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Science Teachers' Variables and Their Reflective Teaching Practices in Nigeria

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Abstract
Background*: The task of teachers is crucial to the success of educational enterprise. Most teacher embark on their day-to-day activities as a routine without taking a pause to appraise their activities to ascertain whether or not such activities align with the stated objectives of the lesson with a view to achieving the national goal of education. The appraisal of past activities of the teacher in the previous classroom interaction is termed reflective teaching. It is imperative for teachers to regularly reflect on their classroom engagements to identify areas that needed to be amended, repeated or avoided. This study therefore investigated the effect of teachers' variables on practice of reflective teaching by science teachers in Senior Secondary Schools in Ekiti State, Nigeria. Attempt was made to find the effect of teachers' gender, qualification, professionalization and years of teaching experience on their reflective teaching practices.*
Materials and Methods*: The study adopted a pre-test post-test quasi experimental design. The study sampled 50 science teachers from 50 Senior Secondary Schools in Ekiti State through multistage sampling technique. The multistage sampling involves stratification, purposive and randomization. Four hypotheses were formulated for the study. The reflective practices of the teachers were analysed through the Classroom Behaviour Analysis Chart (CBAC) and Teacher's Self Reflective Package (TSRP) designed by the researcher and were ensured for face and content validity. The reliabilities of the instruments were determined through split-half method and the results showed reliability coefficients of 0.82 and 0.72 for CBAC and TSRP respectively. The experimental procedure took eight weeks and the data obtained were analysed using inferential statistics of t-test and one-way Analysis of Variance (ANOVA) statistics at 0.05 level of significance.*
Results*: This study revealed that the teachers' gender, qualifications and years of teaching experience had no effect on the reflective practice of science teachers but only professionalization.*
Conclusion: *Science teachers' reflective teaching practices is the same irrespective of gender, qualification and years of teaching experience. Only professional science teachers differ in their reflective teaching practices from their unprofessional colleagues.*
Key Word*: Teachers, reflective teaching practice, skilled, teaching experience.*

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I. Introduction

Teaching as a profession is dynamic just as the society which it serves moves along. It is therefore imperative of any teacher to move in phase with the society, otherwise, the style and contents of teaching would be obsolete and run contrary to accomplishing the essence of teaching. Classroom management is vital in classroom encounter. Effective management of classroom has been classified into four steps that include: defining the behaviour; coming up with a way to modify the behaviour; figuring out how to reinforce the new behaviour and applying the reinforcer[1].

Reflection is an important human activity in which people recapture their experience, think about it, mull it over and evaluate it[2]. In teaching-learning situation, reflective practice refers to the process whereby the educator examines his or her own teaching methods and all activities involved with the aim of determining which or what work best for the students[3]. It is this working with one's past experience that is important in teaching and capable of bringing about effective learning. It is therefore expected that reflective activities should be the regular practice of science teachers[4].

The common practice of teachers seems to be that most teachers, especially those that regarded themselves as experienced, do not take time to reflect on their previous classroom activities but rather assume to have done the best they should on the assumption that they are masters of their subjects and have been practicing for years. However, a study on classroom verbal interaction pattern in the teaching and learning of science revealed that there was no significant difference in the teachers' teaching experience and the classroom verbal instructional pattern[4]. This means that the claim of experience by long term serving teachers is an illusion. Thus, there is need for teachers to often reflect on their classroom behaviour. The need for reflection on

one's past classroom activities was supported by study that mastering of learning activities is a necessary but not a sufficient condition for their execution[5]. The society is changing continuously and all human activities within it, knowledge inclusive. Thus, it becomes imperative for the teachers to imbibe the attitude of regular and continuous reflective practices to regularly update their activities. It was also noted that unskilled teachers would change their classroom behaviour if they are given feedback[6]. This feedback constitutes the reflective teaching intervention. Thus, reflective teaching is a virile tool to train the unprofessional teachers the art of teaching to equip them to be effective in the classroom.

Studies have showed that science teachers' gender does not influence the classroom behaviour pattern they exhibit[7,8]. Although, males and females differ in their physical, emotional and intellectual development, it was opined that there is no link between gender dichotomy and intellectual capability in science[9]. Other study affirmed that sex differences had little or no effect on performance in Mathematics and English language and stressed further that the eventual achievement of learner is a factor of personal efforts[10]. However, [11]argued that children's behaviour in the early elementary years does not reflect any gender dichotomy.

The certificate held by the teacher is expected to play a vital role in effective delivery of the lesson. However, research has showed that teacher's qualification influences students' academic performance as well as his classroom activities[3]. Studies relating to student's performance with respect to teachers' years of teaching experience revealed that experience improves the teachers' classroom interaction[12] while others concluded that teachers' experience enhances better academic performance of students in science[13,14]. These outcomes might be due to constant review of classroom activities by the teachers over the years. This study aimed at examining the engagement of teachers in reflective teaching with respect to their gender, qualification, skillfulness and years of teaching experience.

II. Methodology

The research design adopted in this study was pre-test post-test quasi experimental design. The blue print of the proposed procedures used for testing the hypotheses is as given below:

Design Format:

Experimental Group	O_1	X_a	O_2
Control Group	O_3	—	O_4

where O_1 and O_3 represent the pre-test observations,
O_2 and O_4 represent the post-test observations, and
Xa represents the treatment for the experimental group.

The treatment that was applied to the experimental group was the reflective teaching. Here, the teacher reflected on his/her previous classroom session and amended as need be. The control group maintained their usual classroom teaching without the application of reflective teaching. The sample consisted of 50 science teachers who were selected from 50 Senior Secondary Schools in Ekiti State through multistage sampling techniques across the three Senatorial Districts of the state. The multistage sampling involves stratification, purposive and randomization. The strata took care of the teachers' gender, certification, professionalization and year of teaching experience. Four hypotheses were formulated for the study.

Study Design: Pre-test post-test quasi experimental design
Study Location: This consisted of public Senior Secondary Schools in Ekiti State, Nigeria encompassing both state and federal schools in the region.
Study Duration: October 2019 to November 2019.
Sample size: 30 science teachers.
Sample size calculation: The sample size was estimated on the basis of a single proportion design. The target population from which the sample was randomly selected was considered 170. The confidence interval of 10% and confidence level of 95% were assumed. The sample size actually obtained for this study was 50 science teachers. The plan was to include 70 science teachers (Group I - Experimental, Group II - Control) with 4% drop out rate.
Subjects & selection method: The targeted population for the study was the science teachers in all the public Senior Secondary Schools in Ekiti State (both state and federal schools) as at the time of this research. The science teachers were divided into two groups (each group had 15 teachers) according to doses of statins. The treatment administered on the science teachers were as follows:
Group A (N=15 science teachers) – Experimental group, engaged in reflective teaching practices;
Group B (N=15 science teachers) – Control group, engaged in usual teaching without reflective teaching.

Inclusion criteria:
1. Science teachers of Class II in secondary schools in Ekiti State, Nigeria.
2. Either sex.

3. NCE and Degree holders.
4. Professional and non-professional science teachers
5. Teaching experience $2 \geq 30$ years.

Exclusion criteria:
1. Science teachers in other classes.
2. Non-science teachers.
3. Science teachers of other certificate aside NCE and Degree e.g. Diploma, OND, HND
4. Science teachers in private schools

Procedure methodology

The research took eight weeks in three stages, viz: the pre-treatment stage (two weeks), the treatment stage (four weeks) and the post-treatment stage (two weeks).

At the pre-treatment stage, permission was obtained from the authority of each school for the purpose of the study. The selected science teachers were instructed as to the set-up of the study. However, the specific hypotheses under investigation were not made known to them in other to avoid Hawthorne effect (Omirin, 2008). Each teacher was provided with the Scheme of Work and the lesson notes meant for the study. The lesson notes were discussed with the teachers for proper lesson delivery and an agreement was reached on the time-table for lesson periods for the study. At this stage, the CBAC was administered on the teachers as pre-test before the commencement of reflection on their lessons.

The treatment stage involved the teachers in the experimental group being groomed on the application of reflective teaching with particular focus on the selected classroom activities for this study. The TSRP was given to the teachers in the experimental group and was discussed with the teachers for proper reflective practices. Then, they started teaching having the issues of reflection in mind vis a vis the behavioural focus of this study and reflected on them after each classroom encounter. The teachers in the control group however continued with their conventional mode of teaching without having reflection in minds. In fact, they were not aware of the reflective package. The post treatment stage witnessed the re-administration of the Classroom Behaviour Analysis Chart (CBAC) on all the teachers through the help of research assistants.

The Classroom Behaviour Analysis Chart (CBAC) was scored based on the number of occurrence of the targeted classroom activities as being exhibited by the teacher while teaching in the classroom. These scores were weighted such that every manifestation of each targeted activity was ranked 1. These were added together to form the frequency of each activities. The ground total of these frequencies constitutes the total score of the teacher. The TSRP checklist was scored based on the total scores for each of the classroom activity on CBAC. The average score was obtained on the expectation that the possible highest obtainable score was 40 per activity i. e. each activity would manifest once per minute of a lesson of 40 minutes. In effect, the total maximum obtainable score by each teacher for the six targeted activities is 240. These were ranked into percentages and compared with a criterion level of performance set up by the researcher.

The reflective practices of the teachers were analysed through the Classroom Behaviour Analysis Chart (CBAC) and Teacher's Self Reflective Package (TSRP) designed by the researcher. The first instrument was adapted from a standardized classroom analysis form designed by Flanders (1970) for measuring and analyzing classroom interaction patterns. The items in the Flanders' interaction analysis were converted in an observation sheet called observational coding chart as illustrated by Gay (2000). This chart was modified to form the Classroom Behaviour Analysis Chart (CBAC) that was used for this study. The instrument consisted of three parts. Part A sought the bio-data of the respondents while part B was a table describing the aspect of the teachers' classroom activities to reflect on. These are Questioning Style, Student's Involvement, Class Control, Time-out, Body Gesture and Student's Motivation. Part C contained the chart for recording and scoring the manifestation of these activities of the teacher at every stage of the lesson. These stages are Lesson Introduction, Lesson Body, Summary and Evaluation stages. Through this chart, the occurrences of the selected behaviour were determined at every stage of the lesson and for the whole lesson.

The second instrument was the Teacher's Self Reflective Package. It has three parts, A, B and C. Part A was the bio data of the teacher while part B contained seven steps process taken by the teacher as reflective strategy after each lesson to re-strategise against next lesson. Part C was a checklist to assess the outcomes of the teachers' reflective teaching. It was adapted from U.S. office of Education Checklist format, having put into consideration the environmental factors in Ekiti State. The checklist has four columns for assessing the level of the occurrence of each targeted classroom behaviour of the teacher.

The instruments were validated for face and content validity by two science educators in Ekiti State University, Ado-Ekiti, Nigeria while the reliabilities of the instruments were determined through split-half method and the results showed reliability coefficients of 0.82 and 0.72 for CBAC and TSRP respectively. The researcher personally administered the instruments with the help of a research assistant from each school.

The criterion standard set up for the level of performance are of three categories, as shown below:
A: High Level (60 – 100%)
B: Average Level (46 – 59%)
C: Low Level (0 – 45%)

Statistical analysis

The data obtained through the instruments were analysed SPSS version 20 (SPSS Inc., Chicago, IL). Student's *t* test was used to ascertain the significance of differences between mean values of reflective teaching practices of science teachers with respect to gender, NCE and Graduate teachers and between skilled and unskilled Science teachers. Also, one-way Analysis of Variance (ANOVA) statistics was used to test the significant difference in the reflective teaching practices of Science teachers with different years of teaching experience, all tested at 0.05 level of significance.

Research Hypotheses

The following hypotheses were formulated to guide the study:
Ho_1: There is no significant difference in the reflective teaching practices of male and female Science teachers.
Ho_2: There is no significant difference in the reflective teaching practices of NCE and graduate Science teachers.
Ho_3: There is no significant difference in the reflective teaching practices of skilled and unskilled Science teachers.
Ho_4: There is no significant difference in the reflective teaching practices of Science teachers with different years of experience.

III. Result

Ho_1: There is no significant difference in the reflective teaching practices of male and female Science teachers

Table 1: t – test of male and female science teachers' reflective teaching practices

Variable	N	$\overline{X}$	SD	df	t-cal	t-tab
Male Teachers	23	87.43	6.700	28	0.652	2.048
Female Teachers	7	85.61	5.553			

P(0.52) > 0.05 (Not Significant)

From table 1 above, it shows that t-cal (0.654) < t-table (2.048). The null hypothesis is therefore not rejected. This implies that there is no significant difference in the selected classroom behaviours of male and female science teachers who employed reflective teaching.

Ho_2: There is no significant difference in the reflective teaching practices of NCE and graduate Science teachers.

Table 2: t – test of NCE and Graduate science teachers' reflective teaching practices

Variable	N	$\overline{X}$	SD	df	t-cal	t-tab
NCE Teachers	12	83.42	4.944	28	1.909	2.048
Graduate Teachers	18	87.78	6.787			

P(0.067) > 0.05 (Not Significant)

Table 2 above reveals that t-cal (1.909) < t-table (2.048). Hence, the null hypothesis is not rejected, which implies that there is no significant difference in the selected classroom behaviours of NCE and Graduate science teachers in the reflective group.

Ho_3: There is no significant difference in the reflective teaching practices of skilled and unskilled Science teachers.

Table 3: t – test of skilled and unskilled science teachers' reflective teaching practices

Variable	N	$\bar{X}$	SD	df	t-cal	t-tab
Skill Teachers	15	86.93	6.892	28	0.764	2.048
Unskilled Teachers	15	85.13	5.975			

P(0.451) > 0.05 (Not Significant)

It is showed from table 3 that that t-cal (0.764) < t-table (2.048). Therefore, the null hypothesis is rejected, which means that there is no significant difference in the selected classroom behaviours of skill and unskilled science teachers who engaged in reflective teaching.

Ho_4: There is no significant difference in the reflective teaching practices of Science teachers with different years of experience.

Table 4: One-way ANOVA of science teachers' reflective teaching practices according to years of experience

Variables	Sumof Squares	df	Means of Squares	F_{cal}	F_{tab}
Between Groups	31.103	2	15.4552	0.363	3.35
Within Group	1157.864	27	42.8		
	1188.967	29			

P(0.699) > 0.05 (Not Significant)

Evidently, table 4 reveals that F-cal (0.363) < F-table (3.35). The null hypothesis is therefore not rejected, which implies that there is no significant difference in the selected classroom behaviours of Science teachers of different years of experience who employed reflective teaching strategy.

IV. Discussion

Male and female science teachers are not different in the use of reflective teaching. This result disagreed with literature that there was variation between male and female science teachers' classroom verbal interaction[15] and that male and female differ in their physical, emotional and intellectual development. Meanwhile, this result agreed with some authors' submission that science teachers' gender does not influence the classroom behaviour pattern they exhibit[8,9]. The reason for this results could be that since both male and female science teachers were exposed to reflective teaching the same way, they responded at the same rate. Hence, there was no significant difference in their selected classroom behaviours after employing reflective teaching.

The study also showed that there is no difference in the practice of reflective teaching by science teachers irrespective of their qualifications. However, each category of certification responded positively to reflective teaching. This might be due to the fact that all categories of teachers were ignorant of reflective teaching before this study. So, when they were introduced to the concept and method of classroom observation and reflective teaching, their level of acquisition of reflective skill are the same and thus responded the same way to practicing it. Hence, there was no difference in their exhibition of the selected classroom behaviours.

The result from the study showed a non-significant difference in the reflective teaching practices of skilled and unskilled science teachers. However, the skilled science teachers responded more positively to reflective teaching practices than the unskilled science teachers. Perhaps, this might be due to professional experience of the skilled science teachers.

The study as well showed no disparity in the practice of reflective teaching by science teachers of different years of teaching experience. This means that the teachers, irrespective of their years of teaching experience, responded the same way to reflective teaching strategy. This in effect means that the concept of reflective teaching cannot be gained through experience. This result is at variance with literature that there was significant relationship between the science teachers' teaching experience and their classroom verbal interaction[16]. However, this result confirmed the earlier proposition of this study that even the experienced

teachers are not always aware of the nature of their interactions with the students during classroom encounter. They often regard themselves as experienced and do not take time to reflect on their previous classroom activities but rather assume to have done the best they could on the assumption that they are masters of their subjects and have been practicing for years. Thus, it becomes imperative for the teachers to imbibe the attitude of regular and continuous reflective practices for regular update of their activities.

V. Conclusion

Based on the findings of this study, the following conclusions were drawn:

- male and female science teachers are not different in the use of reflective teaching.
- science teachers respond to reflective teaching the same way irrespective of their qualifications.
- there is no difference in the reflective teaching practices of skilled and unskilled science teachers.
- no disparity in the practice of reflective teaching by science teachers of different years of teaching experience

On the basis of the findings of this work, it was recommended as follow:

→ The concept of reflective teaching and classroom observation techniques should be introduced into the curriculum for training prospective teachers in Nigeria. This will equip the teachers to constantly monitor their classroom interactions for improved classroom efficiency.

→ The science teachers should imbibe the attitude of regular and continuous reflective practices for regular update of their activities.

→ In as much that the skilled science teachers' classroom behaviours responded more positively to reflective teaching strategy than the unskilled science teachers, the teachers should be encouraged to embark on collaborative teaching with their professional colleagues for efficiency on their job.

→ Since this study showed that the concept of reflective teaching cannot be gained through only teaching experience, workshops and seminars should be organized by the governments and employers of teachers for serving teachers to adequately induct them on the concept and methods of reflective teaching.

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