major questions guided the interviews on the use and application of traditional plant medicine in local communities. The five research questions formulated to guide the study were:

- How do local people understand the content, practice, use, relevance and educational implications of traditional plant medicine as local cultural resource knowledge?
- How do study informants reflect and articulate the practice, uses, and effectiveness of traditional medicinal plants in their respective local communities using an Indigenous and scientific knowledge base?
- How does such local cultural resource knowledge reflect differences in communities and their histories, specifically relating to ethnicity, gender, class, sexuality, religion, language, as well as age/intergenerational differences in communities?
- What can research identify by way of other [unknown] uses of plants in the study communities? and
- How is knowledge of the practice and use of plant medicines, their epistemological and philosophical groundings, being transmitted in the wider society?

In the key interviews, our interest was in exploring the philosophical basis and practical implications for the use of traditional plant medicine, specifically, what can be learned by a critical examination of some of the sociocultural, cosmological, and spiritual dimensions and underpinnings of traditional medicine. For example, we wanted to know how and what these knowledge systems teach about society, culture, and history besides medical and health needs. In our study, the use of in-depth interviews was also intended to produce, and assist researchers to probe substantive responses from the questionnaires. These in-depth responses surpass structural accounts and offer understandings of plant medicine as local cultural knowing. The interviews

have focused on developing an understanding of how key informants "transform the social world they inhabit" by speaking, teaching, and learning collectively about traditional plant medicines and local pharmacology. The interviews provided study participants with the opportunity to center their lived experiences in the knowledge and use of traditional medicine. The narratives reported here were gleaned from an analysis of individual interviews with local participants and key herbal practitioners. Open-ended questions were asked in a semistructured interview style. Participants who were asked to speak from their experience were given time to reflect on their responses and to present other issues of interest or concern. Interviewees were asked about their understandings of traditional medicine, its effectiveness, and uses of plant medicine. They were also asked to comment on the significance of subject identity for knowledge production and how questions of local knowledge of the environment were helpful in understanding the uses of herbs.

The preliminary data were quantitatively and qualitatively analyzed for general trends in innovative traditional health practices. Through triangulation, we have been able to compare individual narratives between and among users and herbalists. To ascertain the specific roles and importance of traditional plant medicine, field research data analysis addressed some broader theoretical questions: What is the role of culture, language, history, and social politics in health, development, and society? How do local/indigenous knowledge systems contribute to the search for viable educational and health options and alternatives for Ghana and other southern contexts? What is the connection between traditional plant medicine and school science education in general? How can research information from this study form the basis of a larger comparative research dealing with the sociological, cultural, political, pedagogic, and instructional aspects of traditional medicine and herbal pharmacology in the greater African contexts?

In effect, the study used participants' words to highlight the tensions, struggles, contradictions, and ambiguities in subject(ive) accounts of dealing with local plant knowledge. As noted elsewhere (Dei, 2004), the importance of *voice* allows readers to bring their own interpretations to the data. Participants' voice moves the analysis beyond an abstract theoretical discussion of traditional pharmacology to reveal a nuanced interpretation of the meaning of health and Indigenous knowledge. For the critical researcher, voice provides insight into the historical and present contexts that contribute to participants' standpoint knowledge. For this study, we highlight voices that reflect a diverse, sophisticated understanding of the complexities and relations of difference.

As noted, the findings reported here are based on a pilot study. We focus largely on the qualitative aspect of a broader study that employed multiple data sources (e.g., survey/quantitative, in-depth interviews, focus groups) and data analyses that have been addressed elsewhere (Centre for School and Commmunity Science and Technology Studies [SACOST], 2008). We have undertaken thematic analysis of the data suggesting a combination of method and methodology. We acknowledge that the approach adopted simplifies and presents data bites as findings consistent with quantitative surveys and have chosen not to deal with possible ontological-epistemic distinctions between

research approaches and/or paradigms given some seemingly irreconcilable assumptions between various knowledge traditions.

The report from which this article emerges belongs to the SACOST and University of Toronto. Research participants involved in the broader study were duly contacted with the findings of our report and consented to the information being reported. Pseudonyms are used to identify study participants whose voices are quoted. In addition, both the study participants, including professional herbalists and experts on the field of local plant pharmacology, were consulted in addressing the correctness of the meaning of local words, and the major report was available to them to comment on. Consent of study participants was secured through both oral and written communication.

Findings

In this section we analyze and present the preliminary qualitative findings of our study. In the larger report (SACOST, 2008), we discussed the quantitative findings from the surveys alongside the qualitative data. To note any convergences and divergences in quick responses to survey questions, we decided to interview some local participants on the practice, use, and effectiveness of plant medicine. The responses are analyzed under six main themes that reflect the significance of traditional medicine in the everyday sense.

Using Traditional Medicine

Local participants interviewed attest to the general use of traditional medicine in Ghana. When asked about the frequency of use of traditional medicines, most agreed to its wide use. Wofa Yaw, a traditional herbalist, was doing plant medicine in his village; he personally prepared some concoctions to cure ailments. He no longer practices this in his new abode in the city, but he concedes that,

> In my place, we do not go to the hospital when you step on sharp object and you are infected with tetanus. Some leaves were used in the treatment and other times cutlass is placed in fire and shea butter is dropped on the cutlass and this is put onto the affected area.

He reasons that most people in the rural areas will not go to hospital for certain simple illness. They instead rely on traditional medications for treatment. It is such practice that accounts for the wide use of traditional medicines in local rural communities. However, in the urban setting, the use of traditional medicine, particularly among the Western educated, may not be so intense. As a local participant retorted, "Some highly educated people wouldn't want to go for plant medicine but few may believe on their efficacy."

Later in the interview Wofa Yaw offered more examples of the use of traditional herbs and preparations to cure particular illnesses:

> Egorro [part of a leaf] is used in the treatment of tetanus but I don't know their scientific names … [Also] … When a pregnant woman delivers, palm nut soup is prepared for her using abedro which helps heal her wounds and within three weeks the woman is healthy. Most people in the village believe in these plant/traditional medications. The important thing now is to sustain this practice.

Most rural dwellers know about these traditional medications and treatments. They may rely on some without necessarily consulting traditional herbalists. In our discussions with local participants who believe passionately in traditional medicine, there is a plea for the state to help sustain this medical practice for practical and economic reasons. In fact Ano claims barely to use such medications. But he concedes, "there are some few cases of people using herbal medicine and it works for them." He also points to some concerns about traditional medicine. His worries are captured by this statement: "I don't use herbal medicine though they are good but most are not licenced or endorsed by the Food and Drugs Board. In addition, one herbal/traditional medicine can cure about 30 sicknesses, which is bad."

Ano's concerns relate to the two observations are: the licencing of traditional herbalists and the claims of some of these herbal medications. Whereas Ano notes that "the role of herbalist in the community is to cure the diseases that are not cured by the orthodox medicine" [and that] "plant medicine can be used to prevent some illness," the claims of traditional herbalists to use one concoction to heal several ailments at the same time makes their medical practice at times suspicious. Such worries are often alluded to by Western-educated Ghanaians. They ask how one medication can be a cure for everything. One user of herbal medication interviewed in the capital city, Accra, in speaking about the efficacy of herbal medications, expresses similar concerns. He actually brings additional issues to the fore:

> Herbal medicine is good but most of them are not licenced and endorsed by the Food and Drugs Board so I don't like it though I know it's good. Also, one herbal medicine can cure about thirty (30) illnesses so I don't really go for them. It is sometimes bitter when taking in.

In effect, the fact that most of these practitioners are unlicenced presents some challenges to health care. There is some doubt about the alleged effectiveness of these medications in treating several ailments at the same time. Nonetheless, this respondent maintains that herbal medications are good and may not taste sweet, but they work in providing a cure. In fact, a belief is expressed in anecdotal comments that the more bitter the concoctions, the more effective they are. The crucial point is that it would be helpful if all these practitioners were licenced. The concern is enough to warrant a caution from the respondent: "Traditional medicine is good, but when going to buy them we should be cautious."

Traditional and Orthodox Medicine

In their responses to interview questions, respondents acknowledged the competition between Western/orthodox medicine and traditional medicine. They see this as something worthy of attention as it robs the citizen of adequate health care. In providing a historical reading of the situation, one local respondent observed:

> They [i.e., herbalists] are around everywhere you go, and the traditional medicine was formerly used a lot before the introduction of orthodox medicine and the coming of the white man. But I can say, almost every Ghanaian and people living in Ghana in a lifetime use plant medicine. I can't really tell, but 60% orthodox and 40% to traditional medicine.

The assertion that almost every person living in Ghanaian in his or her lifetime has used traditional medications is commonly held. So is the advent of Western/orthodox medicine associated with the "coming of the white man." There is some understanding that the resulting competition between the two health care systems has had deleterious effects on traditional medicinal practices. As noted, "Westernized medicine" has become the preferred choice of the urban and educated elite. But alongside this development has come the devaluation of traditional medicine by some Western-educated elites. In fact the above-quoted respondent would want to see cooperation between the two health practices instead of the current unhealthy competition. This cause can only help promote the health and well-being of the local citizenry.

> If you go to the hospital and you are not cured they take care of you by treating you with herbal medicine. I think this is the role herbalists play basically. Yes I think both practitioners [traditional herbalist and orthodox medical doctors] can learn from each other. Because there are some hidden things best know to each of them.… but they can learn from each other and blend the two medicines for treatment. The doctors sometimes feel they are superior to the traditional medical practitioners because of their educational status. But this gap can be bridged through seminars. The Ghana Health Association can matter both parties and teach them.

It is asserted that those who are not cured by orthodox medicine return to traditional medicinal sources for treatment. Some hidden forms of knowledge can be uncovered. There is much to learn from both medical practices. In fact such mutual cooperation can be beneficial to both sciences. But in order for any cooperation to be meaningful, it is important for Western science practitioners to acknowledge the benefits of such interdependence and not be simply dismissive of the efficacy of traditional medicine.

Traditional Medicine and Plant Medicine

In this study we were particularly interested in exploring how locals understand both traditional medicine and plant/herbal medicine. This was critical knowledge as there is a tendency to conflate the two and not draw on some important distinctions. For example, Ano, whom we had met earlier, insisted that "plant and traditional medicine are the same."

Wofa Yaw offered this clarification while pointing to the similarities as well: "Traditional medicine is that type of medicine made from our local herbs and plants, and for me plant medicine and traditional medicine are the same." Another local respondent enthuses that traditional medicine is an encompassing practice that borders on significant religious, spiritual, social, and cultural components and dimensions. She emphasizes the spiritual: "I have heard people say that there is some spiritual dimensions of traditional medicine e.g., you have to turn your back before cutting a particular tree. 'This is juju.'" Another respondent observed, "I don't think there is any spirit behind traditional medicine, everything natural." Again, this is informative of the broader understanding that sometimes a few locals offer for traditional medicine.

In other words, traditional medicine is more than using plants and herbs. Certain rituals are performed making the spiritual a central component of the practice of traditional medicine. In fact as noted above, traditional medicine is a broader reference to traditional health knowledge. It may include herbal

plants and plant pharmacology (herbs, scrubs, tree barks), as well as the use of spiritual and social knowledge to treat ailments and illnesses. Plant medicine, on the other hand, refers simply to the use of plants and herbs.

Healthy Individual

We also asked local respondents about what is healthy and/or who is a healthy person. The question was designed to capture local knowledge about health. Ano, who had professed to use herbal medications only occasionally, responded to the question about a healthy individual: "A person is healthy when the person wakes up and have the energy to go to work without having any part of the body weak." Another user of traditional herbal medicine interviewed in the capital, Accra, agreed: "This is when every part of the body is weak and also the person is not able to go through his/her normal activities for the day. Headache, loss of appetite or visiting the gents [washroom] several times." It is interesting that both participants equated health with physical body strength. There is no recognition of the importance of social well-being. The linking of social and physical is not generally recognized among participants interviewed. Wofa Yaw comes close to offer a broader interpretation of health: "A healthy community is a place where we have clean environment free from filth and other harmful things, and a place where the environment is clean."

By situating the discussion in a conception of the environment, Wofa Yaw leaves some room for rethinking health in its social and physical dimensions. The idea of a clean environment and its significance for maintaining local health allows a critical reader to draw on the links of the social and physical environment. Another respondent observed, "I don't think there is any spirit behind traditional medicine, everything is natural." Again, this is informative of the broader understanding that a few local participants sometimes offer for traditional medicine.

The Economics of Health

The rising cost of health care in the country has brought to the table serious considerations of the economics of using traditional medicine. Most participants interviewed lamented about the high cost of medicines obtained from pharmacies and the negative consequences for locals seeking treatment from hospitals and clinics. For example, as Ano noted,

> People use plant medicine because of high cost of medicines on the market and people think the plant/traditional medicine are quite cheap and also people believe in plant medicine, so it is two things: the believe aspect and the economic aspect.

People believe in traditional medicine because it works for them. To others, the low cost of such medication makes it a preferred choice, particularly the poor in the rural areas who cannot afford the rising cost of Western science/orthodox medicine. Rural people are being strategic. Because traditional medications are cheap, this is an inducement and incentive for many to rely on their use for the treatment, cure, and prevention of disease. One city-dweller who admitted that he frequently used herbal medications expressed this forcefully.

> Because of the high cost of orthodox medicine on the market, people prefer traditional to orthodox medicine since it is cheaper. Others also believe so much in it, hence they use it often mainly for the economic [calculation] and belief aspect.

In a climate of scarce economic resources, people have to make rational choices to get the best service for their resources. But Ano sheds further light on the situation. He believes that the government has put more financial resources into Western medicine practice. For one thing, more resources mean more research and the possibility of better results. This in itself has helped affirm the perception of its effectiveness in health, cure, and treatment in the minds of some, particularly those who may dislike traditional medications.

> The orthodox medicine is more effective because they put a lot of money to do research before they come out. But for plant medicine, they don't put in enough money and research into it, hence very dangerous to use.

Thus to Ano, the failure of the state to invest in traditional health care can make practitioners engage in some "dangerous practices" for survival. The differential treatment of orthodox medicine and traditional medicine by the state is thus a matter of urgent concern and in need of addressing. Another local participant when asked for her opinion on the subject, said:

> The orthodox medicine is better and effective because too much money and time [is put] into the preparation of these drugs. Traditional medicine is also good but they don't put in much research inside so in a way it is dangerous. The orthodox is more effective due to these reasons.

It is a feeling that if the state were to invest equally in traditional and plant medicine, the public would generally come to rely on it and widely appreciate its effectiveness in the prevention, treatment, and cure of many ailments. Ano offers some advice when he aptly mentions the role of formal education: "Role of formal education is to educate the people about herbal medicine. Herbal medicine is good, but it still has a long way to go; they shouldn't condemn herbal medicine." He believes that education can do more to promote traditional medicine as science knowledge in the country.

Science and Public Education

Public education is needed in order to disseminate the effectiveness of plant medication to the people. Such medication cannot be condemned, and the traditional health care profession cannot be underresourced. For example, one respondent admitted, "I got to know about plant medicine through people around me." This indicates that such knowledge exists in communities. It is important for such knowledge to be shared at the community level. Public education can assist in this endeavor, and this would augur well to strengthen initiatives aimed at sustaining local people's health.

Another respondent added when speaking about the function of education in this regard:

> I bought a book on Plant medicine and that is where I got my information … and [I see] … The role of formal education in the promotion of traditional medicine in community is to help educate people on plant medicine in schools and communities.

The role of schools is implied in this context. This affirms the critical role that education and educators can play to teach and help disseminate information on traditional medicines. Education has a significant task to perform in the promotion of health care of a contemporary nation struggling with scarce economic resources.

Discussion: Plant Medicine as Indigenous Knowledge

In exploring how such cultural knowledge (i.e., plant medicinal knowledge) from diverse groups in Ghana informs everyday practice and social action about national health prevention, diagnosis, and cure of ailments, we found that raising questions about *what, how,* and *why* were most significant. Although the questions about *what* and *how* are specific to the local people, these questions still offer important leads to a critical understanding and practice of traditional plant medicine. These leads herald the complex dynamics of socio-educational, cultural, spiritual, sociological, and political forces for engaging Indigenous knowledge as a valid way of knowing. In order to promote a holistic education, it is important for teacher education to embrace the multiplicity of knowledges that informs everyday realities of people. Local cultural resource knowledge is a valid way of learning about communities and the interactions of the society-culture-nature nexus. Knowledge of traditional plant medicine is relevant in that it serves the purpose of Indigenous knowledge and general or teacher education. We highlight local voices giving personal observations or assertions in their own right as how they make sense of their world. These voices cannot be downplayed or their legitimacy refuted unless they are situated in an existing literature that supposedly validates local voices.

What is Indigeneity, and what are the possibilities of Indigenous knowledges in creating a new vision of education that holds the promise and possibility of excellence for all? As Dei (in press a) argues, the binary tensions between so-called Western science/scientific knowledge and the Indigenous knowledge system are unproductive for learning, especially if it is acknowledged that we are dealing with multiple systems of knowledge and that no body of knowledge can claim superiority over another. If a distinction must be made in knowledge systems, the focus should be on the processes of differentiation that set knowledge systems apart in their epistemic and philosophical emphasis, as well as how power dynamics shape the production, interrogation, validation, and dissemination of knowledge systems, both internally and globally. The romanticization and decontextualization of knowledges are huge problems for both Indigenous and Western science knowledge. Historically, the privileging of Western ways of knowledge has been accompanied by the tendency to impose such knowledge on others, while simultaneously denying or subjugating traditional/Indigenous knowledge systems (Willinsky, 1998).

Fortunately, Indigenous and oppressed peoples are reclaiming their cultural knowledges and asserting their legitimacy in many spaces. It is clear that the academy is no exception (Abdi & Cleghorn, 2005; Kincheloe & Steinberg, 2008; Semali & Kincheloe, 1999; Wane, 2009; Waterfall, 2008). However, although Indigeneity and Indigenous knowledge constitute a growing field of study in the academy, the connection between Indigeneity and Indigenous knowledge is often merely assumed rather than theorized. Indigeneity is a

claim to identity, history, politics, culture, and a rootedness in place. It is about a sociopolitical consciousness of being as a knowing subject. It is also about an existence outside the purview of colonial encounter and the colonizing relations as determining one's existence. Indigeneity is about how a body/subject is defined by self and group: a definition of an existence outside and resistant to that identity, which has more often been constructed and imposed by the dominant. The politics of claiming Indigeneity in a so-called transnational context allows one to construct an identity that is beyond that constructed in Euro-American hegemony. Consequently, to claim and reclaim an Indigenousness or an Indigenous identity is a political and decolonizing undertaking. The values, world views, and epistemes that govern such Indigenous existence and how we come to know and understand our communities is appropriately termed *Indigenous knowing/knowledge* (Dei, in press).

Although we acknowledge the power of Indigenous knowledge in its own right, we also endorse an instrumentalist "assimilation" of traditional knowledge to promote modern medicinal science and community education and vice versa. We also acknowledge the politics of knowledge engagements across cultures that speaks to the tensions of fusing multiple knowledge systems, the problematic of privileging some knowledge forms over others, and the question of appropriation of an Indigenous knowledge base to serve dominant interests, particularly in the current climate of global capitalism (Agrawal, 1995; Battiste & Henderson, 2000; Dei, Hall, & Goldin-Rosenberg, 2002; Smith, 1999). Because this article is based on a pilot study, we endeavor cursorily to broach the links of Indigenous knowledges and education/learning relevant to education of young learners. Even the proposed findings and related discussion are weak and do not go beyond what is discussed above. Perhaps some of this is a reflection of the fact that this is a report based on a pilot study and further study might well rectify this in the future.

Traditional plant medicine constitutes an Indigenous science dealing with the cultural norms and practices, as well as ways of knowing about health, disease, disease prevention, and cure. Knowledge of traditional plant medicine is associated with long-term occupancy of a place and an awareness and appreciation of the environment. Such knowledge shows dynamism that reflects a continual process and renewal on the part of traditional herbal practitioners and users of plant medicine. Such knowledge is embedded in tradition and modernity and reflects on a people's culture and heritage. Our study has pinpointed philosophical grounding and everyday sense of such a knowledge base and how local community users and practitioners articulate the importance of the physical and sociocultural connections of traditional medicine in general. The study of traditional plant medicine calls for knowledge of the interdependence of culture, society, and nature.

The lesson here is that the teaching of traditional plant medicine cannot be promoted simply through documentation of such knowledge. It must be grounded in the everyday knowledge of local environments and how participants use such knowledge to promote general well-being. It would be useful, for example, to understand why people believe in the efficacy of such traditional medicine knowledge systems and what this means in conceptions of general well-being and individual and community health. This is what we

mean when we point to the relevance of the epistemological and philosophical engagement of such knowledge systems.

Local participants see the need to sustain the local environment in order to contribute to the achievement of sustainable health care development. For our part as researchers, we share the need to scientifically document the knowledge of traditional plant medicine and the use by local communities through sustained field research. We need to understand how and why local participants use their environments to promote local health and well-being. We must also understand the limits of their knowledge and the potential for growth and improvement for social and health development. As science educators, we have a responsibility to develop appropriate instructional and pedagogic approaches to the teaching of traditional medicine. This is one way to ensure their sustainability and to make available such knowledge on a wider scale to local populations. This task is more than imperative in the climate of rising health care costs when African governments under stringent budgetary conditions are finding appropriate ways to meet local needs using available local resources and cultural knowledge. This is *development from within* rather than an overreliance on external help.

In local communities, how traditional medicine knowledge is transferred including intergenerational communication points to significant age, class, and cultural dimensions. Working with local community users of plant medicine and traditional herbalists themselves in a cross-national study, we helped uncover the intergenerational, ethnic, social class, and gender dimensions of such knowledge systems and what these mean for education and health care promotion, as well as national development. Research information would also be helpful in the resolution of perceived tensions between Indigenous/traditional medicine and Western/modern medicine, and assist health workers and policymakers in health and national development issues. A specific academic preoccupation is how to introduce this knowledge into the school and community science curriculum and how the work of Indigenous herbalists and health care workers can be coordinated for effective community health science education. How local populations reach a synthesis of traditional science (as in Indigenous medicine) and Western science (as in modern medical practice) and the implications of such knowledge in the teaching of school and community science in schools are worthy of academic investigation.

Our preliminary study findings have benefits for educators, health care practitioners, and policymakers. Traditional plant medicine constitutes an Indigenous science that deals with cultural norms and practices of health, disease, disease prevention, and cure. Such knowledge shows dynamism that reflects a continual process and renewal on the part of traditional herbal practitioners and users of plant medicine. Our intention is to follow up our pilot study with long-term research documenting the use and effectiveness of traditional medicine from cross-national, comparative perspectives from the standpoints of local participants as users, practitioners, and educators of such knowledge. It is important for future research to explore other uses of plants in communities that are yet to be identified, and whether some of the medicinal plants identified in the existing local literature and texts also have other uses besides the commonly and currently known.

Implications for Teaching and Education

What do we understand by expanding knowledge systems in teacher education? Our understanding is that this is a call to examine multiple knowledge systems and to point out how these knowledge forms can be used to educate learners. In other words, we wish to understand the ontological and epistemological foundations of multiple knowledge systems and the philosophical and guiding principles of knowledge that can help guide contemporary learners to understand their social condition and realities. We chose to focus on traditional plant medicine as a form of Indigenous knowing to examine questions about the *what*, *how*, and *why* of the application of such knowledges and their place in the education of contemporary learners. We take teacher education broadly to mean what educators ought to know and teach about the varied options, strategies, and ways by which local peoples come to know their worlds, make sense of knowledge, and act within such knowledge bases and their worlds. The article is thus relevant to education, teacher education, and knowledge discourses related to education as broadly defined to include adult education, science education, and community-based education and health knowledges.

The subject of Indigenous knowledge and science education has been studied by a number of scholars in the specific case of Africa. Kroma (1995) Jegede (1994), Yakubu (1994), and Solomon (1994) all emphasized the challenges and possibilities of integrating indigenous science into school curricula and the practical implications for teacher education and training. Urevbu (1984) long ago pointed to possible innovations in school science curricula through an African-centered perspective that worked with African knowledge and philosophies. What these works shared in common was a need to allow African learners to identify with their own knowledges and promote science education in ways both applicable and beneficial to local peoples. In outside-African contexts, similar ideas have been expressed in research work on Indigenous and Aboriginal knowledges and education of young learners. Fitznor (2005), and Bierkerman and Townsend Cross (2008) examined the relevance of Indigenous pedagogy using local cultural resource knowledge for Canadian and Australian education respectively. Similarly Cajete's (2008) seven orientations for the development of Indigenous science education have general applicability indicating points of convergence on the issues of Indigenous knowledge and the implications for teacher education, adult education, and community development (Edwards & Hewiston, 2008; Hickling-Hudson & Ahlquist, 2003; Kaomea, 2005) on matters of curriculum development.

The focus on Indigenous knowledge has a politics that envisions a system of education in Indigenous traditions and philosophies on a par with mainstream education (Maurial, 1999). Indigenous philosophies are founded on and express thoughts about the ways of life, traditions, and cultures of Indigenous peoples, from which knowledge all learners can and do derive benefit. Chinn (2007) evaluates Indigenous practices positively and critiques the absence of locally relevant science and Indigenous knowledge in school curricula. Indigenous knowledge is about a way of life and the understanding of local cultures, thereby pinpointing challenges of curricular development. A methodological implication is the development of a framework for teachers' profes-

sional development that can shift science instruction toward meaningful culture-, place-, and problem-based learning relevant to health, environmental literacy, and sustainability.

African education is today grappling with issues of the processes of [in]validation and [de]legitimation of multiple knowledges: this is how knowledge is produced and disseminated nationally and globally. As Dei (2003, in press b) notes, many students from the south have often queried why and how certain knowledges count more than other ways of knowing. It is a troubling sense of privileging some knowledges and devaluing and denigrating others. Critical learners realize that knowledge is operationalized differently in given local histories, environments, and contexts. Unfortunately, the processes of validating knowledge forms fail to take into account this multiplicity of knowings that can together comprehensively speak to the diversity of the histories of ideas and events that have shaped and continue to shape human growth and development. In questioning the hierarchy of knowledge, learners also allude to the problematic position of neutral or apolitical knowledge. It is important, then, in our teaching that we lay bare and grasp the processes through which, for example, Western science knowledge positions itself as a neutral, universal, and nonhegemonic way of knowing. The problem itself constitutes a form of miseducation.

Indigenous/local knowledge has an important role in understanding Africa and helping to break the dominance of certain forms of knowledge. Such knowledge as obtained in local pharmacology presents highly philosophical understandings of local peoples' understandings of their environment and the interactions between the social and physical worlds of communities. Through teaching these forms of knowledge about local environments in the academy (schools, colleges, and universities), educators and learners can decenter the dominance of certain forms of knowledge. For the student of Africa, there is an urgent challenge to "amputate" past culture and community, knowing as Lattas (1993) says, "that the present is itself constitutive of what it is not." This posture of amputating the culture, history, self-identity, and language contrasts sharply with the Fanonian idea of "resistance to amputation." So what does it mean to study Indigenous knowledge? What does it mean to teach traditional knowledge? What knowledge and paradigms do we employ in such undertakings? Who is producing such transgressive knowledge, how and why? (Dei, 2003, in press). Traditional societies must be understood from local participants' knowledge of themselves. It also requires a sincere acknowledgement that traditional societies are in many ways an artificial construct and that there is power of knowledge in theorizing and teaching Indigenous societies beyond their artificial boundaries. We must also see traditional societies beyond homogeneity and candidly explore all the emerging contestations, contradictions, and ambiguities in people's lives. Traditional societies are communities of difference. The politics of claiming universal sameness served well the interests of those who did not want to see certain societies challenge their "stable knowledge" and false sense of superior knowing. Schools can employ abundant knowledge about local communities in educating learners because education starts from where people are. Science cannot be alien to the learner. Learners in pursuit of science must first know the tradition-

al science knowledge of the community. Plant pharmacology offers such knowledge. Bringing in local herbalists, traditional elders, and parents as resource persons to teach about such knowledge can engage a mutual cooperative endeavor with professional educators, all in the service of enhancing youth education in Africa. This study offers important entry points to engage knowledge and to define education broadly so as to take into account local people's environmental knowledge and cultural resource base.

The implications of teaching traditional medicine are enormous. Any teaching of such knowledge will have to start with a careful documentation of the uses and effectiveness of plant medicine; the philosophical and epistemological foundations of such knowledge; and the relations between Indigeneity, science, and traditional medicine. Teachers of such knowledge must themselves be informed of local plant pharmacology, its place in the society-culture-nature nexus, and the relevance of such a traditional knowledge base for understanding and responding to contemporary challenges. In our schools, the urgency of informing learners with the complete history of ideas and events that have shaped and continue to shape human growth and development are increasingly being recognized and deeply appreciated. Science is not simply Western science. Indigenous knowledge about traditional medicine is science and scientific knowledge. Educators can bring rigor and credibility to the study of such knowledge and its place in the school curriculum.

Education is key to national and social development. The extent to which we can "teach" education broadly to learners could help provide youth with the requisite skills, tools, and knowledge to meet and respond to contemporary challenges. We know that historically many African countries have been working to create self-reliant models of development in the framework of people-centered national policies. Such policies mean starting with where people are so that local communities can identify with knowledge and its effect of solving human problems. In the area of health, many remarkable advances have made in a host of Indigenous, local, and southern communities. For example, we know that China's *barefoot doctor* model was based on community-led health initiatives. The experiences of Cuba, Vietnam, and Tanzania in adopting people-centered approaches to health with an emphasis on rooting out the socioeconomic causes of disease have shown some success over the years. Knowledge about traditional medicines is taught in schools to help enhance the well-being of communities.

There are unheralded struggles for social transformation in health in a number of local communities. We need to capture these and teach the lessons of such medical knowledge in the school system. Primary health care (PHC) has always been the cornerstone of community self-reliance. In most countries where PHC was adopted in an Indigenous development framework, it

> affirmed health as a fundamental human right; it called for people's participation in health care; the responsibility of governments for the health of their people; community self-reliance and self-determination; inter-sectorial approach to health; social control over health services; use of traditional health systems; provision of essential drugs and social justice and government commitment to health for all" (Editor, 2004).

Traditional medicine falls into the terrain of PHC. The low recognition of PHC can be attributed in part to the fact that the biomedical model is still privileged in health development initiatives (e.g., the continuing focus on disease-oriented, curative measures, health professionals trained in the biomedical framework, Dakubo, 2005). What is needed is the teaching of traditional medicine in the school curriculum as a *people-centered health intervention*, one in which local people themselves become active participants in their own health care and development. Teaching such knowledge enhances community participation in its own health care. It is about community taking responsibility for its health. Effective community participation will allow local participants to articulate their health issues and concerns through critical consciousness about health matters and through work with state and international support to find home-grown solutions in ways that are culturally, politically, and economically congruent and meaningful to local people.

Conclusion

If health development in Ghana is to shift from the top-down, capital-intensive, technology-based, curative-oriented, disease-focused, and mostly urban-based health system to preventive, local technology, knowledge, and skills and grassroots-based approach to health development, then education has a key role to play. We can start by teaching traditional medicine in the school system. Such education can ensure less dependence on foreign capital and external health expertise.

Teaching traditional medicine as health knowledge will have to work with the understanding that health is a spiritual, emotional, psychological, and social concern that affects most of our communities. Traditional medicine that is used to heal communities works with the synergy of body, mind, and soul. Health needs do not separate the "material" from the "non-material." Traditional medicine as health science when taught in schools must take into account local understandings of the workings of culture, society, and nature. Such teachings must affirm the emotional and spiritual well-being of the individual and the social group as the bedrock of any health development process.

The available literature suggests that our Ghanaian research and the study findings may also be applicable to other Indigenous peoples (Mshana et al., 1999; Okigbo & Okigbo, 2006; and many others). Although this article is specific to one group of Indigenous people, the issues addressed are of interest to other Indigenous groups. As noted above, the study on the whole builds on the existing literature and contributes significantly to the literature about science, whether from a local or Western Indigenous paradigm. In diasporic contexts, emerging research shows that local communities still resort to their traditional medicinal knowledge to address health needs in conjunction with Western medical services. Barimah and Teijlingen (2008) have shown how most Ghanaian immigrants in Toronto (73%) maintain a positive attitude toward the use of traditional medicine. Napolitano's (2001) work among Mexican migrants in the San Francisco Bay area also shows the importance of delivering complementary and alternative (CAM) health treatment to Mexican migrants in the United States. A study of the use of herbal medicine among Chinese patients in Boston also reveals a high level of knowledge and use of

such traditional/Indigenous health practices. Loera, Black, Markides, Espino, and Goodwin (2001) have also demonstrated the complementary use of traditional and Western medicine among Korean-American elderly people in the US. Ryder, Wolpert, Orwig, Carter-Pokras, and Black (2008) have also shown the high incidence of traditional medicinal knowledge and practice among older urban African-Americans.

References

Abdi, A., & Cleghorn, A. (Eds.). (2005). *Issues in African education: Sociological perspectives*. New York: Palgrave Macmillan.

Acheampong, E.Q. (1989). *Conventional medical practice and research into Indigenous herbal medicine*. Paper presented at the inaugural lecture delivered at the University of Ghana.

Addae-Mensah, I. (1989). *Herbal medicine—Does it have a future in Ghana?* Accra: Ghana Universities Press.

Addae-Mensah, I. (1991). *Towards a rational scientific basis for herbal medicine*. Accra: Ghana Universities Press.

Adansi, M.A. (1970). Indigenous plants in Ghana with taste modifying properties or sweetening principles. *Ghana Journal of Agricultural Sciences, 3*, 207-210.

Adegoke, E.A., Akisanya A., & Naqvi S.H.Z. (1968). Studies of Nigerian medicinal plants. Preliminary survey of plant alkaloids. *Journal of West African Science Association, 13*(1), 13-33.

Agrawal, A. (1995). Dismantling the divide between Indigenous and scientific knowledge. *Development and Change, 26*, 413-439.

Amo, R. (2007). *What the health delivery system in Ghana needs*. 1-2

Amo, R. (2008). Herbal medicine.

Ampofo, O. (1976). *Traditional medicine in Africa*. Unpublished manuscript, Brazzaville.

Anfom, E.E. (1986). Traditional medicine in Ghana. *J.B. Danquah memorial lectures, V 1*(17 series), 1-13.

Barimah., K., & Teijlingen, E.R. (2008). The use of traditional medicine by Ghanaians in Canada. *BMC Complementary and Alternative Medicine, 8*(30), 1-10.

Basu, N.K., & Pabrai P.R. (1948). Investigations on Indian medicinal plants. *Chemical Abstracts, 42* 1025.

Battiste, M.A., & Henderson, J.Y. (Eds.). (2000). *Protecting Indigenous knowledge and heritage: A global challenge*. Saskatoon, SK: Purich.

Bierkerman, S., & Townsend Cross, M. (2008). Indigenous pedagogy as a force for change. *Australian Journal of Indigenous Education, 37* (Supplement), 146-154.

Bonsu, B.D. (1994). *The wit of Akans*. Kumasi: Terra Nova Press.

Bonsu, B.D. (2007). *Sankofa Nananom Nhahamma Nnuro*. Accra: Ghana Publishing.

Cajete, G. (2008). Seven orientations for the development of Indigenous science education. In N. Denzin, Y. Lincoln, & L.T. Smith (Eds.), *Handbook of critical and Indigenous methodologies* (pp. 487-496). Los Angeles, CA: Sage.

Chinn, P.W.U. (2007). Decolonizing methodologies and Indigenous knowledge: The role of culture, place and personal experience in professional development. *Journal of Research in Science Teaching, 44*, 1247-1268.

Dakubo, C. (2005). *Applying an ecosystem approach to community health research in rural Northern Ghana*. Unpublished doctoral dissertation, Carleton University.

Dei, G.J.S. (2003). Recreating knowledge to teach and learn about Africa. *Journal of Postcolonial Education, 2*(1), 39-48.

Dei, G.J.S (2004). *Schooling and education in Africa: The case of Ghana*. Trenton, NJ: Africa World Press.

Dei, G.J.S. (in press a). *Indigenous knowledge and critical education: A reader*. New York: Peter Lang.

Dei, G.J.S. (in press b). *Teaching Africa*. New York: Springer.

Dei, G.J.S., Hall, B., & Goldin Rosenberg, D. (Eds.). (2002). *Indigenous knowledges in global contexts: Multiple readings of our world*. Toronto, ON: University of Toronto Press.

Dokosi, O.B. (1998). *Herbs of Ghana*. Accra: Ghana University Press for the Council for Scientific and Industrial Research.

Easmon, J.F. (1891). Remarks on some Indigenous native drugs employed in the treatment of disease at the Colonial Hospital in Accra. Economic Agriculture of the Gold Coast. *Colonial Report, 41*, 18-40.

Editor. (2004) *The global assault on health*. People's Health Movement. http://www.phmovement.org/pubs/issuepapers/hong16.htm1

Edwards, S., & Hewiston, K. (2008). Indigenous epistemologies in tertiary education. *Australian Journal of Indigenous Education, 37* (Supplement), 96-102.
Fitznor, L. (2005). *Aboriginal educational teaching experiences: Foregrounding Aboriginal/Indigenous knowledges and processes, First Nations, first thoughts*. Edinburgh, UK: University of Edinburgh.
Harley, G.W. (1941). *Native African medicine*. London: Frank Casds.
Harley, G.W. (1970). *Native African medicine: With special reference to its practice in Mano Tribe in Liberia*. London: Frank Casds.
Hickling-Hudson, A., & Ahlquist, R. (2003). Contesting the curriculum in the schooling of Indigenous children in Australia and the United States: From Eurocentrism to culturally powerful pedagogies. *Comparative Education Review, 47*(1), 64-90.
Jegede, O. (1994). African cultural perspectives and the teaching of science. In J. Solomon & G. Aikenhead (Eds.), *STS education: International perspectives on reform* (pp. 120-130). New York: Teachers College Press.
Kaomea, J. (2005). Indigenous studies in the elementary curriculum: A cautionary Hawaiian example. *Anthropology and Education Quarterly, 36*, 24-42.
Kincheloe, J., & Steinberg, S. (2008). Indigenous knowledges in education: Complexities, dangers and profound benefits. In N. Denzin, Y. Lincoln, & L.T. Smith (Eds.), *Handbook of critical and Indigenous methodologies* (pp. 135-156). Los Angeles, CA: Sage.
Kroma, S. (1995). Popularizing science education in developing countries through Indigenous knowledge. *Indigenous Knowledge and Development Monitor, 3*(3), 13-15.
Lawson, G.W. (Ed.). (1986). *Plant ecology in West Africa: Systems and processes*. New York: John Wiley & Sons.
Loera, J.A., Black, S.A., Markides K.S., Espino D.V., & Goodwin J.S. (2001). The use of herbal medicine by older Mexican Americans. *Journal of Gerontology Medical Sciences, 56A*(11), M714-M718.
Lyon, M.L. (1990). Order and healing: The concept of order and its importance in the conceptualization of healing. *Medical Anthropology, 12*, 249-268.
Maurial, M. (1999). Indigenous knowledge and schooling: A continuum of conflict and dialogue. In L. Semali & J. Kincheloe (Eds.), *What is Indigenous knowledge? Voices from the academy* (pp. 59-78). New York: Falmer.
Mensah-Dapaah, K. (1968). Traditional healing. *Ghana Journal of Science, 21*, 16-21.
Morton, J.F. (1968). A survey of medicinal plants of Curaçao. *Economic Botany, 22*(1), 87.
Mshana, N.R., et al. (1999). *Traditional medicine and pharmacopoeia: Contribution to the revision of ethnobotanical and floristic studies in Ghana*. Scientific, Technical and Research Commission of the Organization of African Unity (OAU/STRC).
Okigbo, R.N.M., & Okigbo, E.C. (2006). An appraisal of phytomedicine in Africa. *KMITL Science Technology Journal, 6*(2), 83-94.
Okiy, G.E.O. (1960). Indigenous Nigerian food plants. *Journal of West African Science Association, 6*(2), 117-121.
Oku-Ampofo, F. (1977). Traditional medicine: Some examples of its use: Plants that heal. *WHO Chronicle, 31*, 428-432.
Semali, L., & Kincheloe, J. (Eds.). (1999). *What is Indigenous knowledge? Voices from the academy*. New York: Falmer Press.
Ryder, P., T., Wolpert, B., Orwig, D., Carter-Pokras, O., & Black, S.A. (2008). Complementary and alternative medicine use among older urban African Americans: Individual and neighborhood associations. *Journal of the National Medical Association, 100*(10), 1186-1192.
Centre for School and Community Science and Technology Studies (SACOST). (2008). *Local perceptions and attitudes on the practice, use, effectiveness, and importance of herbal pharmacology and traditional medicine in Africa: A cross-national study*. Winneba, Ghana: Author, University of Education.
Smith, L. (1999). *Decolonizing methodologies*. London: Zed Books.
Solomon, J. (1994). Conflict between mainstream science and STS in science education. In J. Solomon & E. Aikenhead (Eds.), *STS Education* (pp. 3-10). New York: Teachers College Press.
Taylor-Smith, R. (1986). Investigations on plants of West Africa III. Polytechemical studies of some plants of Sierra Leone. *Bulletin de I'Institut Francaise de l'Afrique Noire, 2 (29), 538-541.*
Twumasi, A.P. (1978). *Medical systems in Ghana*. Accra: Printing House.
Twumasi, P.A. (1979). A social history of the Ghanaian pluralistic medical system. *Social Science and Medicine, 13B*(4), 349-356.
Urevbu, A.O. (1984). School science curriculum and innovation: An African perspective. *European Journal of Science Education, 6*(3), 217-225.
Usher G. (1962). *A dictionary of plants used by man*. London: Constable and Company.

Wane, N. (2009). Indigenous education and cultural resistance: A decolonizing project. *Curriculum Inquiry, 39*(1), 159-178.
Waterfall, B. (2008). *Decolonising Anishnabec social work education: An Anishnabe spiritually-infused reflexive study*. Unpublished doctoral dissertation, University of Toronto.
Watt, J.M., & Breyer-Brandwijk, M.G. (1962). *The medicinal and poisonous plants of Southern and Eastern Africa*. Edinburgh, London: E. and S. Livingstone.
Williams, J. (1955). *Useful plants of Nyasaland* (P.J. Greenway, Ed., G. Jackson, Illustrator). Zomba: Government printer.
Willinsky, J. (1998). *Learning to divide the world: Education at empire's end*. Minneapolis, MN: University of Minnesota Press.
Yakubu, J.M. (1994). Integration of Indigenous thought and practice with science and technology: A case study of Ghana. *International Journal of Science Education, 16*, 343-360.
Xavier, L. (1977). Traditional medicine: Some samples of its use. *WHO Chronicle, 31*, 428-432.