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A Case for the Use of English in Developing Science and Technology in Nigeria

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The language of modern science and technology is unquestionably English. It has become the main repository of scientific and technological developments and innovations. For a number of reasons ranging from the historical to the pecuniary, it is also the language of teaching and learning in Nigeria's educational institutions. The position taken here is that the inadequate grasp of English that is evident amongst young learners in science and technical education in Nigeria has serious and direct implications for the country's efforts to join the scientific world community. This article maintains that as long as there is a reluctance to admit and to fully embrace the role of English in modern science and technology, and therefore to devote more time and resources to the proper teaching and learning of the language in schools, the technological advancement that Nigeria aspires to will be slow in coming. It goes on to examine the difficulty of providing the kind of English language needed to facilitate Nigeria's ambition of becoming a scientific economy and proceeds to offer a few suggestions to remedy the present situation,

Introduction

English has successfully established itself as the preferred language of science and technology and this has been duly noted by a number of researchers and

academics. Amongst them are Belveridge (1968), and in more recent times Graddol (2003) and Montgomery (2004) who similarly attest to the dominance of English in these fields. They agree that the supremacy the English language enjoys will continue for a very long time because it has successfully entrenched itself as the lingua franca of scientific effort. This ascendancy has been acquired over the years and is traceable to a number of factors which will be examined briefly in the following.

Foremost among the reasons why English enjoys the position of strength it presently occupies, is the fact that its vocabulary is the largest of any language in the world. It therefore has the advantage of being able to express more precisely than other languages a huge range of human experiences and achievements. An inherent propensity that makes it more open to change has imbued English with a dynamism that makes it a unique vehicle for conveying developments in different spheres of life. Thus its vast and ever increasing vocabulary carries the weight of the language more so than its grammar or pronunciation. The same has been observed by Winchester (2003) who noted that in recent times, a great number of new vocabulary in English appear to originate at a very rapid rate from the fields science and technology.

Certainly, when compared to other western languages such as Italian, Spanish, or indeed languages with large populations such as Arabic and Chinese, the huge capacity for adaptation that English possesses and the advantages that arise from this become all the more evident. For example, while English has been receptive to outside influence since its early days when the original Anglo-Saxon base of the language borrowed words from the Norse and Danish languages, and later further expanded its vocabulary through increased contact with

other peoples from around the world, the French language on the other hand, because of an overriding concern with maintaining the 'purity' of the language, has been more inhibited in its interaction with other linguistic influences. As a result, its vocabulary is comparatively more limited leading even the French Academy of Sciences to adopt English rather than French as its language of discourse.

This vocabulary advantage may also explain why countries like the United States, Britain, Canada, and Australia for which English is a first language are able to effectively dominate the scientific world community. Certainly a greater number of Noble Laureates in the Sciences has emerged from these English speaking countries. Between 1901, out of 187 people awarded the prize for Medicine 140 come from these countries. In Chemistry it is 79 out of 151, while in Physics it is 95 out of 181. In instances where the awards are shared, one of the candidates is always from an English speaking background. Of course it could be argued that countries such as Japan and China have acquitted themselves well in the same fields without necessarily employing English as their main medium of communication. Instead, using the Japanese language and Mandarin Chinese, they have been able to successfully position themselves as leaders in science and technology without relinquishing the use of their indigenous languages in the classroom. But while we can point to these exceptions, most African countries including Nigeria, either for historical colonial imperialism, or because their pecuniary situations have not made adequate investments in teaching and developing their own indigenous languages, continue to use English in their classrooms.

However, since the task here is not to argue for or

against the use of indigenous languages, let us examine in more detail the link between English and science and how the present state of teaching and learning the language in our classrooms is affecting Nigeria's aspirations for scientific development.

The Relationship between English and Science

The special bond that clearly exists between the English language and science is demonstrated in the interaction that occurs between them. At different times, each appears to influence and perpetuate the development of the other. For instance, while language is the vehicle of ideas which are first initiated silently by way of thoughts then spoken or written to communicate the same to others, the material culture developed by science and technology in turn provides it with concepts and things to talk about. English as language has been particularly quick to embrace new ideas, to adopt words or to make up new vocabulary in order to provide a means of naming and expressing the relationship between new concepts. Most of the words used in science and technology are taken from other languages with little or no change e.g. words like *fulcrum*, *radius*, and *cortex* are taken from the classical languages of Greek or Latin. At other times it has taken bits and pieces roots, prefixes, suffixes from these languages to create new terms. For example, the Latin prefix *super* (above, beyond) and the Latin root *son-* (sound) are combined to form the word *supersonic*. Another example is the Greek noun *nephros* (kidney) which is used to create words such as *nephropathy* (disease of the kidney), *nephralgia* (pain in the kidney), or *nephrotomy* (a cutting of the kidney). Thus does English demonstrate its innate ability to generate an almost infinite store of words.

Similarly, the scale and dynamism of science has

made it an active creator of new words/language. The very purpose of science determines the nature of the words to which it gives birth. An example such scientific coinage is the term *symbiosis* which conveniently summarizes a particular biological state while the word *Teflon* refers to a plastic substance used in commercial products. Words such as these sometimes go on to be used in everyday speech as when we talk of a symbiotic rather than a parasitic relationship between people. Occasionally, scientists have taken ordinary English words and endowed them with specialized meanings, *energy, power, salt, base* are a few examples. Indeed the advancements of science and accompanying technology have been so rapid that no language has been able to keep up hence there are occasions when entirely new words have been invented to accommodate modern concepts, discoveries, and inventions. Two examples are *Sputnik* for a space craft and the term *ester* for a compound formed by the interaction of an alcohol and an organic acid. Words like these satisfy the need the sciences have for exactness in naming. As Flood (1960) rightly points out an appropriate vocabulary is essential to the development of any subject. Thus it is that scientists have invented names by which to refer to various chemical substances, physical states, processes, relationships and so on. A kind of shorthand language has been developed that allows for precise meaning and in this creative process, English has been an efficient tool.

The general trend of using English for scientific discourse has the additional advantage of facilitating international collaboration, the sharing of discoveries and innovations among diverse people from very different background. However this global partnership also has a latent potential of dividing the world into those who have the tools of articulation necessary for communicating and

contributing to scientific ideas and research and those who do not possess them and therefore cannot participate in the dialogue. Graddol (2009) observes the same when he writes that 'English is becoming a major machine for social and economic exclusion and creating new divides'. Certainly the present states of things where two thirds of all scientific papers are written in English prove his point. The immediate implication is that only those who are receptive to complex new information in English, who can use the same medium or articulate and negotiate their ideas, can or will publish in international journals. This reality is amply recognized by many countries which are striving to be major participants in the world economy. For such countries and even China can be counted among them (with the proliferation of English language schools found in that country) consider communication in English a basic skill which children need to learn from an early age so that they can use it for later study.

Indeed if as Hasan (1990) points out that English has become a basic resource with which our present world is built and organized and therefore a fundamental part of the educational process, the state of affairs in Nigeria where good English language skills appear to be on the decline in institutions of learning ought to sound warning bells for all concerned with matters of education and issues of national development. The level and quality of comprehension demonstrated by the average Nigerian student of an increasingly scientific/technological reality is poor in comparison with what obtains elsewhere. Their inept grasp of knowledge and lack of skills in negotiating their way through the maze of scientific information and technological advances is evident in both their speech and writing and needs to be addressed urgently both at policy making as well as at student/teacher levels.

English and Science in Nigeria

In Nigeria, the National Policy on Education appears to give English a lot of prominence, stipulating as it does six years of learning English at primary school level, another six at secondary school, and in some cases an additional year or two under the Use of English course at university. However, a conflicting impulse to defend our own languages/culture and other patriotic sentiments appear to get in the way of the proper acquisition of the kind of English that will allow Nigerian students to participate fully in science and technology. Most people have the capacity to learn other languages, but to some extent, learning another language is also intimately bound up with the process of operating in another culture says Brumfit (1985). This means that every time we communicate in another's language we are in a way involved in a cross-cultural operation as we attempt to achieve enough overlap between our intentions and ideas and those of another person. During this process, second language learners extend the frontiers of their knowledge while at the same time improve on their ability to negotiate new cultural contexts. It is therefore possible to suggest here that level of competence demonstrated in our use of English can act as an indicator of how much we are truly involved in the modern culture of science and technology. The better we are to utilize the language, to bend it to our will and make it serve our purposes, the stronger Nigeria's presence will be in the international science dialogue.

The kind of advanced reasoning used in scientific communication is dependent on the acquisition of specific linguistic structures of argumentation, including logical connectors and as well as a specialized vocabulary. Yet a quick perusal of many articles in

journals in Nigeria will demonstrate that scientists do not always express clearly and concisely what they have to say. Many published papers on science and technology include verbose and ambiguous sentences which indicate that ideas are either not well thought out or that the authors are unable to express their thoughts clearly and concisely. The problem of poor communication is thus unfortunately perpetuated when science students are asked to study such articles defeating the purpose of exposing them to information which they can in turn use in their own work.

The necessity of acquiring a working understanding of the fields of science and technology, as well as the ability to master strategies for matching our knowledge with that shared by others, is a task that Nigerian students as second language speakers of English have to tackle. As already noted, anyone who uses a language necessarily has to learn skills of adjustment and negotiation needed to operate within it. In Nigeria such a development can be accomplished only if students are exposed to good models of English both in speech and in writing. Frequently, inadequate funding and poor infrastructure are put forward as the reasons why in spite of turning out thousands of graduates in the sciences and technology, the country is still incapable of producing people who can contribute meaningfully to the creation of a more scientifically developed society. However, rather than some of the reasons attributed to Nigeria's shortcomings perhaps the problem is something as basic as students not fully understanding the courses they have supposedly studied in English.

Good science education is inseparable from good language skills and yet an underlying conviction that students who are not studying for a degree in English are not obliged to perfect their language skills remains firmly in place in most institutions in Nigeria. this attitude is

even more pronounced in specialized Universities of Science and Technology where English is regarded by majority of students and a quite a few of their lecturers in other subjects as an unimportant part of their degree course. The setting up of the Use of English course for first year students is a response to a problem that was identified by the country's policymakers. Nonetheless, the time table space and other resources required to run effective language programs are simply inadequate; thus apart from a little plastering of the cracks, not much progress is achieved.

Yet in a world increasingly mediated through the use of one technology or the other, students in Nigeria need to be scientifically literate which means they need to be able to ask, find, or determine answers to questions derived from their curiosity about their everyday experiences. They have to acquire the ability to identify scientific issues, read with understanding articles about science, and engage in conversations about the validity of scientific conclusions. Similarly anyone who claims to be scientifically literate should be able to evaluate the quality of scientific information on the basis of its source and the methods used to generate it and to replicate it if necessary. The ability to plan experiments, predict outcomes and write about them are important not only for mastering the science involved but also to communicate that knowledge to others since scientific work is not conducted in isolation. All of this demand, particularly in the context of a second language situation as found in Nigeria, a broader approach to the learning of science which includes effective language acquisition. Rather than employing traditional science methods which emphasize the robotic acquisition of facts and procedures, an intensive involvement in science and

technology can arise out of a strong language ability to understand, interpret and to communicate.

Teaching the Language of Science

Hassan (1990) has emphasized that language is instrumental in creating change in societies. Therefore, it is important that issues of language teaching and learning are addressed if we hope to develop scientific mind in students so that they go on to become productive professionals in the field. It is vital that we find ways by which students can acquire competence in English as well as a sound knowledge of the sciences hence below are a few suggestions of how English language learning can be designed and implemented to assist science instruction.

Firstly, improving existing methods of teaching science and technology to students requires a radical departure from the present way of doing things. The goal of a science education will only be met if all teachers have the knowledge and skills necessary for educating others. This is not merely stating the obvious but arises out of a need to emphasize how essential it is that language teachers in particular are adequately trained in their profession. Too often English teachers end up becoming what can only be described as content specialists rather than language teachers. These are the ones who do not take into account the total learning requirements of their students. However, the same can be said of science teachers. This is why a serious teacher education programme should include a comprehensive curriculum, one that has the capacity of addressing the language needs of all student teachers in Nigeria regardless of the subjects they specialize in. Teachers who receive appropriate training are more likely to be confident in their work, use the medium of English well and go on to create supportive

instructional environments and opportunities for their students.

Curriculum development should carefully consider the number of concepts students are expected to learn. Instead of the rather overwhelming large number found presently in science courses, concepts could be carefully organized to form connections across the various disciplines. Indeed the Third International Mathematics and Science Study held in 1992 criticized the United States for its 'splintered vision'. The way science education is presented to the American student appears to emphasize familiarity with many topics rather than concentrate attention on a few was the main focus of its criticism. It noted that failure to focus on fundamental goals or to link content together across the various disciplines taught students to grasp pieces of information but did not enable them to understand the whole. A similar trend prevails in Nigeria where students manage to learn fragments of information but are unable to make the connection between them or to advance them outside of their immediate examination requirements. The problem here is made more acute by the fact that not only do students have to struggle to understand complex information; they have to do so while grappling with learning in another language. An approach that concentrates on fewer concepts will help improve the quality of knowledge they absorb by providing a more in depth understanding of how science works.

Making science information accessible to English language learners requires modifying written materials used for study. The assumption that the average Nigerian student is already proficient enough in the language is belied by the poor quality of verbal expression as well as written book. Teachers must not forget that for most

Nigerian students, English is a second language and that they therefore need to modify their speech, make it more comprehensible by being conscious of the way they express information, the number of new vocabulary they introduce during lessons, the grammatical structures they choose to use etc.

In a similar way, effective English language education for science students also needs to make use of a variety of avenues through which students can learn science concepts. English language programme which incorporate opportunities for investigating science concepts help to further reinforce what is learned in science classes. For example, inquiry techniques such as data collection and reporting which allow for the use of English in purposeful and meaningful ways will not only enhance students' understanding of science through the process of designing interview questions, asking questions, and then recording the answers, it will also provide them with opportunities of improving their use of written and oral language. It is to be expected that learners who have not mastered the linguistic structures necessary to scientific discourse will fall behind in scientific understanding and reasoning. Restructuring English language programs to include a variety of methods which offer more opportunities for investigating scientific concepts will help improve students' levels of comprehension. Such an approach corresponds with what is already known about effective education as it reinforces information and provides further practice in scientific discourse while simultaneously improving students' confidence in their use of English. In Nigeria where learning is mainly based on textbook information, inquiry techniques such as interviewing professionals and experts is an affordable way of exciting students' interest in a

variety of subjects. If their interview subjects are from the fields of science and technology, the result will be more familiarity with specialized terms and discourse patterns which are necessary if students are to confidently engage in discussions essential to scientific inquiry.

Many students understand the science and technical subjects they choose to study but are unable to communicate this effectively to others. What such students need is more help with their reading and writing rather than further instruction in science subjects. It is important that they are able to comprehend written information and to write about it. It is not without good reason that Barras (1978) draws attention to the irony of budding scientists being taught to use instruments and techniques many of which they may never use in their working lives while the ability to effectively use language in writing, an ability which they called upon to use as students and will need in the future as scientists and researchers is neglected or sidelined. And yet as Barras goes on to point out, the requirements of good writing are similar to that of scientific endeavour in that both demand clarity of purpose, accuracy, completeness, simplicity and so on. All teachers therefore have to share in the responsibility of ensuring that students are able to express themselves lucidly in English.

Another possible way of helping students is by making scientific texts accessible to them through not only simplifying the vocabulary and re-organizing sentences, but by providing more background information which can be introduced or reinforced as comprehension passages in English lessons. Providing students with opportunities for using the language of science, encouraging linguistic and cognitive development can help to make science content more

accessible to them. This can be done through cooperation between science and English teachers who together can identify linguistic structures or patterns associated with a particular topic and incorporate them appropriately in their lessons.

The suggestions offered here are by no means exhaustive and indeed some might not be practicable but they are intended to point possible ways of dealing with a major problem confronting teachers and students in this country. Whatever position we adopt with regards to the use of English in schools, it is likely to remain the medium of instruction for many more years to come and therefore, we cannot escape the necessity that for future scientists in Nigeria to be effective participants in their chosen fields, they need to be able to read and write well in this adopted language.

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