educational perspectives

VOL. 6 NO.2 AUGUST 2003

A JOURNAL OF
The Faculty of Education
LAGOS STATE UNIVERSITY
Lagos, Nigeria.

CONTENTS

PREPARATION OF SCIENTIFICALLY LITERATE STUDENTS: PQRST TO THE RESCUE

FOLUSO OKEBUKOLA (Ph.D) & BUNMI ONAFOWOKAN (Ph.D)
Lagos State University

ABSTRACT

This paper presents and discusses an expository study on the use of the PQRST as a heuristic method for the attainment of scientific literacy in the science classroom. PQRST a reading-study technique is presented, explained and discussed as a potent method that can be used in teaching science concepts and reading science materials. The modalities, practical applications and pedagogic viabilities are also examined. There is evidence that it is a useful tool in the hand of the science teacher to meet the demands made by reading, on the understanding of science.

INTRODUCTION

Science educators and major science organizations are increasingly advocating the preparation of scientifically literate students (Lederman, 1992; National Research Council. (NRC). 1996: Baptiste. 2000; Nwagbo 2000.) The reason for this is not far fetched. The attainment of high level of scientifically literate society including secondary school students is one of the major goals of science teaching. It is a truism that scientific literacy is a bastion for technological development – the hallmark of any modern society.

Anderson (1987) defined a scientifically literate person as one who has developed an understanding of the concepts, principles, theories and processes of science as well as an awareness of the complex relationships between science, technology and society. More importantly such a person should develop an understanding of the nature of science. He conceptualized two levels of scientific literacy, low and high. Anderson argued that low literary in science focuses on knowledge of facts about the world while high literary centers around the use of scientific facts in the description and explanation of natural phenomena and everyday life experiences. In the light of this, good science teaching is defined as that geared towards developing an attainable form of high scientific literary and good science teachers as "those adequately prepared to help their students achieve an attainable form of high literacy" (P.4). He argued that teachers who are supposed to teach for an attainable form of high scientific literacy should themselves be highly literate in science. Such teachers should be capable of transforming their knowledge and understating of science to a level that students can attain by their mastery and competence in the use of language – the vehicle for communication. Without this, teachers' knowledge and understandings would remain virtually tacit and unavailable for teaching. Teachers would not be able to help students develop the desired understandings of science. In other words, teaching for inculcation of scientific literacy demands that the science teacher should be able to read science textbooks with understanding and impart such knowledge into the students.

Nwagbo (2000) noted, "students can learn a lot from topics that cut across different disciplines". She noted for instance that such topics like environmental pollution, energy transformation, and conservation of natural resources could be explored beyond curricular demands and used to enlighten the students on global issues. A potent method that can be used in the attainment of scientific literacy in the science classroom in juxtaposition with the proven methods such as guided inquiry, discussion, activity, and field trip is the PQRST.

It is the intent of this paper to discuss the modalities and pedagogic viabilities of the PQRST method as a useful tool in the hand of the science teacher to meet the demands made by reading on the understanding of science.

Reading and Science

The following passage from a science textbook (Sund, Adams and Hackett 1980) illustrates some of the reading demands in science.

> *The chart below shows some common compounds. It also shows the chemical formula and the phase of the compound.*
>
> | *Compound* | *Formula* | *Phase of matter* |
> |---|---|---|
> | *Carbon dioxide* | CO_2 | *gas* |
> | *Water* | H_2O | *Liquid* |
> | *Ammonia* | NH_3 | *gas* |
> | *Salt* | *Nacl* | *solid* |
>
> *There are simple rules for writing chemical formulas. The formula for water is H_2O. The small number '2' means that a water molecule has two atoms of hydrogen. The 'O' has no number after it. No number means there is only one atom of oxygen. The number '1' is not written in chemical formula. A molecule of water has 2 atoms of hydrogen and 1 atom of oxygen. CO_2 is the formula for carbon dioxide (Carbon (IV) oxide). What elements make up carbon dioxide? How many atoms of each element are in a molecule of carbon dioxide? (Pg. 90).*

The above explanation of the rules for writing formulas is specific and reflects technical reading and writing – a peculiarity of content area texts (Okebukola, 1994). It must be carefully read, or the concept may not be grasped. The passage also includes several terms specific to science: element, molecule, compound, atom, carbon dioxide, and formula. And like mathematics and social studies science uses several symbol sets. The chemical symbols and the numerical subscripts in the formulas must all be mastered in order to understand this science passage correctly. A further distinction in

Food group	Main Function	Deficiency effect
Protein	Growth & repair of wornout tissues in the body	-
Fats and Oils	Provision of energy	-
Vitamin A	Formation of visual pigments and maintenance of healthy skin.	Night blindness, skin sores.
Vitamin B	Vitality	Beriberi, anemia, pellagra, failure of red blood cell to mature, heart failure etc.
Vitamin C	Quick healing of wounds	Scurvy
Vitamin D	Increases calcium absorption from gut: important in bone and tooth formation.	Rickets
Vitamin E	Fertility	-
Vitamin K	Aids in blood clothing	Failure of blood to coagulate.

Many animals and plants have been determined by their genetic factors to be short. Some have been affected by insufficient or lack of proper growth nutrients hence they do not look normal and healthy. Some diseases also cause ill health and unhealthy growth and development in plants and animals.
Observe some of the unhealthy looking plants, animals and people. Note the cause of their ill health and unhealthy growth and development.

Mr. Baoku shows some photographs of people with typical diseases, ill-health, underdevelopment due to poor or inadequate nutrients he also uses plants and animals examples.

Question – Mr. Baoku tells students to write down questions they might have about the generalization and questions that they think might be answered as they read through the selection. He tells students not to refer to their books at this stage. He goes round to check students' questions.

Read – He tells students to keep their questions and to read the passage writing down brief notes that might help them answer their own questions.
Pupils Activities. Carry out the food tests described below.

Test 1

Carry out carbohydrate test by putting 1-2 drops of iodine in a teaspoonful of maize flour. Notice the change in colour from white to blue- black. When any food has starch, it will turn blue- black with iodine.

PQRST reading and study technique. He explains that science textbooks are often structured so that a generalization or theory (explains the meanings of generalization or theory tapping from learners' reservoir of knowledge and day to day experiences) is stated near the beginning of a selection, the generalization is expanded and supported throughout the rest of the selection and a summary statement of the generalization or theory is usually presented at the end. He has his students look at a section of their science textbook that demonstrates this structure.

Mr. Baoku then explains that a technique called PQRST helps readers consciously identify the generalization or theory and become more aware of the supporting details. He reminds his students that they should be active readers who anticipate what may come next, based on what has come before. He then presents each of the steps in PQRST, demonstrates what a reader might do at each step and verbally tests a number of students to make sure that they know what should be done at each step.

Preview. Mr. Baoku asks his students to open their books to a specific election that has not been read before. He tells them to preview the selection, jotting down a note about the generalization or theory. When all are finished, he asks what they think the generalization or theory is and has several students supply the reason for their decision. Below is Mr. Baoku's selected passage from the book 'integrated science 2' (Okebukola 1991, pp. 21)

A Balance Diet

To look healthy and grow well we should eat carbohydrates which give the body energy; proteins, which make the body grow and help in healing; vitamins which protect and preserve the body; fats and oil which give heat to the body and minerals which preserve and protect the body; water which forms a large part of the blood and roughage to prevent constipation. Some of the foods such as carbohydrates are required in large quantities and others such as vitamins and minerals are required in only small quantities.

When you eat a little bit out of these food groups in the correct proportion, you are taking a balanced diet.

When you do not eat enough of any of them, you are said to be malnourished. This is the cause of ill healthy, diseases and unhealthy growth and development. The following table shows the food groups, their main functions and deficiency diseases.

Test 2

Carry out the fat and oil test.

Break one groundnut and rub the broken end over a piece of filter paper or any white paper. Hold it against light. What do you see? An oily patch shows you that groundnut contains oil.

Summarize – Mr. Baoku tells students to group relevant facts and also attempt to specifically answer their own questions using their notes as a place to start.

Text – Mr. Baoku has a few students read their summaries aloud while the other students silently compare their own to those that are read. This can also be done in groups. Students then discuss the accuracy of the summary statements and the answers to the questions identified earlier. During this process, teacher asks his questions based on the areas students did not touch on. Students are encouraged to use the passage as a reference to justify their conclusions. Mr. Baoku reinforces the use of PQRST on a continuing basis.

Conclusion

The use of PQRST as an instructional strategy in the science class as presented in this paper requires readers to bring their own knowledge to bear on the text while at the same time using the information in the text.

This method used in content area reading also encourages students to monitor comprehension (Okebukola 1999). During the reading they keep questions in mind and monitor to see when answers are found. Comprehension monitoring means that readers must actively attend to content, be aware of ideas, separate impotent information from unimportant ones and know when something has not been properly understood. In essence the method helps to foster internal comprehension monitoring and metacognitive abilities.

References

Anderson, C. (1987): "The Role of Education in the Academic Disciplines in Teacher Preparation". Paper Presented at the Rutgers Invitational symposium on Education: The Graduate Preparation of teachers, New Brunswick, N. J.

Baptiste, P. (2000): Will there be Science Literacy for this Millennium?

Leu. D. and Kinzer, C.K. (1995): *Effective Reading Institution.* N. J. Prentice Hall.

National Research Council (1996): *National Science Education Standards.* Washington. D. C. National Academy Press.

Nederman N.G. (1992): Students' and teachers' conceptions about the nature of science: *A Review of Research Journal of Research in Science Teaching* 29. 331 – 359.

Nwagbo, C. (2000): Enriching STM Education Through Teaching for Inculcation of Scientific Literacy. Proceedings of the 41st Annual Conference of the Science Teachers Association of Nigeria 372-375.

Okebukola, F.O. (1994): "Achievement in English as determinant of mastery of science concepts". Journal of Science and Movement Education. Vol.1 No. 1 164 – 165

Okebukola, F.O. (2000): Connecting Adolescents and Reading: Interests at the Senior Secondary Level. *New Dimensions in Educational Development*. 64-75.

Okebukola, P.A.O. et al (1991): *Integrated Science 2 Nigerian Junior Secondary School Basic Textbook* Ibadan. NPS.

STAN (2000): Proceeding of the 41st Conference of Science Teacher Association of Nigeria 19-22.

Sund, R. B. Adams, D. K. & Hackett J. K. (1980): *Accent of Science* (Level 6) Columbus.