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In-Service Staff Training Programme for Effective Science Teaching

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Abstract The way Science teachers handle classroom instruction and the recent Student poor performances in external examinations, 2014 Senior Secondary School Certificate (SSCE) are strong indication that learning is not going on effectively in schools. This calls for the assessment of what goes on in the classroom, particularly in the area of teaching and learning and how In-service training could be used to provide remedies. The problem is that there appeared to be differences between what Teachers 'do' in the classroom and 'what' they are expected to do in terms of teaching, organization of learning activities and getting students to acquire necessary skills, the way the scientists do. Of course this is a common problem in both Developed and Developing countries. In this paper an attempt is made to bridge the gap between the previous reports findings, highlights problems associated with the planning and organization of in-service training and proffered recommendations towards improving classroom instruction and organization of In-service training for serving teachers.

Keywords: *effective science, staff development, programme*

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1. Introduction

The importance of science in life cannot be over emphasized not because of anything but simply we live in an age where every technological discovery and innovation has something to do about science. In short if science is properly handled and taught accordingly it is expected to provide students with enough things to think about and encourage the acquisition of necessary skills rather than resulting into memorization as observed among the students.

Generally speaking, there are indications that some teachers still rely on the outdated conventional methods, techniques or approaches which they were used to during their training and hardly want to consider other options in accordance with what is being recommended or prescribed in the new curriculum, (Ibrahim, 2008). Of courses in all the science related courses, Biology, Chemistry, Physics etc, the emphasis has been on how to get the students to learn the prescribed content, acquire necessary skills and do things way the scientist did in the past.

Going by what is happening in the classroom by the teachers, the students' poor performances in the external examinations and the key position held by the classroom teachers in the implementation of school curriculum activities, appropriate training and retraining (in-service) becomes very essential in Nigerian educational system. Unlike in the Western Countries like Canada, Japan, USA, the problem is not much in the area of availability or existence of In-Services but rather in the poor organization of such Services. How does a person identify, classify or evaluate a programme of In-service training that are poorly organized or managed?

Before talking about strategy for organizing workshops or In-service training there is need to examine the criteria or factors to be used in selecting appropriate teaching methods in a lesson.

2. Methodology of Teaching

While the term Androgogy is used to describe the science of teaching in Adult programme, Pedagogy deals with the service of teaching among the youth.

Since there many methods or approaches to teaching, each teacher learn to use a method that is suited to the Subject matter, Topic, Objectives or outcome of students' learning needs, Stage of the lesson and or Teaching resources available. In teaching, the concern of every teacher should be on "how" to make students learn in addition to having good mastery of the subject matter.

The term teaching has been defined in different ways by different authors. In the paper, teaching is defined as:

- Process by which the learner is made to learn a given subject matter in accordance with the pre-determined goals or objectives.
- Process of imparting knowledge, skills and professional attitudes in order for people to gain idea, information, concept and experiences.

In order word, Teaching is a "Triad" method which involves the (1) the teacher, (2) the students and (3) the

subject matter to be learned. The outcome of teaching therefore is the result of complex interaction among the three. Generally, the term teaching is used to cover all what a teacher does including stimulation (arousal of interest), guidance (providing educational advice); direction (leading students to the relevant and appropriate activities), and encouragement (reinforcement)

It must be mentioned that no single method can be considered the best among the others. It is therefore the responsibility of the teacher to select a single or combination of methods in accordance among other things, the subject matter, topic and instructional objectives.

3. Criteria for Selecting Teaching Methods

A teacher decision as to which of the techniques he/she should use in a particular teaching is guided by a number of factors which include:

(1) Nature of Subject Matter/Topic: Where the content of the subject is mainly oral as in History and English, certainly it would demand a different approach than where the subject matter is practical oriented as in physics, chemistry, Biology, Mathematics, Integrated Science etc. In short, any chosen method should be appropriate to the subject matter.

(2) Objectives or Learning Outcome: A method or technique to be selected should be relevant to the stated behavioural objectives of a given lesson or be guided by Bloom's Taxonomy of educational objectives namely, cognitive, affective and psychometer.

(3) Space Available: Certain methods of teaching like Demonstration, Dramatization, Project and Micro teaching require more space than the others. Laboratory work in sciences and technical classes requires more space than in other Art related courses or subjects.

(4) Students Learning Needs: These include students' interest, aptitude, educational background and experience. There is need to consider the age and interest of the students, moving from Concrete to Abstract level of thinking.

(5) Stage of the Lesson: A teacher can vary his teaching depending on the stage of the lesson. While some methods are more appropriate when introducing a lesson, others are best during or at the end of a lesson. An example of this is Questioning or Socratic Method in which a question can be asked at the beginning, middle or end of a lesson.

(6) Instructional Materials Available: Of course availability and adequacy of teaching or instructional aids determines which method to be used. Where there is no enough material or specimen, group method or team teaching is more appropriate.

(7) Time Available: Whichever method is to be selected, it should take cognizance of the time available for the lesson. Lecture method will be more appropriate when there is no enough time allocated for the lesson than discussion or problem solving and enquiry method.

Among the teaching methods that have enjoyed wider acceptance among teachers both in the developed and developing countries are:

Traditional Approach: Examples are: Lecture method, Field trip, Questioning/Socratic method, Discussion, Discovery, Play away, Group, Project, Assignment, Demonstration etc.

Modern Approach: Examples are: Microteaching, Team teaching, Simulation and Games, Programmed or Distance learning.

The above methods can also be classified as Teacher or student centered and or Activity based. While some are commonly used in the Arts related subject or disciplines, others are useful or best in science related subjects depending on the theme or topic of the subject matter.

4. Studies on Science Teaching

The way and manner a teacher handled a course/subject goes a long way in promoting or discouraging students from offering sciences (Olorundare, 1998). In the National Policy on the Education, the Federal Government (FRN, 1985) emphasized that teachers of Integrated Science are expected to use activity-oriented approach such as demonstration, discovery and problem solving.

In Science generally, the focus should be on how to develop in students, the ability to apply simple scientific principles in different situations and at the same time acquired scientific attitude in solving problems.

According to Weston (1971) the two main methods that have been found to be useful in teaching science concepts include the act of:

(1) Informing the students about some Principles, Laws or theory so that the students only have to listen and memorize where necessary.

(2) Providing experience or appropriate situation that could encourage the students to discover for them through some activities like experimentation, observation, manipulation and discovery.

Generally in the activity based approach to science teaching, lessons are presented or designed in such a way that through their mental processes students discover concept and principles, make necessary observation, learn to organize and carry out investigations which in turn aids better retention. Talking about Integrated science teaching, Bajah (1983) argued that in Nigeria the course was introduced in the school curriculum with the intention of meeting the needs of the child and that of the society.

To show that it is one thing to design and have a good plan, and it is another thing to put into practice the recommended strategies in the classroom. Okeke (1973) revealed that many teachers handling sciences in Nigerian schools have discouraged some students from offering science mainly because of the approach used in their teaching. This is one of the reasons why many African countries including Nigeria are not having enough trained and qualified science teachers (Odubunmi, 1980).

In supporting the above claim Mani (1981) among other researchers found out and reported that Integrated Science has not been taught as intended and that lesson presentation are mostly teacher centered which was not in line with the philosophy of Integrated Science worldwide.

On the basis of the above findings and personal experiences the problem is yet to be completely solved, therefore there is need to assist the practicing teacher on how to handle science instruction more effectively through workshops or In-service training programmes.

5. In-Service Training/Workshop

Generally speaking, Staff development through Seminars, In-service training or Workshops offer one of the most promising ways for improving class room instruction. It is an attempt to assist the classroom teachers/lecturers to improve on their teaching strategies, techniques, handle new instructional materials or possessed the necessary information and Skills that are required for effective lesson delivery. In essence the dream of self reliance, skill acquisition and entrepreneurship trough education can only be realized through a well defined programme. In most cases, staff development activities are organized by an Institution, a Corporate body, Associations or Government agency and is normally lasted for a short period of time.

An activity similar to that but which may take a long time period is what is referred to as In-service training education. In this case workers who are already in the service go on training or course programme in order to update or acquire the intellectual and professional skills that are necessary to discharge their duties more efficiently (Newberry, 1979). It must be mentioned here that the completion of In-service education, in most cases, leads to certification which qualifies one to a new status. For example, an NCE holder who attends a Degree training course while in the service would later qualify as a Degree holder (a new status), following the completion of the In-service programme.

For a nation building, each country has to decide between investing on teachers or ignorance. Across the nation, In-service education is viewed by many educators as an absolute necessity for quite a number of reasons that is if the classroom teachers are to perform their roles more effectively (Stallings, 1982). Surprisingly, some people who have attended seminars, and or workshops were reported to have come back home disappointed rather than returning with enthusiasm and encouragement to participate in such a pogramme if called upon again (Louck & Melle, 1962).

Besides that attempts made to follow the trends of researches on In-service education showed that the research findings are often speculative, contradictory and often confusing, purposely because the research techniques, the instruments and the groups studied vary greatly in terms of culture (Holly, 1982). According to Jackson (1978) drawing conclusion and making decisions on the basis of research findings in some studies on staff development can lead to frustration and confusion.

According to Ozigi (1977), In-service training is usually organized to:

(a) Elicit participants' reaction to their professional training.
(b) Introduce an innovation or to update knowledge.
(c) Improve skills in the use of the instructional materials.

6. Qualities of Science Teachers

With the introduction of new innovation in Science teaching and use of instructional materials to bring about effective learning and retention due to technological advancement, the question which comes to mind is whether the practicing classroom teachers do have the intellectual and professional skills necessary to discharge their duties more effectively. The major reason for having a workshop or In-service training is for serving instructors to bridge important gaps which poor training might have produced under the regular training and or to improve serving teachers' knowledge, skills and competences (Mani, 1978). In their country, Loucks and Melle (1982) reported that at a time, there was a call made that all the unqualified or untrained serving teachers should be encouraged to participate on an In-service education.

Unlike in the other discipline, all the Science teachers are expected to possess concurrently two competences:

(1) Technical
(2) Personal competency

Technical competency involved skills such as, experimentation, initiative, use of appropriate instructional strategy; observation & problem solving; adequate mastery of the subject contents, foundation of education (philosophy of science teaching) and knowledge of the nature of curriculum and instruction. On the other hand "personal competency" deals with the teachers' attitudes to work, mode of dressing, behavior, and perception of his role, professional ingenuity and professional responsibilities.

In his own contribution, Ozigi (1977) maintains that in-service trainings are organized for the following reasons:

i. To increase the participants learning or change their attitudes.
ii. To elicit positive participants' reactions to their professional training.
iii. To introduce an innovation or for general awareness.
iv. To improve skills on instructional techniques and use of teaching materials.

As earlier mentioned, capacity building, and in-service education or trainings take the form of workshops, seminars or conferences. According to Nwachukwu (2000) among the problems that educators observe in some in-service training or workshops both in the developed and developing countries include;

i. poor organization and inappropriate contents selection.
ii. wrong timing of the period of the year that is devoted for the exercise to take place..
iii. attitude of the school authority in not wanting to finance or send many staff on In-service programmes particularly the teachers.
iv. The meager salaries that are paid to the teachers presently mmay not allow many teachers to show interest.
v. Failure of the organizers of the workshops/seminars to relate their programmes to the genuine needs or interests of the participants.
vi. Duration of the workshops/seminars and training may be too long or short for the realization of the programme objectives.
vii. Lack of follow up or evaluation after the exercise to see to the mystery of the subject content or acquisition of the required skill.

7. Organizing an In-service Training: Developing professional and Humanistic Skills

From the experience, staff development or capacity building workshops usually offer one of the best ways to improve classroom teaching and learning. In fact many educators are of the opinion that teachers have to search for the patterns of school organizations and management that would give freedom to learners in order to bring about better learning outcomes. (Gordon, 1979 & Ibrahim, 2008B). That is, to promote better understanding, teachers need to emphasize learner/student centered approach which permits and encourage students or learners to have enough freedom to select,, to participate in activities and make self evaluation through acquisition of necessary knowledge and skills.

Effective classroom planning and management, therefore consists of controlling teachers' behaviours that tend to produce high level students involvement in the classroom activities, with minimal interruptions and efficient use of instructional time. In other words, whatever actions that is required to stimulate learners thinking, enlarges their imagination, promote initiative, sustain attention, make learning real and enhance teaching and learning process is worth looking at critically (Hunt, 1976).

According to Charlotte (1979), just as teachers should reinforce good behaviours in the classroom, it has been argued that teachers training programme should consider different theories and select appropriately, depending on the situation and the age of the learners. Below are guiding principles:

1. Teachers retraining programmes should emphasize discipline related skills in addition to considering the importance of conducive learning environment. The reason being that classroom control and management skill remain a problem in schools at all levels. For example, in public schools, students/teachers ratio or students population is more diverse than ever before, thus making it difficult for the teachers to know all their students or perhaps to find classroom control/management difficult.

Talking about individual differences, apart from differences in the educational background and aptitude the number of student with emotional or learning problem is increasing. Only in the recent time that the impact of praises, responses or teachers feedback and effect of micro-teaching on students' performance and learning are getting serious attention and investigation it deserved (Akubue, 1991).

Apart from that, there is indication that many teachers entered the profession with little or no training in school discipline techniques most especially the non professionals or HND holders. This could be one of the reasons why disciple problem are common in public schools. In fact, public criticism of schools and the debilitating effect of teachers stress and burn out are closely linked to the problem of students' behavior (Rudolf and Pearl, 1972). Of course, this is the reason why it is made compulsory for most Post secondary or Tertiary institutions to offer courses on class room management and planning and curriculum studies. What is provided in their courses including psychology tends to be either theoretical or academic in nature without providing teachers with the actual competency base.

2. Teachers' preparation programmes should emphasize the coherent relationship between theory and practice. Wolfgang and Glickman (1980) argued that teachers hardly had enough knowledge about content organization (topic selection) and about professional approaches to classroom management to facilitate student learning. The problem facing educational development across the nation is lack of recognition of the importance and the differences between theory and practice in classroom teaching and learning (Ibrahim, 2008B). The overwhelming supply of conflicting theories and techniques often resulted in the teacher not knowing which is to be chosen and when to use them appropriately to alleviate the desired objectives.

For example, where does a teacher begin in the process of making use of Reinforcement, discipline or leadership style/strategic in the classroom? What comes first, rules or relationship? Praise or punishment etc.

3. In all the training programmes, organization of learning activities and use of appropriate teaching techniques should be seen as necessary tools for classroom teachers

From the above discussion, it means teaching goes beyond standing in front of the students. Apart from the good mastery of the subject matter, the teacher should be able to use appropriate teaching techniques to arouse the students' interest, make learning easier or facilitate teaching and learning.

In summary, to assist the developing countries, in their efforts to improve educational standard, effort is required to redesign the existing curriculum for a more practical approach that is skill based, coherent and humanistic in nature.

On the basis of the above theoretical frame work and previous professional teaching experiences, a two stage approaches to classroom teaching for training teachers on in-service programmes are suggested. This is briefly discussed below:

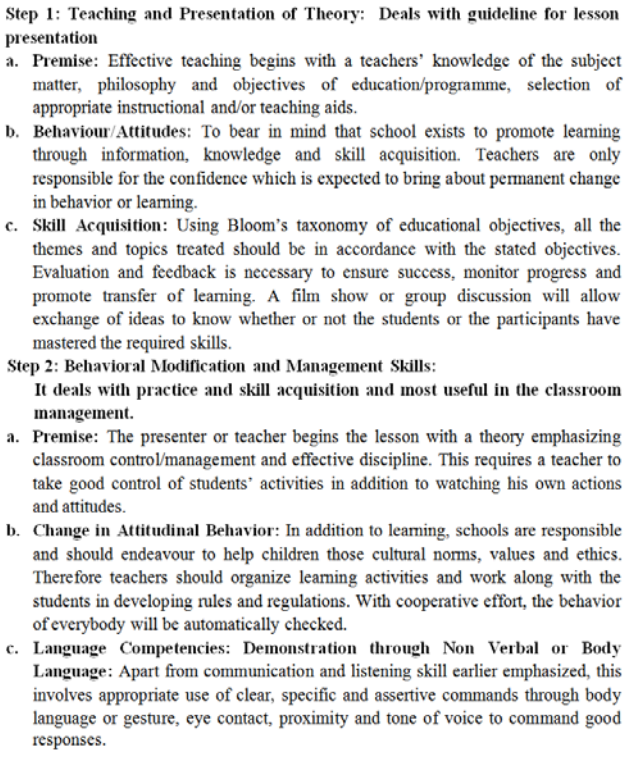

Figure 1. Steps in Presenting Learning Activities

To achieve the two competencies above requires adequate planning and organization of workshops or any In-service education very well. Of course this demands the understanding of some of the problems being encountered in the past across different countries knowing the peculiarities. Brophy (1983) and Holly (1982) gave further breakdown of points that must be noted in planning any programme of In-Services or Workshops to forestall any problem that could affect the implementation.

Among the widely used method of teaching are; Demonstration, Discussion, Dramatization, Problem solving, Field trip, Discovery, Project/assignment method, Team teaching, Simulations and programmed instruction or distance learning

Below are some of the problems associated with the planning and organization of workshops/seminar or in service training.

Problems Associated with In-Service Education and Workshops

(a) Finance

Many school authorities seem not to be interested in financing any workshops or attendance of seminars organized for staff mainly because they wanted to maximize profits. This is common among private institutions or schools. At times the staff who might have been interested in such sometimes often seen complains, of not having enough money to undertake such a programme (due to meager salary paid to the teachers). For these reasons the school proprietors or authority usually turn down such a demand for attendance of such a programme.

(b) Needs and Interest of the Participants

Failures of the organizer of the workshop/seminars to relate their programme to needs of the participants often cause discouragement. Of course many programmes were reported to have been organized for material gains by the organizers without giving adequate attention to the goal/objectives of such; programmes or not meeting the needs of the participants (Loucks & Melle, 1982).

(c) Individual Differences

Failure to accommodate for the differences existing among the participants in terms of age, area of specialization, social status, educational background, sex, etc. For example, programmes content having to do with numeracy are often found to be difficult for staff who are not mathematically inclined and at times many complain of the activities to be below their level or standard..

(d) Instructional Materials and Facilities

Many In-service or workshops could not achieve the purpose for which they were organized mainly because of availability of instructional materials, inadequate facilities (laboratory) and chemicals for effective teaching and learning. At times, the participants are not encouraged when they don't have enough instructional materials and not permitted to have enough practical activities to encourage observations, problems solving, reporting or transfer of learning.

(e) Area of Focus or subject content.

At times the focus of the activities may not adhere strictly to the objective or goal of the organizer. This can be due to the time factors, with the participants being given information rather than been allowed to practice what is learned in the classroom. This attitude at times has been reported to lead to frustration among the participants.

(f) Duration of the Programme

Depending on the area of concern or the objectives of the workshops seminars and training, the duration may be too long or short for the realization of the objectives particularly if it involves group discussion or practical work. Experience has shown that the time factor has been a major factor affecting the realization of the goal of some programmes. Even people are known to have requested for more time or days most especially when the participants found the programme activities more interesting and exciting.

In support of the above, Nwachukwu (2000) argued that, regardless of the country concerned, the problems are identical and each should endeavour to solve any problems identified immediately or as the need arises.

Recommendation and Conclusion

As earlier mentioned, whether the Training, Workshop or Seminar is organized within a given setting or it is being organized by a training agent, the outcome or goals of the training can be classified into the following areas; awareness, acquisition of concept skills, update of knowledge, managerial skills, sensitization and application of theory and principles.

In organizing or planning of in-service education many factors would have to be considered. However, the following questions can serve as a guide: what kinds of training processes would assist the teachers to grow in the required skills? What should be the scheduled of training? How large should workshop groups be? Which learning activities and instructional methods shall be most appropriate in achieving the proposed objectives? What, if anything, should the participants do within or after the workshop?

1. In the realization of the programme objectives, the selection of well informed and knowledgeable resource personnel becomes crucial. It can be argued that many organizers of workshops and seminars, in an attempt to maximize their profits, at times, only select as resource persons their close associates, friends, incompetent and inexperience people. This attitude, if observed closely have a lot of effects not only on the realization of the objectives, but also goes a long way in affecting future attendance of the participants.
2. Finance closely related is the sponsorship which was identified as one of the problem affecting attendance of teachers in a workshop. The school authority will have to design or allocate certain amount of the generated income towards the welfare of the staff. Anything that can be done as incentives should be carried out for the teachers often complain of not wanting to spend out of their meager salary to undertake any programme, though they realize the importance of such a programme in their future career.
3. Contrary to the above, it has been realized that some staff do not show interest in attending any in-service training, most especially if it has to do with having to change their old ways of doing things. This is further worsened by the authority's habitual treatment of having to be biased in selecting people for such a

development programme. Opportunity, therefore, must be given to everybody without prejudice or could be done on rotational bases.

4. Looking at the classroom activities and the roles which are expected to be performed by the teachers, it will be seen that teachers hardly have enough time for their personal activities. With the growing students population, at all levels of education, it will certainly be very difficult for classroom teachers to functions effectively in their primary assignment.
5. Participation in too many committees at times render many teachers useless and gives the academic staff little time for academic pursuit including research work. To help reduce this problem, many of the administrative assignment that are being given to the academic staff such as registration of the students, verification of certificates and compilation of the results can be given to the members of the registry or other administrative staff of the institution.
6. The duration of the training has also gained upper hand on discussion in the planning of in-service education. There are indications that in-service programmes consisting of a single session are largely ineffective (Lieberman and Miller, 1981), although the duration of the training programme is largely influenced by the programme's objective and the kinds of activities to which the participants are to be involved. A staff development schedule that seems to be effective is a series of 5 to 7 hours workshop spaced over one or two weeks apart, with two or more training sessions separated for practice. (Holly, 1982) Invariably, it implies that what is to be taught or discussed (content) should be given to the participants in small "chunks" spaced over time. The "one shot" presentation as in lecture method, commonly practiced does not allow for the gradual change in the concerns based approach, and in the notion of mutual adaptation. In such a situation, there is hardly enough opportunity for on-going discussion of the problems, skills to be learned and transfer of knowledge of what has been taught.
7. Presently, there are many institutions and bodies that are involved in the professional preparation of teachers. This includes Federal University of Education, Open State University, etc. However one wonder if these training institutions do succeed in achieving the objectives of producing a high quality professionals for the education industry, given the condition under which many of them operate. What is bad in the state or local government assisting some private institutions in achieving the goal of education in Nigeria? Text books and instructional materials could be sold to private schools at reduced cost and many facilities made available adequately to take care of growing students' project.

The federal government would have to devote more of their Annual budgetary allocation to the education to help breed set of students who will show interests in sciences, see teaching profession as a lucrative job and ready to change their attitude in accordance with the technological development across the nations.

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