Review Article

Using Mother-Tongue in Teaching of Science and Technology: Reference to the North-East and North-West Geo-Political Zones, Nigeria

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Abstract

This work conducted a study of language medium and the teaching of science and technology through the medium of mother-tongue in North-East and North-West Geo-Political Zones, Nigeria. a case study research design was used in collecting data for the study. We investigated some selected public primary school students in the two geo-political zones of the North-East and North-West. There are an estimated 100,000 primary school students in the two zones. Each zone is stratified along with the component. 18 schools were selected at random for the study from each geo-political zone. A minimum of 30 students were equally selected at random from each school from the zone under investigation. Questionnaires, oral interviews, and informal interactions were employed simultaneously to elicit information. The Sapir-Whorf hypothesis which holds that our thoughts are shaped by our native languages; and that speakers of different languages, therefore, think differently was used as the theoretical framework of analysis. The work discovered among other things that the science and technology learning area has various challenges as pointed out by the participants. On the whole, the work concludes that the people's language is not only part of their socio-cultural heritage; it is the natural medium of thought, expression, and communication within that culture.
Keywords: Language, Mother-tongue, Science and Technology, Learning

INTRODUCTION

Language plays a major role in the development of a nation. It constitutes a lot to individuals and societal development. Scientific and technological development cannot be achieved without language. Indeed, for decades after the independence of Nigeria, she is still grouped among the underdeveloped countries of the world; and this has led to the hue and cry for national development. This translates to the fact that developing nations cannot produce more goods and services because of a shortage of human capital and 'primitive' tools. The problem with Nigeria is that in our haste to attain the same height as the Western countries whereas we left the rudimentary processes of development. We want to do anything to avoid the adjective 'primitive' being used to describe us.

The fact remains that we cannot talk of national development without taking into consideration individual development. Individual development, in turn, cannot take place without language and that is why we have languages for the deaf and dumb and also for the computer (Uguru, 2007). In the same lane, (Butler, 1990) in his emphasis on the importance of language tour society writes: "Linguistics communication is without doubt one of the most important features of human life and we get better at inducing computers to stimulate it, the effects on our everyday living are bound to multiply". This means that linguistics is a multifacet discipline. It has some relationship with all aspects of human life.

Language as a phenomenon is generally regarded as a manifestation of inner thoughts. It will be observed that human thinking is controlled by language just as man's thoughts are controlled by language. Human beings equally perceived reality according to their languages. It is difficult to see any separable elements in the language skills, especially in terms of listening, speaking, reading, and writing; and the relationship with thinking. Taking solace from the words of Professor Unoh that underdeveloped or at best the under-developed state of Nigerian languages is most regrettable given the significance of the native language

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to a people. The language of a people or a speech community is "a precious national gift from God which the owners may willingly share but not willingly forsake". The people's language is not only part of their socio-cultural heritage it is also the national medium of thought, expression, and communication within their culture.

Technology is a necessary tool for self-reliance and the development of any nation, since man first learned to wield an animal bone and kill his prey more efficiently, technology has progressively changed our activities and attitude towards our environment. Technology in its broadest sense is the human creation of a physical system that performs a task. Some definitions of technology emphasize its effects in terms of the human attempt to control nature and the environment. Indeed, in the words of Date 1981, as cited in (Augustne and Okon, 2020) that technology is often identified with the hardware of production and distributions, whether in the term of machines, factories, roads, storage facilities, telephones, know-how, experience, education, organizational forms, and management techniques are also included in the definitions of technology. Science is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about a phenomenon. The existence of science has interplay between technology and society as something discounted even in some seemingly enlightened discourse. Therefore, it has to be appreciated at large in society due to the vital role it plays.

The application of language other than the indigenous languages in the teaching and learning sciences had eventually led many pupils to develop negative attitudes towards science. It is against this backdrop that this research work investigated the application of mother-tongue in the teaching and learning of science and technology subjects in Nigeria. Therefore, this research work is aimed to determine the challenges of developing language for science and technology, teachers' understanding and facilitation of science and technology subjects, the opportunity of multilingual classrooms, and the effectiveness of mother tongue on the teaching and learning of science and technology subjects.

Historical Overview of the Hausa People

Hausaland, sometimes referred to as the Hausa Kingdom, was a group of small independent city-states in northern Central Africa between the Niger River and Lake Chad that flourished from the 15th to 18th century. The origin of Hausa was hitherto not known, but one hypothesis suggests that they were a group of indigenous peoples joined by a common language-Hausa; while another theory explains their presence as a consequence of the migration of people from the Southern Sahara Desert. Indeed, the name Hausaland derives from the Hausa term *Kasar Hausa,* meaning the

'country of the Hausa language, through the area also included other people such as the Tuareg, Fulbe, and Zabarma. The term 'Hausa' was in use only from the 16th century as the people called themselves according to which specific city-state or kingdom they belong to.

Hausaland was located in the Sahara region between the Niger River and Lake Chad in North Central Africa in what is today northern Nigeria. The Sahel is the semi-arid strip of land running across Africa between the Sahara Desert in the north and the Savana grassland to the south. Hausaland specifically stretched from the Air Mountain (north) to the Jos Plateau (south) and from Borno (east) to Niger valley (west). This region saw the development of towns by the Hausa-speaking people from 1000 to 1300 CE.

Hausa people, wherever they had sprung from, by the early 15th century, many small Hausa chiefdoms had come together to create several walled cities which controlled their respective surroundings countryside. Traditionally, there were seven cities-states (the Hausa Bakwai), these were Biram, Daura, Gobir, Kano, Katsina, Rano, and Zaria. Each of these cities had its king or ruler, the *Sarkin Kasa*, who was advised by a chief councilor or Vizier, the Galadima, and a small council of elders typically consisting of nine (9) members who also determined the next ruler in line.
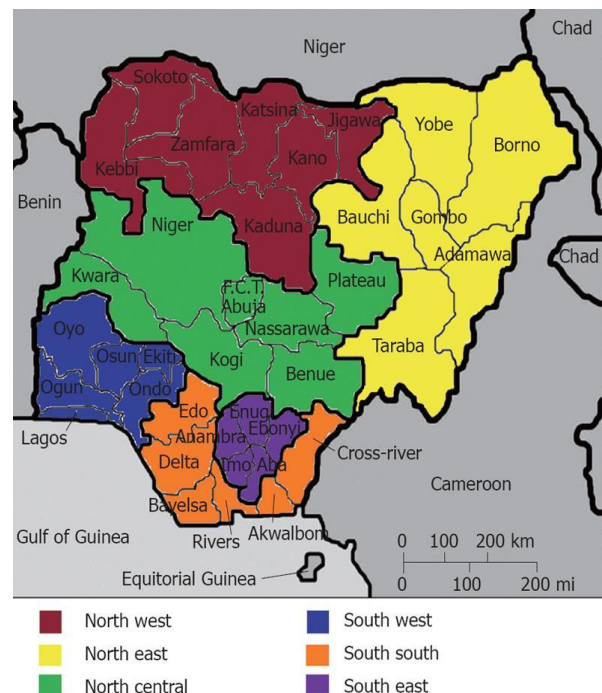

Fig 1: Map of Nigeria showing the six geopolitical zones and 36 states

Review of the Related Literature

Language is central to or pervasive in the realm of the human. Language forms the basis of whatever social cohesion we can attain, determine our worldview. Language intimately links the past with the

present and the present with the future. We cannot escape its influences even by silence. Human beings need language to grasp things intellectually and to get others to do so, to a large extent, language defines humanity. Zhang (1997) stated that language is the key to the heart of people if we lose the key, we lose the people. David (2006) opined that language is undoubtedly one of the most important areas of the curriculum. They are both means to an end and an end in themselves. That is, they provide a child with the tools to communicate and at the same time an integral part of the creative process that results from this communication when the language arts are taught with awareness, as well as enjoyment, students gain competence of their language and confidence in themselves. They learn to integrate the components of language into all aspects of their lives.

The emphasis of science education is to enhance students' scientific thinking through progressive learning activities that involve planning, measuring, observing, analyzing data, designing and evaluating procedures, and examining evidence. Learning science will enable our students to lead a fulfilling and responsible life by encouraging them to learn independently, deal with new situations, reason critically, think creatively, make wise decisions and solve problems. Through science activities, students should develop an interest in science and thus they will be motivated to become active learners in science. Students should also develop an understanding of science, technology, and society (STS). They should be able to make informed decisions based on evidence. Students with a high ability or a strong interest in science need more challenging learning programmes. These programmes should stretch the students' science capabilities and offer opportunities for students to develop their potential to the full.

Therefore, the choice of medium of instruction has remained a bone of contention in many countries of the world throughout history. Some countries preferred and still prefer, not their language, but a language in which intellectual pursuits have been pursued more extensively than in their language. English is the language in which the major proportion of scientific information is published. Scientists in many developed as well as developing countries like Nigeria conduct their scientific work in English and not in their languages. It is against this backdrop that this research work tends to investigate an account of science through mother-tongue and second language. The work would want to explore the linguistic history of science; the concept of mother-tongues as used in sciences as well as the concept of scientific contribution through English, which come not only from the native English-speaking scientists but from scientists of other speech communities.

Many theories and studies have pointed out that using the mother language would give the students a better opportunity to learn academic content. On mother tongue-based education, Cummins (2000) stated that 'children who come to school with a solid foundation in their mother tongue develop stronger literacy abilities in the school language'. Similarly, Thomas and Collier (1997) recognized that the deeper a students' level of the first language cognitive and academic development, the faster students' progress in the second language.

Furthermore, according to Dekker (2010), the mother tongue-based multilingual education provides a strong foundation in the learners' first language, enabling them to build knowledge and experiences they bring to the classroom. Lastly, mother tongue-based instruction provides the means for students to understand the science concepts better and helps them to be more critical and rational thinkers. According to Nolasco (2009), Benson (2005) and Sibayan (1994), when the students' mother language is used in the classes, various concepts are easily understood by students and it enables them to be more critical and rational thinkers. The mother language is also best used as a bridge in learning the main languages of instruction (Sibayan, 1994).

Mother tongue education could also be said to be any form of schooling that makes use of the language or languages that children are most familiar with. This is usually the language that children speak at home with their families. The 'mother tongue' does not have to be the language spoken by the mother. Children can and often speak more than one or even two languages at home. For example, they may speak one language with their mother, another with their father and a third with their grandparents. Although there is overwhelming evidence that children learn best through their mother tongues. Indeed, millions of children around the world receive education in a different language. This is usually the dominant language of the country they live in. In the case of former colonies, this may not be the language spoken in the community at all, but the language of the former colonial power, for example, English, French, Arabic, Dutch and Spanish. Languages that children may hear for the first time when they enter school.

According to Lepschy (2002: 4) the notion of mother tongue and native speaker "still remains elusive and hazy and its history difficult to ascertain." Usually, it is understood as the first language somebody learns, the "native language" or the language of socialization. The mother tongue is mostly the language of the homeland and the language of the group to which a person belongs, so very often both ethnic or national identities, as well as regional ones, are strongly connected with the mother tongue. Mother tongue is seen as "one's own" language, inseparable from personal identity (LaDousa 2010).

Children who speak a different language at home than the language in which they are taught at school will by definition become bilingual. The degree to which they become bilingual may vary considerably however and depends on the goal of the school programme. There are bilingual education programmes that aim at teaching children a second language at no expense to their first language. In such programmes equal use is given to learning in both languages; and children learn how to take full advantage of their multilingualism within a particular speech community. In Nigeria for example, the majority of schools, however, offer education only in and through one language which is the English language instead of the mother-tongue advocated for. Thus, children lose or leave behind their mother tongues and use only the language of the school.

Theoretical Framework: Sapir Whorfian Hypothesis

The Sapir-Whorf hypothesis holds that our thoughts are shaped by our native language and that speakers of different languages, therefore, think differently. This hypothesis is controversial in part because it appears to deny the possibility of a universal groundwork for human cognition, and in part, because some findings taken to support it have not reliably replicated. We argue that considering this hypothesis through the lens of probabilistic inference has the potential to resolve both issues, at least concerning certain prominent findings in the domain of comprehension of concepts and ideas. Thus, the researcher employed the principle of linguistic relativity. This formulation implicitly acknowledges that Sapir and Whorf were not the first or only scholars to have theorized about relations between language and thought and that other strands of thinking about the issue also exist. The main point of debate in the discussion of linguistic relativity is the correlation between language and thought. The strongest form of correlation is linguistic determinism, which would hold that language entirely determines the range of possible cognitive processes of an individual. This view has sometimes been attributed to Benjamin Lee Whorf, and to Ludwig Wittgenstein, but it is not currently the consensus that either of these thinkers espoused determinist views of the relation between language and thought.

Procedure

A case study research design was employed in collecting data for this study. Though, there have been several suggestions to ensure that research of this nature fits into the context of Northern Nigeria and in Nigeria in general. Struwig and Stead (2004) write about the need for researchers to be cognizant of the socio-historical, temporal and contextual factors and the role that they play in the research process. In any case, other scholars use case studies sparingly because they involve a small number of participants, although the focus is on arriving at a complete description of the situation.

Therefore, the case study method is preferred because it is usually an in-depth type of study. The study investigated some selected public primary school students in the two selected geo-political zones of North-East (NE), and North-West (NW). The North-West geopolitical Zone comprises of Kaduna, Kano, Jigawa, Katsina, Zamfara, Sokoto, and Kebbi states; North-East Zone is made up of Borno, Yobe, Adamawa, Taraba, Bauchi, and Gombe states. We gave an in-depth historical overview of each of the two geopolitical zones with a view of linking the existence of an individual state with the linguistics background and the efficacy of the mother-tongue in the teaching and learning of science and technology subjects.

The Population of the Study

The population of the study comprises selected public primary school students from the two North-East and North-West geopolitical zones of Nigeria. There is an estimate of about 100,000 primary school students in the two geopolitical zones of North-West, and North-East. Participants were randomly selected from public primary schools of these areas through a stratified random sampling technique. Each is stratified along with component states. For instance, North-East comprises six states; and North-West comprises seven states. This study involves 11 states of the 19 states of the northern region with FCT, Abuja. Three states were selected at random from each geopolitical zone. Six (6) public primary schools were equally selected from each of the states selected for the study (that is, two schools from each senatorial district). Thus, eighteen (18) schools were selected for the study from each geopolitical zone, making a total of thirty-six (36) schools from the zones under investigation. A minimum of thirty (30) students were selected at random from each school making a total of one hundred and eighty (180) students per state. Therefore, a total number of five hundred and forty students were selected for investigation in each zone. On the whole, we looked at one thousand and eighty (1080) public primary school pupils which are selected at random for the study.

Method of Data Collection

The subjects are selected from a large pool of students who showed interest after the objective of the study was explained to them. A questionnaire, oral interviews and informal interaction were employed to elicit information from the students. Key Person Interview (KPI) was also used to verify/supplement the information obtained from the oral and informal interactions. A few members of participants were interviewed to ascertain the efficacy of the teaching of science and technology subjects through the medium of mother-tongue.

We also use the reading materials taken from science textbooks in the English language which are used by the primary school students in public schools across selected primary schools within the study areas.

We translate the materials into the Hausa language which is the dominant native language. From the translated materials, corresponding test questions are developed to confirm students' understanding of the science and technology content. Administering tests in this language helps to assess the students' understanding of science ideas from the reading materials. We developed the tests consisting of multiple choices, true or false items, and open-ended questions in which students/ participants are allowed to explain in their mother tongues the science concepts in the readings.

DATA ANALYSIS, RESULTS AND DISCUSSIONS

Much data was collected to constitute the mass data before this was analyzed to create patterns and meaningful insights. This mass data is made of words, observations and images. For steps as highlighted by (Bhatia 2018), (a) getting familiar with the data (b) revisiting research objectives (c) developing patterns and connections. All these were followed as we prepared the data for analysis.

Having analyzed the data, the study reveals several position aspects about teaching science and technology in mother-tongue. For instance, in a multilingual country such as Nigeria, teaching in Nigerian indigenous language in addition to English content subject in science and technology would enable teachers to use other languages besides English. The School system should enable learners to write an examination in native languages as well. These advantages can assist in promoting multilingualism and enable teachers to utilize code-switching as well.

On the aspect of teachers' understanding and facilitation of teaching science through mother-tongue, the researchers discovered that facilitation and teaching through mother tongue needs a shift in thinking and philosophy of teaching. This means, seeing teaching and learning differently because language should be able to achieve some improvement in result indeed, it is not only about effective communication but also language impact on a child's self-confidence and sense of self in society are undermined if the mother tongue cannot be used for learning and these may be aggravated by the experience of repeated underachievement. This advantage has cognitive, psychological and cultural aspects, all manifested in the ongoing failure of our education system. Most of our participants pointed out that they always tried to use both English and Hausa in teaching science.

On the aspect of the challenges of developing language for science and technology, the science and technology learning area has various challenges, as spelt out by the participants. The principal among these is knowing what to teach and how to teach it. Yet critical behind this is translating and using the correct science concepts when using mother tongue. The language aspect requires an extra necessary but daunting skill from the teachers in the study. The teachers were aware that their teaching in Hausa would be as effective as their translation of content, for bad translation would aggravate understanding by both learners and teachers. The teachers stated that while they were aware of the need to use well-translated materials, they were not always able to produce effective translations for their classrooms.

CONCLUSION

This research takes and maintains the same position with the National Policy on Education (NPE) which affirmed that Government recognizes the importance of language as a means of promoting social interaction, national cohesion and preservation of our culture. The policy endorsed the need for every child to learn the language of the immediate environment. In the interest of national unity, it is expedient that every child shall be required to learn one of the three major Nigerian languages Hausa, Igbo or Yoruba. It is not surprising that many children cannot speak any of the indigenous languages including their mother tongue. The challenges of teaching in the mother tongue may remain unattainable unless Nigeria's education system is decolonized, English may remain the official language since it is our colonial heritage (Adekunle, 2008). Fafunwa (1998) attributed the continued retention of English as our official language to colonial mentality. Fafunwa stressed that children should be given early education in their mother tongue because it will last longer in their memory than any other tongue. Even The United Nations Education Scientific and Cultural Organisation (UNESCO, 1953) found out that children will excel more when taught in the local language. Fafunwa faulted the school of thought that Yoruba or other native languages have no numerals, scientific formulas and terms. Since English used Arabic numerals successfully, any Nigerian language could as well borrow numerals and others from other regions of the world. Therefore, Language learning and teaching as critical, other factors impact teaching such as teacher preparedness resources used and the socio-economic status of the learners. Yet, language is a tool that is pivotal in the classrooms and the use of learners' mother tongue is as critical as the teachers are committed to using languages they are proficient in.

RECOMMENDATIONS

1. That the National Policy on Education (NPE) which affirmed that Government recognizes the importance of language as a means of promoting social interaction, national cohesion and preservation of our culture should be sustained. The policy endorsed the need for every child to learn the language of the immediate environment. In the interest of national unity, it is expedient that

every child shall be required to learn one of the three major Nigerian languages Hausa, Igbo or Yoruba. It is not surprising that many children cannot speak any of the indigenous languages including their mother tongue. The challenges of teaching in the mother tongue may remain unattainable unless Nigeria's education system is decolonized, English may remain the official language since it is our colonial heritage.

2. Science and technology education should be an essential component of a learning continuum for all, from pre-school to actively engaged citizenship through the medium of mother-tongue. Therefore, indigenous language must not be only taught and used but taught properly at all levels of the educational ladder both by utilizing the outcome on research with these languages and by ensuring adequate and suitable training for the teachers concerned.

3. Support schools, teachers, teacher educators and students of all ages to adopt an inquiry approach to science education as part of the core framework of science education for all through the medium of mother-tongue;

4. Science education should balance requirements of breadth and depth of science knowledge to ensure young people and adult learners are both motivated to learn and equipped to fully engage in scientific discussions and decisions and to facilitate further and deeper study through the medium of mother-tongue.

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