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THE TEACHER AND TEACHING WITH INSTRUCTIONAL MATERIALS IN THE TEACHING OF SCIENCE SUBJECTS AND THE CONTRIBUTION OF GUIDANCE AND COUNSELORS THEREIN

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ABSTRACT: *The aim of this study was to investigate the preferred crises management strategies among lecturers in tertiary institutions in Cross River State, Nigeria. The population of the study was one thousand two hundred and forty two (1,242) lecturers. The total sample used for the study was five hundred respondents who were drawn through stratified random sampling from four institutions of higher learning in Cross River State. The instrument used for the data collection was the researcher's developed Preferred Crisis Management Strategies Questionnaire (P.C.M.S.Q). It has two sections, A and B. Section A contained the personal data while B contained four point Likert scale type, made up of sixteen (16) items. The data collected from the samples were subjected to statistical analysis using the population and independent t-test. To accomplish the study objective, two hypotheses were formulated to guide the study. The following findings emerged; the preference for force crisis management strategy by lecturers was significantly low in tertiary institutions in Cross River State. Sex does not influence lecturers' preference for dialogue as a crisis management strategy. Based on these findings, the following recommendations were made. The government should adequately fund education, and the schools should devise local sources of generating funds while well-meaning individuals and companies should assist, dialogue should be adopted as evidenced in the study.*

KEYWORDS: Tertiary institutions, Preferred, Crises, Management, Strategies, Lecturer.

INTRODUCTION

The launching of the first Russian Sputnik (Balogun, 1971) gave impetus to the series of curriculum projects which began with the physical Science Study Committee (PSSC) and the Biological Science Curriculum Study (BSCS) in the United States, leading to the Nuffield project in the United Kingdom (UK) and in West Africa, the curriculum developments in physics, chemistry and biology. As the curriculum projects were beginning in the US, the predicted industrial revolution in education was being realized. Thus "teaching Machines" "knowledge industries" and Automation" became features of the educational scene.

Some of the objectives of education are to give training in finding knowledge, acquiring skills, manual and mental dexterity. Interest in science is thus the extension of one's scientific knowledge and in the means of discovery. A good science education therefore must not stop at teaching mere principles and facts, but must proceed to teach an understanding of scientific attitude and values. This can be done by persuading the individual to become involved in concrete problem- situations of the scientific world. As the counsellors should encourage the teachers of science to cultivate in student classic attitude to find out as much as possible for themselves through their own active search/participation.

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The teacher of science therefore should cultivate in students an attitude to find out as much as possible for themselves through their own active participation. This is the notion of arriving as often as possible at empirical statement via empirical induction. This is the concern of science. Gardner (1975) pointed out that despite the universal acceptance of science as school subjects, little scientific thought has been given to the question of how to teach it. While addressing the question and how best science subjects should be taught, this article will briefly explain the concept of science, meaning of instructional materials and their functions. The instructional materials for teaching the physical science subjects will be suggested. The constraints to the use and suggestions for improving the use of instructional materials are also made.

Concept of science

Science as a concept can best be explained by stating what different educationists and writers have said about it. According to Gardner (1975), science is a complex structure of many related disciplines, whose development depends on the scientist's imagination and his deep desire to understanding his world. The scientist, Gardner stressed has a personal commitment to learning, to the pursuit of truth, to the surmounting of obstacle, and to the widening horizon.

UNESCO (1975) describes science as a conceptual series of concepts and conceptual schemes that have developed as a result of experimentation and observation. Science is a speculative enterprise. The validity of a new idea and the significance of a new experimental finding are to be measured by the consequence in terms of other experiments.

Science can be explained as a human enterprise or activity designed to search for more accurate descriptions of things and events in nature. The search leads to new discoveries, new insights about unifying patterns, concept formation, understanding and new knowledge. Science therefore, is not static, but rather a dynamic, yet objective process of seeking knowledge, a way of rationally explaining event and phenomena.

Science has been seen as double edged sword that does both good and harm to the human race. According to Gardner and Passmore (1975) the modern society perceives the tree of science as a bearer of mixed fruits. Science and its half-brother-technology are credited with promoting reason over superstition, health over disease, affluence over poverty, education over ignorance. Yet, according to them the fruits of science are always sweet. Science and technology are roundly condemned for accelerating over population, polluting the environment, destroying irreplaceable natural resources and dehumanizing mankind.

Both in the highly developed and developing countries, reactions have set in against the physical science-physics, chemistry and biology. Various writers have drawn attention to the proportional; and frequently absolute decline in enrolments in the physical science subjects (Gardner, 1975). Teachers of science are therefore faced with a difficult problem. Based on the above information, pertinent questions which arise are;

1. What are the causes for decline in the enrolment in the physical science subjects?
2. How effective are the teaching methods used by the teachers of science?
3. Do the teachers use instructional materials in teaching the physical science subjects?
4. How appropriate and relevant are the instructional materials used by the science teachers?

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The focus of this article is NOs 3 and 4 above. Researchers' feels that lack of instructional materials in the school system or inadequate use of instructional materials in instructional situation can affect the performance of students in their examinations. Supporting the above assertion, Adeyanju (1991) Ezewu (2000) posited that perhaps the poor results of the post-primary schools especially that of 1985 which was described as the worst in 44 years in Nigeria could be attributed to absence or total failure on the part of the primary school teachers in the use and production of instructional materials. According to them, Vanguard (Dec. 16, 1985 p.7) presented information that at least 70 percent of the 600,000 candidates who sat for the 1984-85 May-June West African School Certificate Examination failed.

Gardner (1975) is of the view that science as taught in schools should resemble the science known by the practicing scientist. This can be done the curriculum theories argue, if the key concepts of each discipline can be made explicit and transmitted via the instructional materials. This article is concern with instructional materials used in the teaching and learning of science subjects in schools. It is pertinent therefore to explain briefly the concept of instructional material before the functions are outlined.

Meaning of instructional material

Instructional material and instructional media are now used to mean every material or equipment which were formerly referred to as 'teaching aid', instructional aid', 'audio-visual aid'. Instructional material according to Schman (1977) is an information carrying technologies that are used for instructional purposes with the hope of delivering education information very quickly and very vividly too. According to Ike (1992), Allen (1963) defines instructional material as devices which present a complete body of information and largely self-supporting rather than supplementary in the teaching-learning process. These definitions by implication mean that the pupil or learner who has access to media capable of presenting information can learn a concept without requiring the services of a teacher. This explains the emphasis that every instructional material should be well prepared and should be as real as possible. It should however, be noted that however good instructional material may be in terms of production, it requires the skill of the teacher to use it to make teaching-learning more effective, quicker and enjoyable.

Significance of instructional materials

The relevance of instructional materials in the teaching learning situations should no longer be over emphasized. Many research evidences confirm that instructional material can be used to enhance teaching and learning. According to Dale (1969) Heinich, Mollenda and Russel (1982), Nwosu (1991), Denga (2003), Eina and Ajayi (2008) stated that in the classroom, instructional materials can

1. supply a concrete basis for conceptual thinking;
2. have a high degree of interest for students;
3. supply the necessary basis for developmental learning and hence make learning more permanent
4. offer a reality of experience which stimulates self-activity on the part of the pupils;

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5. provide experience not easily secured by other materials and contribute to efficiency, depth and variety of learning.

In addition to the general functions, instructional materials also play significant roles for the teacher. Supporting this assertion, Erickson and Curl (1972) pointed out that instructional materials:

1. provide the teacher with a means of extending his student' horizon of experience;
2. help the teacher provide his students with meaningful learning to the vast reservoir of really as well as to graphic and pictorial materials;
3. provide the teacher with interest compelling springboards which can lunch students into a wider variety of learning activities.
4. Help the teacher to overcome the physical difficulties of presenting subject matters, and
5. Provide the teacher with tools to carry out diagnostic testing, research, and remedial work.

Science subjects are very rich in instructional materials. For easy understanding of scientific terms and concepts both students and teachers should use instructional materials. It is therefore pertinent to list some of the instructional materials which are used or can be used for teaching various science subjects (Physics, Chemistry, Biology and Integrated Science).

Instructional materials for teaching and learning science subjects

One facility that is common to all science is the science laboratory. The most common reason proposed for the inevitability of the laboratory in schools is based on the argument that science is experimental and therefore any course in science should reflect this by including laboratory work.

Henry (1975) asserted that the universal assumption by science teachers at secondary and tertiary levels is that the large amounts of time, space and money demanded for laboratory work are justified. Students of science spend a lot of study hours doing practicals in the laboratory. Henry distinguished between practical work and laboratory work. According to him, practical work is taken to include any activity involving students in real situations, using genuine materials and properly working equipment. Practical work may be performed in the laboratory but clearly practical activities are not confined in the laboratory.

Laboratory work on the other hand may be regarded as practical work performed in the laboratory. Laboratory work is a range of activities from the experimental investigations to confirmatory exercises and skill learning. Stressing the need for the establishment of science laboratory in every school, Glass (1960) maintained that the laboratory is the place where one learns most readily what questions can be asked fruitfully, and how they must be put. It is where one learns why science insists on precise measurement, accurate observations, and clarity of communication.

Keffer (1975) explained why laboratory work is important in the teaching of chemistry. It is not easy according to him, to determine whether apparent irregularities are due to nature or to the experimenter. The student must decide this for himself at the laboratory beach.

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Repeated often enough, these experiences lead to the development of critical judgment. Henry (1972) reported that a study on laboratory work objectives in chemistry revealed among other things that laboratory work:

1. Assists learning as it helps in the better understanding of chemical principles, the building of reinforcement of chemical knowledge and principles, increased motivation and also fostering the growth of pupils' confidence in their ability to understand chemistry.
2. enables students to gain a true experience in chemistry;
3. teaches useful practical skills in developing useful basic experimental skills in students;
4. develops desired traits and appreciations such as the habits of being observant, careful, patient and persistent;
5. necessary for problem-solving enquiry approach. For example, through laboratory work, pupils should develop the ability to devise new experimental methods answering problems;
6. relates abstractions to realities. In other words, it bridges the gap between the abstractions of theoretical chemistry and the realities of actual reactions.

These observed attributes of the laboratory work about chemistry stated above are also applicable to other science subjects. These attributes explain why there is emphasis that there must be science laboratories in schools and laboratory practice is compulsory for all students in science classes.

Other instructional materials for teaching science

The instructional materials listed below are found in the science laboratory depending on whether it is physics, chemistry, biology or integrated science laboratory. The objective for listing these instructional materials is to enable student teachers to select those that they can produce by themselves.

Biology: Diagrams, posters, charts, flipcharts, strip charts, specimens, objects, models, mock-ups, diorama of ecological systems, dry glass tube, delivery tube, rubber tubing, retort stand, tripod stand, measuring cylinder, conical flask, stopper, thistle funnel, test tube, beaker, funnel, film loop projector, Technicolor, slide projector, filmstrip project, Bunsen burner, thermo flask, potassium permanganate bones, aquarium, microscope, slide, microprojector, overhead projector, opaque projector, dissecting set, quadrant, plant press, clinostat among others.

Chemistry: Thermometer, glass rod, filter paper, lens, bulb, porcelain boat and copper, clock glass, siphon tube, pipette, burette, mortar, firebrick, flat bottomed flask, diagrams, graphs, periodic table, overhead projectors, opaque projectors, film loop projectors, among others.

Physics: Engineer's calipers, slide calipers, venire scale, micrometer, screw gauge, top-pan balance, spring balance, measuring cylinder, measuring flask, pendulum, trolleys on ball-bearing wheels, ticker-tape vibrator, meter rule, plumb line, steelyard, claw hammer, pliers, sugar tongs, wheel barrow, nutcrackers, the lever, pulley, inclined plane, engineer's vice, car lifting jack, hydraulics press, lift pump, windlass, brace, screw driver, box spanner, density

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bottle, vacuum pump, the manometer, sphygmomanometer, (for measuring blood pressure), barometer, the common pump, Hare's apparatus, hydrometer, celsus scale, six's thermometer, Boyle's law apparatus, Charle's law apparatus, Joule's apparatus, thermopils, coker, wet and dry hygrometer, pinhole camera, the camera, ray box, mirror, kaleidoscope, periscope, telescope, prism, microscope, optical fibres, spectrometer, electromagnet, magnet, tuning fork, crova's disc, musical scales, senometer, resonance tube, iron fillings, gold-leaf electroscope, Columba's hemispheres, the Wins Hurst machine, van de Graff generator, Hamilton's mill Leclanche cell, wire-wound rheostat, ammeters and voltammeters, Hofmann's voltammeter, Faraday's magnet, Barlow's wheel, the multimeter, the arometer, potentiometer, simple solid block calorimeter, Rutherford-Bohr a town models, diagrams, charts, graphs, models among others.

Integrated Science: Diagrams, charts, graphs, posters, specimen, chemicals, spirits, balloon, aquarium, bones, objects, ball bearing barometer, hand lens and holders, prism, pulley, resistor, flex/insulated copper wires, models, thermometer, switches, tripod stand, Bunsen burner, spring balance, bean balance, test-tube, rubber tubings, glass tubings, gauze, wooden blocks, magnets, among others.

There are many other instructional materials which are not included in the above list. This by implication means that the teacher of science has many instructional materials at his disposal for teaching the science subjects. It is reasonable to conclude therefore that there are constraints to the use of these instructional materials by the science teachers if they are not used adequately in instructional situations.

Constraints to the use of instructional materials for teaching science subjects

Some of the constraints include:

1. Some of the science teachers are unable to identify some of the instructional materials and their sources for teaching certain topics in science.

2. Lack of adequate knowledge in the subject areas may be responsible for the inability of the science teacher to identify what instructional materials to use or how to use it.

3. Lack of adequate knowledge for improvising or producing relevant instructional materials. In other word, some science teachers are not resourceful.

4. Inability to select the relevant instructional material for teaching specific topics in the science subject by the science teacher is also responsible for the ineffective use of the media.

5. Finance is another problem. Most science teachers are reluctant to spend their money on buying or producing the needed instructional material.

6. Some of the science teachers do not know how to operate or use some of the available instructional materials. In other words, some of the science teachers do not have adequate training in the use of some of the instructional materials.

The objective of the teacher should be to communicate an understandable message to the learner. One of the ways of doing this is the ability of the teacher to utilize instructional materials adequately to enhance effective and efficient teaching. There is need therefore for the science teacher to improve upon the strategies of teaching science subjects.

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Strategies for improving teaching of science subjects

Some of the suggestions for improvement are:

1. The science teacher should be resourceful. Where the needed instructional materials are not available, the science teacher should improvise and produce them. In other words, he should learn the techniques for producing simple instructional materials. Okpara (1996) Callaham and Clark (1997) has suggested some strategies which can enable the integrated science teacher to improvise the needed materials and equipment. For example, the teacher can make electromagnet from nails and insulated wires, insect and fish nets from mosquito nets; battery holder from pieces of wood; using discarded syringes for measuring volumes or as drooping pipettes, using discarded cans for constructing stoves; using milk cans for making spirit burners; using magnifying glass for microscopes, ray box for teaching phototropism; copper, aluminum, or other metals and wire for teaching reactivity of metals.

2. The science teacher should possess the skills for selecting instructional materials for teaching science subjects. Ramsey (1975:101) suggested that the science teacher should apply the following criteria in selecting appropriate materials.

    i. the material should be relevant to the learner;

    ii. the material should be at an acceptable level of readability for the learner

    iii. the material should be scientifically accurate;

    iv. the materials should present science as an ongoing process rather than a body of dogma already known; the materials should be attractive, well set with large print and good graphic design;

    v. the simplest equipment possible should be used for the learner to explore the ideas;

    vi. the material should be presented in a way that is potentially of interest to the learner;

    vii. the activities the learner is to perform should contribute to the overall development of his skills and abilities.

3. Only teachers who are trained in the sciences should teach the area of the science in which he/she graduated.

4. Teachers of science should attend conferences, seminars, workshops and in-service courses to update their knowledge of the modern changes in the subjects, methods of teaching sciences, techniques of producing and using instructional material.

SUMMARY

A good science education does not stop at teaching mere principles and facts but must teach an understanding of scientific attitudes and values. The teacher of science therefore should cultivate in students an attitude to find out as much as possible for themselves through their own active participation. Science has been explained as a human enterprise or activity designed

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to search for more accurate description of things and events. However science has been seen as a double edged sword that provides good as well as bad services to man. In both highly developed and developing countries, enrollment in the physical science in examinations is declining. Efforts should therefore be intensified by science teachers to see that methods of teaching it are improved. One of these methods is the adequate and effective use of instructional materials by the teachers. Many instructional materials are available for teaching the science subjects. However, lack of adequate knowledge about the subject, production, utilization, and selection of instructional materials including lack of finance are among the constraints to the effective production and utilization of instructional materials for teaching the science. The science teacher should therefore update his knowledge in the subjects, production, utilization and selection of instructional materials by attending conferences, seminars, workshop and in-service courses.

CONCLUSION

The result of this work can be helpful to student in any academic program that is endeavouring to improve the students and the experience of the community organization hosting the students. The highlight of important role of the teacher to the learning experience of the student and the importance of adequate communication resources, and support provided to them in fulfilling their role in school can use these preliminary findings to ensure that appropriate preparation and support are in place to ensure that students involvements in this form of learning results in positive, relevant and constructive practical experience.

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