The Challenges of Implementing Diagnostic Evaluation in Nigerian Secondary School Mathematics Education Programme

Emmanuel A. Edoho, PhD
Department of Science Education
Faculty of Education, University of Calabar, Calabar

&

Ekpo, Idongesit Moses
Department of Science Education
Faculty of Education, University of Calabar, Calabar
e-mail idongmoses@yahoo.com
phone 08023759130

Abstract
Testing and evaluation are viewed as the major instruments for holding schools accountable for the resources (human and financial) they receive. It provides feedback to all stakeholders in the educational sectors including the learners. The integration of the feedback from the evaluation processes gives more input into the teaching-learning process. Evaluation is classified into diagnostic, formative and summative according to use in classroom instruction. This paper examines what diagnostic evaluation is, its application in the Nigerian classroom situation and the challenges militating against its implementation especially in the mathematics classroom. Some of the challenges identified include lack of skills in constructing and administering diagnostic tests and interpreting the scores, large class sizes, poor record keeping culture, examination malpractice, low financial resources allotted to education and classroom activities and non consideration/inclusion of diagnostic period in the scheme/school calendar. Recommendations also made to the relevant stakeholders especially to the government and the training institutions toward the application of diagnostic evaluation and integration of results in the teaching learning process to enhance achievement of the objectives of mathematics education programme. The paper recommends regular capacity building for teachers to be fully abreast with the concept of diagnostic evaluation and its application in the classroom teaching. Improvements in the present infrastructure level in our schools to accommodate the increased number of students as well as incentives to the mathematics teachers are also advocated. It is believed that the integration of diagnostic evaluation into our mathematics teaching and learning would improve students' comprehensive level, reduce students' errors, misconceptions and provide timely mediation measures in achieving learning outcomes. It will also eliminate the inherent fears in students in the learning of mathematics.
Key Words: Evaluation, Diagnostic evaluation, Mathematics Classroom.

Introduction

Mathematics is a compulsory subject at the basic and post basic levels of our educational systems. Most of the skills taught at these levels are very vital and useful. At the basic level, developing children's abilities for mathematization is the main goal of mathematics education. At the post basic level, the aim is to develop the child's resources to think and reason mathematically to pursue assumptions to the logical conclusion and to handle abstraction. This includes a way of doing things, the ability and the attitude to formulate and solve problems. Generally, mathematics is a subject of reason and logic. It is therefore expected from a student of mathematics to acquire knowledge of certain facts and develop a rational mind. It is pertinent therefore that each student has to be assessed to determine his/her readiness for the aforementioned objectives to be met. Classroom evaluation of outcomes is among the instructors' most essential tool and the effective use of it enhances achievements for both the teacher and the learners. Evaluation help identify students' learning needs. Evaluation must therefore be done at the beginning of the learning process to identify where the students are in terms of cognitive, affective and the psychomotor levels of learning; what they need to learn and how (diagnostic). Evaluation has to take place as the teaching/learning process is ongoing (formative) and as the teaching/learning process terminates at each level (summative). Each level of evaluation provides very useful information on the teaching learning process and provides feedback for improvement in the process. This paper discusses Diagnostic Evaluation, the challenges inherent in its implementation in the Mathematics classroom and makes recommendations towards the alleviation of these challenges.

What is Evaluation

Evaluation is an indispensable part of any education system as it helps the teacher to verify if he/she has been successful in transferring the intended knowledge to the pupils. Scriven (1991), points out that Evaluation is the process of determining the merit, worth and value of things and evaluations are the products of that process. According to him, evaluation is not the mere accumulation and summarizing of data, it involves gathering and analyzing the data that are needed for decision making on one hand and getting to conclusions about merit or net benefits based on evaluative premises or standards on the other hand. By this, evaluation is engaged in data gathering, clarification and verification of relevant values and standards.

Cronbach (1965), defines evaluation as the process of ascertaining the decision areas of concern, selecting appropriate information and collecting and analyzing the information in order to report summary data useful to decision makers in selecting among alternatives and is aimed at choosing the most appropriate form of a given situation or activity for the decision maker.

National Open University of Nigeria (NOUN) (2006), sees evaluation as a purposeful educational process which helps in gathering relevant and adequate data about learners' achievement or otherwise of dimensions of behaviour associated with the

educational objectives specified by either the teacher or the curriculum designers for the purpose of instruction. In other words, evaluation can be viewed as the process of determining the degree to which aims and objectives of an educational activity are achieved.

Kant (2019) defines Evaluation as a systematic, continuous process of determining the effectiveness of the learning experiences provided in the classroom. It is a method to decide if the desired goals are achieved by the pupils.

Hoosain and Naranie (1999) see Evaluation as a systematic process of obtaining information for the purpose of making decision. The ultimate purpose of evaluation is therefore decision making. The decision could be about students; teachers, curricular and teaching methods and strategies.

According to Ugodulunwa (2008), evaluation is the process of measuring behaviour of an individual and using the result in taking relevant decision(s) about the individual, curriculum and instruction or a programme. According to her, it also refers to a process of gathering and documenting knowledge, skills, attitudes and beliefs upon which judgment or evaluation can be made. From the above definitions, it should be noted that for effective evaluation, data collected should be relevant and adequate; learners' achievement should be on various dimensions rather than on only cognitive testing and objectives to be evaluated clearly specified and well stated.

Types of Evaluation

In the definitions of evaluation, it is clearly seen that the purpose of evaluation is feedback for decision making. When used for classroom instruction, Esu, Enukoha & Umoren (2016) identified two kinds of evaluation namely formative and summative evaluations. NOUN (2006) identifies three types of evaluation methods namely: Diagnostic evaluation, formative evaluation and summative evaluation. Generally these types are not independent, though they are different. The differences relate to the purpose for which it is conducted. The concern of this paper is mainly on Diagnostic evaluation. According to Kant (2019), this type of evaluation may also be useful during a programme of instruction to identify the specific difficulties that students may be experiencing and to determine why they are having these difficulties. The information obtained can be used to design appropriate remediation, differentiated, and follow-up programmes. According to Umoinyang, Asim, Akwa & Bassey (2004) Diagnostic evaluation supplements formative evaluation and provides an in-depth search for possible source of learning difficulties.

Queenette (2014) noted that Diagnostic tests or activities are designed to uncover individual students' specific misconceptions and developmental level for a particular topic. Hoosain & Naraine (1999) observed that Diagnosis may be done through written and oral tests, written work, and interviews or one-on-one conferences involving the teacher and students. They also emphasized that a combination of different sources of information about students (written work, interviews, observations) is likely to result in a more accurate diagnosis. Wiliam (2009, p. 47) stated, "If the [formative] assessment provides additional information that locates the precise nature of the students'

difficulties, then it is considered to be diagnostic". This definition is similar to the definition of assessment for learning, which Stacey, Price, Steinle, Chick, & Gvozdenko (2009, p. 1) stated "occurs when teachers use inferences about student's progress to inform their teaching; especially teaching close in time to that assessment".
It is primarily used to diagnose students' difficulties and to guide lesson and curriculum planning.

Ofem, Idika & Ovat (2017) saw diagnostic assessment as a form of formative assessment technique that is mostly in the cognitive domain to ascertain students' level of understanding, cognitive ability in a particular content area. According to them diagnostic assessment can be likened to a diagnosis carried out on a patient in order to make the right prescription. Any good doctor that must hit the sickness at once must first diagnose the problem. Accordingly the teacher in the classroom must do same if learners must be helped to improve in their mathematics achievement. According to Gani (2015), Diagnostic evaluation improves teaching and learning in education as it identifies the strengths and weaknesses of students and also as an indicator of the effectiveness or ineffectiveness of the education system. Through diagnostic analysis, teachers can give students the opportunity to improve their knowledge from the known to the unknown (Wiliam, 2009). Weaknesses or misunderstandings can be viewed as a new pathway rather than become a stumbling block forever affecting a student's mathematical comprehension (Widjaja, Stacey, & Steinle, 2008). Furthermore, they opined that the outcome of a well-designed diagnostic evaluation with a proper remediation will go a long way in reducing failure rate in the standardized examinations and improves performance in the area of skill acquisition.

Diagnostic testing generally takes the form of a carefully constructed test (Wiliam,2009). Such tests are crafted to allow not only the developmental level to be made evident to the teachers administering the test, but also the student misconceptions (Steinle & Stacey, 2008). When the answers are viewed, teachers gain an insight into an individual student's understanding of a particular concept (Steinle & Stacey,2008), thus exposing any misconceptions (Widjaja, Stacey, & Steinle, 2010).
Barr, Blacbowicz, Katz & Kaufman (2013) outlined the principles of diagnosis as follows:

1. Diagnosis is a decision making process. Teachers are constantly making decision about individuals or group of students in achieving learning outcomes.
2. Diagnosis process considers the whole learner. This implies that teachers should examine multiple forms of data including past experiences, attitudes, learning styles, interest, strengths and weaknesses, reasons for referrals, conducting interviews with parents etc.
3. Diagnostic evaluation is thorough and balanced
4. Diagnostic is a team effort: it is impossible to single handedly learn about the child from various perspectives like physically, psychologically, emotionally, socially and academically.
5. Determine the specific nature of learning difficulties: Diagnosis of learning difficulties depend on the nature of the difficulty.

6. Determine the factors causing learning difficulties
7. Diagnosis and remediation go hand in hand. The effectiveness of any teaching and learning process depends on teacher understanding the learners' level of mastery of the subject area and is achieved through diagnostic assessment.

A clear analysis of the above definitions vis-à-vis the current state/national condition in our educational sector reveals several challenges that would hinder the implementation of diagnostic evaluation in our classroom settings. Some of the challenges are discussed below:

Challenges of Implementing Diagnostic Evaluation in Mathematics Education Programmes in Nigerian Secondary Schools

1. **Lack of skill to construct good diagnostic test instrument:** The validity and reliability of scores obtained by using any assessment instrument is determined by the level of skill and knowledge of the constructor of the instrument (Oyedeji, 2014). Research studies have shown that most of the Nigeria secondary school teachers lack basic knowledge and skills to construct good assessment instrument, administer and interpret the scores obtained from the assessment of the students (Marcus & Joseph, 2014). Morestill, most teachers lack skills in constructing tests that would not only show scores but would also indicate specific strengths and weaknesses of the learners in certain concepts. A poorly constructed test may lead to wrong conclusions about student knowledge so teachers must be clear of what misconceptions or understandings they are trying to undercover (Widjaja, Stacey, & Steinle, 2010). Likewise, teachers must also be aware of the strengths and weakness of their chosen diagnostic test and use it in conjunction with another means of uncovering misunderstandings if the analysis does not reflect teacher expectations (Widjaja, Stacey, & Steinle, 2010). The analysis received from diagnostic testing should demonstrate to teachers how students think mathematically, and, depending on the style of diagnostic test, how students articulate their understanding. This lack of skill to construct good diagnostic test instrument by teachers possess a major challenge in the administration of diagnostic evaluation.

2. **Large class size and time:** Population explosion in our schools makes it difficult to have effective assessments and evaluations. With the large population in the classroom, especially as mathematics is a general subject, teachers find it difficult to teach talk less of assessment and interpretation of scores. Many formal diagnostic tests are time intensive, as teachers must analyse students answers to uncover students' misconceptions, and pinpoint the learning needs (developmental level) of each student. Once this is completed then the teacher can implement intervention strategies. Tomlinson (2009) suggests that this may be the reason why many teachers do not use formal diagnostic tests even though teachers are aware of the benefits. This becomes very alarming in urban centers and states where free education is completely entrenched in the system.

3. **Absence of proper record keeping and proper monitoring:** Teachers give assignments, projects, classwork and homework and they are hardly marked. In few cases where they are marked, the records are kept in files or lockers but are not used for diagnostic purpose which they are meant for. This is a very critical ethical problem for the students' progress and hinders diagnosis of the students' challenges for correction and improvement.

4. **Examination malpractices:** Government and examination bodies have made every effort to curb examination malpractice, yet the problem still persists even at a more alarming rate. Arijesuyo and Adeyoju (2015) defines examination malpractice as any illegal act committed by a student single handedly or in collaboration with others like fellow-students, parents, teachers, supervisors, invigilators, printers and anybody or group of people before, during or after examinations in order to obtain undeserved marks or grades. With this examination malpractice most of the scores obtained by students do not actually portray the standing of the student in that particular examination. The results of the students do not portray their actual ability in the particular test. This makes diagnostic evaluation difficult.

5. **Lack of understanding of continuous assessment:** One of the most important and significant development in Nigerian educational system was the introduction of the use of continuous assessment. Studies have shown that secondary school teachers do not really understand the meaning of continuous assessment test (e.g Atsumbe & Raymond, 2012). Majority of them take it to be a continuous or periodic testing such as weekly test, bi-weekly test, and test at the end of each unit of the curriculum. Continuous assessment should be used as a measure to ascertain what the child gains in terms of knowledge, industry and character development, taking into accounts all his/her performances in tests, assignments, projects, and other educational activities during a given period of term, year or during the entire period of and educational level. The scores generated during the continuous assessment could be used for diagnosis. This is at variance with the regular practice.

6. **Resources:** The main reason "good" educational programmes flop in practice have to do with resources. In most States and the Nation, education has a low budget size, and the task of educators is to do the best they can with the lean resources provided. Diagnostic evaluation requires funding for testing, analysis and interpretation of results for further feedback. Paucity of funds therefore poses a threat to this process especially as the class-sizes in our schools are not friendly.

7. Non inclusion of Diagnostic evaluation in the scheme of work or the curriculum or in the schools' academic calendar makes it less important and attracts less

attention by the teachers as they focus more on formative and summative evaluation. Diagnostic evaluation requires some processes and procedures to make it effective. As such, lack of dedicated and committed teachers will constitute a serious problem to the setting, administration, marking and scoring of meaningful diagnostic tests (Adebule, 2005).

Recommendation

Based on the challenges highlighted, the following recommendations are made:

1. For teachers, there should be regular capacity building workshops, in-service trainings and seminars to update the teachers in testing and evaluation as well as interpretation of results for feedback and integration of feedback into the teaching learning process.

2. Since there is a dire need for free and compulsory education at all levels in the country the expectation of reduction in school enrolment is a near impossibility. Consequently, the government should urgently embark on the building and equipping of more schools and also employ more teachers in all fields to reduce student/teachers ratio in schools. Adequate trainings should be done to empower the employed teachers.

3. Emphasis should be placed on testing, evaluation and feedback integration during the training of pre-service teachers. The process of Diagnostic evaluation should serve as a core area in Testing, measurement and Evaluation courses. The importance of continuous assessment and feedback integration as core for Diagnostic evaluation should be emphasized.

4. Enough provision/resources should be made available by the Government and other stakeholders to school continuous assessment specialists/counselors in all schools to ensure safe-keeping of records, retrieval and referrals.
5. Incentives or motivation should be provided by employers and relevant stakeholders for mathematics teachers who have the responsibilities of teaching and scoring all the students script almost on daily
6. Provision should be made by the curriculum developers, school authorities and classroom teachers in the curriculum and schools academic calendars for diagnostic evaluation. Rewards should be provided for students who have improved in their performances based on the integration of feedbacks from the diagnostic assessments; and not only on those who have always performed exceptionally.

Conclusion:

This paper examined the concept of evaluation types of evaluation with emphasis on diagnostic evaluation. The challenges facing the implementation of diagnostic evaluation in Nigerian secondary schools systems were discussed. Some of the challenges include: Lack of adequate skill on the part of the part of the teachers to

construct and administer good diagnostic test instrument; large class size; absence of proper record keeping and monitoring; examination malpractices by the students; inadequate resources including human and financial as well as non inclusion of periods for diagnostic evaluation in the curriculum or school calendar. The paper recommends regular capacity building for teachers to be fully abreast with the concept of diagnostic evaluation and its application in the classroom teaching. Improvements in the present infrastructure level in our schools to accommodate the increased number of students as well as incentives to the mathematics teachers are also advocated. It is believed that the integration of diagnostic evaluation into our mathematics teaching and learning would improve students' comprehensive level, reduce students' errors, misconceptions and provide timely mediation measures in achieving learning outcomes. It will also eliminate the inherent fears in students in the learning of mathematics.

References

Adebule, S. O (2005). Functional assessment for quality education in Nigeria. *International Journal of Research in Education 2* (1 & 2), 173- 180

Atsumbe, B. N & Raymond, E. (2012). Problems of implementing continuous Assessment in Primary Schools in Nigeria. *Journal of Education and Practice ,3* (6) 71 -77.

Barr. R., Blacbowicz, C. T., Katz, C. & Kanfman, B. (2013). Principles of diagnosis. Retrieved from www.reading. ccsuedul. case study.pdf

Cronbach, L. (1965). "Course Improvement through Evaluation". *Teachers College Record,64,* 672-683.

Esu, A. E. O., Enukoha, O. I. & Umoren, G.U. (1998). *Curriculum Development in Nigeria for Colleges and Universities.* Calabar. Stifaith Prints.

Gani, P. S. (2012). Diagnostic assessment of senior secondary two students achievement in qualitative aspects of Economics in Akwanga Educational Zone, Nassarawa State *Unpublished MED Thesis,* Department of Educational Foundations, University of Jos.

Hoosain, E. & Naraine, B. (1999). Evaluation in the mathematics Classroom. *Humanistic Mathematics Network Journal, vol. 21,* article 9.

Kant, S. (2019). Evaluation methods (Pedagogy of Mathematics). "https///grade up. Co/study notes on –evaluation-methods pedagogy-of mathematics.

Lundberg, F. C (2006). Evaluation: definitions, methods and models. *An ITPS framework. Working paper R 2006 .002.* Sweedish Institute for growth policy studies. Sweden.

Marcus, A. C & Joseph, E. A. (2014). Science Teachers and continuous assessment implementation in secondary schools: competence and effects, *Journal of Research and Method in Education (I0SR – JRME) 4(4)* 36 – 41.

National Open University of Nigeria (2006). Mathematics Curriculum and instructions in secondary schools. Lecture notes.

Ofem, U. J., Idika, D.O., & Ovat, S. V., (2017). Effect of Diagnostic and feedback approaches in enhancing achievement in mathematics among secondary school students in Calabar Municipality, *International Journal of Scientific Research in Education. Vol. 10*(2) 221 – 227.

Oyedeji, S. O. (2014). Educational Assessment in Nigerian Secondary Schools: Historical analysis, challenges and prospects. https://www.academic.edu/15924391.

Queenete, J. (2014). Diagnostic testing and changes to teaching practice in Year 9 mathematics classes. *Unpublished MED thesis.* Melbourne Graduate school of Education, The University of Melbourne.

Scriven, E. (1991). *Evaluation thesaurus.* Beverly Hills, CA, SAGE Publications.

Stacey, K., Price, B., Steinle, V.,Chick, H., & Gvozdenko, E. (2009). SMART assessment for learning. *Paper presented at the conference of the International society for design and development in Education.* Carious, Australia. September,28- October,1.

Steinle, V.,& Stacey, K. (2008). What does three quarters look like? Students' representation of three quarters. In M.Goos, R. Brown & K. Maker (Eds). *Navigating currents and charting directions.* Proceedings of the 31st Annual conference of the Mathematics Education Research Group of Australia. pp483-489. Brisbane: MERGA.

Tomlison, C. (2009). The issue: Differentiated instruction. *Theory into Practice 44*(3) 183-184

Umoinyang, I. E., Asim, A. E., Akwa, A. M. & Bassey, S.W.(2004). *Principles and techniques of educational assessment and evaluation.* Calabar: Helimo Assosiates

Ugodulunwa, C. A. (2008). *Foundational of educational measurement and evaluation*. Jos. Fab Educational Books.

Widjaja, W., Stacey, K & Steinle, V (2010). Locating negative decimals on the number line: Insights into the thinking of preservice primary teachers. *Journal of Mathematical Behaviour 30* (1) 80-91.

William, D. (2009). An integrative summary of the research literature and implications for a new theory of formative assessment. In Audrade, H.L.& Gizek, G.J (Eds). *Handbook of formative assessment* (pp38-64). England, Abingdon Publishers.