

# UTILIZATION OF EVALUATION IN THE DEVELOPMENT OF QUALITY MANPOWER IN SCIENCE AND TECHNOLOGY EDUCATION

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## Abstract

This paper considered the concept of evaluation in education. Some evaluation models relevant to science and technology education like Tyler's, Hammond's and Stuffiebearis models were discussed. The paper further examined the roles of evaluation in the development of quality manpower in science and technology. Some of these roles include programme improvement, decision-making, programme planning, personnel improvement, etc. Science and technology programmes must be constantly evaluated if the quality of manpower produced must be guaranteed.

## Introduction

Science and technology have in modern times become critical factors in the determination of the economic well being of any nation. This is because through the study of science and technology a nation develops its manpower in such critical areas as agriculture, engineering, architecture, medicine and other science based professions and technologies all of which constitute the bedrock of a genuine national development (Awokoya, 1976). The benefits of science and technology have transversed every conceivable sphere of human life. For example, man's ability to produce high quality goods and services has increased tremendously, a lot of new drugs, vaccines, sophisticated equipment and tools have been produced which are helping in the diagnosis and treatment of various diseases thereby enhancing longevity. High yielding varieties of crops and animals as well as disease-resistant varieties have been developed. Through science and technology, transportation and communication have improved remarkably, sophisticated buildings that provide comfortable accommodation for people have also been constructed.

Development in science and technology according to Akpan (1992) starts with education of the people in science and technology. The extent and pace of the development according to him will depend on how well the curriculum in science and technology has been planned, organized and implemented and these processes will depend mostly on the teachers, the students and the learning environment. Many countries all over the globe have, therefore, recognized the importance of science and technology education as vital tools for technological advancement. In view of this, government has put in place a number of measures and policies as entrenched in the National Policy on Education and the National Policy on Science and Technology to enhance their development.

To ensure quality in the system, the need to constantly evaluate the implementation of science and technology education programmes has been stressed by Afe (1992); Awotunde (1992); Okeke (1997); and Ibole (1999). Evaluation of a programme is an attempt to determine whether the programme is being run in line with the objectives for setting it up and whether the programme is achieving the desired effects. Specifically, evaluation has been defined by Okoro (1991:13) as the appraisal of the worth or value of a thing or action and the making of appropriate decision on the basis of such appraisal. Generally when a programme is evaluated some data related to the programme are collected, analyzed and interpreted so that decisions, regarding the programme can be made. These decisions may lead to programme improvement, programme replanning among others.

This paper therefore examined the concept of evaluation in education, some evaluation models that are relevant to science and technology education programmes were discussed and the roles of evaluation in the improvement of the quality of science and technology manpower were also considered.

## The Concept of Evaluation in Education

There have been several attempts by various authors to provide a clear definition of evaluation. Cangelosi (1991:3) defined evaluation as a judgment about the quality, value, effectiveness or impact of something (e.g. a product, process, person, organization or collection).

Evaluation according to Okoro (1991:3), can simply be defined as the appraisal of the worth or value of a thing or action and the making of appropriate decision on the basis of such appraisal. To Bello and Okafor (1997), evaluation is seen as a process that attempts to determine as systematically and objectively as possible the relevance, effectiveness and impact of activities in the light of their objectives. Programmes in education are established for some purposes and it is the function of programme evaluation to determine the extent to which the purposes of the programme are being achieved

A careful study of these definitions reveals that though areas of emphasis may differ they have much in common. Evaluation essentially involves the collection of information or data and using the data to judge the worth or value of the programme in question and finally taking decisions about the programmes on the basis of the data collected and the judgment made.

#### Evaluation Models Relevant to Science and Technology Programmes

A model according to Bello and Okafor (1997) is a system or a working mechanism with which curriculum evaluation operates based on the purpose in which evaluation is focused. It shows the components and structures of evaluation and how these are interrelated in bringing about a specific intent. Okoro (1991) opines that, an evaluation model may be regarded as a set of steps or a system of thinking which if followed or implemented will result in the generation of information which can be used by decision makers in the improvement of educational programmes. According to him, evaluation models are a great help to evaluators because they provide a general guide, which can be adopted or modified to suit specific programmes being evaluated. Examples of such models are as discussed as follows:

##### 1. Tyler (1949) Model or the Objectivist Model

The focus of Tyler's curriculum model according to Mezieobi (1993), is that evaluation should be based more than anything else on predetermined objectives which should form the rationale, for determining the effectiveness of the curriculum in terms of being relevant and functional as well as its appropriateness in realising the objectives of the programmes of curriculum and instruction. With specific reference to instructional evaluation, according to him, this school of thought aptly thinks that since the ultimate objective is to produce desirable changes in the behaviour-patterns of learners, the objectives had better be stopped behaviourally to warrant proper evaluation of competence- based objectives if the strengths and pitfalls of the curriculum with regard to the extent of the actual achievement or performance of the learner would be ascertained. The ensuing feedback, according to him, would after synthesis be utilized for programme efficacy. From the foregoing, it can be clearly seen that there is an interdependence between objectives and evaluation such that evaluation makes it possible to determine from the demonstrated achieved objectives what has or has not been achieved from the intended outcomes as determined from the clearly defined objectives.

##### 2. Hammond (1973) Evaluation Model

This model, according to Worthen and Sanders (1973) concerns itself with the determination of how effective a curriculum (existing or innovated one) is in meeting local needs as embodied in expressed objectives. Like the Tyler's model, this model also proposes that the basis for effective evaluation is a set of predetermined, clearly defined behavioural objectives which are perhaps locally oriented in terms of reflecting the needs of the locality in which the curriculum is to operate.

##### 3. Product Evaluation Model

This school of thought, according to Mezieobi (1993), revealed that curriculum evaluation should focus on the products of the educational institutions who were exposed via teaching to a planned or unplanned curriculum up till the terminal stage in their programme of study. In this evaluation model, he pointed out that evaluation focuses mainly on the cumulative academic achievement of learners or on their performance effectiveness as judged by their ability to translate skills, values, attitudes and competencies acquired in school into functional productive utility in real life situation after they had left the school.

#### 4. Context, Input Process Product (CIPP) Evaluation Model (Stufflebeam (1973) Model)

Stufflebeam's model is based on his definition of evaluation as a process of delineating, obtaining and providing useful information for judging decisions alternatives. Thus, this model identifies four types of evaluation. These are: (1) Context evaluation (2) Input evaluation (3) Process evaluation

#### 5. Product Evaluation

These four types of evaluation correspond with four types of decisions. The four types of decisions are: planning decision, structuring decisions, implementing decisions and recycling decisions. Planning decisions determine the goals and objectives of the programmes, structuring decisions determine the procedures or the means to be adopted in attaining the desired objectives. Implementing decisions deals with the utilisation and implementation of procedure, and recycling decisions reviews achievements and make decisions on modifying, terminating or continuing the programme. The main components and specific aspects of the CIPP model by Stufflebeam (1973) are discussed as follows:

##### 1. Context Evaluation

Context evaluation is concerned with the determination and validation of goals and objectives. This usually takes place when planning the programme. Context evaluation is useful in describing the relevant condition that surrounds the programmes. It refers to the operationalisation of the broad objectives of the government concerning the programmes and the objectives for which the science and technology education programmes were established.

##### 2. Input Evaluation

Input evaluation provides information on resources available and how resources may be used to achieve desired ends. This entails the assessment of staff, students, physical facilities, equipment, library resources, funds and other resources that will be involved in the educational programmes.

##### 3. Process Evaluation

Process evaluation provides periodic feedback on the quality of implementation and this is undertaken during the period of programme implementation. This type of evaluation is concerned with course offering, teaching methods and the various kinds of activities and interactions that take place in the classrooms.

##### 4. Product Evaluation

Product evaluation will determine the effectiveness of the programme in achieving the objectives and goals of the programmes. It also relates the programme outcomes to the overall objectives of the programme and the process component,

#### Ensuring Quality Manpower Development in Science and Technology Through Evaluation

The roles of programme evaluation in education are numerous. Bajah (1986) states that the basic rationale for evaluation is that it provides information for action while its primary justification is that it contributes to the rationalization of decision making. Okoro (1991) indicates that, the main purpose of evaluation in education is to judge the worth, usefulness, effectiveness or value of something, be it an educational programme, curriculum, text book, students' performance or equipment. Other roles of evaluation as put forward by some scholars are as discussed below:

1. Programme Improvement: Evaluation makes it possible for data and information relating to programmes and students to be collected. Such collected data according to Okoro (1991) are used in judging the effectiveness of the programme and in detecting deficiencies in the programme that need to be removed.
2. Accountability; Another reason commonly advanced for the evaluation of programmes is the need to justify expenditures of time, talent and money. These are expenditures which curriculum leaders are likely to be questioned at any time. Okoro (1991) pointed out, that vast sums of money are spent on education by the government. This money ought to produce good educational programmes for students; programmes that would serve the needs of the

country and bring about the desired changes in the behaviour, character, skill level and social life of students who pass through the programmes. Evaluation therefore, ensures that all educational expenditures are justified by the improved learning or other favourable outcomes that might result from the expenditure.

3. **Decision-Making:** Decisions must be made with regard to all aspects of education and at all stages in the provision of education. Ofoegbu (1997) shows strong support for programme evaluation as a basis for presenting evidence for the sake of facilitating decision making in stages of curriculum development. Such decisions according to him may lead to continuation, termination or modification of the educational programmes. Evaluation, therefore assists in decision making by providing the information on the basis of which wise decision can be taken.

4. **Programme Planning:** Evaluation also aids the planning of a new programme and in deciding whether to expand, modify or discontinue with the existing programmes. High quality education programmes can be provided for the citizen of any country only by careful planning. Planning ensures that any educational programme established will serve the needs of the country and the community. Proper planning according to him involves the collection of information about objectives, needs of the community, students to be served, cost of programmes and availability of teachers. These information play an important role in effective planning in education.

5. **Personnel Improvement:** Evaluation also helps in ensuring that educational personnel are well trained and are carrying out the functions that they are best suited to carry out. According to Saylor and Alexander (1974), evaluation in schools helps to judge the merits of all the administrative and managerial arrangements and practices and the structures within which the school itself operates. The skill and ability of administrative and instructional personnel in educational institutions no doubt, determine to a large extent the quality of programmes offered. Staff should therefore, be assisted to identify their strong and weak points and be encouraged to improve on their performance.

Other purposes commonly advanced for the need to evaluate programmes in education include the significance to participants of knowing what they have accomplished. This knowledge tends to improve their morale and supply guide posts by which they may plot further action.

### Conclusion

The benefits of science and technology to national development in the life of any country are enormous. In order to ensure quality in the development and technology manpower there is the need to constantly evaluate the science and technology education programmes in the schools. If this is done constantly and efforts are made to correct the deficiencies discovered, the country no doubt will be heading towards the path of technological advancement.

### Recommendations

The following recommendations are hereby put forward:

1. Efforts should be made to evaluate science and technology programmes constantly to ensure quality in the system.
2. Administrators of schools must ensure that evaluation is carried out constantly and deficiencies discovered corrected to ensure quality.
3. Government must ensure that adequate funds are provided for development of the science and technology education programmes in schools.
4. Facilities and equipment needed for the programmes must be adequately provided in the schools to ensure quality.
5. Government must also ensure that quality man power are provided in the schools to teach the science and technology subjects.

## References

- Afe, J.O. (1992). The Role of Technological Education in National Development. In P. O. Awotunde (Ed.), Issues in Technology Education for National Development. National Association of Teachers of Technology Monograph Series. Jos: Crown Printers. 1, 9-14.
- Akpan, E.U.U. (1992). The Role of Secondary Education in Technology Education for National Development. In P.O. Awotunde (Ed.) Issues in Technology Education for National Development. National Association of Teachers of Technology Monograph Series. Jos: Crown Printers. 7, 73-84.
- Awokoya, S.O. (1976) Science and National Development Journal of STAN, 4 (3), 12-16.
- Awotunde, P.O. (1992). Towards Improving Technology Education for Technological Development in Nigeria. In P.O. Awotunde (Ed.) Issues in Technology Education for National Development, Monograph Series. Jos: Crown Printers 7, 59-67.
- Bello, O.O and Okafor, P.N. (1999). Evaluating Science Education: Implications for the Learners. In O.O Buseri (Ed.), 40<sup>th</sup> Annual Conference Proceedings of Science Teachers Association of Nigeria on Evaluating Science, Technology and Mathematics Education. (32-36).Ibadan: Heinemann.
- Cangelosi, J.S. (1991). Evaluating Classroom Instruction. London: Longman Publishing Group.
- Ibole, P.M. (1999). Two and Three-Quarter Decades of Integrated Science in Nigerian Educational System: The Journey So Far. In O.O. Buseri (Ed.), 40<sup>th</sup> Annual Conference Proceedings of STAN on Evaluating Science, Technology and Mathematics Education, (156-161). Ibadan: Heinemann.
- Mezieobi, K.A. (1993). Social Studies Curriculum. Owerri: White and White.
- Ofoegbu, S.A. (1997). Women's Adult Education Programme in Abuja, Federal Capital Territory, Nigeria; a Curriculum Evaluation. An Unpublished Ph.D. Thesis, University of Jos.
- Okeke, R.J..(1997). Perceptions of Teachers Regarding the Strategic Learning Activities and Media. • for Primary Science Teaching. Nsukka: University of Nigeria.
- Okoro, O.M. (1991). Programme Evaluation in Nigeria. Obosi: Pacific.
- Saylor, J and Alexander, W.M. (1974). Planning Curriculum for Schools. New York: Holt, Rinehart and Winston, Inc.
- Stufflebeam, D.I. (1973). An Introduction to the PDK Book: Educational Evaluation and Decision Making. In B.K Worthen and J.R. Sanders (Eds.), Educational Evaluation: Theory and Practice. (Pp. 45-53). California : Wadsworth.
- Worthen, B.K. and Sanders, J.R (1973). Educational Evaluation: Theory and Practice. California: . Wadsworth Publishing Co. Inc.-