

Evaluation Procedures for the Teaching and Learning of Chemistry (Science) in Nigerian Secondary Schools: A Conceptual Approach

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ABSTRACT

Education as an enterprise prepares an individual towards understanding his or her society better than before in order to lead a fulfilled and responsible life. Hence, everyone yearns for education through diverse efforts to learn a discipline or career task and earn a satisfied living. This quest for knowledge through education demands feedback report to ascertain the level of progress made for the effort towards learning the task of engagements. Evaluation provides the basis for the feedback and subsequent decision about the learner. This paper addressed the different evaluation techniques, purpose and characteristics of evaluation instruments. The procedures for evaluating students' learning outcomes as well as teachers' instruction were discussed. Some of the major objectives of teaching and learning science in school were highlighted and conclusion drawn to hinge on evaluation as an integral part of instructional process, characterized as a process by which people make judgments about value and worth. No instruction can be said to have taken place without evaluation.

Keywords: Evaluation, Assessment, Measurement, Instructional instruments, Learning Science.

Aims Research Journal Reference Format:

Idiege, K. J., Elenwoke, U.E & Okore, S.E. (2017): Evaluation Procedures for the Teaching and Learning of Chemistry (Science) in Nigerian Secondary Schools: A Conceptual Approach. *Advances in Multidisciplinary & Scientific Research Journal*. Vol. 3. No.2, Pp13-22.

1. INTRODUCTION

As humans, our lives consist of two phases viz; material and mental. It is the material phase of the life that we teach in schools to earn our salary to satisfy our material needs of life. However, the mental phase of the life is related to the satisfaction of our inner personality, which we derived from our job as teachers. Therefore, a perfect blend of the general harmony and satisfaction is by the proper combination of the two aspects of life; material and mental, without neglecting each other. Unfortunately, many science (Chemistry) teachers today teach in schools for the purpose of earning only salary and concentrate more on pushing the students to pass examinations (both internal and external) without deriving the maximum possible satisfaction of their inner personality.

It should be noted, however, that the value of our teaching act is measured by the ideal which inspires us to teach. The nobler the ideal, the greater will be the beauty and efficiency of action dedicated to achieve it. The quality of teaching improves by adopting better aims and objectives that guide and inspire our teaching for generations to reap and enjoy as a rich harvest.

Interestingly, before any chemistry (science) teacher venture into a classroom to teach, it seemingly appears that he or she is being challenged by three (3) important questions that beckons for answer:

1. What do I want my students to know or accomplish?
2. What strategies do I adopt in order to accomplish them?
3. How do I provide a valued judgment to ascertain the level of accomplishment?

This seminar paper seeks to discuss and address the third (3rd) question on evaluation procedures for the teaching and learning of science in schools.

1.1 The Concept of Evaluation Process In Teaching and Learning Science

Evaluation is a process by which we find out how far the learning experiences as have been developed and organized are actually producing the desired results. In school, educational evaluation is an integral part of the teaching-learning process in the classroom that provides information for the teachers to take various decisions on the learner (student) and the progress of learning. Evaluation has been defined by many educators (Kizlik, 2014; Sardar, 2013; Ajaja, 2009; Gbamanja, 2002) as a systematic process of determining the extent to which educational objectives are achieved by the learners (students). It involves a variety of things which essentially examines the strength and weakness of any planned educational objectives and instructional mastery. In a broader sense, Uche (2014), opined that evaluation involves an examination of the attainment of objectives, the quality of the teacher and teacher effectiveness, the capacities of the learners, the relative importance of the various subjects, the effectiveness of the equipment and materials, the suitability of the instructional environment, together with all the strategies as well as methods proposed to achieve the desired objectives. Eze (1991) observed earlier that evaluation is concerned with the determination of the validities of a course and its potential impact upon the individual and society.

Besides, education has since been viewed as a process by which teaching-learning occurs to change the behaviour patterns of the students in a positive way. Therefore, a process by which we find out whether the change in behaviour has occurred or not; if not, why it has not occurred, and what can be done in order to let the planned changes take place is called evaluation. This is important because learning is markedly retarded when students are not informed of the results of their efforts. Evaluation is the process delineating, obtaining, and providing useful information for judging decision alternatives. It is also a systematic process of determining the extent to which instructional objectives are achieved by students (Uche, 2014). Educational objectives are essentially focused on students' learning behaviours and characteristics, while teacher's effectiveness is centred on his or her ability and capacity to teach, give assignment and organize class or academic work effectively. Evaluation involved the total assessment of a students' learning by the instructor (or teacher). It includes obtaining data about understanding the processes of learning, subject matter competence, multiple talents, learning attitudes and skills, ability and willingness to work or study.

Evaluation of students' academic achievement is usually based on written tests, performance tests, and observation of their general behaviour. It is therefore not surprising as (Ajaja, 2009; Lamanauskas, 2011; Uche, 2014; Tobin & Roth, 2015) observed that evaluation process includes both measurement and non-measurement technique for describing changes in students' behaviour, as well as value judgment concerning the desirability of the behavioural changes. However, Uche (2014) observed that evaluation is a continuous, systematic and constant activity that serves a student as reward for successful performance or as a spur to greater effort after unsuccessful performance.

He stressed further that evaluation broadly consist primarily of collection and use of information to make decisions and pass valid judgment about an educational programme of activity or learning experiences which includes instructional materials, the instruction processes and methods, the learning outcomes of students, etc. Consequently, evaluation involves the gathering of relevant information for the purpose of making appropriate judgment or appraisal based on some defined or stipulated criteria. In other words, evaluation is an inclusive term that requires the application of a broad range of techniques for the process or task of appraising the progress and achievement of students in the educational enterprise.

1.2 Distinctions between Evaluation, Assessment and Measurement

As science educators, we need to constantly understand the differences between measurement, assessment and evaluation as often used interchangeably in classroom during our science teaching-learning process. Indeed, these terms mean very different things, yet some of us find it unable to adequately explain the differences.

1. **Measurement:** Refers to the process by which the attributes or dimensions of some physical objects are determined. When we measure, we generally use some standard instruments to determine how big, tall, heavy, voluminous, hot, cold, fast, or straight something actually is. Standard instruments refer to physical devices such as rulers, scales, thermometers, pressure gauges, etc. We measure to obtain information about what is. Such information may or may not be useful, depending on the accuracy of the instruments used and our skill at using them. We measure how big a classroom is in terms of square metres, we measure the temperature of the room by using thermometers, we use an ohm metre to determine resistance in a circuit, volt metre to determine the voltage and ammeter to determine the amperage (current) in a circuit, etc. In all these examples, we are not assessing anything yet, rather, we are simply collecting information relative to some established rule or standard. Therefore, assessment is quite different from measurement, and has uses that suggest very different purposes. Succinctly put, the verb "measurement" means to apply a standard scale or measuring device to an object, series of objects, events, or conditions, according to practices accepted by those who are skilled in the use of the device or scale. The important point in the definition is that the person must be skilled in the use of the device or scale. For example, a person who has in his or her possession a working ohm metre, but does not know how to use it properly could apply it to an electrical circuit but the obtained results would mean little or nothing in terms of useful information. Measurement is the process of assigning numerals or figures to objects, quantities or events in order to give qualitative meaning to such qualities. Measurement stops at ascribing the quantity, but not making valued judgment. Measurement is a scale that measures qualitatively, while assessment is the status of the individual or group using the scale.
2. **Assessment:** Is a process by which information is obtained relative to some known objective or goal. Assessment is a broad term that encourages testing. **A test** is a special form of assessment. Tests are assessments made under contrived circumstances especially so that they may be administered. Testing is an evaluational technique so well known, used and understood by many teachers worldwide. There are many types of test including standardized tests, essay tests, problem tests, multiple choice test, matching tests, etc. In other words, all tests are assessments, but not all assessments are tests. We do often times test at the end of a lesson or unit. We assess progress at the end of a school year, term, semesters, etc. through testing. Also, we assess verbal and quantitative skills through such instruments as Chemistry Achievement Test (CAT), Physics or Biology Achievement Test, etc. Whether implicit or explicit, assessment is most usefully connected to some goals or objectives for which the assessment is designed. A test or assessment yields information relative to an objective or goal. In that sense, we test or assess to determine whether or not an objective or goal has been obtained or achieved. Assessment of skill attainment is rather straight forward. Either skill exists at some acceptable level or it does not. Skills are readily demonstrated. However, assessment of understanding is much more difficult and complex. Skills can be practiced but understanding cannot. We can assess a person's knowledge in a variety of ways, but there is always a leap, on inference that we make about what a person does in relation to what it signifies about what he or she knows. Assessment simply means to stipulate the conditions by which the behaviour specified in an objective may be ascertained. Such stipulations are usually in the form of written descriptions. Assessment is a fact finding activity that describes conditions that exist at particular time. It often involves measurement to gather data. Assessment organizes the measurement data into interpretable forms on a number of variables. It does not explain reasons nor proffer recommendations.
3. **Evaluation:** It is perhaps the most complex and least understood of the terms by majority of us as science educators. Evaluation houses test, measurement and assessment. Inherent in the idea of evaluation is "value". When we evaluate, we are just simply doing engagement in some processes that are designed to provide information that would help us make a judgement about a given situation. Generally, any evaluation process requires information about the situation in question. A situation is an umbrella term that takes into account such ideas as objectives, goals, standards, procedures, tests, measurement and assessment. When we evaluate, we are simply saying that the process will yield information regarding the worthiness, appropriateness, goodness, validity, legality, etc. of something for which a reliable measurement or assessment has been made. For instance, to determine the temperature of a classroom, we need to get a thermometer and take several readings at different spots, and perhaps find the average of the readings. This is simply measuring. The average temperature tells us nothing about whether or not it is appropriate for learning. Therefore, in order to do so, students would have to be polled in some reliable and valid way. It is that polling in process that evaluation is all about. If for instance, the average classroom temperature was 40⁰c is simply information. It is the context of the temperature for a particular purpose that provides the

criteria for evaluation. A temperature of 45⁰c may not be very good for learning to some students, while for others, it is ideal for learning. So, as practicing teachers, we evaluate every day. Teachers are constantly evaluating students, and such evaluations are done usually in the context of comparisons between what was intended (learning, progress, behaviour) and what was obtained. The behavioural verb “evaluate” according to Kizlik (2014) is to classify objects, situations, people, conditions, etc. according to defined criteria of quality. Indication of quality must be given in the defined criteria of each class category. Evaluation differs from general classification only in this regards or respect. By and large, Kizlik (2014) opines we measure distance, we assess learning and we evaluate results in terms of some set of criteria. Evaluation is a systematic process of determining what the actual outcomes are but it also involves judgment of desirability of whatever outcomes are demonstrated (Travers, 1955 cited in Tobin and Roth, 2015). It is the process of ascertaining the decision of concern, selecting appropriate information and collecting and analysing information in order to report summary data useful to decision makers in selecting among alternatives (Alkin, 1970 cited in Sardar, 2013). It is the process of delineating obtaining and providing useful information for judging decision alternatives (Steafllebeam, et al., 1971 cited in Lamanauskas, 2011). Evaluation adds the ingredients of value judgment to assessment. It is a qualitative measure of the prevailing situation. It calls for evidence of effectiveness, suitability or goodness of a programme. It is the estimation of the worth of a thing, process or programme in order to reach meaningful decision about that thing, process or programme. It is concerned with the application of its findings and implies some judgement of the effectiveness or desirability of the product, process or progress in terms of carefully defined and agreed upon objectives or values.

2. TYPES OF EVALUATION

There are basically two types of evaluation; formative and summative. These types of evaluation operate at two main levels; programme and student evaluation levels. The programme level has to do with the determination of whether a programme has been successfully implemented or not. The student evaluation determines how well a student is performing in a programme of study. The purpose of formative evaluation is to find out whether after a learning experience, students were able to do what they were previously unable to do. Its ultimate goal is usually to help students perform well at the end of a programme. Formative evaluation is a kind of evaluation of a programme or unit given from the beginning of the programme and continues alongside the programme.

Summative evaluation, on the other hand, is given at the end of the programme or unit specifically for the sake of grading, promoting or certification. Educators usually advocated that in order for one to achieve good evaluation results, one must adopt both formative and summative evaluation processes. However, Gbamanja (2002) classified evaluation into four (4) types, namely:

1. Placement evaluation
2. Formative evaluation
3. Diagnostic evaluation
4. Summative evaluation

The placement evaluation accesses the learners’ readiness to begin an instruction, as well as the extent to which the learner have already achieved the objectives of the planned instruction. Hence, it is an evaluation of the learner’s entry behaviour in a sequence of instruction. The formative evaluation is given periodically to monitor learning process during instruction and provides continuous feedback to both learner and teacher concerning learning success and failures. Where failures are identified, appropriate remediation could be administered during the process as corrective measures for improvement.

The diagnostic evaluation is most often concerned with the learner’s persistent or recurring learning difficulties that are left unresolved by the standard corrective prescriptions. It exposes the learners’ particular problems that have been difficult to amend. Its primary objective is to study the problem in detail, so that the causes of the learning problem could be identified and thereafter appropriate remediation procedure is set up. In other words, it evaluate the learner’s (or students’) learning difficulties during instruction. The summative evaluation is an evaluation of the course objectives as well as the entire teaching process that is usually given or administered at the end of a course or unit of instruction; and the results are used primarily for assigning grades or for certification. Its scope covers inclusively a wider range of materials.

2.1 Some Fundamental Facts about Evaluation

Uche (2014), outline some of the following fundamental facts about evaluation:

- i. The continuous nature of evaluation demands that the teacher appraises or judges the performances, progress and achievement of each student on a minute, hourly, daily, weekly, or monthly basis as may be most appropriate. Therefore, a conception of evaluation as an activity that occurs at the end of a lesson, course or programme is quite erroneous and dangerous.
- ii. Evaluation serves to accumulate data on the instructional activities of a teacher and the learning gains recorded by students. The results of gains are a reflection of change in behaviour which may be used as evidence for ascertaining whether students are progressing along certain desirable lines or not. Therefore, objectivity is the hall mark of the process of gathering data, however, this can hardly be achieved in its entirety given the nature of human beings.
- iii. Evaluation need not be seen as an activity that is confined to the teacher. Indeed, there are data suggesting that learning is more effective if students can accurately appraise their individual progress and make appropriate adjustments in terms of their strategies for learning. It is therefore, expected that teachers impart self-appraisal skills to students and thus, assist them in identifying their strengths and weakness in terms of instructional mastery.
- iv. There are a large array of techniques or strategies for teachers to evaluate students' learning and consequently the effectiveness of teaching. Modern approaches to evaluation of teaching science focus not only on the cognitive, but also on the affective and psychomotor dimensions of teaching effectiveness as well as students' learning. Therefore, evaluation of teaching is by implication an evaluation of learning and there are quite a number of instruments that may be applied for both purposes.
- v. Evaluation serves as a feedback system that aids teachers to modify and thereby improve upon their teaching, and for students to know where they stand on an achievement continuum in order to invest appropriately in terms of efforts and thereby attain the desired levels of mastery. However, the overall result of improved learning and teaching is a more positive and accurate perception of self and consequently a greater level of confidence with which the learner handles his or her learning responsibilities.
- vi. Evaluation is more result-oriented when each individual student or learner is considered in terms of growth and development as a person rather than a member of a group. In this regard, the tendency of teachers describing the achievement of a whole class of learners rather than those of specific individual learners is inconsistent with the concept of individual differences. Generally, depiction of class norms by teachers has less to tell about the students than specific achievement levels of students.

2.2 Purpose of Evaluation

Evaluation of teaching and learning of science in school serves a number of purposes. These purposes are examined by Gbamanja (2002), Uche (2014) and Tobin & Roth (2015) includes the following:

1. To generate the relevant data that may be employed for the purpose of determining the efficiency of instruction and the degree to which students have made appropriate behavioural changes as a result of the teaching-learning process. This is essentially because instruction serves to move students from their present level of mastery to a new level of learning as may be determined by instructional objectives.
2. Evaluation provides the basis for determining the effectiveness of instruction and the efficiency of the teaching process.
3. It provides data on the basis of which scores and grades may be assigned to students and appropriate reports communicated to parents, employers and other relevant agencies. This is because of the centrality of the evaluation process to teachers, students, parents and others that it must be made objective and accurate.
4. It serves to enable teachers make realistic appraisal of their successes and failure regarding instructional efficiency and the degree of students' learning; thereby making relevant adjustments as it follows sometime that when students have not learned adequately, the teacher has not taught efficiently.
5. Through evaluation, students are helped to make realistic self-appraisal of their learning efficiency. They now come to understand where they stand in terms of mastery of skills and concepts in relation to other students. They may thereafter initiate relevant steps that may lead to greater learning efficiency.
6. Evaluation serves to stimulate greater motivation and investment of efforts on the part of both the teacher and students. This is because a committed teacher works diligently to get the best out of his or her students; and is constantly modifying his or her instructions, as well as investing resources to ensure instructional efficiency. Similarly, students expect a positive evaluation as it is consistent with social expectations. They would work harder to earn good scores or grades. Poor achievers would equally invest greater efforts in order to achieve improvement in learning.

7. Evaluation may identify the need for a redefinition of goals of teaching and learning. The classroom often constitutes a laboratory for testing curricular decisions. Data resulting from evaluation of the teaching and learning processes may suggest the need for adjustment of specific curricular decisions in order to maximize the benefits of the teaching-learning process. In other words, evaluation helps to clarify objectives, particularly if certain objectives in the curriculum do not yield good results. Those objectives could be modified, clarified, or even deleted for better and reliable results to be obtained.
8. We evaluate in order to promote students to higher classes. Students should be allowed to progress as they complete work at one stage in school.
9. Evaluation is used for guidance and counselling purposes
10. Evaluation for entrances into higher institutions and colleges as students must be required to pass certain assessment and measurement processes, as well as showing evidence of good character in many cases before admissions are granted.

2.3 Characteristics of Evaluation Instruments

The instrument used for any evaluation must be:

- a. Valid
- b. Reliable (consistency)
- c. Objective
- d. Usable
- e. Continuous

Validity applies to the method and indicates the degree to which an evaluation device actually provides evidence of the behaviour desired. Therefore, the validity of an evaluation instrument is the extent to which it measures what it is supposed or intended to measure. It is a matter of degree and pertains to the results of the evaluation instrument and not the instrument itself. Three (3) basic types of validity exist, which are;

1. **Content validity:** Is the extent to which a test measures a representative sample of the subject matter content and the behavioural changes under consideration (Grondlund, 1976 cited in Gbamanja, 2002).
2. **Criterion-related validity:** Refers to how well test performance predicts future performance or estimates current performance on some valued measure other than the test itself. It is often called **predictive validity**.
3. **Construct validity** refers to how test performance can be interpreted in terms of certain psychological constructs. It is also referred to as **face validity**.

The reliability of a test instrument is the extent to which it measures accurately and consistently what it was intended to measure. Test scores merely provide a limited measure of behaviour obtained at a particular time. Unless the measurement can be shown to be reasonably consistent (i.e. generalizable) of the same behaviour, little confidence can be placed in the results. The process of determining, therefore, is to determine how much error is present under different conditions. Gronlund in Gbamanja (2002) suggested the following methods of estimating reliability:

- i. **Test-retest method:** is a measure of stability. The procedure is to give the same test twice to same group with any time interval between tests from several minutes to several years.
- ii. **Equivalent form method:** This is a measure of equivalence, by giving two forms of the test to the same group in close succession.
- iii. **Test-retest with equivalent forms:** This is a measure of stability and equivalence. The procedure is to give two forms of the test to the same group with increased time interval between forms.
- iv. **Split-half method:** This is a measure of internal consistency. The suggested procedure is to give a test once. Score two equivalent halves of the test (e.g. odd and even items); correct reliability coefficient to fit whole test by Spearman-Brown Formula.
- v. **Kuder-Richardson method:** This is a measure of internal consistency. The suggested procedure is to administer a test once. Score total test and apply Kuder-Richardson formula.

- ❖ **Objectivity:** This refers to when the scoring of a test is not affected by the personality of the scorer.
- ❖ **Usability:** This refers to relative easiness to administer and score a test, and not too expensive in terms of materials needed.
- ❖ **Continuity:** Evaluation must be a continuous process. It is an integral part of classroom instruction.

3. PROCEDURES FOR EVALUATING STUDENTS' LEARNING AND TEACHERS' INSTRUCTION IN SCIENCE TEACHING-LEARNING PROCESS

There are quite a number of procedures adopted for the purposes of evaluating students' learning, as well as teachers' instruction. It is assumed that when we evaluate students' learning, we are indirectly also evaluating the instrumentation to which students were subjected. However, the following procedures as outlined by Uche (2014) fit into students' learning.

- a. **Observational technique:** Generally, teachers make their observations on students almost on daily basis and use the gathered data for the purpose of evaluating the degree of success of their instructions. In terms of getting precise data on students' behaviour, observation has its limitation. But teachers can be trained in order to gain greater precision in the art of observation and data collection. For instance, a teacher may be trained to focus attention on a particular behaviour of interest at a given time and how the various indices of the manifestation of the behaviour may be derived and recorded. Other teachers gain greater experience in classroom teaching and enhance their skill objectively as they observe students' progress in the cognitive, affective and psychomotor domains of learning, as well as the degree to which individual or groups of students are attaining the objectives of instruction. Specific traits such as cooperativeness, athletic skills, honesty, respect for others, empathy, creativity, etc.
- b. **Paper and pencil tests:** These include teacher-made tests, quizzes and other forms of assignments that take the form of paper and pencil tests. These may sometimes occur during instruction or at the commencement or termination of instruction. Also, included in this category are questionnaires and other forms of affective and psychomotor instruments that require the use of paper and pencil for the purpose of making appropriate responses. Nevertheless, paper and pencil tests that are utilized for evaluation of students' learning must be valid and reliable.
- c. **Consultation:** Consultation is a widely used strategy for evaluation of students' learning. It requires that students on an individual or group basis meet face to face with a teacher for the purpose of discussing issues relating to students' progress and problems. Issues raised during such discussions serve to highlight what problems students face. However, increased school enrolment in many parts of the developing countries including Nigeria and the overcrowded schedules that teachers operate under have almost completely eliminated consultation as a vital part of a school programme. However, a diligent teacher can always make out time to confer with at least those students with pressing issues or problems. This will demand that the school authorities provide a consultation time in the school programme and a quiet space that can be used for consulting with students. Through consultation, students achieve better understanding of their selves, acquire skills for self-appraisal, and resolve problems of cognitive, affective and psychomotor interests. Students who feel shy to raise issues relevant to their individual and group interest in a classroom may do so easily in an atmosphere of rapport that is afforded by consultation. This period may be utilized for providing additional or advanced work to the right students or for guidance and remediation of poor achieving students while maintaining privacy and confidentiality.
- d. **Self-education:** This is yet another useful but surprisingly neglected strategy for evaluation of students learning. Basically, it transfers the onus of evaluation from the teacher to the student, though the teacher has a critical role in preparing the student for effective self-evaluation. This strategy is based on the assumption that an individual's capacity to evaluate his failures and successes in life is crucial for personal survival. Thus, the schools must impart skills that are needed for effective self-appraisal. The expectation is that students may later appreciate its need, the relevance of teaching and learning and the relationship between regular self-evaluation and personal progress in both school and out of school situations. Self-evaluation thrives to promote free expression of self in an environment that is free from threat and humiliation. The teacher may require his or her students to keep records or charts of their school science work like the number of maths, physics, chemistry or biology problems failed in a week, month or term. Students may be required to employ rating scales or checklists in evaluating their levels of preparedness for an examination, compliance to certain school or laboratory regulations, determination to succeed in school work, disposition to members of academic groups or sex, cooperativeness, honesty, etc. Sometimes, they may be required to write narrative statements or essays on their individual progress and problems relating to attitude towards mathematics, physics, chemistry or biology. Rating scales and checklist portraying series of behaviours or traits may be developed and teachers could ask the students to rate themselves based on their personal traits or behaviours.
- e. **Classroom questions and discussions:** This is one of the strategies that ensures that a good many a student are kept active through their contributions to a class discussion. These contributions may come by way of oral expressions of facts, perceptions, attitudes, opinions or feelings that may be self-generated or arise as responses from questions or issues that were raised by the teacher or fellow students. By the quality of factual presentation made, opinion expressed, perceptions and attitudes communicated by students, a teacher is able to gain some understanding on the growth or progress along the cognitive and

affective dimensions. It requires mutual trust and respect among the participants in a learning process and an understanding of the need to make mistakes and benefit from them. The teacher serves only as a facilitator and provides the necessary stimulus that would prop students into making contributions. Such contributions need not be used as a basis for grading, but serves the need for active student participation in the teaching-learning process.

3.1 Procedure For Evaluating Teachers' Instruction

As earlier suggested, evaluation of students' learning is an important component of evaluation of teaching. But such evaluation does not specifically and directly focus on the teacher as an important element of the instructional delivery system. However, a perusal of available literature (Brophy, 1979; Brophy and Everston, 1976; Good, 1970; Good and Brophy, 1979 and Gaus, 1968) cited in Uche (2014) suggest the following as important ingredients of effective classroom instruction:

- i. Knowledge of subject matter
- ii. Stimulating presentation of content to students
- iii. Capacity to adequately demonstrate concepts and principles
- iv. Affording reasonable time for explanation and elaboration
- v. Providing for immediate practice and feedback
- vi. Artful use of questions
- vii. Encouraging students' participation
- viii. Providing for independent practice and application
- ix. Weekly and monthly reviews of instruction and content
- x. Effective and flexible classroom management
- xi. Realistic perception of students
- xii. Effective application of relevant instructional strategies, etc.

However, Ajaja (2009) classified all these simply into: personal qualifications, teacher-student relationships, classroom management, instructional skills and professional attitudes. For the purpose of evaluating a teachers' instruction, a trained observer must stand by to see the teacher in action as practiced in schools for trainee teachers or student teachers. The observers carry a rating scale. The scale must consist of items drawn from the ingredients of effective classroom instruction. Where resources are available, a video recording of the instruction would be most appropriate especially for effective feedback, and acquisition of relevant instructional skills. Above all, continuous assessment in the science classroom according to Gbamanja (2002) must be a regular practice and should include:

- i. Normal formal and informal tests
- ii. Laboratory exercises which must be marked
- iii. Performance in laboratory activities
- iv. How students handle science materials and equipment
- v. Observation of scientific attitudes in students as assessed in every activity

4. EDUCATIONAL OBJECTIVES FOR EVALUATION PURPOSES

Educational objectives make clear what learning outcomes are expected from our teaching. They are our teaching goals expressed in terms of the desired results of instruction. Therefore, the main objectives of science teaching in our schools may be summarized briefly as follows:

- i. To acquire knowledge of important facts, principles and fundamental concepts
- ii. To develop understanding of important principles and concepts
- iii. To develop problem-solving skills
- iv. To develop scientific attitudes, values and qualities
- v. To develop interest in science and scientific activities and in observing and studying the physical environment, both natural and man-made
- vi. To develop a sense of appreciation in respect of impact of science on human life and wonders of nature.
- vii. To develop manipulative skills for experimentation and drawing.

These objectives are clearly specified and stipulated in the new National Policy on Education (NPE) of the Federal Government of Nigeria (2014).

5. CONCLUSION

Evaluation can be characterized as the process by which people make judgments about value and worth. It is a process by which people make value judgment about things. Therefore, it is obvious that evaluation is a delicate and sensitive task or activity it is not a simple and obvious process. It has its formal and informal sides. Evaluation should be correlated both with the purpose and to specific educational situations. It is very important to strengthen teachers' and students' motivation when evaluating. If we are able to integrate the evaluation process as discussed in our daily science teaching, we would be richer in our experiences to help the students in learning or doing science effectively. We will derive greater inner satisfaction out of our teachings.

Evaluation is such an integral part of an instructional process; that no instruction can be said to have taken place without evaluation. Indeed, the evaluation must occur on an hourly and daily basis in order to ensure a continuous generation of data that may be used for justifying redirection of the teaching-learning process and a re-examination of the goals and methods of instruction. This would lead to improvement in teaching on the part of teachers and learning on the part of students.

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