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Application of Instructional Technology for Assessment of Instructional Objectives in Teaching-Learning of Basic Science and Technology

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***Abstract* – Students' disinterest in learning of science courses at the secondary school level cannot be remedied if effective teaching methods are not employed at the basic education level. The study aimed at determining the difference between pupils' performance in Basic science and technology test based on allotted time and standard of performance for each behavioural objective by the teacher during class time activities. The study was an experimental design. The population comprised all teachers in Akwa Ibom State. The sample was based on the criteria of selection of schools under study. One of the schools was kept as a control group while another was kept as an experimental group. The intact classes in School A(control) had 215 pupils while School B (Experimental) had 192 pupils. The lesson notes were researcher-designed for both control and experimental groups. The teachers in the experimental group were then exposed to a pre-demonstration of the lesson plan on Magers' components of time as a constraint and standard of performance for setting behavioural objectives. The finding revealed that there was significant difference between pupils' performance in Basic science and technology test in experimental group as the calculated t- value (24.45) was higher than the critical value (1.97), thus the null hypothesis was rejected. It is recommended among others that if as in most instances 35 minutes are allowed for a lesson, the teacher may consider a time chart of 20 minutes for instruction and 15minutes for evaluation during which the instructor actually teaches, allows time for demonstrations and interaction.**

***Keywords* – Assessment of Instructional Objectives, Basic Science & Technology (BS&T), Learner-Centred, Instructional Technology.**

I. INTRODUCTION

The education system in developing countries including Nigeria faces challenges in teaching approaches and other multifarious problems of poor quality of teachers, poor funding, overpopulation in classrooms and obsolete materials, thereby leading to the production of half-baked graduates from institutions with certificates but with virtually no requisite skills. This calls for effective instructional practices with the aim to correcting any poor teaching-learning methods for the benefit of the learner right from the lower primary school in science education. Teaching, generally seen as a process of manipulating the variables of instruction to make things known to people, is seen by Ibe-Bassey (2012), as an art and craft involving teachers who are part of an ad-hoc decision making about the management of their classroom for the implementation of government educational policies. Such decisions may include:

- the selection of the types of materials to use for instruction,
- the stating of behavioural or instructional objectives,
- the selection of instructional(constraints?) and strategies,
- the selection of appropriate evaluation practices and techniques,
- the selection of students' and teachers' activities Ibe-Bassey (2012).

To assess instructional objectives for a particular piece of instruction to a specific group of learners, the application of instructional technology principles as a sub-set of educational technology is needed. Manga & Mangal (2010), submit that instructional technology is concerned with determining and providing appropriate stimuli to the learner to produce certain types of responses for making learning more effective. They further maintain that instructional technology determines instructional media, materials, method and subject content required to achieve objectives, and ways to improve the lesson based on evaluation and other constraints. Instructional technology is highly interactive, learner-centred and systematic to instructional issues. A well-constructed learning objective should communicate the conditions under which the instructional technology principles are performed during and at the end of a given instruction.

The application of principles, models, theories and practices of educational technology should therefore be prioritized and adopted in the teaching-learning of Basic Science & Technology in primary schools for effective science instructions. This will provide students with the opportunity to play a more active role in their learning through teachers' systematic planning, to measurement, assessment and improvement of learning out-comes. The entire instructional system component involves materials tests, students and teachers' guides, developed to meet instructional needs in terms of objectives so that learning problems can be solved.

According to Inyang-Abia (2004), instructional objectives being the intents and expectations of activities deliberately arranged to facilitate learning should describe the proposed changes in the performance of learners after successfully executing planned activities of learning experiences. Instructional objective should be implemented in a learner-centred, or student focussed perspective. Sufficient time should be allowed for interaction between the teacher, materials used for

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instructions and learners, if the tenets of basic science and technology education are to be attained.

Mager (1962),-Mager (1979), Gagné (1972), Gagné, & Briggs,(1974) among others proposed models approach to writing and implementing instructional objectives about observable outcomes (called behavioural objectives) that can be built up to become a curriculum. According to their assessment "an objective is simply the description of a pattern of behaviour, performance or action that the teacher wants his learners to achieve using a particular action, tool and constraint". The questions are, Are primary school teachers teaching basic science and technology in such a way that the students' performance both in class and out of class as proposed by researchers meet the general objective of Basic Science & Technology? Do their teaching intents as indicated by their learning objectives allow students to observe and explore the environment while using their senses and manipulative skills to solve life problems? The Mager approach considers the condition, standard time constraint and mode of performance among other components in the stating of objectives to ensure effective and all round learning. These components serve as the checks and balances for accurate evaluation especially in the sciences where either of the cognitive, affective nor psychomotor values must not be undermined.

According to Peter (2013), investments in science, mathematics and technology at the basic education level "will prepare … citizens to be able to capitalize on the many high income jobs of the future which are scientific and technology literate dependent". What hopes are there to actualize this?

II. Statement of the Problem

The manner teachers are recruited, trained and deployed in schools can play a major role in learning outcomes. What obtains now is that about ninety percent of youth corps members posted to various states of the federation in Nigeria is usually deployed compulsorily without consideration to requisite professional training relevant to teaching methodology as should be applicable in primary and secondary schools for their one year primary assignment. While that practice continues yearly, employment seeking post National Youth Service Corps (NYSC) graduates from tertiary institutional establishments irrespective of the type of professional training again, and mostly lacking in classroom management styles involving writing of instructional objectives, and also in time management to accommodate lesson evaluation of the set instructional objectives either during or after teaching but within the period allowed for the lesson. These were some of the disturbing issues that aroused the researchers' minds to carry out this study.

III. Objectives

The Following Objects Were Set to Guide the Study

1. To determine the difference between pupils' performance in Basic Science & Technology test based on time limit set for each behavioural objective by teachers in the experimental and control groups.
2. To determine the difference between pupils' performance in Basic Science & Technology test based on standard of performance for each behavioural objectives by teachers in the experimental and control groups.

Hypotheses

1. There is no significant difference between pupils' performance in Basic Science & Technology test based on time limits set for each behavioural objective by teachers in the experimental and control groups.
2. There is no significant difference between pupils' performance in Basic Science & Technology test based on standard of performance for each behavioural objective by teachers in the experimental and control groups.

IV. Significance of the Study

Proper writing and implementation of instructional objectives in lesson during (class time) and after lesson delivery on basic Science & technology using a "particular action with a particular object, in a given situation, and with a particular tool, learned capabilities and other constraints",

- The school authorities, classroom teachers, students and government will be able to use the result of the study to tackle the problem of poor teaching approaches, examination malpractices and an increased interest in offering science & technology courses among university students.
- The teacher will be able to organize instructional activities in a way that will maximize learning outcomes within the given time frame.
- It will help the teacher to select the materials which can accomplish the desired outcomes. The emphasis will be on accountability of learning rather than grades obtained by the end of school terms.
- Teaching/learning will be learner-centered in activity and highly interactive.

Theoretical Framework

This Work is Guided by:

- Gestalt cognitive theories of learning based on cognitive perspective relevant to teaching basic science education. Nwagbo (2013), presents a "cognitive psychologist who views people not as passive recipients who are pushed and pulled by environmental forces but as active participants who seek experiences". Basic Science and Technology should be taught in a way that encourages transfer of learning beyond the classroom situation.
- Robert Gagne's theory advocates for teachers' use of task analysis of instructional objective for teaching. In applying Gagne's theory in science teaching according to Peter (2013), the science teacher should state the objective for learning any content. A teacher should follow the Gagne' five categories for examining different types of learning outcomes, namely: intellectual skills, verbal information, motor skills, and

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cognitive strategies; Guided classroom and Laboratory attitudes in science teaching is favoured by Gagne.

- This work is further based on a model of evaluation of need assessment on instructional goal postulated by Mager (1979). An example of a Mager objectives assessment is: " Given 3 minutes of class time, the student will solve 9 out of 10 multiplication problem of the type : 5*4 = " In applying Mager model to basic science teaching, science teaching should be focussed on problem solving during class time task activities.

Based on the theories the researchers have adopted the need to create a defined time frame and standard for performance as components of the instructional objective to motivate the pupils to aim higher in learning science for productivity.

V. METHODOLOGY

The study was an experimental design. The population comprised all teachers in Akwa Ibom State primary schools with an estimated number of 1,260. The sample for the study was chosen through a criteria considering the following:

(i) Availability of basic science and technology facilities in schools.
(ii) The teachers' experiences and opportunities for continued professional development.
(iii) The schools that have at least two intact classes of primary six pupils.

Based on the criteria, the first six schools that closely tallied in rank were chosen as sample for the study within Uyo capital city. Thus, from each of the schools, two teachers were chosen giving a total of twelve teachers. One of the schools was kept as a control group while another was kept as an experimental group. The intact classes in School A(control) had 215 pupils while School B (Experimental) had 192 pupils. The lesson notes were researcher-designed for both control and experimental groups on the same topic but divided into three lessons. The only difference is that for the experimental group the lesson plan was developed with an adaptation of Magers' components of time as a constraint and standard of performance for stating behavioural objectives while the control group was developed without that component. The teachers in the experimental group were then exposed to a pre-demonstration of the lesson plan.

Data Collection

The sections on evaluation in the designed lesson notes for both control and experimental groups were used as test items for data collection. The test items were administered to the pupils in both the control and experimental groups. The items were scored and collated, accordingly based on each objective and analysed with t-test statistics.

VI. FINDINGS

The following are Findings From the Study

Hypothesis One **:** There is no significant difference between pupils' performance in Basic Science & Technology test based on time constraint set for each behavioural objective by teachers in the experimental and control groups.

Table 1. t-test: Two-sample assuming unequal variances

	N	$\bar{X}$	*SD*	*DF*	*t-cal*	*t-crit*	*Decision*
School A (Control group)	215	25.03	12.27				
				376	26.14	1.97	Significant
School B (Experimental group)	192	60.09	14.52				

Table 1 reveals that there was a significant difference between pupils' performance in Basic Science & Technology test based on condition (time limit) for performance indicated in the behavioural objectives by teachers in the experimental and control groups as the calculated t- value(26.14) was higher than the critical value(1.96) . Thus the null hypothesis was rejected.

Hypothesis Two : There is no significant difference between pupils' performance in Basic Science & Technology test based on standard set for each behavioural objective by teachers in the experimental and control groups.

Table 2. t-test: Two-sample assuming unequal variances

	N	$\bar{X}$	*SD*	*DF*	*t-cal*	*t-crit*	*Decision*
School A (Control group)	215	37.37	4.89				
				376	24.46	1.97	Significant
School B (Experimental group)	192	64.56	14.69				

Table 2 reveals that there was significant difference between pupils' performance in Basic Science & Technology test based on standard for performance indicated in the behavioural objectives by teachers in the experimental and control groups as the calculated t- value (24.45) was higher than the critical value (1.97). Thus the null hypothesis was rejected.

VII. DISCUSSION

It is obvious from the findings that the pupils in the experimental groups were at an advantage of being focussed in their learning activities. In each aspect, for instance, the time constraint indicating a higher mean score reveals the fact that the teachers' apportioned suitable time frame at appropriate points during lesson delivery prompted the pupils' good performance. This is in line with Mager (1962), -Mager (1979), Gagné (1972), Gagné, & Briggs, (1974) among other proposed approaches to writing and implementing instructional objectives. According to their assessment "an objective is simply the description of a pattern of behaviour, performance or action that the teacher wants his learners to achieve using a particular action, tool and constraint. The inclusion of the condition adds a check on the pupils. Even

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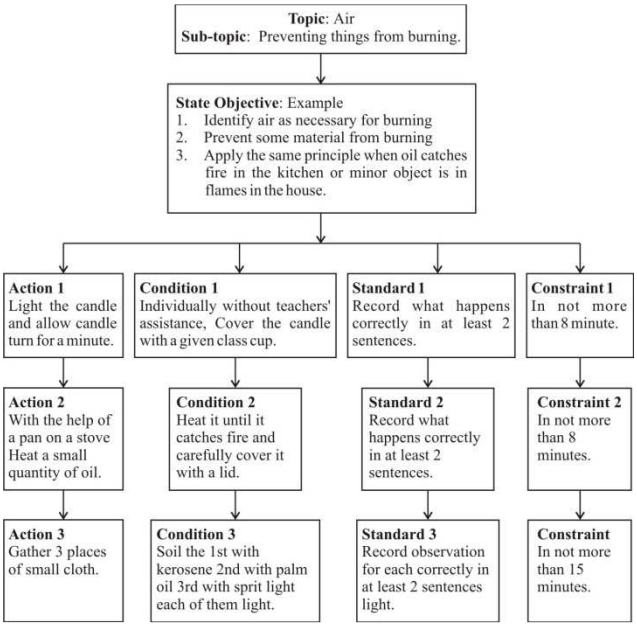
in the teacher's absence, the child sees the need to interact with or meet the required tool. This is also in line with Mangal & Mangal (2010) submission on instructional technology. It should provoke certain types of responses for making learning more effective. He further maintains that instructional technology determines instructional media, materials, method and subject content required to achieving objectives, and ways to improve the lesson based on evaluation and other constraints.

VIII. CONCLUSION

The teachers' effectiveness in classroom delivery highly depends on his ability to create behavioural objectives that will motivate the pupils and put them in a position to interact with the learning environment which is very crucial to science and technology. Primary school teachers require greater orientation regarding the stating of instructional objectives and especially the importance of including the constraints as prompts for pupils involvement and interaction.

IX. RECOMMENDATION

- ✓ If Government policy or decision has shifted towards engagement of youth corpers, irrespective of professional discipline to teach in schools, then such corpers need camp training in teaching methodology for effective lesson delivery and acceptable competence in assessment of instructional objectives in basic science and technology.
- ✓ A good number of applicant graduates by observation, are not deployed in their professional fields of specialization. It then sounds sensible to suggest that educational technologists be engaged for the re-skilling and supervision of the hitherto non-education graduates willing to be engaged in the school system, which currently seemingly has more engagement room than other disciplines. This would equip them with necessary knowledge to use educational technology for building the hope of the nation in their classrooms.
- ✓ If as in most instances 35 minutes are allotted for a lesson, the teacher may consider a time chart of 20minutes for instruction and 15minutes for evaluation during which the instructor actually teaches, allows time for demonstrations, answering and asking of questions and a compressed drill to round up before the time keeper's bell exits the teacher for another lesson.
- ✓ There should be an intensification of the in-service course programs to enable teachers update on instructional skills and teaching competencies.



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