

INFLUENCE OF SCIENCE TEACHERS' COMPETENCE ON THE STUDENTS' PERFORMANCE IN SECONDARY SCHOOL BIOLOGY

By

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Abstract

This study was an in-depth analysis of how the competency of a teacher promotes effective teaching and learning process through the learners. Two hundred and forty students were randomly selected from senior secondary schools in two LGAs from Kogi Central Senatorial District, to serve as subjects for the research work. These students were divided into four groups in which each contained sixty students. One was experimental group and three others were control groups. WIHITC (what is happening in this class) was the instrument applied on 16 servicing-teachers to get the best competent teacher to handle the experimental group while the students in the control groups were taught by other teachers. Quasi-experimental design was applied in order to control the variables and to ensure the validity of the study. Pre-test was conducted on all the students in the four groups before biology topics on ecology as treatment was offered for two weeks. At the end of the second weeks, post-test was conducted which achieved fruitful results. The method used was analysis of variance and t-test. The result revealed that the experimental group outperformed those under control groups. Based on this, competency has much influence on the learners' performances hence students in experimental group excelled above those in the control groups. So trained and experienced teachers are recommended to teach science at all levels to improve the standard of education.

The inability of students understanding of teachers instructional strategies has been in vogue among science teachers (Mani, 1980); this led some science educators to embark on research work on science teacher's competencies on students' performance.

They looked forward in search of various ways by which understanding of the learners could be improved towards better implementation of the national curriculum. According to Olumorin (2008), the demand for more and better schools in all parts of the continent, the need to relate curriculum to the child's environment, the need for appropriate Text books and other instructional materials, the desirability of training in vocational and technical skills and indeed the overall problem of preparing the future citizens of Africa who will be fully oriented to their environment cannot be effectively accomplished without the aid of competent teachers. So, the main force behind any curriculum to be implemented according to specification is the teacher. For any teacher to be a competent force of the curriculum many qualities are expected of him (Bello, 1985). It has been rightly mentioned by Ben Yunusa (2000), that the classroom forms a cornerstone in curriculum implementation.

Competency in a teacher makes the society to label such a person as a good teacher or not. According to Alphonso (2006), a good teacher is the one that works towards achieving the primary goals of education; by inculcating permanent literacy and numeracy, and the ability to communicate effectively; and lay a sound basis for scientific and reflective thinking. Also, he is a type that is patient, whose reasonable advancement in teaching, gives him the willingness to keep on explaining, knowing that eventually it will make sense. This is a teacher with true compassion that cares for his students and is ready to help them.

Then, for the learners to understand any teaching depends much on the level of competency of such teachers. Recent studies such as that of Lin (1998) confirmed that there are some competent quality in science teachers that promotes learning. This suggests, high quality of imparting knowledge by applying various learning strategies with different instructional materials denotes the level of competency of such individual teacher. In any lesson, it is the sum quality of the teacher that enables him pilot the course of instruction and leads his students through new learning experience to achieve high percentage of success which is the evidence of teachers' competence (Graham, 2007).

According to Ofoha Dorothy (2011), Science teachers with competency qualities, plan instruction which promotes critical thinking, creativity, decision making based upon subject matter to improve students' learning and motivation with emphasis on individual differences greatly influence the performances of the learners. Fraser, (1996) reported that programmed on teachers competency in teaching recorded higher results of student performance in science subjects. In line with competency in teaching, Lin (1998) equally reported that the three years subsequent results of classes known to be handled by more competent dedicated and compassionate science teachers lead in the National Assessment of Education Progress (NAEP) test. Adesoji (2008), revealed that there is a relationship between attitude and methods of instruction and also between attitude and achievement of the learners.

There are numerous aspects that involve the training of science teachers that contributed to their competency in their field. It is very paramount for science teachers to understand the nature and context of science. He must know the values, beliefs and assumption inherent in the creation of scientific knowledge within the specific community and compares science with other ways of knowing things (Peter, 1999). According to Graham (2004), science teachers are capable of analyzing and evaluating the consequences, constraints, and the scientific design process used to develop and implement solutions to problems. Science teachers curriculum is targeted to acquire knowledge on how scientific knowledge and technological advances are discovered and developed by individuals and communities and how it contributes to the positive changes in the societies (Sibel, 2000). In the general skills of teaching, the science teacher is capable of using teaching strategies, and methodologies in passing new concept to the students. They are able to establish interactions with students, through the use of questioning techniques that promote learning and achievement (Maricar, 2000). These implementers of curriculum are capable of effectively organizing classroom, laboratory and field experiences in different student groups.

Darrell, (2002), noted that the competency of a science teacher is also demonstrated in the way and manner he/she operates laboratory equipments while preparing some materials used in science laboratory with reports on their findings. They also establish and enforce laboratory safety which includes storage and disposal of hazardous waste in the science laboratory.

Laboratory activities have become the centre of attention at all levels of science teaching. The Nigerian Secondary School Project emphasizes laboratory experience as a means by which meaningful learning in science can take place. The teaching processes of science teachers influence the students' learning processes which consequently affect their laboratory skills (Darrell, Allan and David (2002). The teaching skills demonstrated stimulated thinking skills that consequently influence laboratory manipulative skills; which make the learners appreciate the scientific values.

Science practical lessons help the learners to understand science concepts and laboratory activities, make abstract concepts to become concrete and experience-based, because students are given the chance to explore (Marricar and Socorrot 2000).

According to Aliyu (1979) and Sibel etc (2000), they highlighted the roles played or areas by which laboratory activities have been employed as:

- a means to verify a science principles, law or theory known to the students.
- a means of practicing one or more of the listed process skills like observing, classifying, measuring or interpreting data.
- a means of determining the relationship between cause and effect.
- a means of obtaining and learning scientific information.

Statement of the Problem

Quite a lot of research work such as that of Aliyu, (1979), Mani (1980), Darrell, Alan and David (2002) been carried out on related topic, yet the performance of students in Biology is still very disappointing and very poor.

Biology is the science subject that is usually made compulsory for all students either science, commercial or arts at the Senior Secondary School Level. This reflected in the National Policy on Education that every student must offer one of the science subjects. Due to the role biology plays in ones life, all students preferred offering biology at Senior Secondary school Certificate Level. Despite its pride of place the general performance of students in it still leaves much to be desired.

Can teachers' competency influence students' performance? This therefore becomes the focus of this investigation.

Purpose of the Study

This study aimed at:

- i. Investigating the influence of teachers' competence on students' performance.
- ii. Finding out the attitude and interest of the Senior Secondary School Students towards learning biology in Okene and Adavi LGAs Educational Zone of Kogi State.
- iii. Determining the influence of the laboratory environment on teachers' competence in teaching learning processes.

Research questions:

The following questions were formulated to guide the study:

- i. To what extend does lack of teachers' competence affect the performance of students in biology.
- ii. To what extent does poor attitude and interest of senior secondary school students affect their performance in biology.
- iii. To what extent does laboratory environment influence teachers'' competence in teaching biology.

Hypothesis

There is no significant difference in the performance of students taught by competent teachers and those taught by any other teacher.

Methodology

The simple random sampling technique was used. The population was stratified into four groups out of the five LGAs that made up the senatorial district, five school were selected from each of the two LGAs making a total of 10 schools.

The study is Quasi-experimental design in order to control the variables and to ensure the validity of the study. The study was conducted in both Okene and Adavi LGAs in

Kogi State. The population of the study comprised of 240 (SS III) biology students in the 10 secondary schools, and they were arranged into four groups. One Experimental group and other three groups were used as control groups. Each group was made up of sixty students.

An instrument on competency skills in teachers adapted and modified to be used in the study to check and select competent teachers. This instrument was called “WHAT IS HAPPENING IN THIS CLASS” (WITHITC). Services of four experts, such as, one expert in measurement and evaluation, two experts in science education and one in curriculum and instruction were employed to validate the instrument all in the faculty of education, Ahmadu Bello University, Zaria. The instrument is in Likert type of 5 options, such as (Q.A.) – Quite adequate (5), (A) – adequate (4), (F.A.) – fairly adequate (3), (I) – inadequate (2) and (G.I) – grossly inadequate (1). To ascertain, the reliability of the instrument it was administered twice in the pilot study at an interval of two weeks. Two public schools at different locations were used for the test-retest reliability method. The results of the separate exercise were correlated by applying the Pearson’s product movement correlation statistics. The co-efficient of $r = .76$ was obtained and this was considered adequate enough in checking the consistency of the items in the instrument. The instrument was used on 16 biology teachers teaching under observation. The result of four that scored high marks of the sixteen biology teachers are shown in the Table I below; and the best of the four teachers found to be rich in pedagogical repertoire of knowledge with the highest score 3.98 in the competency skill qualities was selected to teach experimental group of biology students while other three teachers with scores: 3.42, 3.17, and 2.25 were assigned to teach the three control groups of students.

Table I: below shows instrument of WITHITC designed to test the level of competency skill in teachers.

Procedure

The four groups of students had lessons on selected topics on photosynthesis aspects of biology e.g. Light phase, Photolysis, Dark phase, mechanism in the stomata, and experiment on the release of oxygen during photosynthesis, for two weeks. At the end of the second week, they all finished receiving the lessons as the treatment on the learners. WITHITC scale which was designed by Fraser, and Mcrobbie (1996) was modified to suit the purpose and utilized in conducting the selection exercise.

The modification in the instrument

Some items like ethical issues was replaced with item like laboratory equipments and management with the students. Secondly, the instrument was modified to a Likert format, e.g. (Q.A.) – Quite adequate (5), (A) – adequate (4), (F.A.) – fairly adequate (3), (I) – inadequate (2) and (G.I) – grossly inadequate (1).

Results

With application of the instrument WIHITC the result of the best five out of 16 biology teachers is shown in Table 1 below. Then, the best teacher with 3.98 mean score was the holder of B.Sc. Ed Biology was assigned to teach experimental group, while other three teachers with scores: 3.41, 3.17 and 2.25 taught students in others as control groups. But the fifth teacher with 1.70 was not assigned.

Table 1: WIHITC Instrument

Competency skills in teachers	QA	A	FA	I	GI
Lesson plan	3	3	2	4	2
Ability in curriculum knowledge	3	4	1	4	1
Understanding nature and context of science	2	3	2	4	3
Quality in inquiry	3	4	2	4	2
Compartment of the teacher	2	4	3	3	1
General skills of teacher	4	3	2	5	1
Laboratory equipments and management	3	3	2	4	3
Questioning techniques	4	3	3	4	1
Cohesiveness	3	4	3	4	2
Students participation	4	3	2	4	1
Passionate quality	3	3	2	4	2
Blackboard summary	4	4	3	4	1
Total	38	41	27	48	20
Mean /x —	3.17	3.41	2.25	3.98	1.7

Note: The table above shows the mean scores of 5 out of 16 science teachers that the instrument (WIHITC) was applied upon.

The four groups of students were tested before the treatment and their result was subjected to analysis of variance (ANOVA). This is to be certain that there is no existence of significant difference among the students in the pre-test examination.

Table 2: One-way Analysis of Variance (ANOVA) of pre-test result of Four Groups of Biology Students

Sources of variance	Sum squares	df	Mean squares	F-ratio	F-calculated
Between groups	3108.07	2	1037.08	17.62	0.39
Within groups	53931.90	238	113.45		
Total	57039.97	240	1150.53		

Significant $P \leq 0.05$

The Analysis in the above table revealed that, there was no existence of significant difference among the entire students set up for experimental treatment. This is true of the fact that, F-calculated value is far more than significant value.

Table 3: One-way Analysis of Variance (ANOVA) for post-test Examination after treatment.

Source of variance	Sum squares	df	Mean squares	F-ratio	F-calculated
Between groups	3102.07	2	1034.02	9.13	0.0001
Within groups	53891.13	238	113.22		
Total	56993.20	240	1147.24		

Significant $P \leq 0.05$

To test the hypothesis; the scores of all the students in the four groups were subjected to one-way analysis of variance (ANOVA) as it is shown in Table 3 above. The F-calculated is far less than significant value. This implied that, there is significant difference in the performances of students after the treatment given.

Table 4: Comparison of the Mean scores, Standard deviation and variance of WIHITC Instrument.

Test	Experimental groups				Control groups			
	N	Mean	SD	Variance	N	Mean	SD	Variance
Pre-test	60	37.82	5.22	27.20	180	37.50	5.11	27.09
Post-test	60	60.92	10.31	106.35	180	54.05	6.41	41.13

Table 4 serves as summary of the three tables above. At a glance, it is obvious that from pre-test of both experimental and control groups, no significant difference but the result of post-test revealed the significant difference.

Discussion:

From the foregoing analysis, in an attempt to ascertain that the level of understanding of all the selected students for the research work will not be significantly different (i.e. to be almost of equal level) before the treatment could be given; Table 2 analysis of pre-test proved non-existence of such difference. By implication, teachers' methodology of teaching is one major aspect of competency on students' understanding of concept which tells much about the learners' performance. Tables 3 and 4 proved that, significant difference was established after the treatment from post test examinations. So, this implied that students taught by competent hands usually perform reasonably better than those taught by any other teacher that is not a professional.

The competency skills in Table 1 were designed to select the best competent teacher. The result from the post-test proved that, competency qualities in the teachers was manifested through the performances of their students. This went further to prove that, he scored highest on an item like-understanding nature and context of science in the competency scale. Mani (1981) and Ajala (2002) viewed that competency and mastering of subject matter are strong promise to solving to solving learners' problem in several ways. Based on self-reports of some few Biology students in experimental group, that among the science skills demonstrated by their biology teacher, they observed that the level of competency was displayed highest in the use of the instructional materials, questioning techniques, and in motivational skills to foster the students' concentration and participation in the lessons. This view validates several other views expressed by Lin, H.S. (1998) who described competency in a teacher as a panacea to promote quick understanding and potentialities in the learners.

According to Adesoji (2008) and Odunusi (1981), a sound subject background is the most important competency a science teacher should possess. In view of this importance, teaching of science particularly biology should be handled by science educators to ensure adequate and appropriate learning to take place.

Recommendations

On the basis of the findings, the following recommendations are made: Professionalism in the teaching field should be promoted so that, only trained and competent teachers are made available to teach different science subjects. Federal Ministry of Science and Technology should provide adequate facilities particularly instructional materials that would assist to expose the learners to experience science concepts and process skills from real life context before becoming involved with issues that provide for application.

It is very important and a matter of urgency for the government to sponsor most practicing teachers to attend workshops, seminars to improve their teaching experiences with new teaching methodology.

Conclusion

The results of this research work have further established that, high quality or competent teachers in most cases are trained teachers. From the findings, it was discovered that the best competent skilled teacher was a B.Sc. Ed holder that handled the experimental group who excelled above others. So, trained teachers are the most appropriate instructors that could handle the learners better. In summary, the level of competency in a teacher determines his impute in imparting knowledge to the learners and their understanding level could further influence them to exploit their potentialities.

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