FORMATIVE ASSESSMENT SKILLS AMONG BASIC SCIENCE TEACHERS IN SECONDARY SCHOOLS IN NSUKKA EDUCATIONAL ZONE OF ENUGU STATE

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Abstract

This study explored teachers' formative assessment skills in Basic Science in secondary schools. The study employed descriptive survey research design. The researchers developed an Observational Schedule on Teachers' Formative Assessment Skills (OSTFAS) which was used for data collection. Cronbach alpha was used to determine the internal consistency of the instrument. The sample comprises 50 Basic Science teachers drawn from the population of all the Basic Science teachers in junior secondary schools in Nsukka educational Zone of Enugu State using multistage sampling procedure. Mean and Standard deviation were used to answer the research questions while analysis of variance (ANOVA) and independent sample t-test statistics were used to test the null hypotheses at 0.05 level of significance. The result shows that academic qualifications, years of teaching experience and gender of Basic Science teachers have influence in the display of formative assessment skills. However, academic qualifications and gender have no significant influence on the formative assessment skills. The study recommended among others that teachers should be provided with an opportunity for an intensive in-service training and workshops on how to improve on their formative assessment skills, for a better teaching and learning in schools.

Keywords: Formative assessment, Basic Science, formative assessment skills, secondary school teachers.

Introduction

Basic science is a unifying science subject which is taught at the lower, middle and upper basic education levels. It lays the foundation for the study of pure science subjects like Biology, Chemistry and Physics at both senior secondary school and tertiary institution

levels Furthermore, it helps researchers understand living systems and life processes that leads to better ways to predict, prevent, diagnose and treat diseases. Based on this, the teaching and assessment in this subject should be done in such a way that students would gain the knowledge of science and have the zeal to study it at their future academic levels. For the teacher to effectively do this, both the teaching method and type of assessment used, should be one that engages students actively, and in turn tries to bring out the best in them. This is because, Basic Science as a subject engages students in science from the start as well as prepares students for further studies in science of various subjects in secondary schools and higher institutions. The importance of basic science in the development of students' creative thinking ability, knowledge and skills for better decision making in life, justify the need to assess teachers' formative assessment skills in teaching Basic Science in schools.

The role of assessment as an integral part of teaching and learning is important as it helps in gathering reliable information for both teachers' and students' use. The assessment of human abilities started as early as about 4,000 years ago when china used written test to rate applicants for civil service until it gradually found its way to the field of education. Today, assessment is indispensable in making certain degree of justification to the extent to which learning has taken place. Nworgu, (2015) observes that teaching and learning cannot be said to have taken place without appropriate and adequate testing. During assessment, the teacher is able to draw informed decisions about students' performance, and also provides a feedback on how teaching and learning took place. The assessment however, allows teachers to make further decisions about other stages involved in the process of teaching and learning. For an assessment to be effective, it should be patterned and developed based on the principles of effective assessment practices. To develop an effective assessment, several steps including planning how to assess, identifying the learning goals and targets, writing good quality items, using marking practices, and selecting an assessment form (Chatterji, 2003).The criteria for selecting a form of assessment should be based on the impact of the assessment on expected students' learning outcomes, validity, reliability and feasibility. Assessment however focuses on some fundamental questions: what to assess, how to assess, why we assess and ways in which information obtained from assessment is used to shape teaching and learning processes (Lau, 2016; Pellegrino, 2016).

As a result, assessment is viewed from three basic dimensions: assessment for learning assessment of learning and assessment as learning. This classification is made based on the purpose of assessment. Assessment for learning is described as formative assessment, assessment of learning is described in terms of summative type of assessment and assessment as learning is the participatory assessment procedure (Siarova, Sternadel & Masidlauskaite, 2017). This study however, focuses on the formative type of assessment.

Several authors have come up with different definitions to suit the true meaning of formative assessment. Formative assessment is an assessment that tends to shape and enhance effective learning. Siarova et al (2017) see formative assessment as activities undertaken by teachers and by their students in assessing themselves with the sole aim of providing information which will be used as feedback to modify teaching and learning activities. Formative assessment is employed in a classroom setting to aid instructional procedures. Whatever outcome obtained at the end of any instruction constitute all the activities emanating from the very beginning of that lesson; and to ensure proper child development, the teacher should be able to assess the students at intervals, as instruction is still ongoing. A teacher cannot say if a child is performing well or not, by assessing them only at the end of instruction. This is because; there are series of conditions that might have occurred, which will affect the students' performance if the assessment is only taken at the end of the lesson, which the teacher might not be aware of. Such conditions may include exam malpractice, students developing exam fever, test anxiety, or chances of the students even falling sick during the course of being assessed at the end of an instruction, and this might affect the overall performance of such students either positively or negatively. So, it is imperative for the teacher to always take cognizance of students' performances during the process of instruction. This will enable the teacher make a concrete judgment about the ability of the students individually. In line with this, Arrafi and Sumarni (2018) describe formative assessment as the type of assessment done in the classroom, which is inseparable from students' improvement purposes; this is because it is used to obtain information about students' learning through the collection of an evidence of their performance, and using this evidence to improve their quality.

Formative assessment is composed of a variety of tools that help provide feedback to teachers or students more effectively, hence, the need for assessing the formative assessment skills displayed by basic science teachers in secondary schools. There are certain qualities the teacher should possess for him or her to effectively carryout formative assessment. These skills include: ability to create an interactive classroom environment, ability to ask cognitive challenging questions in the course of instruction, ability to identify and manage differences among students in terms of speed of learning, ability to combine instructional strategies in the course of teaching and learning, ability to challenge students inquiry skills by offering ideas and questions to contrast meaningful knowledge, and so on.

Gender is an attribute socially ascribed to differentiate males from females. According to Udosoro (2011), gender is a cultural construct that distinguishes the roles, behaviour, mental and emotional characteristics between males and females developed by a society. Gender has always been an issue of concern to science teachers and researchers especially as some subjects have been ascribed to be mainly for the male teachers or female teachers. Another variable studied in this paper is teachers' years of experience.

Teachers' years of experience in this context is defined as the length of time spent by the teacher in gathering relevant skill set and pedagogical knowledge for effective classroom delivery. These experiences are usually measured by the number of relevant workshops, symposia and even conferences attended by the teacher. Teachers who have spent a long time in the field are generally believed to have gathered relevant experiences and will possibly be more effective in delivering curriculum content. The effectiveness of a teacher with several years of experience in the field however does not cancel out the importance of the teacher's qualifications.

Teachers' qualification is one of a number of academic and professional degrees that enable a person to become a registered teacher (Mbonu, 2019). These teaching qualifications may include TCII, NCE, B.Ed/BA/B.Sc Ed, PGDE, M.Ed and PhD. It is thought that the higher the qualification, the more effective the teacher becomes. This paper therefore sought to discover the extent to which gender, teachers' years of experience and academic qualifications influence the formative assessment skills of the basic science teacher.

Learning processes however, do require skills to elicit the thinking that underlie students' oral and written responses as well as the capacity to make suitable instructional decisions based on this thinking. For teachers to deviate from teacher-centered classrooms to incorporating formative assessment into student-centered instruction, they must have the knowledge as well as the skills necessary to be successful. Teaching students how to learn, think, solve problems and take realistic decisions can be described as problem based learning process.

The understanding of the importance of science by educators made them believe that science education should start much earlier in a child's life not only to teach them problem solving skills but also engages them in science from the start. The teacher employs these skills in teaching and learning for development of interest in science, acquisition of basic knowledge and the application of scientific knowledge to meet contemporary societal needs, understanding and identifying career opportunities in science (FRN, 2013).

Studies have revealed that in most situations, you get to discover that some students might perform excellently in an end of term examination but do not perform so well when given a short quiz in a form of formative assessment, in the course of teaching and learning. This may make one to wonder if the teachers do not possess the required skills to assess these students formatively or that they do not adequately possess them, or if they possess the skills but rather feel it is not necessary to incorporate them during the period of instruction. The outcome of this study will enable the researchers and the general public to know where the problem of poor performance of students in Basic Science, come from. The general purpose of this study was to determine teachers' formative assessment skills in Basic Science in secondary schools.

Research Question

The study was guided by the following research questions:

1. What is the influence of academic qualification on formative assessment skills possessed by Basic Science teachers?
2. What is the influence of years of teaching experience on formative assessment skills possessed by Basic Science teachers?
3. What is the influence of years of gender on formative assessment skills possessed by Basic Science teachers?

Research Hypotheses

Three hypotheses were formulated and tested at 0.05 level of significance

1. There is no significant influence of academic qualification on formative assessment by Basic Science teachers.
2. There is no significant influence of years of experience on formative assessment by Basic Science teachers.
3. There is no significant influence of gender on formative assessment by Basic Science teachers.

Methods

The Descriptive survey research design was adopted for the study, which according to Nworgu, (2015), is a design used for studies that aim at collecting data on, and describing in a systematic manner, the characteristics, features or facts about a given population. This design is ideal for the study because the study seeks to assess the formative assessment skills among Basic Science teachers in junior secondary schools. The study was carried out in Nsukka educational Zone of Enugu State, Nigeria. The zone comprises of Nsukka, Uzu-Uwani, and Igbo-Etiti Local Governments Areas. The study adopted multistage sampling procedure. In the first stage, simple random sampling technique by balloting with replacement was used to select two Local Government Areas out of the three; Nsukka and Igbo-Etiti emerged. At the second stage, the technique of simple random sampling by balloting with replacement was also used to select 50 schools i.e. twenty five schools from each of the selected Local Government Areas. In each school, one Basic Science teacher was selected for the study. Hence, a sample of fifty (50) teachers was used for the study. The OSTFAS contains two section A and B. Section

The method of data collection was observation. An Observational Schedule on Teachers' Formative Assessment Skills (OSTFAS) as the instrument for data collection. The

OSTFAS contains two sections A and B. Section A contains demographic data of the respondents and section B contains the item statements, with a total of twenty five (25) items which sought information on teachers' formative assessment skills. The response format was modeled on a four (4) point Likert type scale of Very High Extent (VHE), High Extent (HE), Low Extent (LE) and Very Low Extent (VLE), with numerical values of points of 4, 3, 2, and 1 respectively, to seek information on formative assessment by teachers. This was used to classify teachers' formative assessment skills into high or low scores. Based on the OSTFAS, a score of 50 and above implies high influence (HI) while a score of 49 and below implies low influence (LI). This is in line with Schwarzer and Jerusalem's (1995) criteria and Alivernini and Lucidi's (2008) criteria.

The OSTFAS instrument was subjected to face validation by giving the draft copies to three experts in measurement and evaluation, faculty of education, university of Nigeria, Nsukka. Four research assistants were employed and properly trained on the modalities and to expect from each teacher at each stage of using the guidelines in the schedule. The researchers and the research assistants visited the schools three (3) consecutive times and observed the basic science teachers as they teach the students. The researchers and the research assistants recorded their observations on the formative assessment skills possessed and/or exhibited by the teacher using the guide (schedule). Mean and standard deviation were used to answer all the research questions based on the data collected, Analysis of variance (ANOVA) F-teststatistics was used to test the null hypotheses 1 and 2 while independent sample t-test statistic was used to test the null hypothesis 3 at 0.05 level of significance.

Results

Research Question 1: What is the influence of academic qualification on formative assessment skills possessed by Basic Science teachers?

Table 1: Mean and standard deviation of the influence of academic qualification on formative assessment skills possessed by Basic Science teachers

Academic Qualification	N	$\overline{X}$	SD	Dec.
NCE	21	54.63	1.75	HI
BSc	11	39.72	2.12	LI
MSc	18	63.70	1.96	HI

Key: N = Number of respondents, $\overline{X}$= mean, SD = Standard Deviation, Dec = Decision, LI = Low Influence, HI = High Influence
Minimum score of 25 and maximum of 100

The result in Table 1 shows the influence of academic qualification on formative assessment skill of Basic science teachers. The result showed that the mean ratings of 54.63, 39.72 and 63.70 with a standard deviation of 1.75, 2.12 and 1.96 for NCE, BSc and MSc respectively. This result indicates that Basic Science teachers with MSc and NCE had higher mean ratings in basic science than those with BSc. This means that MSc and NCE as an academic qualification appeared to have high influence on formative assessment skill of Basic science teachers.

Research Question 2: What is the influence of years of teaching experience on formative assessment skills possessed by Basic Science teachers?

Table 2 : Mean and standard deviation of the influence of years of teaching experience on formative assessment skills possessed by Basic Science teachers

Years of teaching Experience	N	$\overline{X}$	SD	Dec.
0 – 5	4	42.66	2.17	LI
6 – 10	29	59.76	1.88	HI
Above 10	17	72.62	1.63	HI

Key: N = Number of respondents, $\overline{X}$= mean, SD = Standard Deviation, Dec.= Decision, LI = Low Influence, HI = High Influence

The result in Table 2 shows the influence of years of teaching experience on formative assessment skill of Basic science teachers. The result showed that the mean ratings of 42.66, 59.76 and 72.62 with a standard deviation of 2.17, 1.88 and 1.63 for 0 – 5, 6 – 10 and above 10 for years of teaching experience respectively. This result indicates that Basic Science teachers with 6 – 10 and above 10 years of teaching experience had higher mean ratings in basic science than those with 0 – 5 years of teaching experience. This means that 6 - 10 and above 10 years of teaching experience appeared to have high influence on formative assessment skill of Basic science teachers.

Research Question 3: What is the influence of years of gender on formative assessment skills possessed by Basic Science teachers?

Table 3: Mean and standard deviation of the influence of gender on formative assessment skills possessed by Basic Science teachers

Gender	N	$\overline{X}$	SD	Dec.
Male	33	63.15	1.57	HI
Female	17	62.98	1.64	HI

Key: N = Number of respondents, $\overline{X}$= mean, SD = Standard Deviation, Dec.= Decision, LI = Low Influence, HI = High Influence

The result in Table 3 shows the influence of gender on formative assessment skill of Basic science teachers. The result showed that male Basic science teachers had a mean rating of 63.15 with a standard deviation of 1.57 while their female counterparts had a mean rating of 62.98 with a standard deviation of 1.64. The mean ratings for male teachers is slightly higher than that of their female counterparts. This implies gender appears to have a slight influence on formative assessment skill of Basic science teachers in favour of the males.

Hypothesis 1: There is no significant influence of academic qualification on formative assessment by Basic Science teachers.

Table 4: Analysis of variance on the influence of academic qualifications on formative assessment skills of Basic Science teachers

	Sum of squares	df	mean sum of squares	f	sig.
Between Group	26.376	2	13.188	1.679	0.394
Within Group	369.091	47	7.853		
Total	395.467	49			

Table 4 shows that the calculated value of f (1.679) for the influence of academic qualifications of Basic Science teachers on formative assessment skills is 0.394. Thus, influence of academic qualifications of Basic science teachers on formative assessment skills is not significant since the probability value is greater than 0.05 level of significance.

Hypothesis 2: There is no significant influence of years of teaching experience on formative assessment by Basic Science teachers.

Table 5: Analysis of variance on the influence of years of teaching experience on formative assessment skills of Basic Science teachers

	Sum of squares	df	mean sum of squares	f	sig.
Between Group	80.119	2	40.060	5.971	0.047
Within Group	315.347	47	6.709		
Total	395.467	49			

Table 5 shows that the calculated value of f (5.971) for the influence of years of teaching experience of Basic Science teachers on formative assessment skills is 0.047. Thus, the influence of years of teaching experience of Basic Science teachers on formative assessment skills is significant since the probability value is less than 0.05 level of significance.

Hypothesis 3: There is no significant influence of gender on formative assessment by Basic Science teachers.

Table 6: t – test analysis on the influence of gender on formative assessment skills of Basic science teachers

Gender	N	$\overline{X}$	SD	t-value	Df	p	Dec.
Male	33	63.15	1.57	0.35	48	0.61	NS
Female	17	62.98	1.64				

Key: N = Number of respondents, $\overline{X}$= mean, SD = Standard Deviation, t-val= t-test value, df= degree of freedom, p= Associated Probability Value, Dec = Decision, S=Significant

The result in Table 6 also showed that a t-value of 0.35 with an associated probability value of 0.61 was obtained with respect to the influence of gender on formative assessment skills of Basic science teachers. Since the associated probability value of 0.61 when compared with 0.05 set as the level of significance was greater and found not significant, the null hypothesis three (H_{03}) was not rejected. Therefore, inference drawn was that there was no significant influence of gender on formative assessment by Basic science teachers.

Discussion of Findings

From the findings, academic qualifications of Basic Science teachers have influence in the display of formative assessment skills. This was further explained in the result of the hypothesis that there is no significant influence of academic qualifications on the formative assessment skills of Basic Science teachers. This is in line with OECD (2013) that assessment competencies which the teachers acquire in initial teacher education and professional development enhance their display of these formative assessment skills. David (2016) also reported that it is not about teachers' qualification but about teachers innate potentials; teachers who are effective at improving some outcomes often are not equally effective at improving others.

The findings show that years of teaching experience of Basic Scence teachers have influence in the display of formative assessment skills. Furthermore, the hypothesis gives an indication that the influence was significant among the various years of teaching experiences. Variations in the teachers' ideas as identified by Silver (2015) are factors

that influences there assessment processes and skills. Years of teaching experiences would influence teachers' formative assessment of their students (Alotaibi, 2011). Alkharusi, (2011) pointed out that the differences in assessment strategies of lecturers might have been due to the experience or the assessment courses undertaken by the lecturers to their counterparts at the lower levels during their academic careers. Alkharusi further explained that Teacher's improvement in assessment and practices is a gradual process, which is associated with time or experience.

The findings show that gender has high influence on the formative assessment skills of Basic Science teachers. The result from the hypothesis also shows that the difference in the formative assessment skills displayed by Basic science teachers with respect to gender is not significantly different between the male and female teachers. This is in line with Alkharusi, (2011) report that there is no statistically significant gender difference in the self-perceived assessment skills among teachers.

Conclusion/Recommendations

Since formative assessment corrects the anomaly of students being faced with challenges such as anxiousness, disruptiveness, nervousness, fear-drivenness, and loss of confidence which as a result, may pose a big challenge as their real abilities may not be adequately ascertained. The however recommend that:

1. There should be a re-orientation of teachers, emphasizing the importance and need for formative assessment techniques in assessing students' learning processes, which is geared towards improving learning.

2. Teachers should be provided with an opportunity for an intensive in-service training and workshops on how to improve on their formative assessment skills, for a better teaching and learning in schools.

3. The ministries of education (Federal and State) should work collaboratively with school principals and school administrators in the provision of basic formative assessment tools necessary for the deployment of formative assessment strategies by subject teachers.

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