

PROFICIENCY AS A PANACEA FOR INCREASING TEACHERS' CAPACITY IN THE USE OF LABORATORY TECHNIQUES FOR EFFECTIVE TEACHING OF PRACTICAL BIOLOGY

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Abstract— This paper examined proficiency as a panacea for increasing teachers' capacity in the use of laboratory techniques for effective teaching of practical biology. The writers lamented the decline in the performance of students in biology over the years which are partly due to inadequate instructional strategies by teachers. The authors also applauded the effort made by government of Nigeria in professionalizing teaching by the establishment of Teachers Registration Council (TRCN). The concept of professionalism and the characteristics of profession were examined. Approaches for effective conduct of biology practical with relevant examples were explained in this article. The paper concluded by noting that teaching is a noble profession in which the practitioners update their knowledge on a continuous basis. The authors recommended the fishing out of non-professionals from the teaching profession to enhance sanity in the education sector. In the same vein, non-professional teachers who want to remain in the teaching profession should be made to undergo relevant training before continuing in the profession.

Index terms- Proficiency, Panacea, Laboratory, Techniques, Practical.

I. INTRODUCTION

Students understanding and achievements in biology over the years at the West African Examination Council (WAEC) and Senior Certificate Examinations (SSCE) have been on the decline especially in the understanding of basic practical concepts and acquisition of practical skills for the performance of simple tasks (WAEC, Chief Examiners Report 2002-2006). This development have negative consequences on the teaching and learning of biology which plays a prime role in pursuing professional science courses such as Medicine, Pharmacy, Food Science and Technology, Nursing, Nutritional studies and

several careers in the field of life sciences in higher institutions of learning. This underscores the inclusion of biology as one of the pre-requisite requirements for the admission of students into the afore-mentioned courses in Universities and other tertiary institutions of learning.

Persistent decline in the achievement of students and acquisition of laboratory practical skills have been argued to arise from a number of factors in the school system. These factors include students poor attitude to learning, inappropriate teaching strategies by teachers which resulted in the students not acquiring appropriate science process skills (Cirfact, Zumyil & Metshak, 2007). Other factors that may contribute to low achievement and non-acquisition of practical skills are lack of motivation of teachers by their employers, employment of non-professionals to teach the subject in which they lack in-depth and pedagogical knowledge and non-recognition of the contribution of teachers to the upliftment of mankind by the society.

The failure of secondary school students to meet the expectations of the public in biology achievement has been attributed to their inability to tackle practical questions correctly. This problem may arise from the teachers' inability to utilize the teaching periods effectively. In this regard, Nwagbo (2007) noted that most biology teachers use all the lesson periods for teaching the theoretical aspects of the subject, neglecting the weightier practical aspects which have the potentials for developing critical thinking and objective reasoning abilities in the student. The practical aspect of any science course, including biology, forms the building blocks for technological development and for future academic pursuit in the subject. In spite of the emphasis laid on the practical activities in science subjects, most teachers still resort to verbal presentation of facts or theoretical teaching. The highly theoretical approach to teaching of science (including biology) may be attributed to lack of laboratory skills and technique by the teachers, to satisfactorily fulfil the teaching roles. This,

coupled with lack of laboratory personnel in most schools worsens the problem. The teacher is therefore saddled with the dual responsibility of teaching and serving as laboratory assistant. The consequence of this dual responsibility of the teacher on teaching is the total neglect of the areas that teachers are less competent in, that is, management of laboratory.

However, since biology has to be taught both theoretically and practically in order to prepare students well for external examinations and future tasks, the teacher has to be proficient in carrying out the teaching exercise. Moreover, the new biology curriculum emphasizes laboratory technique and skills among others in teaching the content of the subject (Federal Ministry of Education (FME), 2008). There is no biology teacher that can carry out his or her task effectively without being familiar with the fundamental techniques that leads to acquisition of desirable and useful skills. This is why most biology workshops are aimed at enhancing teachers' competence in the area of practical aspect of the subject. Equipped with such competencies, the teacher will be able to handle the students effectively in practical work, thereby developing desirable skills in them. Laboratory techniques have to do with particular ways of doing things in the laboratory, especially those that leads to learning of special skills. Laboratory techniques include collection of specimens, preparation of reagents, use of microscopes, preparation of slides, and preservation of specimens among others. Knowledge of these techniques will go a long way in equipping teachers of biology for more effective and efficient discharge of their duties.

Several attempts have been made to raise the standard of education and the quality of products from the education industry. One of such attempt is the establishment of Teachers Registration Council of Nigeria (TRCN) by the Federal Ministry of Education. The aim of establishing TRCN include among other reasons, the raising of the failing standard of education and bringing back the lost glory and credibility of the teaching profession (FRN, 2002). In order to raise the falling standard of education, teachers have to be proficient in the discharge of their duties.

Proficiency, according to advanced learners' dictionary is the ability of an individual to do something well as a result of learning and practice. Thus, professional teachers are expected to exhibit proficiency in both content and pedagogical approaches to teaching. This according to Cirfat etal (2007) is required for the effective teaching and learning of science at the primary, secondary and tertiary levels of education.

Inadequacy in the level of attainment of educational objectives which are being reported by researchers (Abdulwahab,2000; Akinsola, Lawal & Oyedokum, 2007) is evident by the inability of graduates to exhibit skills and perform tasks at their various levels in biology suggests that there is a decline in the capacity of teachers in the use of laboratory techniques. This paper is therefore set to examine the role of teachers' proficiency in the effective use of laboratory techniques for the conduct of practical in biology.

II. THE CONCEPT OF TEACHERS' PROFESSIONALISM.

Practitioners in every profession possess peculiar characteristics which placed them in a position to do things

better and distinct from amateurs. Such practitioners who distinguished themselves in their respective fields are referred to as professionals. Branford, (1965) as cited in Zaria (2002), enumerates the characteristics of professionals in a profession to include: learnt and taught in a formal school setting before the professional can practice, involvements in full time occupations that constitute their principal source of income, strong motivation or calling as a basis for their choice of a professional career and a stable life time commitment to the career, ability to apply diagnostic skills, competence and application of general knowledge to the special needs of the clients with an absence of self interest.

A critical look at the above few characteristics of a profession reveals that a proficient teacher should have enough training, self motivation and the ability to display skills and competencies that can be applied in solving the problems and satisfaction of the needs of learners as a matter of priority. One of those characteristics of profession that has direct bearing on the capacity of a teacher is the ability to apply diagnostic skills, competence and application of general knowledge to the special needs of the students without self interest. This implies that the objectives of education should be placed above personal interest and pursued with all sense of vigour. This may facilitate the attainment of the National Philosophy of Education (NPE). Similarly, the ability to apply diagnostic skills in attending to the needs of learners has far reaching positive influence in shaping their characteristics. This might solve the lingering problems of learners that may interfere with the learning process.

The Teachers' Registration Council of Nigeria handbook (FRN, 2002) defines a teacher as a person who had undergone approved professional training in education at the appropriate levels and is capable of imparting knowledge, attitudes and skills to the learner. Teaching is therefore expected to be carefully planned and executed by professionals in the teaching profession. In the same way that building plans are essential to engineers on building sites for the construction of complex and beautiful structures, professional teachers are also trained in the aspect of planning and designing their instruction to achieve targeted goals in learners.

The capacity of biology teachers in the use of laboratory techniques for effective conduct of biology practical depends on their proficiency as well as their ability to exhibit scientific attitudes such as honesty, humility, carefulness, perseverance, open mindedness, objectivity, rationality and curiosity (Ndu, Asun & Aina, 1999). These scientific attitudes guide and direct the activities of scientists in a controlled and orderly manner which makes the profession unique. In order that teachers may be effective in the use of laboratory techniques, proficiency must be exhibited before, during and after each lesson.

The following approaches by a professional biology teacher could be more result orienting for effective biology lessons:

III. BEGINNING WITH THEORETICAL BACKGROUND:

Practical lesson should begin with a theoretical background. The principles underlying a given phenomenon should be clarified to the learners before embarking on the practical. It is a common practice among some biology teachers to "chalk and talk" with less attention to the conduct

of practical lessons. This practice should be discouraged as much as possible since biology is a practical oriented subject. Accordingly, Ileje (2006) supported the integration of practical activities in biology lessons by saying that practical works are part of the study of biology and should go hand in hand with the theory. Practical work should form the bulk of biology teaching and should lead to theorization. For example in organizing a practical lesson on ‘‘studying the cells of the supporting tissues in plants’’, an introductory lesson should explain to the students the importance and types of supporting tissues in plant. This may provide background knowledge to the students and possibly enhance the understanding of the practical concepts.

IV. PLANNING OF PRACTICAL LESSON FROM SCHEMED WORK.

The scheme of work is a final breakdown of the syllabus that gives weekly details on what to teach, how to teach and when to teach (Azoro, Onoja & Egeruoh, 2011). The scheme of work has a column for teachers and students performance activities. Practical lessons are designed to reflect these activities. The activities are performed sequentially as the topics are taught progressively. Any lesson that is taught without a concrete plan is unethical whether it is a theory or practical lesson. Specific behavioural objectives should therefore be clearly stated in the plan. The behavioural objectives of practical lesson should be stated in the psychomotor domain of educational objectives. In this regard, Ada (2002) stressed that action verbs for behavioural objectives in the psychomotor domain should be those that are concerned with the teaching and learning of the manual, motor and experimental skills. Examples of such action verbs that are relevant in a practical lesson plan are: draw, compare, set up, observe, prepare, use, make, demonstrate, measure, weigh, mix, isolate, design etc.

Considering the topic on plant supporting tissues above, the behavioural objectives can be stated as follows: At the end of the lesson, students should be able to:

- i. Prepare transverse section of the stem of *Talinum triangulare* (water leaf plant).
- ii. Observe plant supporting tissues.
- iii. Compare the epidermis, cortex, vascular bundle and pith in the specimen provided.
- iv. Draw and label the cells that make up the vascular bundles.

V. DETERMINE THE SPECIMEN, APPARATUS AND REAGENT TO BE USED

The teacher should determine the requirements for the practical lesson and ensure that they are readily available, sufficient in number, and pre-tested and their usability assured before the actual day which the practical lesson is slated to hold. This mean that a proficient teacher is expected to put the necessary facilities in place before the lesson begins. The practice of looking for materials in the course of the lesson should be discouraged and stamped out from the mind of teachers if there are to be effective in the instruction process. A proficient teacher should demonstrate the practical before the actual day or time for the practical lesson. This is referred to as

pre-class practical lesson preparation. The practice saves the teacher from unforeseen disappointment and embarrassment that may result from faulty apparatus or reagents. Where the reagents or apparatus are too costly or scarce, improvisation can be made before the commencement of the practical. Students may be asked to bring some materials that are common and less costly to the class. Teachers should weigh the dangers that may arise from collecting certain specimen before sending students. Considering the topic on plant supporting tissues, materials to be used include: microscope, razor blade or scalpel, forceps, watch glass, stain, *Talinum triangulare* (water leaf plant), slides and water. Students may be asked to bring razor blades and the water leaf plant to the class. In the absence of watch glass, large bottle covers can be improvised; hand lenses can be used if there are no microscopes.

VI. PRACTICAL LESSON INSTRUCTION OR GUIDE ON WHAT THE STUDENTS SHOULD DO

There are necessary things the teacher should put in place before the commencement of the actual lesson. Once this is done, the lesson will flow smoothly without hitches. Ndioho (2007) refer to this stage as the pre-laboratory phase or phase two, which involves necessary guidelines and precautions that students are supposed to follow. Such instructions, if possible should be distributed to students in print for clarity and references. Where it is not possible to give students print guide, it can be written on the board for students to copy in their notebooks or prepared on a cardboard sheet and placed in a conspicuous area of the chalk board for students to follow.

An example of student’s guide or instruction of practical conducted on the cells of the plant supporting tissues can be as follows:

A. Practical No. 1

Aim: To study the cells of the supporting tissues in the stem of *Talinum triangulare*.

Materials/apparatus: *Talinum triangulare*, razor blade, scalpel, eosin stain, hand lens, microscope, microscopic slides, cover slips, dishes, forceps.

Procedure: Use scalpel or sharp razor blade and make several thin transverse sections of the stem of water plant (*Talinum triangulare*) provided. Drop the plant section inside the water in the watch glass. With the aid of forceps lift a thin section of the stem and place on a clean slide. Use 2-3 drops of acetic eosin solution and stain the section. Rinse after 3 minutes with water. Mount the slide on the stage of the microscope, observe at a low power magnification. Make a large diagram of the transverse section of the stem and label the following parts, epidermis, cortex, vascular bundle and pith.

Observe the section again under high power magnification of your microscope. Take special note of the size, shape, thickness of the walls and thickness of the corners of each cell. Draw the vascular bundles and label the cells that make up the bundle in your drawing book.

VII. SET UP THE LABORATORY AND ARRANGE THE APPARATUS IN NUMBER OF GROUPS

In laboratories where there are laboratory assistants or attendants, they can be given instruction to arrange the reagents

and apparatus (materials) for practical lessons. Where there are no laboratory staffs, the setting up of the laboratory is done by the subject teacher. It is good to arrange students in groups where the apparatus are not enough or the specimens cannot go round the students. Grouping students is good because it facilitates learning among the students. It also makes guidance and supervision easy for the teacher. In a practical lesson that involve a class of forty students but only eight microscope are available to use for the practical, the students can be grouped into eight allowing five students to work together in groups. Group leaders are appointed by the teacher to coordinate the working of the groups.

Evaluation: Evaluation is the crucial stage of any instructional process. It is the stage where the teacher determines the attainment of the lesson objectives. Evaluation of practical lesson is better done on the spot. This give a true picture of what a particular student can do. At this stage the teacher move from one group to the other and assesses the students work.

Students should compile individual reports and submit for marking and scoring. Such scores from practical lessons can form part of the continuous assessment. The marks can be shared such that practical lessons are allocated 10% leaving 10% to assignments and the remaining 10% to written test making a total of 30% for the continuous assessment score. The terminal examination has a total score of 70% and can be shared such that 50% is allocated to essay and objectives while 20% is exclusively for practical examinations.

These steps should be followed in subsequent lessons. The only modification that may be required is the materials needed for specific practical activity and the steps necessary to carry out the experiment. With the above approach, students' skills may be enhanced through the proficiency of teachers in the use of laboratory techniques thereby increasing students' achievement in both internal and external examinations.

CONCLUSIONS

Teaching is a noble profession that requires continuous update of knowledge in order to be current and alive to the responsibility. Learners always look forward to the teacher for new knowledge and explanation for concepts that are not clear to them. A teacher occupies a central position in transforming the individual to fit in properly into the society. This is an arduous task which requires knowledge and wisdom.

Professional teachers should adhere to the ethics of the profession and apply appropriate pedagogical approaches in the conduct of laboratory practical. The productivity of teachers at various level of education rest solely on their preparation and the use of teaching resources that will boost the instructional process. This will go a long way in increasing the capacity of teachers in the use of laboratory techniques.

RECOMMENDATIONS

The following recommendations may enhance productivity and instil sanity in the teaching profession:

i. The Teachers Registration Council of Nigeria (TRCN) should live up to its constitutional responsibilities by ensuring that only qualified teachers are certified to teach. Machinery should be set in motion to propel teachers

disciplinary committee to checkmate teachers that engage in unprofessional acts.

ii. TRCN should prevail on Federal and State governments to stop engaging the services on non-professional teachers in the teaching profession.

iii. Non-professional teachers that are already engaged in teaching should be given the ultimatum to undergo professional training if they are interested in the teaching job.

iv. Professional teachers should attend refresher courses regularly so as to excel in the teaching profession.

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