TEACHING SCIENCE TO STUDENTS LEARNING ENGLISH AS A SECOND LANGUAGE (ESL): THE ROLE OF SCIENCE TEACHERS IN ENGLISH LANGUAGE TEACHING

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Abstract
There is no denying that science is an important subject that can be taught to children. It helps them develop scientific skills and attitude early in life. However, one of the problems confronting effective teaching of science is learning the language of science. It holds that teachers of science usually find it difficult to teach science effectively due to language barrier. This is not only due to the presence of first language but also due to the status of the English language as a second language. Science teachers jettison learning and use English at the detriment of their students. The paper thus explains the role of science teachers in ensuring effective use of language by themselves and inculcating same in the students. This, it is believed, will help to enhance efficient teaching of science. It is recommended that teachers of science acquire basic English; spellings, grammar, registers, pronunciations, etc. to strengthen their performance thereby helping the students.

Key words: **Science, language, knowledge, ESL (English as Second Language).**

Introduction

Science is everywhere; hence, children need everything to increase their understanding of science. According Gross (2012), "children inquire, observe, compare, imagine, invent, design, experiment, and theorize when they explore natural science materials such as water, sand, and mud" (p.1). It is however, important to note that these scientific activities are done using a language. This is true when it is agreed that;

a. Science is a way of exploring and investigating the world around us…not only a way of knowing; it is a way of doing (Wenham, 1995);
b. Science involves the discovery of factual knowledge, causes of what is observed and procedures (Wenham, 1995); and
c. Language is the indispensable tool needed in doing(a) and (b) above.

The place of language in teaching and learning of science cannot be overemphasized. What use is the book without words and pictures? In fact as argued by Postman (1971),

> *Almost all of what we customarily call 'knowledge' is language, which means that the key to understanding a subject is to understand its language. A discipline is a*
> *way of knowing, and whatever is known is inseparable from the symbols (mostly words) in which the knowing is codified. What is biology (for example) other than words? If all the words that biologists use were subtracted from the language, there would be no biology. Unless and until new words were invented. Then we would have a 'new' biology! What is history other than words? Or astronomy? Or physics? If you do not know the meaning of history words or astronomy Words, you do not know history or astronomy. This means, of course, that every teacher is a language teacher: teachers, quite literally, have little else to teach, but a way of talking and seeing the world* (Wellington & Osborne, 2001).

The implication is that language learning is as important as learning the science itself. For instance, according to the National Research Council's (2011) Framework on education, an inquiry-based science requires a set of science and engineering practices which include:

a. Asking questions and defining problems;
b. Developing and using models;
c. Planning and carrying out investigations;
d. Analyzing and interpreting data; and
e. Evaluating and communicating information

(Quinn, Lee, & Valdes, 2014).

These practices are both a representation of what scientists do as they engage in scientific enquiry and a necessary part of what children must do to learn science and understand the nature of science. So, if science learning requires children to engage in these practices, it holds that meaningful "language for use" leaning occurs in context where students are expected to communicate about science (Quinn, et al, 2014).

A science classroom can be a rich language learning and science-learning environment if the teachers ensure that the children are supported. It is a language learning environment for all students as the discipline itself brings a pattern of discourse and registers that are unfamiliar to most of them.

Hence, teachers' knowledge about language and language learning can improve the overall science learning experience of all students who are learners of English as a second language. The motive is not to make science teachers behave **as** language teachers would, rather, the idea is to help them further appreciate their roles as advocates of effective language learning and language use.

Definition of Science

It has to be stated at the outset that science is more complex than definitions which one can memorize and then put the issue away (anonymous). However, science is a system of acquiring knowledge. It is used to refer to the body of knowledge gained through observation and experimentation (Mufutau& Ibrahim, 2012). The basic products of science are truth and understanding.

Based on these products, science can be defined as enquiring facts which are known to be true, empirical, reliable, explicit ontologically valid, testable, systematic, comprehensible, and having minimal error. It is also defined as knowing the relationship of facts to each other so that one can describe, predict, control, synthesis and explain. Science has three basic goals: research to understand (pure research); research to solve particular problems (applied research); and dispensing solution (practitioner). It is a knowledge generating activity which is based on systematically organized bodies of knowledge obtained through objective observations.

Importance of Teaching Science to Children

There are many reasons we can offer to justify putting energy into providing students with the opportunity to learn science **(**Settlage and Southerland, 2012, p.xi).

i. It helps the children to have a worldview of science. In other words, they will begin to look at things in a way that is probably not the same as others.
ii. The value system of science influences the way children think.
iii. Children learn to question and satisfy their curiosity through science.
iv. It enables children to be open-minded.
v. It inculcates in the children the spirit of skepticism thereby pushing them to always seek more data to become convinced.

In addition, the New South Wales Department of Education (2015) stated that it is important to teach science to children because it;

a. Develops patience and perseverance in them;
b. Helps them develop a healthy form of skepticism; and

c. Can spark their minds that they too can help solve some of the world's big problems.

Language as a Barrier to Science Teaching

Language is central to the sustenance of groups of people for it is the vehicle through which constituents of culture are communicated. As Ademowo (2012) opined, language is the primary vehicle through which knowledge is acquired, shared and transmitted.

Language is "an abstract system of word meaning and symbols for all aspects of culture which includes speech, writing, characters, numerals, symbols and gestures(expressions of non-verbal communication)" (Schaefer, 2000, p. 52). It is central to the interaction process (Bewaji, 2002).

Ademowo (2012) argued that language is vital in communicating what we acquire or conceive to be knowledge. It is only through the possession of linguistic capabilities that we can communicate what we know.

One of the major challenges faced by students learning English as a Second Language (ESL) when learning science is learning the language of science (Wellington & Osborne, 2001). This is in line with the assertion of Ferreira (2011) who stated that one of the major difficulties experienced by learners when learning science is learning the language of science.

Similarly, Jaipal (2001) argued that besides learners' prior knowledge and experience, sign system, especially language, and interpersonal relations between teachers and learners also mediate learning. According to Ferreira (2011), language plays an important role in the teaching and learning of science (p.102).In consonance with this, Tailor and Prinsloo (2005) pointed out that after poverty, language, in particular proficiency in the medium of instruction, is the largest single factor that affects learner's performance at school. In most cases, even with the best intentions, science teaching frustrates students largely due to the language teachers use. Paying attention to language "is very important to improve the quality of science education and every lesson should by implication be a language lesson" (Schaffer, 2007, p.5).

To do well, learners should be able to extend their knowledge of concepts beyond basic vocabulary and be able to engage in, and manipulate the appropriate discourse (Shaffer, 2007, p. 6). In other words, according to Henderson and Wellington (1998), spotlight should be turned towards science education with the emphasis on learning science as one learns a new language. Citing Osborne (1996), they argued that learning physics is more akin to the learning of a foreign language than it is to the learning or listing of facts. This is true of other science subjects as it affects all sciences. Hence, there is a strong justification for emphasis on language in science teaching and learning.

In Nigeria, as in other countries where English is a second language, learners do not only communicate in English (a second language), but also use it as a medium of learning other subjects. The problem faced by teachers of science is that of teaching a particular subject in English while the learners are still learning the language. These learners thus require additional support to develop their language skills and learn science with ease.

A point to note is that scientific language is not just specialist vocabulary, as it is possible to discuss a topic scientifically without using heavy technical vocabulary. Rather, it involves using "the right kind of language to scaffold deductive and inductive reasoning, formulate hypotheses, make generalizations, identify exceptions, connect evidence to thesis, classify, relate, organize, plan, and persuade" (Wellington & Osborne, 2001, p. v).The basic features of science language, besides science vocabulary, are precision, details, validity of claims and theories, evidence, etc. It also involves conveying information not just through oral or textual form but also through visual and mathematical representations (Quinn, Lee & Valdes, 2014).

Role of Science Teacher like an English Language Teacher

One important fact usually ignored by teachers of science is that science education can be a vehicle for enhancing the language of students. Hence, science teachers are language teachers. Their role cannot be over emphasized. Perhaps that is why Settlage and Southerland (2012) opined that:

> …the science teacher's mind also needs to be engaged. The science teacher's mind is one that tries to recreate science learner enthusiasm so it is channeled through learning science…. However as a science teacher, you shouldn't be contented simply with having students enthused. You should also accept responsibility for advancing each child's understanding of science as you direct their excitement for a grander purpose (p. xxviii).

The best way for the teacher to do all these is to ensure appropriate language use by himself and the students. This is not unconnected to the fact that learning science is more than having children discover it for themselves. Teachers are legitimately expected to guide their students to existing sources of scientific knowledge to assist their students' learning.

A lot of work in science involve writing of investigations, hence, learning to present evidence in the style of a scientific paper is valuable (Henderson & Wellington, 1998). It is important for teachers to explore different ways of getting pupils to present written records of their investigations and to give them the opportunity of showing their understanding of a scientific concept or topic. Here, the teacher of science can engage the pupils in creative writing. This is imperative when it is considered that scientific writing must be objective, finished and coherent.

To this end, the role of teachers, according to Ferreira (2011), include

a. Using investigations and practical work for clarification of concepts. This will promote concrete learning because it is in the field that science becomes lively and where thinking locally becomes thinking globally.
b. Using analogies to help clarify thinking and help learners overcome misconceptions and create avenues to visualize abstract concepts.
c. Code switching: -This involves going from one code to another i.e. from one language, or variety of a language, to another to aid understanding. This is applicable where learners understand the two codes.

Similarly, according to Wellington and Osborne (2001), it is important for teachers to note that it is not enough

a. To ask students to read the textbook. Rather, the reading task has to be structured so that the students will ask the kind of silent questions scientists would ask.
b. To assign a report to be written: the students should be taught what questions the reports should answer, how the answer should be coherently connected with each other and how each answer and each connection should be put in the right kind of words, sentences and paragraphs.

The teacher would therefore need to ensure that the students acquire, among others

a. Knowledge of register;
b. Knowledge of sentence and sentence structure;
c. Knowledge of formal and informal expressions;
d. Knowledge of paragraph development;
e. Knowledge of reports writing;
f. Knowledge of coherence and transitional elements; and
g. Knowledge of spellings.

Conclusion

Attempts so far have been made to establish that;

1. Every science lesson is a language lesson.
2. Language is a major barrier to most children in learning science.
3. There are many practical strategies teachers of science can employ to help to overcome the barrier.

Hence, it can be deduced that although science teachers realize and recognize the important role of English language in teaching science and the need to help the students who lack proficiency in the language to understand scientific concepts and principles, it is worrisome that many of them are not aware of the role they need to play in controlling the language barrier in science class. Science teachers should realize their indispensable role in assisting learners in language related problems. Because language in science matters, their listening, speaking, reading and writing skills have to be improved to learn and perform maximally. It can be concluded that if teachers of science should master the English language enough, they will be effective in improving students' interest and performance in the sciences.

Recommendations

From the above, it is hereby recommended that:

a. Students should be taught to express themselves clearly in speech and writing.
b. Students should be taught to develop and enhance their reading skills.
c. Students should be taught to use grammatically correct sentences in order to communicate effectively.
d. Spelling is convention that matters. It should be taught with emphasis on those words whose orthographies do not conform to their pronunciations. This is imperative because English is not a spelling –pronunciation language.
e. Students should be taught to use appropriate registers to describe and explain a process.
f. The uses of the different transitional elements should be incorporated in science education class.
g. Students should be taught in all subjects to express themselves correctly and appropriately and to read accurately and with understanding.
h. In writing, students should be taught to use correct punctuation and follow grammatical conventions. They should also be taught to organize their writing in logical and coherent forms.
i. In speaking, pupils should be taught to use language precisely.
j. Students should be taught to listen to others, and to respond and build on their ideas and views constructively.
k. In reading, students should be taught strategies to help them read with understanding, to locate and use information, to follow a process and to synthesize and adapt what they learn from their reading.
l. Language should be kept as simple as possible.

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