

Teaching Science and Technology: The Employment of Indigenous African Languages

by

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Abstract

Our preoccupation in this paper is how African languages could be used effectively with dominant European languages in the African polity such as English in achieving the seemingly herculean task of African techno-scientific development. First, we examined various researches conducted in education, communication and psychology on the role of indigenous languages in knowledge acquisition, in enhancing cognitive understanding and in removing pedagogical barriers in learning. Next, we evaluated the precarious state of indigenous languages in African states' educational language policies. Last, we suggest how best to achieve an African Languages Scientific Manual using what we called the Pragmatic Approximating Process.

Keyword: Indigenous languages, Science, Technology, Development, Bilingualism, Africa.

Introduction

The state of development in Africa today is such that there is hardly any African who does not crave for a better Africa: an Africa that will be free of the 'third world' genre; an Africa that will not be dumping ground for sub-standard goods and whose citizens will not be guinea pigs for testing new scientific products and above all; an Africa where there will not be dearth of all that make humans truly human. A lot of factors are adducible for the precarious condition of living in Africa.

While scholars such as Walter Rodney (1983), Chiwenzu (1987), Theresa Hayter (1986) among others chose to blame the west, most especially colonialism, neocolonialism and even Globalization; others such as Frantz Fanon (1967), Kwasi Wiredu (1980) Nguigi wa Thiongo (1986), among others believe that what we need is not crying over spilled milk for even after colonialism, Africans are yet to completely breakaway from their 'slavers', a very good essay in this direction is David Tam West (1997) "How Africans Underdeveloped Africa".

While we see holistic approach to conceptualizing development as a commendable exercise, we choose in this work to focus specifically on techno-scientific development. This is undoubtedly essentially because Africa's backwardness in modern science and technology is having a far-reaching effect on all facets, most especially in the face of globalization that is making rich countries richer, and poor, technologically backward, countries poorer. Diverse angles are capable of being explored towards this end. But, our concern here shall be on how indigenous African languages could be effectively used with the present education media of instruction, e.g. English, in advancing knowledge that would promote the growth of science and technology in Africa. Our position is that since the use of indigenous languages enhances cognition and removes pedagogical barriers in learning, it should also be allowed equal substantial right in the African education space medium and also be employed as a medium of instruction in higher primary, secondary as well as adult basic schools all over Africa in teaching science-based subjects.

On Language and Knowledge

Language is central to the sustenance of a group of people for it is the vehicle through which other constituents of cultures are communicated. In fact, it is the primary vehicle through which human culture is acquired, shared and transmitted (Hammound 1975: 398). Without language, there is bound to be problem in the society for thoughts, ideas, information, etc would be incommunicado. Hence, Richard Schaefer (2000: 52) sees language as the foundation of every culture. To him, it is "an abstract system of word, meaning and symbols for all aspects of culture which includes speech, written characters, numerals, symbols, and gestures and expressions of non-verbal communication". Lughram (1975) identified four ways by which language is used in the society, namely, as a means of expression, for the purposes of record, to set matter in motion and as an instrument of thinking. Based on these functions that it performs, some scholars are of the view that language, a mean of communication, is as vital to human socialization and existence just as blood is vital to the human body. In fact, to them, we will not be wrong if we describe culture as inconceivable outside of language for it is with it that such non-material aspects of cultures, which give identity to a group, such as folklore, proverbs, etc are conceived, shared and transmitted.

This explains why languages are “sometimes regarded as a reservoir of culture which controls human thought and behaviour and sets the boundaries of the worldview of its users” (Alamin 2001). Language is also so important to the growth and sociability of a people that it is among the very first forms of behaviour that we learn as children, and later when we learn other skills and acquire more knowledge, much of this reaches us only through the medium of language (Burling 1970: 124). From Burling’s position, we can describe language as the harbinger of knowledge. The question then is: what is knowledge?

Knowledge can be described as ‘what is known’. It is the preoccupation of the branch of philosophy called epistemology. This branch of philosophy deals with the source, extent and limit of “what we claim to know”. Knowledge, according to Baldwin (1960: 603), can be defined in three ways:

1. Knowledge as the cognitive aspect of consciousness in general; where to know means to perceive or apprehend or to understand or comprehend.
2. Knowledge is also used in contrast to mere opinion sometimes called belief. In this application it signifies certitude based on adequate grounds. There may be belief or subjective certitude without objective foundation
3. Knowledge is further used for what is ‘known’ as such. Thus we speak of Chemistry as a body of knowledge. Knowledge is used as a synonym for cognition and also to specify cognition. That is the cognition that satisfies three conditions which are (1) Truth (2) self-satisfying and indubitability (3) Logical impossibility.

The three definitions above form the fulcrum of the entire epistemological discourses. The first is on the evaluation of how we, humans, come to *comprehend* or come to know; the second concerns the identification or difference between knowledge and *opinion* or *belief* and the third deals with the body of knowledge, principally on how knowledge is acquired and the extent of their validity vis a vis their method of acquisition of knowledge in the fields or endeavours designated as body of knowledge..

In all the cases discussed, language is vital in communicating what we acquire or conceive to be knowledge. For even when we perceive, or become conscious of an object, it is only when we have the linguistic capability that we can communicate what ‘we claim to know’. Communicating what is known, paralinguistically, also require the learning of language of signs. Also, our beliefs which sometimes constitute our identity as well as our value system, are so vital to our existence that not having a structured language with “its semantic, syntactic, phonetic, morphemic and semiotic dimensions”(Ozumba 2004: 18) can mar its existence, continuity and even its meaningfulness.

Indigenous Languages and Knowledge Acquisition

Today, half of global languages have assumed the term 'indigenous languages' because they are fast moving towards extinction. Half of these threatened languages are African languages. Similar lot is likewise befalling 'indigenous' languages of the 'native' Americans. Krauss (1998:5) raised this alarm in one of his papers when he informed that "of 175 languages to what is now the United States of America, only 20 are being naturally acquired by children". It wouldn't be out of place if we make an abstraction that when a language disappears, a medium or vehicle of communicating a culture is gone!'. So, with what will other elements of the culture be adequately communicated? What becomes of the identity of the people, their proverbs, songs and folklores that teach morals, among others? That will be a colossal loss, not only for the affected people but the entire world for a conveyor of knowledge with all its attended machineries of making meaningfulness and meanings of life realities would have been lost. Anyone that appreciates the extent of this colossal loss ought to be appreciative of the efforts, and commitments, of the United Nations Scientific and Cultural Organisation, UNESCO, to promote the sustenance of all mother tongues of the world. Who knows, even the so-called foreign, dominating, languages of today, might become threatened by extinction tomorrow like the once widely used Latin language.

In as much as we are quite concerned about the sustenance of mother tongues for the purpose of protecting cultures, with all its constituents, and identity, we are as much more concerned in this work with its effect on knowledge acquisition: its roles in acquisition of knowledge and how this can promote better understanding. Most importantly because we are aware that despite the growing population of speakers of foreign languages, majority of the rural dwellers in countries where foreign languages dominate are still holding, where it has not been totally shrouded in obscurity in the name of modernity, on to their mother tongues. Either taken as 'Lingua Franca' or 'Official' language, we are also concerned that despite realizing the inadequacies of the foreign languages, as glaring in the usages of the indigenous languages during political campaigns and when seeking the support of the locals who are the majority, most African leaders have not deemed it fit to promote the indigenous African languages or, at worst adopted similar mother tongues, for the sake of pursuing and institutionalizing development within their domains. One question that is likely to surface due to our allegation of neglect against African leaders, nay policy makers, is: do indigenous languages have a role in knowledge acquisition?

Of course it does. In fact, research results in the fields of education, linguistics, anthropology and cognitive psychology are unequivocal on this: students who enter school with a primary language other than the national or dominant language perform significantly better on academic tasks when they receive consistent and cumulative academic support in the native heritage language (McCarty, 2003). When used as instructional purpose, as research results have shown, many scholars have contended that it is capable of enhancing cognitive understanding and removing pedagogical barrier in learning. Let's examine four of such researches, namely, *The Native American Language Research*, *The University of Bradford Research*, *The Ife Six-Year Primary Project* and the *Swahili Research*.

We can start with the research conducted by Ramirez in 1998 which shows that of 12,000 students in the San Francisco Unified School District, students who received instructional support in their native language for five years before being transitioned to all-English classes outperformed students in all-English classrooms on the Comprehensive Test of Basic Skills. Further, it was also found out that students in long-term or late-exit bilingual education realized a higher overall grade point average and had the highest attendance rates, 'always exceeding the district average'. Here the incredible performance can be explained in terms of the ease with which the students blend the language used with their thought that is firstly in their mother tongue. On attendance, the lack of restriction on when and where the language, which they are at home with, can be spoken cum the similarity between home and school in terms of the language use around them was also found to have resulted in high attendance.

Similar to the above is the research conducted by Thomas and Collier (1997). The research, adjudged as the most extensive longitudinal study of language minority student achievement (1982-1996), found out that for 700,000 students representing 15 languages in five participating school systems, 'the most powerful predictor of academic success' was schooling for at least four to seven years in the native heritage language. What is important to note about the Thomas and Collier study is that the findings held true for children who entered school with no English background, children raised bilingually from birth, as well as 'children dominant in English who were losing their heritage language. Another research akin to this was reported by Holm & Holm (1995) on the use of Navajo in teaching subjects such as Mathematics, both in Navajo and English, which also recorded excellent result.

Research result on the use of Punjabi in teaching the native Indians in Great Britain conducted by researchers at The Bradford University in 1978 also discovered that the control group which combined the use of Punjabi and English performed better in term of marks scored than the other group of the same origin with which English Language was the sole medium of instruction (Klein, 1994). The better performance of students when taught in their mother tongue, most especially in Mathematics, was also confirm by the result reported by the Ife Six-Year Project (Afolayan, 1976 and Bewaji 2002) in which the use of Yoruba, the mother tongue of the pupils enable them to perform better in 'Isiro' the Yoruba equivalent of 'Mathematics'.

Apart from their above average performance in 'Isiro', the control group, those taught all the subjects, except English Language, in Yoruba, likewise recorded better result than that of the uncontrolled group.

Although the above researches were primarily targeted at those in their first three-five years of school, the elementary and primary education, result from a research conducted among secondary school circle in Tanzania (Okombo et al in Salawu, 2002) has likewise underscored the superiority of teaching in Swahili rather than in English, the colonial master's language, for effective development of cognitive functions and for better understanding of the topics taught. Furthermore, the research shows that majority of the pupils do not have a better understanding of most of what they were taught in English, which was evidenced in their answers to questions asked for evaluation which are often vague and laden with all indices of lack of proper grasp of the subject, nay topic. Two reasons are adducible for these noticeable cognitive difficulties: lack of understanding of what is taught due to lack of mastery of the language, English; and problem of communicating their thought even when they understood the question(s) posed. Invariably both are still based on 'mastery problem'. For it is only when a user has firm grasp of the vehicle of communication to be used that understanding will be easier and communication circle complete, with appropriate feedback. Otherwise the whole essence of communication becomes cumbersome and too sketchy for a Second Language speaker to understand.

What we have been able to show with the research results discussed thus far is that the use of mother tongue, or native heritage, is very important in knowledge acquisition. One, because it helps the pupils/students to be more relaxed, happier, have a better understanding of the subjects taught and therefore responds positively to the teachers' questions. Answering questions in a coherent, creative and correct way has the possibility of boosting the teachers' moral, as they would be gingered to want to do more to assist the pupils/students in learning. Secondly, the pupils are likely to be more motivated to attend school

The bi-lingual system, which the researches seems to root for, can be described as a method of teaching, or imparting knowledge for the sake of application and creative modification, that prescribe the use of two languages, one native or indigenous language and a 'foreign' or official language, as media of instruction. Their position is indicative of the fact that using the local languages, whether solely at first or combined contemporaneously with the foreign language at a go, is the key to better understanding of the subjects, or the topics. It is therefore not surprising that all the researches discussed above underscored the same points that can be summarized thus:

1. That the mother tongue of the learner is the most effective language to be used in instruction
2. That rapid transition from mother tongue to second language medium does not allow for satisfactory development of the students' linguistic and cognitive abilities and;
3. That bilingual {and multilingual as the case may be} programme integrated into the regular curricular gives the best results (Salawu 2002: 45-58).

According to these scholars, of diverse backgrounds, to neglect the native heritage or indigenous languages, in favour of the foreign languages, which are in most cases second language to the learners, is to be courting confusion for the learners. To them, the monolingual system which sanctions the use of only 'foreign' language is not only defective and incapable of enhancing learning, by virtue of the cloudy messages that it sometimes communicates, but also capable of producing only certificated humans who are devoid of undertaking novel creative ventures that can engender meaningful contribution to the discipline of the subject taught. Jettisoning indigenous language in the name of literacy and 'westernization' seems therefore to be an uninformed action. In fact, such submission calls into question the idea of literacy widely held by most Africans who sees 'Literacy' simply as the ability to learn and speak in the 'foreign' languages. For it is nothing but an anomaly to narrow literacy only to the ability to write, read and speak foreign language(s).

Language Policy and the Fate of Indigenous Languages in Africa

In most of the African states' educational policies the indigenous languages are often neglected and inferioritized to the benefit of the foreign 'colonial' languages. It is proper here to recognize the effort of the United Nations Scientific and Cultural Organisation (UNESCO), which organized an Intergovernmental Conference on Language Policies in Africa in Harare, Zimbabwe in 1997 (Mohochi, 2004). The product of that conference was a resolution tagged Harare Declaration on Language Policy in Africa which specifically challenged all African governments to review their National Language Policy in such a way that the indigenous languages will have more social, political and educational use in their polity. Without belabouring the obvious, the Harare Declaration like so many others before it, such as the African Languages Bureau, turns out to be a mere rhetoric, at best a shelvable product of a 'sponsored talkshop'. The language policy in African countries, close to three decades after the last African state breath fresh air of freedom (also known as independence) has fervently remain perpetually un-African.

The advent of colonialism and the consequent partitioning of Africa, we must note, have likewise made possible the division of Africans into language blocks so much so that today in Africa we have *Arabophones*, *Anglophones*, *Francophones*, *Lusophones* and *Hispanophones*; not to mention the scores of languages that have no relation to the languages of the European colonizers (Etanga-Manuelle, 2000: 67) that have refused to be cowed to leave the public domain like Swahili, Hausa, among others. Today, three patterns of language policies are commonplace in African states (Adegbiya 1994:144):

(a.) Amodal (b.) Unimodal and (c.) Multimodal:

a. *Amodal Policy Pattern:* Most policies that follow this pattern are those that extol one foreign language and belittle the other languages, which are mostly indigenous languages. This is the practice in most French and Portuguese ex-colonies such as Senegal, Togo, Angola, Cameroon and Guinea Bissau. This policy is often a product of their colonial master's legacy that cannot often be changed overnight because these policies are often tied to 'juicy' programmes, such as the French Assimilation Policy, by the colonizers. Since it is an amodal system, the colonizer's language, e.g. French, becomes the only acceptable means of communication and that of instruction in social, political and education sphere of the people's life. Indigenous languages become private and inferior languages of the 'uncivilized' and that of the 'locals' in the society.

b. *The Unimodal Policy Pattern:* Here, the policy is weaved around a widely spoken indigenous language that is adopted either as national or official language while the other indigenous languages are allowed to function within their domain, serving other functions such as during political campaigns, public announcements, etc. The adoption of Kirundi in Burundi, Swahili in Tanzania and Somali in Somali, are very good examples in this direction. Unlike the amodal system wherein the foreign language dominates the entire dealings within the polity, the unimodal policy allows for the use of the foreign language or the coloniser's language, in some sectors of national life, most especially in education.

c. *The Multimodal Policy Pattern:* Under this policy pattern one foreign or exogamous language as well as one or more indigenous 'majority' languages are extolled over and above other 'minority' languages. The concentration on the 'majority' languages in most cases often threatens the continued existence of the 'minority' languages. African countries that operate this kind of policy include Nigeria (with its English, Yoruba, Igbo and Hausa), Kenya (with its English and Swahili), Sierra Leone (with its English and Creole), Ghana (with its English, Akan, Ewe and Moshi-Dogomba), etc.

What is significant for us to note here is that indigenous languages are utterly marginalized in almost all the policy patterns examined above. But one might be tempted to separate the Unimodal Policy Pattern which extols one indigenous language above other languages, yet when the reality of the fact that such languages are not used as “resource for development”(Wiredu 1980, Oladipo, 1996) dawn on one, one is bound to align with the earlier submission. The highest role apportioned to any African language in all of the patterns above is simply social or for wider communication purposes. They are not given any pride of place but limited use in formal education. At most, like in Nigeria, for example, they are mere media of instruction at the lower rung of the education system most especially at the first three years of primary education (NPE, 2001).

Experiences from Philippine, Mexico, Wales, Canada, Russia, Yugoslavia and Japan have, however, shown that the indigenous languages are fit for all rung and levels of education as effective media of instruction that is capable of eliminating pedagogical difficulties in learning and thereby enhancing better understanding. Again, this assumption has been quashed by the diverse education and psychological research results examined earlier in this paper. Let us quickly note here that our position is not another project in cultural nationalism but rather an effort towards “cultural cross-breeding”(Oladipo 1996: 81); for we are not advocating a total jettisoning of the foreign languages but rather that which will allow a bilingual kind of teaching arrangement. This, to us, will obliterate the present clandestine use of the method by some zealous African teachers. Approving such will mean that such teachers will have no fear of the system punishing them for introducing ‘vernacular’ where it is not approved. And it will also enable them to teach the science-based subjects effectively.

But the major problem that might hinder whatever effort directed towards this end is how to have adequate manual for translating the scientific terms into the indigenous languages without, or with minimum, loss of meaning. Here we propose the Pragmatic Approximating Process.

Pragmatic Approximating Process

The Pragmatic-Approximating Process can be defined as the “process of painstaking thinking, discussing, explaining and approximating new words in translating scientific concepts and theories from foreign to an indigenous African languages without any possibility of loss in meaning occasioned by cross-cultural translation’.

The process involves three stages, namely,

- a. Explanation stage
- b. Thinking stage
- c. Approximating stage

The first stage of the ALSM will involve active dialogue, which entails explanations and discussions on the English meaning of scientific objects, theories and theories. Questions and clarifications for adequate understanding will also take place at this stage. The second stage will involve deep thinking, personal reflections on the explanations offered at the first stage. This stage will enable participating linguists and scientists, who are not to necessarily be of African origin, to personally re-examine the concepts explained, objects described or process narrated. The third and final stage will involve supplying approximates, for the scientific terms under discourse.

Expected to be involved in these stages are scientists, the linguists, the philosophers, the anthropologists and, of course, educationists. All these participant professionals, involved in PAP, are bound to respect the three canons or articles of faith as opined by Robins (in Owolabi 2006: 5). These are:

Exhaustiveness: which means that all the regularities contained in the language (or languages) as manifested in the language material or data, are to be adequately accounted for without leaving the minutest of details.

Precision: long explanations must be avoided hence a shorter and precise statement which utilizes few terms is to be preferred to one that is longer, less precise, or more involved.

Consistency: this means that the different parts of the statements formulated or translated should necessarily agree with each other, so that contradictions will be avoided.

If the tenets of these three canons can be respected and/or adhere to, then the three processes, highlighted earlier will be a huge success and lead us to the actualization of our goal: that of evolving a manual that will make science terms intelligible in native/indigenous languages. The essence of evolving these professionals is to ensure that they are agreed on the equivalence of the translated terms or words.

The problem of cross-cultural translation is bound to rear its ugly head during PAP but with the fourteen methods of creating new linguistic terms identified by Owolabi (2006), we are sure to be able to obliterate this obstacle. These ‘devices’, as identified by Owolabi are: semantic extension, composition, dialect or internal borrowing, loanwords or external borrowing, specification, explication, idiomatization, simple equivalence, acronyms, coinage, description, translation, adaptation and range extension (Owolabi 2006:40).

Pragmatic-Approximating Process rejects all forms of cultural nationalism hence the anthropologist(s) should ensure that this is not allowed during PAP. It encourages, where and when necessary, positive terminology development for ease of translation (Owolabi 2006: 24) and for the enrichment of the language of the approximators. It also advocates the bracketing of all prejudices and eschews neutrality as much as possible. The native language terms The implication of PAP theory is that it will enable us to be sure that we are translating the original scientific words correctly and also that we are putting the word in the same practical use, as the other scientists worldwide, in our various African languages, and likewise producing the same, and even better, results that could stand universal test which is characteristic of science and technology.

Conclusion

Our efforts thus far have been directed at justifying why and how indigenous African languages should be employed in teaching science and technology-based subjects in our educational system. This, we posited, does not mean that the use of English language or French or Portuguese as education medium should be discontinued; rather what we are advocating is that both be officially approved, and the indigenous languages be developed, and adopted accordingly, as classroom media with consequential provision of scientific books in both languages. The ALSM, African Languages Scientific Manual, we submitted, can be produced in the relevant African languages using the Pragmatic-Approximating Process so that scientific objects, concepts and theories can be more meaningful and easier to understand for students and thereby aid the learning process and ignite the necessary creativity that would induce techno-scientific development in Africa.

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