

## SCIENTIFIC JUDGEMENTS ON STUDENTS' PROGRESS BY INSTRUCTORS

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### Abstract

*Evaluation is an impetus that help in providing answers concerning the process and product of teaching and learning. The paper argued on some issues in making valid scientific judgements on the overall performance of the learners at end of semester or course. In view of this the paper highlighted the concepts associated with the evaluation; secondly, a focus was given to the two types of evaluation (formative, and summative) and their reflection on how best instructors can construct test, or examination questions. On a third note, emerging issues on evaluation were discussed. Hence the author highlighted some suggestions, that teachers/instructors should embrace planning before instruction; use of Bloom's taxonomy levels and also the use of Table of specifications (TOS), with specific examples of some concepts in biology. Conclusively, the author suggests that for teachers/instructors to judge their pupils'/students' achievement on a taught item they need to embrace planning their lessons and prioritizing achieving objectives guided by Bloom's taxonomic items and TOS.*

**Keywords:** Scientific Judgments, Students' progress, Emerging discourse

### Introduction

Nigerian National policy on education stated clearly the national goals on assessment, and evaluation process at all levels of education (FRN, 2013). To ensure the attainment of the stated goals the policy specifically indicates that, the goal of assessment shall be to; measure the ability of students; enhance the global competitiveness of the products of the Nigerian educational system; improve the credibility of examinations conducted in Nigeria; eliminate the interactable problems associated with the traditional Paper Pencil Test (PPT); and improve learning (FRN, 2013).

There are many evaluation bodies, some are international, while some are national. Some of the national evaluation bodies include NBEM, WAEC, NECO, NABTEB, etc. The National Universities Commission (2007) as one of the evaluation agencies in Nigeria that has the mandate to evaluate the degree programs in Nigerian Universities specifically highlighted various methods of assessment in section 1.5 to 1.5.2 and that teachers are the assessors, as such they have the opportunity to select any method. Evaluation helps in providing ways in which the school system and instructional procedure can be best modified and improved. Agrawal (2017) explained that evaluation plays a fundamental role in providing a decision on what the teacher teaches and what the students learn. On this note, one can say successful teaching and learning process cannot be achieved without quality evaluation. It has been argued that "In order for teachers to make valid judgments about their students' thinking and

understanding then the thinking level of items need to match the thinking level of instruction” (Fives & Dionato, 2013: 6).

Further more, Agrawal (2017) affirmed that, quality of any educational program is directly associated with the quality of evaluation. Despite the importance of assessment, measurement and evaluation, as teachers for so many times we had students complaining about the test or examination questions as unrelated to the learning activities. In this situation there is mismatch between the objectives, content and set of questions provided (Fives & DiDonato-Barnes, 2013:6). Thus, the problem of mismatch or lack of coherence leads to evaluation that cannot provide the correct evidence which the teacher can use to provide a valid judgment about students' progress (Fives & DiDonato-Barnes, 2013:6).

Science has been defined by Oxford Languages Dictionary (.goole.com) as the intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experiment, it is a knowledge that is verifiable.

Making scientific judgements of students achievement and academic performance is a valid evaluation. Therefore, understanding how best evaluation should be done to improve the quality of education and provide a valid and scientific judgment on the students' progress is of paramount importance. These form the basis for the justification of writing this paper.

### **Pre-instruction Evaluation**

- 1a) How many of us are conversant with lesson planning?
- b) If you are conversant do you plan your lesson before delivery?
- 2a) Do you set objectives and remain conscious of achieving them throughout period of instruction?
- b) At what point in time do you evaluate your pupils/students. Is it at pre, during, at the end of instruction period?
3. Do you know about Table Of Specifications (TOS)?

The paper has the following objectives:

- 1) To provide a clear meaning of the concepts associated with evaluation,
- 2) To clearly identify the two types of evaluation (formative, and summative) that are critical to students' achievement and rating thereby making some reflections on how best instructors can make meaningful construction of test, or examination questions, and
- 3) To bring to focus, some emerging issues on evaluation.

In trying to achieve the objectives, the author has tried to point out some examples, with specific reference to some biology concepts. This is without prejudice to other disciplines, as the author is biased in area of specialization (Biology Education).

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However, let me start by providing clear meaning of some concepts that are interchangeably used by the novices as the same. These concepts are Test, Measurement Assessment, and Evaluation. Thus, as instructor/teacher one need to be conversant with the concepts and how, when, and where the concepts are used appropriately.

### **Meaning of Test, Measurement, Assessment and Evaluation**

There are a lot of misconception on meaning of test, measurement, assessment and evaluation. That is why sometime these four important different concepts are interchangeably used.

#### **Meaning of Test**

Test can be simply described as a tool, instrument, activity or set of question, an examination which is used to measure knowledge, skills, aptitude, performance or a particular characteristics. It is a form of questioning or measuring instrument used to access the status of one's skill, attitude and fitness.

Tests can be classified based on educational objectives (which is our major concern here) or otherwise. This is with the aim of determining the extent of attainment of objectives or to obtain information regarding level of pupil/student performance in relation to the three domains of learning. On this basis, assessment measures can be classified in to:

1. Measures of cognitive ability; i.e when pupils/students are asked to list, define, state, etc.
2. Measures of affective behavior; i.e when pupils/students are asked to discuss, differentiate, identify similarity, elaborate, justify, etc.
3. Measures of psychomotor ability; i.e when pupils/students are asked to draw/make diagram, demonstrate, measure, group items, etc. (Nworgu, Habor-Peters, Emenogu, Nkemakolam, Unachukwu, Okapala, Anene, Ndubuisi, & Ezeh, 2003:41).

Another important classification is based on quality. Here the criterion classified tests in to:

1. **Teacher-made (classroom) Tests;** this are usually unstandardized, since the teacher determine the instructional objectives, this is because it is assumed that the teacher is in the best position to know the characteristics of his subjects, but the instructor/teacher may be biased to suit his own purpose.
2. **Standardized Tests;** which are more carefully and accurately designed to cover many classes of a specified type in areas that are common to these classes. They are trial tested, administered to a large representative sample with a manual and procedure for administration. (Nworgu *et al*, 2003:41))

#### **Meaning of Measurement**

Measurement is the process of assigning attributes, dimensions of some object in order to provide quantitative meaning to such qualities, Measurement stop at providing quantity

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without making value judgment (Srinivasan, 2016). It is an act that involves the assignment of numerical values to whatever is being tested, so it deals with describing quantity of something. Therefore, measurement in context of learning is the process of applying measuring tools or standard scale to an object based on the acceptable practice. Nworgu *et al.* (2003) explained the concept of measurement as described in Horrocks and Schoonover as assessment to a position on scale of greater than or less than. Thus, such assessment can be quantitative or qualitative series.

### **Meaning of Assessment**

Assessment is a process of gathering quantitative and qualitative data of what a student can do, and how much a student possesses. Chambers dictionary has described assessment as estimating the value, power of a thing.

### **Meaning of Evaluation**

The word Evaluation is derived from Latin word, “*valupure*” which means the value of a particular thing, idea or action. That is to say that it is method of assessing the worth or value of something. Evaluation is also described as systematic and scientific process of determining the extent to which an action or set of actions were successful in the achievement of pre-determined objectives.

Two most important definitions suffice in this context. The Comback in Ben-Yunusa (2008) who defined evaluation as the ‘collection and use of information to make decisions about the educational programme’; and the Tyler’s in Ben-Yunusa (2008) who stated that ‘evaluation deals with the appraisal value or the estimation of worth of a thing or programme’.

In a broader sense Evaluation is a systematic process of providing information for decision making. It includes both Test, Measurement and Assessment, because it involves information gathering, information processing, judgment forming and decision making. Evaluation can be Formative (Process) or summative (product). It is Formative when it is used to provide continuous feedback to both teacher and student concerning learning successes and failures while instruction is on process. On the other hand Summative evaluation is done at the end of a course of instruction to know to what extent the objectives previously fixed have been accomplished. In other words, it is the evaluation of students’ achievement at the end of a course.

Related empirical studies “suggests that engagement, interaction, and communication between evaluation clients and evaluators is critical to the meaningful uses of evaluations” (Kelli et al, 2009:389), although they emphasize more on findings rather than process. On the other hand it is best “relying less on learner evaluation and more on the practical benefits of learning experiences” (Richard *et al.*, 2015: 3).

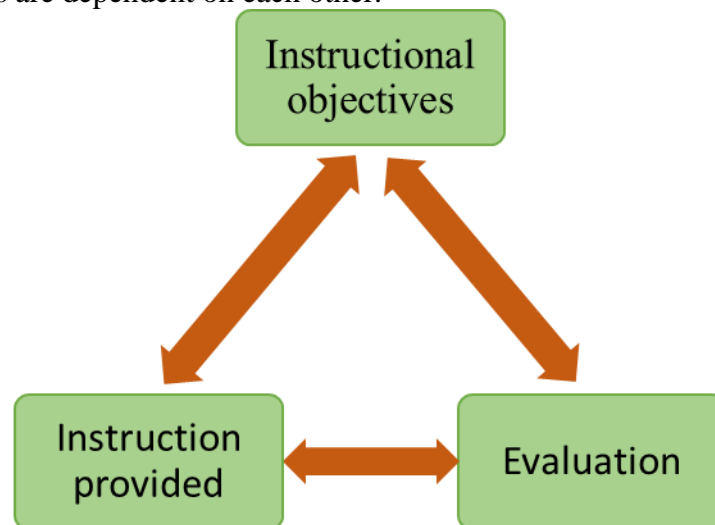
## Conceptualization of Evaluation in Teaching and Learning

It was mentioned elsewhere, that “Evaluation is the systematic process of collecting evidences about learners’ progress and achievement in both cognitive and non-cognitive (affective and behavioral) area of learning on the basis of which judgment are formed and decisions are made” (Agrawal, 2017). Thus, evaluation started where measurement stop, this because as measurement assigned attributes to some object that are either quantitative, then evaluation provide judgement for decision. Agrawal (2017), describe evaluation as a Broader term that include testing and measurement, that provide a description students behavior, and provide judgement on the worth or desirability of the behavior assessed or measured.

Evaluation is an essential part in the teaching and learning processes, this is because when a question is asked and answer provided during teaching and learning process then evaluation (formative) has taken place. Teaching and evaluation are connected and cannot be separated. Agrawal (2017) affirmed that, teaching, and learning cannot be possible without evaluation. However, with all degree of emphasis, instructional objectives provide direction and connection between teaching and evaluation.

Instructional objectives are those intended learning outcomes that learners should attain at end of instructional period. Objective is usually stated in a measurable term to evaluate the learner behaviors that can either be of cognitive, affective, and psychomotor. The measurable terms can be exemplified as define (cognitive), explain (affective) and demonstrate (psychomotor). It is expected of every instructional period to employ at least two, if not all the stated domains.

The following figure provide the connections and interrelation on the instructional objectives, learning process and evaluation. The figure shows the existence of network and that the three components are dependent on each other.



**Figure 1:** The three components of teaching and Learning (Agrawal 2017)

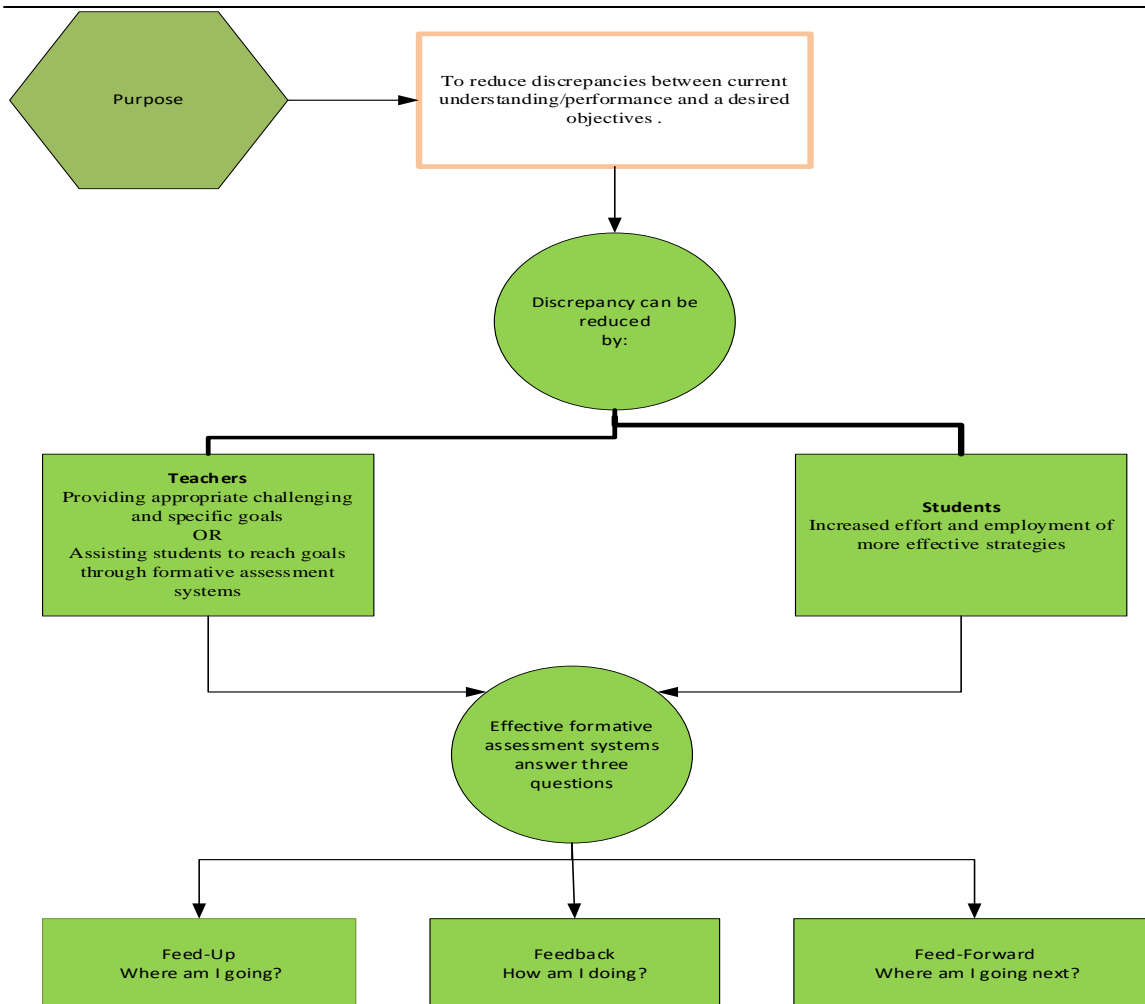
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## **Types of Evaluation**

Evaluation is the process of making judgements of value or worth of teaching and learning processes, which may be students' aptitude, interest, achievements or method used in the instructional process (Gullo, 2005, Yambi, 2018). There are many types of evaluation depending on needs or objectives of the evaluators. Some of the types include formative, summative, diagnostic/prognostic and placement evaluation. However, the main concern of this paper is about the formative, summative evaluation and their reflection on how best the teachers in the higher institution can provide a valid judgment on the students' progress. Thus, a brief account of the two evaluation processes is provided below:

### **Formative Evaluation**

Formative evaluation is concerned with process of evaluation that examine the students' progress based on the desired instructional objectives. It is aimed at inspecting students' achievement and progress on a specific objective based on the Bloom's taxonomy. One of the advantages of formative evaluation for learning is to provide feedback and directions to adjust instructional strategies; guide and lead students to achievements and success (Yambi and Caluyua, 2018). In another word formative evaluation monitor the progress of the learners during the course, class or session with the aim of providing improvement for the quality of the instructional process based on the feedback obtained. Kumar et al.(2016) explained that formative evaluation answers questions concerning the process and product of teaching and learning. Formative evaluation also provide answer about the feedback during the instructional process based on the objectives as summarized in the figure below.



**Figure 2:** Formative Assessment System (Frey and Fisher, 2011)

### Summative Evaluation

Summative evaluation is the process of providing judgment on the overall performance of the learners, , (Yambi and Caluyua, 2018). It is also involved in making decisions for grading and usually done at the end of course, semester or term. In addition, certification process is done on the basis of summative evaluation results and that also the effectiveness of the curriculum transaction process are determined (Kumar *et al.*, 2016). It provide a comprehensive evaluation towards achieving accurate judgements of the students at the end of instruction, or end of semester examinations. The teachers are expected to develop a valid test instrument that is clear, precise, and quantifiable. This could be achieved through Bloom’s taxonomy and also the use of a Table of Specification (TOS). This is to give accurate representation of the content in the test as a function of time and level of intended objectives. See example of adopted TOS in Table 2 and how best a teacher can use the table.

In the process of curriculum development there are basically formative and summative evaluation of students.

It has been mentioned somewhere that “the summative model of assessment is linear and separates out the three elements: first there is teaching; then there is learning; finally there is assessment”. It has also been described as “seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go and how best to get there”.

### **Bloom’s Taxonomy and Table of Specification**

Bloom in the 1950’s identified six levels of thinking and those levels were revised by a group of researchers in 2001 (Fives & DiDonato-Barnes, 2013).

The levels of thinking that emphasizes recall, memorization, identification, and comprehension, are considered as lower level. Higher levels involve the processes of applying, analyzing, evaluating and synthesizing. However, teachers can make a valid judgment (evaluation) about their students’ understanding and thinking level if test items (questions) developed match the thinking levels of instruction. In other words valid evaluation can only be achieved if the test items match with the instructional objectives in line with Bloom taxonomy levels.

One of the outstanding approaches that help teachers ensure the validity of test is called *Table of Specifications* (TOS).

Table of Specifications (TOS) improve the validity of the judgments from test responses, and help teachers to relate the instructional objectives, cognitive levels and number of test items that should assess each objective (Fives and DiDonato-Barnes, 2013).

Therefore, TOS is a very important tool that lecturers/teachers should hold and understand, how best they can use and apply in the process of test development towards actualizing valid judgement (Evaluation). The following table provides a summary of Bloom’s taxonomy levels, their brief explanation and example.



<b>Levels</b>	<b>Descriptions</b>	<b>Illustrations</b>
Knowledge	Remembering (recalling) facts, patterns, setting, and methods	Define evolution
Comprehension	Understanding what is being	_____ is the maintenance of regular body environment of a living organism. (a) Temperature (b) Pressure (c) Homeostasis (d) Respiration
Application	Using previously learned information in new and concrete situations to solve problems that have single or best answers	With the aid of a diagram, show the features to qualify an organism for a vertebrate
Analysis	Breaking down informational materials into their component parts so that the hierarchy of ideas are clear	Differentiate between a plant and an animal cell
Synthesis	Putting together elements and parts to form a whole	Justify the characteristics of living things on a given specie
Evaluation	Judging the value of material and methods for given purposes	Identifying equipment used for collecting different types of animal species

Thus, the following (table 2) provide a description of how a TOS can be constructed.

**Table 2: Showing adopted version of TOS to suit biology teacher/instructor**

<b>Topics</b>	<b>Instructional Objectives</b>	<b>Time Spent to Topic (Minutes)</b>	<b>Percentage of Class Time on Topic</b>	<b>Number of items (10)</b>	<b>Lower Level Recall, Identification Comprehension</b>	<b>Higher level Apply, Evaluate, Create</b>
Cell Structure and Organisation	Define cell	15	6.3%	$\frac{6.3}{100} \times 10 = 0.63$	1	
	Identification and functions of various cell organelles	35	14.6%	$\frac{14.6}{100} \times 10 = 1.46$	1	
	Describe cell organisation	30	12.5%	$\frac{12.5}{100} \times 10 = 1.25$	1	
	Distinguish between Plant & Animal Cell	40	16.7%	$\frac{16.7}{100} \times 10 = 1.67$		2
Classification of Living Organisms	Classify living organisms according to levels	25	10.4%	$\frac{10.4}{100} \times 10 = 1.04$	1	

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Identify the classification and characteristics of plant	35	14.6%	$\frac{14.6}{100} \times 10 = 1.46$	1
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The TOS is a relationship establishment mechanism which bonds what we do in the classroom by way of achieving cognition on the part of students instructed, the objective(s) of the instruction and amount of test meant to assess each objective.

The table has columned properties which include Instructional Objective; Time Spent on Topic; Percentage of Classtime on Topic; Number of Test Items; Lower Level and Higher Levels. It has been advised by Fives et al. (2013) that teachers take note of ;

The number of test items to include and  
The distribution of multiple choice and short answer items, when constructing the TOS.

In appraisal of the TOS, Nootar et al. (2004) put forward that using TOS helps teachers to be accountable for the content they teach and the time they allocated to each objective. Considering actual class time spent on each objective by the teacher is a valid evidence of test content for classroom tests. Thus a TOS can help the instructor make sure that the more relevant objectives are assessed.

### **Every Teacher/Instructor Needs TOS**

It is worthy to mention that the use of TOS by teachers/instructors is one way to demonstrate professional judgement in developing test for their students. This should be informed by lesson and unit planning, instruction and assessment as function of students' learning and knowledge.

The judgement if based on the TOS, will attract acceptability due to its reliable features.

### **Tertiary Institutions and Evaluation**

The universities are considered as complex institutions, semi-autonomous sectors and even more autonomous faculty members. Quality assessment of program, what the university does and facilities of any higher institution are shared and done mostly informally by many stakeholders (Stake et al., 2018). Some of the stakeholders include government agencies, the faculty, students and their families etc. Evaluation is an important tool that help in actualizing good management of the university and its faculties. Thus, evaluations are considered as formal if they are planned, routinised, recorded and publicized (Stake et al., 2018). However, development of test questions form the basis of valid evaluation, thus, the common practice of test development in the Nigerian University is that individual lecturers develop test question and then will be given to external examiner for validation.

## Conclusion

The paper has considered students' gossips as to how their teachers/instructors administer test and examinations not mindful of the time they spent teaching an item, which ends up in questions been unrelated to the learning activities, thereby causing mismatch between the objectives, content and set of questions provided. The paper has pointed out report that lecturers/instructors need knowledge to improve their evaluation of students.

The paper has also clarified some conceptions on evaluation and related terms. It has also identified the connections between instructional objectives, instruction provided and evaluation. Formative and summative evaluations were highlighted.

Some emerging issues were also discussed, which include Bloom's Taxonomy of Learning levels and use of Table Of Specifications (TOS) to achieve valid scientific judgements of pupils/students' achievement and academic performance on subject matter of instruction.

## Suggestions

Based on the clarifications highlighted in this paper and the discourse which sufficed, it is the recommendations of the author that:

1. Teachers/instructors should carefully plan their instruction before delivery.
2. Teachers/instructors should be concious of what they wish to achieve (objectives) throughout the period of instruction.
3. Teachers/instrutors lesson content should be informed by objectives so intended.
4. When planning evaluation for their pupils/students, teachers/instructors should be mindful of Bloom's Taxonomy of learning levels.
5. In order for teachers/instructors to judge their pupils/students' achievement on a taught item, they need to embrace the use of Table Of Specifications (TOS).

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