Research Paper

Rubric-Referenced Self-Assessment – An Empowering Tool For Basic Education Students' Learning In Basic Science, Taraba State, Nigeria.

Samuel Garpiya Bileya
Department of Science Education Taraba state University, Jalingo

Danjuma Gideon Stella
Department of Science Education Taraba State University, Jalingo

ABSTRACT
The use of rubric-referenced self-assessment in the learning of basic science was investigated in this study. Quasi experimental design was used for the study. The population of the study was 85 students. 2 intact classes of 42 and 43 Upper basic II students were used as sample of study. 2 objectives, 2 research questions and 2 hypotheses were raised. Basic Science Achievement Test (BSAT) developed by the researchers, was used for data collection. The reliability coefficient of the instrument using Kuder Richardson coefficient of internal consistency was found to be 0.80. Mean and standard deviation were used to answer the research questions while the hypotheses were tested using ANCOVA at 0.05 level of significance. Result obtained indicated that students under Rubric-Referenced self-assessment strategy score higher than those taught using a conventional method. It was therefore concluded that Rubric-Referenced self-assessment strategy empower students' learning in basic science. It was recommended among others that Rubric-referenced self-assessment strategy should be used to enhance the teaching and learning of Basic Science.
KEYWORDS: Achievement, Basic science, Gender, Rubrics and Self-assessment.

I. INTRODUCTION

Basic education is elementary to human and societal growth. It is the foundation upon which other levels of education are built and a necessary prerequisite for human and national development. Basic education was introduced into the Nigerian educational system under the Universal Basic Education (UBE) program. UBE is a reformed program in Nigeria's basic education delivery system, (from basic 1 to basic 9) designed to reinforce the implementation of the National Policy on Education (NPE) with the aim of providing greater access and establish quality learning all over the federation as it is open and essential (Danjuma 2015). The Universal Basic Education (UBE) covers the Primary and the first three years of Secondary School usually known as the Junior Secondary School (JSS). The Universal Basic Education is designed to ensure free access to education, reduce the rate of dropout to the minimum, make education relevant to the needs of learners and make education a lifelong enterprise (Aboluwodi 2015). In the same vain, Etuk, Ering and Ajake (2012), opined that the primary target of the UBE policy was ensuring that every Nigerian child acquires a minimum of 9 years basic education. The enumerated objectives, among other reasons, are supposed to prepare upper basic students for the study at the secondary school level. One of the core and compulsory subjects in the basic education programme is Basic Science.

Basic Science by conception and definition emphasized the content as well as the process of science, the development of mental skill, acquisition of appropriate motor capabilities and the evolution of positive attitude amongst others (Datom, 2015). Basic Science refers to the basic training in scientific Skills required for human survival, sustainable development and society transformation. It also makes a particular contribution to developing powerful ways of thinking within science and more importantly beyond science. This skill enables the child acquire a valued and valuable part of culture which will go a long way in preparing students to handle the challenges of the 21st century learning which according to Koay (2013), is focused on the four pillars of

---

learning with the aim of preparing learners to deal with all societal challenges at all times. Consequently, the teaching and learning of basic science emphasizes learner-centered instruction which is in line with the objectives of basic science teaching and learning.

According to Agogo (2017) these objectives include enabling the learners to acquire skills in:
  i. Thorough and careful observation,
 ii. Accurate and complete reporting of observation.
iii. Organizing acquired information from observation
 iv. Making generalization based on acquired information.
  v. Making predictions based on the information acquired.
 vi. Partake in experiments and class activities
vii. Use of models in explaining phenomena

These objectives of basic science teaching and learning encourage student-centered active learning where the teacher is merely a guide and a facilitator of instruction. In spite of the relevance of Basic Science as the basis on which scientific and technological studies rest, the achievement of students in the subject has been reported to be poor (Ochu & Haruna, 2015). Basic Science teachers are poorly trained in both content knowledge, assessment techniques and pedagogy (Ibe, 2008 as cite in Datom, 2015).This could be one of the factors responsible for low achievement in secondary school science since the subject is the foundation of science education in Nigeria. Hence, a need to try out other instructional strategies and assessment techniques such as rubrics as a self-assessment tool.

Panadero, Jonsson and Strijbos (2016) defined self-assessment as a technique through which students assess and possibly evaluate the qualities of their own learning processes and products. Self-assessment occurs when a student assesses and makes judgments about the progress of his/her own work. Self-assessment promotes independent learning, helping pupils to take increasing responsibility for their own progress. Students do not become self-evaluative overnight (Udoh, 2015). Hence the purpose of self-assessment is to generate feedback that promotes learning and improvements in performance. Rubrics as a self-assessment tool can be used as a reflective tool for students to revise their papers which provides concrete revision plans for students to pay attention to in order to attain higher grades. Students not only learn how to revise their papers, they also learn to set higher expectations in their learning experiences (Chamcharatsri, 2016). A rubric is a scoring tool that lays out the expectations of a task or assignment across 3 to 5 levels of performance which is used to state standards, instructional goals and objectives for the type of performances that students should be able to achieve while completing a task (Chowdhury, 2019). Thus rubrics are referred to something that is used to confidently guide and direct students towards achieving success. A rubric divides the assigned work into separate components and provides clear description of characteristics of work associated with each component, at varying levels of mastery (Tshering, & Phu-ampai, 2018).
Chowdhury (2019) highlighted the benefits of using Rubrics as follows;
1. Notifies Students of Expectations
2. Provides Informative and Timely Feedback
3. Helps to Maintain Grading Consistency and Fair Assessment
4. Fosters Student Learning and Self-Assessment

Students portray a positive attitude and perception on the use of rubrics for its support in learning process (Eshun & Poku, 2013; Kulprasit, 2016; Raposo-Rivas 2016). As important as the benefits of the use of rubrics is to learning, students' gender could have an influence on basic science students' use of the assessment tool for learning.

Gender is the range of physical, biological, mental and behavioural characteristics pertaining to and differentiating between the feminine and masculine (female and male) population (Filgona, 2017). Nwona and Akogun (2015) noted imbalance against girls in science, technology and mathematics. Gender had no effect on academic performance of students (Eravwoke, 2011). Oludipe (2012) investigated the influence of gender on Junior Secondary School Student's academic achievement in basic science Findings of the study revealed that there was no significant difference between the academic achievement of male and female students. However, the results of Odagboyi (2015) showed that there was a significant difference between students' achievement in favour of the males. These findings gave room for inclusion of gender as a moderating variable for this study.

Purpose of the Study
This research is concerned with empowering Basic science education learning through the use of Rubric-Refrenced Self-assessment in Basic science. Specifically the study intends to;

1.   Find out the difference in the mean achievement scores of students assessed using rubric-referenced self-assessment and those assessed without the use of rubric-referenced self-assessment in Basic Science.
2.   Find out the difference in the mean achievement scores of male and female students assessed using rubric-referenced self-assessment in Basic science.

Research Questions
1.   Is there any difference between the mean achievement scores of students assessed using rubric-referenced self-assessment and those assessed without the use of rubric-referenced self-assessment in Basic Science?
2.   Is there any difference between the mean achievement scores of male and female students assessed using rubric-referenced self-assessment in Basic Science?

Hypotheses

HO_1; There is no significance difference in the mean academic achievement scores of students assessed using rubric-referenced self-assessment and those assessed without the use of rubric-referenced self-assessment.
HO_2; There is no significance difference in the mean academic achievement scores of male and female students assessed using rubric-referenced self-assessment.

II.   METHODOLOGY
This study adopted the quasi-experimental design. Specifically the pre-test post-test non-equivalent control group design. The study was carried out in Jalingo education zone, Taraba State, Nigeria. The sample for the study was drawn using multi stage sampling technique. Out of the 3 local government areas in the education zone under study, Jalingo local government area was selected using simple ransom sampling. 2 government owned co-educational schools with 3 streams of upper basic II classes were purposively selected. This was followed by the sampling of 1 intact classroom from each of the sampled schools using random sampling making a total of 2 intact classrooms. One of the 2 intact classes was designated experimental group while the other class was designated control group. Eighty five (85) upper basic II science students drawn from the two intact classes out of which 34 are females and 51 are males were involved in the study. In all, 46 students were used for treatment group and 39 students were used for control group. The instrument used for data collection developed by the researchers was a 31 item multiple choice test developed by the researchers tagged Basic Science Achievement Test (BSAT). The instrument covered the two main topics in the basic science curriculum: Work, Energy, and Power and Simple machines. Using Kuder Richardson coefficient of internal consistency for the instrument was found to be 0.80. To control for possible pre-existing differences in overall ability between the experimental and control groups a pretest was administered to both groups before the commencement of the experiment in the respective schools. The experimental group was taught with rubric-referenced self-assessment strategy while the control group was taught with conventional strategy using the same content outline for four weeks.

Research questions were answered using mean and standard deviation while the hypotheses were tested at 0.05 alpha level significance using analysis of Co-variance (ANCOVA).

III.   RESULTS
Research Question 1: Is there any difference between the mean achievement scores of students assessed using rubric-referenced self-assessment and those assessed without the use of rubric-referenced self-assessment in Basic Science?

Table 1: Mean and Standard Deviation of achievement Scores of Students assessed using rubric-referenced self-assessment and those assessed without the use of rubric-referenced self-assessment in Basic Science.

Group	N	Type of test	Mean	Mean Gain	Standard Deviation
Control	39	Pretest	15.69		4.555
	39	Posttest	17.38	1.69	3.978
Treatment	46	Pretest	22.98		5.166
	46	Posttest	34.50	11.52	4.070

Table 1 show the mean scores and standard deviations in the achievements of students assessed using rubric-referenced self-assessment and those assessed without the use of rubric-referenced self-assessment in Basic Science. It is observed that the mean scores of students in the control group is 15.69 in pretest and 17.38 in posttest, while their standard deviations are 4.555 and 3.978 for achievement test. Students in the

experimental group have the mean scores of 22.98 and 34.50 in pretest and posttest respectively and standard deviations of 5.1 66 and 4.070. It was further observed that the mean gain scores for control and experimental group are 1.69 and 11.52 respectively. This implies that rubric-referenced self-assessment strategy favoured students more than the conventional assessment strategy where students were assessed without the use of rubric-referenced self-assessment. This further suggested that rubric-referenced self-assessment approach could empower students' learning in basic science.

Research Question 2: Is there any difference between the mean achievement scores of male and female students assessed using rubric-referenced self-assessment in Basic Science?

Table 2: Mean Achievement Scores and Standard Deviation of Male and Female Students assessed using rubric-referenced self-assessment in Basic Science

Group	N	Type of test	Mean	Standard Deviation
Male	28	Pretest	23.43	4.417
		Posttest	34.93	3.671
Female	18	Pretest	22.28	6.229
		Posttest	33.83	4.656

Table 2, shows the results of data analysis based on research question two. It indicates that the male students obtained higher mean scores in the Pre-test and Post-test of the Basic science Achievement test than the female students. The table also indicates that both the scores for the male and female students in the Post - test were higher than the Pre-test results for the two groups.This indicates that rubric-referenced self-assessment and gender interact to students' achievement in Basic Science.

Hypotheses
The hypotheses that guided the study are stated below, and their results are placed in table 4.
HO_1: There is no significance difference in the mean achievement scores of students   assessed using rubric-referenced self-assessment and those assessed without the use of   rubric-referenced self-assessment.
HO_2: There is no significance difference in the mean achievement scores of male and female students assessed using rubric-referenced self-assessment.

Table 3. Results of Data Analysis (**Analysis of Covariance**) and Test of Hypotheses based on Hypotheses

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6800.010[a]	4	1700.002	186.454	.000
Intercept	1156.739	1	1156.739	126.870	.000
PRETEST	603.640	1	603.640	66.207	.000
GROUP	2280.708	1	2280.708	250.146	.000
GENDER	1.083	1	1.083	.119	.731
GROUP * GENDER	1.079	1	1.079	.118	.732
Error	729.402	80	9.118		
Total	67885.000	85			

Significant at P<0.05

Table 3 shows that there is significant difference in the achievement of basic science students when assessed using rubric-referenced self-assessment strategy at 0.000 level of significant which is less than 0.05 level of significance set for the study. The null hypothesis (HO_1)of no significant difference was, therefore, rejected indicating that there is significant difference.

Table 3 indicates 0.731 level of significant which is greater than 0.05 level of significant set for this study, the null hypothesis (HO_2) was upheld. This implies that there is no significant difference in the mean achievement scores of male and female students assessed using rubric-referenced self-assessment.

IV.   DISCUSSION OF RESULTS
1.   The results of this study revealed that the students taught basic science with rubric-referenced self-assessment performed better than the students taught with conventional method. In other words, the difference between the adjusted mean achievements of the treatment group was significant in favour of the treatment group. This finding of the study was supported by Tshering and Phu-ampai (2018) study which showed that rubrics enhanced students' learning achievement which led to students' positive opinion towards rubric usage in Educational Assessment and Evaluation. Eshun and Poku (2013) also concluded that in terms of studio based learning, 86% of the students had a positive perception on the use of rubrics for its support in learning process. Similarly, in Raposo-Rivas" (2016) study, almost one in three students (72.4%) were satisfied with the use of

rubric in their learning. equally, Kulprasit (2016) also found that students showed a positive attitude toward the writing rubrics when rubrics were used as assessment for learning in English as Foreign Language (EFL). It is worthy to note that Students' involvement in development of rubrics empowers them to be more engaged and active in their own learning. Rubric-referenced self-assessment seemed to have provided an environment free from stress and boredom in which male and female students have achieved some level of equilibrium in basic science. This could be another tool for reducing gender gap in science education because rubric-referenced self-assessment strategy is innovative and have the potential to motivate learners towards learning Science.

V. RECOMMENDATIONS

i. Rubric-referenced self-assessment strategy should be used to enhance the teaching and learning of Basic Science.
ii. Students should be encourages to participate in the creation of rubric.

VI. CONCLUSION

These findings have strong implications for the teaching and learning of Basic Science in Nigerian secondary schools. This implies that Rubric-Referenced self-assessment strategy have a positive effect on the students' achievement in basic science thereby empowering students' learning in basic science.

REFERENCES

[1]. Aboluwodi, A. (2015). Political Will and Strategic Planning in the Implementation of Universal Basic Education in Nigeria: The Obafemi Awolowo Example. *Journal of Education and Research,* 5 (1), 6-22.
[2]. Agogo, P.O. (2017). *Issues in Nigerian integrated Science Curriculum.*Makurdi: Optimism Press.
[3]. Chamcharatsri, B. (2016). Student-generated rubric assessment: A meaningful literacy practice. *Journal of Assessment & Teaching of English Language Learners, 1, 50-60.*
[4]. Chowdhury, F. (2019). Application of Rubrics in the Classroom *: A Vital Tool for Improvement in Assessment, Feedback and Learning.* *12*(1), 61–68. https://doi.org/10.5539
[5]. Danjuma, G.S. (2015). Effects of Collaborative and Competitive Learning Strategies on Upper   Basic II Students' Interest and Achievement in Basic Science. *Unpublished Ph.D Thesis*,   University of Nigeria, Nsukka.
[6]. Datom, N. A. (2015). Effectiveness of Demonstration and Guided Discovery methods on Interest and Achievement of Upper Basic Science Students. *Unpublished Ph.D Thesis*, Ahmadu Bello University, Zaria.
[7]. Eravwoke O. U. (2011). The effect of concept mapping teaching-learning technique on teachers attitude and students achievement in chemistry. *Unpublished M.Ed Thesis of University of Benin, Benin city*
[8]. Eshun, E. F. & Poku, P. O. (2013). Design students" perspectives on assessment rubric in studio-based learning. *Journal of University Teaching and Learning Practice,* 10(1), 1-13. Retrieved January 8, 2017 from http://ro.uow.edu.au/jutlp/vol10/iss1/8/
[9]. Etuk, G. R; Ering, S. O; & Ajake, U. E. (2012). Nigeria's Universal Basic Education (U.B.E) Policy: A Sociological Analysis. *American International Journal of Contemporary Research,* 2 (7), 179-183
[10]. Filgona, J. (2017). Effect of Gender on Senior Secondary School Students' Academic Achievement in Geography in Ganye Educational Zone , Nigeria. *European Journal of Education Studies 394–410. https://doi.org/10.5281/zenodo.400596*
[11]. Kulprasit, W. (2016). EFL Students" attitudes toward authentic and formative assessment: The role of writing rubric. *International Journal of Languages, Literature and Linguistics,* 2(1), 32-37
[12]. Nwona, H. A., & Akogun, N. A. (2015). Breaking gender barrier in science, technology and mathematics education. *Nigeria Journal of Research in Education, 98-*108.
[13]. Ochu, A. N. O., & Haruna, P. F. (2015). Challenges and prospects of creativity in a Basic Science classroom: The perception of the Basic Science teachers. *British journal of education, society and behavioural science, 5*(2), 237-243.
[14]. Odagboyi I. A. (2015). The Effect of Gender on the Achievement of Students in Biology Using the Jigsaw Method. *Journal of Education and Practice Vol.6, No.17, 176-179 ISSN 2222-1735 (Paper) ISSN 2222-288X (Online) www.iiste.org*
[15]. Oludipe, D. I. (2012). Gender difference in Nigerian junior secondary students' academic achievement in basic science J*ournal of Educational and Social Research* 2(1) 93-98.
[16]. Panadero, E., Jonsson, A., and Strijbos, J. W. (2016). "Scaffolding self-regulated learning through self-assessment and peer assessment: guidelines for classroom implementation," in Assessment for Learning: *Meeting the Challenge of Implementation, eds D. Laveault and L. Allal (New York, NY: Springer), 311–326*. doi: 10.1007/978-3-319-39211-0_18
[17]. Raposo-Rivas, M. (2016). University students" perceptions of electronic rubric-based assessment. Digital Education Review. Retrieved April 5, 2017 from http://revistes.ub.edu/index.php/der/article/viewFile/15442/pdf_1
[18]. Tshering, & Phu-ampai, S. (2018). Effects of using rubrics on the learning achievement of students in educational assessment and evaluation. *Paper Presented at NIDA International Conference for Case Studies on Development Administration, Bangkok (8 Th September, 2017), December*, 1-12. Thailand.
[19]. Udoh, A. P. (2015). Strategies for Improving The Teaching And Learning Of Government As A Core-Subject In Senior Secondary Schools. *International Journal of Education Planing and Administration ISSN:* 3249-3093, *5*(1), 51–61.