

A Comparative Analysis of the Effect of Greeno Problem Solving and Demonstration Teaching Methods on Students' Achievement in Agricultural Science

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Abstract

The main purpose of the study was to make a comparative analysis of the effects of the greeno problem solving and demonstration teaching methods on students' achievement in agricultural science in Kogi East Education zone of Kogi State. Two each of specific purposes, research questions and hypotheses guided the study. The study adopted a non-equivalent pretest, post-test control group design. This paper is relevant as the result of the study will assist agricultural science teachers in Secondary Schools to embrace the use of Greeno problem solving method (GPSM) in the teaching of agricultural science concepts. This is because, the method will assist to improve student's understanding and achievement when compared with other conventional methods. The study population included all the 18, 225 SSII students from 195 secondary schools for 2010/2011 academic session. 240 (SSII) students in six intact classes in three coeducational schools were purposively sampled for the study. The instrument for data collection was the Agricultural Science Achievement Test (ASAT) which was made up of forty multiple choice items. The internal consistency of the instrument (ASAT) was 0.79 which was determined using Kuder Richardson (K - R20) formula because the items were scored dichotomously. Six (6) agricultural science teachers, two from each school serve as the research assistants for the teaching and administration of the instrument. Descriptive statistics were used to answer the research questions while the Analysis of Covariance (ANCOVA) was used to test the null hypotheses formulated at 0.05 probability level. Students taught agricultural science using the experimental method taught with greeno problem solving method (GPSM) obtained higher mean score than those under the control method taught with demonstration method (DM). Male students performed better than their female counterparts when taught with either the experimental (GPSM) or control method (DM). Based on the findings, useful recommendations were proffered.

Keywords: Comparative, Greeno, Problem-solving, Students' Achievement, Demonstration

INTRODUCTION

Agriculture is taught as one of the course offering referred to as agricultural science at both the junior and senior secondary levels in the Nigerian secondary schools and tertiary institutions. Because of its critical or prominent or important role to the supply of staple food requirements and raw materials for agro-allied industries and provision of employment, it is offered as a compulsory course at the secondary school level. (Federal Republic of Nigeria, (FRN) , 2004). The major goals of inclusion of agricultural science in the secondary school curriculum in Nigeria, include to enable them (students) acquire basic knowledge, skills and to develop positive attitude to agriculture and agricultural occupations.

The teaching of agriculture/agricultural science at this level is also intended to stimulate and sustain students' interest in agriculture; inculcate farming skills in students; enable students to integrate knowledge with skills in agriculture and prepare

students for future studies in agriculture. The realization of the objective of secondary school agricultural education will largely depend on the employment of effective teaching method by competent teachers.

The compulsory status of agricultural science in the secondary school curriculum notwithstanding students' performance in senior secondary school certificate examinations like National Examination Council (NECO) and West African Examination Council (WAEC) has not been very impressive. The poor performance of the students has been observed by the Chief Examiners of the school certificate respective examination bodies in their respective reports (Ibitoye, 1998; Egun 2007 and WAEC Office Lokoja, 2007). The students are primarily taught with such conventional teaching methods as demonstration and lecture methods. These methods don't seem to be providing the desired effects on the students' performance. The quality of teaching and

performance of students very much depend on the proper instructional strategies and approaches. If the teacher influences what the students learn through teaching methods, then the link between teacher classroom interactions and students learning needs to be investigated, hence the study.

The teacher as an agent of change employs different strategies which go a long way to modify teachers' and students' behaviour and academic achievement. In order to improve academic achievement of the students in agricultural science, it is imperative for the teacher to give proper and adequate attention especially in the choice of method(s) appropriate for the inculcation of knowledge and skills and appropriate attitudes in students. There are many methods employed in the teaching of agricultural science as pointed out by Olaitan (1984) and some of these methods include demonstration, problem solving, project, discussion, lecture, concept mapping, fieldtrip/excursion to mention but a few. Greeno problem solving model (GPSM) and demonstration method (DM) were selected for this study. Both approaches selected were activity and student-centred oriented but their respective levels of activity and students centredness are not the same. Greeno problem solving model was developed in 1973 and is made up of four phases which include: reading the text and interpreting the concepts, retrieving the relevant information, constructing solutions and carrying out other operations. It requires a more democratic environment, relies heavily on questioning, listening and responding; requires interpersonal skills with group dynamics, makes students gladiators instead of spectators and students are actively engaged in the problems that have meaning to them in addition to been stepwise, innovative, activity-based, student-centred and very much more effective in students' achievement in the physical sciences like physics, mathematics, chemistry and biology as major distinguishing features. (Pekene, 2002). Because of the peculiar technicalities involved in the use of Greeno problem solving model based on previous researches, it has not been popularly applied in the teaching of applied sciences like agricultural science in Nigerian secondary schools in general and Kogi State in particular compared to the demonstration approach.

As for the demonstration method, it involves the use of materials and provides a visual experience, which is usually increased in value by verbal explanation (Nwachukwu, 2001). It is characterized by certain level of skills and practicals, introducing new skills; developing understanding; showing the appropriate ways of doing things; enlist the various senses of a human being; motivate students; saves time and energy especially for the teacher; enhance the prestige of the teacher, as students get convinced of the teacher's command of the subject and give a real

life situation of course of study as students acquire skills in real life situation using tools and materials. It is one of the effective methods applied by teachers in achieving learning in real life situations. Agricultural science is practically oriented and therefore requires practical interactions and applications with the use of demonstration method.

Many intervening variable influence students' performance in addition to student-teacher interaction. Some of these include: gender, school location and type of school. Gender in relation to academic achievement has been an issue of concern to researchers in education. The effect of gender on students' achievement in agricultural science has been particularly an area of interest to researchers. The issues of gender are pertinent in this present study because the schools in the study area are made up of either males or females. One cannot really ascertain whether disparity exist between the performance of males and females in agricultural science when the same or different methods are employed by the teacher.

From the foregoing, the study intends to comparatively analyse and determine the effect of Greeno problem solving and demonstration methods of teaching on students' achievement in agricultural science based on gender in Kogi East education zone of Kogi State.

PURPOSE OF THE STUDY

The main purpose of the study is to comparatively determine the effect of Greeno problem solving and demonstration methods of teaching on students' achievement in agricultural science in Kogi East Education zone of Kogi State, Nigeria. Specifically, the study sought to:

1. determine and compare the achievement scores of students taught agricultural science with greeno problem solving and demonstration methods respectively in Agricultural Science Achievement Test (ASAT).
2. determine and compare the academic achievement scores of male and female students in agricultural science when taught with greeno problem solving and demonstration methods.

RESEARCH QUESTIONS

Based on the objectives of the study, the following research questions were formulated:

1. What are the students' respective mean achievement scores in Agricultural Science Achievement Test (ASAT), when taught agricultural science with greeno problem solving and demonstration methods?
2. What are the male and female students mean achievement scores in the Agricultural

Science Achievement Test (ASAT) when taught agricultural science with greeno problem solving and demonstration methods?

HYPOTHESES

The following null hypotheses (Ho) were formulated and tested at 0.05 level of significant.

Ho₁: There will be no significant difference between the mean achievement scores of students taught agricultural science with the greeno problem solving and demonstration methods of teaching.

Ho₂: There will be no significant difference between the mean achievement scores of male and female students taught agricultural science with the greeno problem solving and demonstration methods of teaching.

METHODOLOGY

The study employed a non-equivalent pretest, post test control group design. It was carried out in Kogi East education zone of Kogi State. The population of the study was all the 18,225 senior secondary two (SSII) students from 195 secondary schools in the study area. The sample for the study was 240 (SSII) students in six intact classes in three purposively

sampled schools from each of the three education zones of Kogi East. The instrument used for data collection was the Agricultural Science Achievement Test (ASAT) developed by the researcher. The ASAT was made up of forty (40) multiple choice items. The internal consistency of the instrument was 0.79. Six (6) agricultural science teachers, two each from the three selected schools served as research assistants in the teaching and in the administration of the instrument. The study used the greeno problem solving method as the experimental group and the demonstration method as the control group. Descriptive statistics were used to answer the research questions while the analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 probability level.

RESULTS

The results of this study are presented as follows:

Research Question 1

What are the students' mean achievement scores in agricultural science achievement test (ASAT) when taught with greeno problem solving and demonstration methods? This question was answered by the data analysis in table 1.

Table 1: Relative students' mean scores in agricultural science test (ASAT) taught with greeno problem solving and demonstration methods

| Group | Symbol | Pretest (mean) | Post test mean | Mean gain difference |
|---|--------|----------------|----------------|----------------------|
| Greeno problem solving method (Experimental method) | N | 120 | 120 | |
| | X | 47.09 | 72.27 | 25.18 |
| | SD | 3.93 | 7.54 | |
| Demonstration method (Control group) | N | 120 | 120 | |
| | X | 47.77 | 66.57 | 18.8 |
| | SD | 4.48 | 7.75 | |
| Demonstration method (Control group) | N | 120 | 120 | |
| | X | 47.77 | 66.57 | 18.8 |
| | SD | 4.48 | 7.75 | |

N = Number of subjects, X = Mean, SD = Standard Deviation

deviation of 7.54. This therefore, shows the degree of closeness of the test scores. But for the control group,

Table 1 shows that prior to the use of greeno problem solving method (experimental method) in the teaching of agricultural science by agricultural science teachers in the experimental group, the students mean scores was 47.09 while the standard deviation was 3.93. The control group had pre-test mean score of 47.77 and a standard deviation of 4.48 in the ASAT which is higher than the experimental group. The standard deviation of 3.93 for the experimental group as against 4.48 for the control group showed that the range of scores between the experimental and control groups was very narrow. But after the treatment which was teaching the students in both groups, the pre-test mean scores for the experimental group students improved appreciably from 47.09 to 72.27 with standard

it was an improvement from a mean score of 47.77 to 66.57 and an increase in standard deviation of 4.48 to 7.75. The table also shows that the mean gain difference of 25.18 under the experimental group (GPSM) was higher than that of the control group (DM) which was 18.8.

Ho₁: There will be no significant difference between the mean achievement scores of students taught agricultural science with the greeno problem solving and demonstration methods of teaching.

Table 2: Analysis of covariance of the mean achievement scores of students taught agricultural science with greeno problem solving and demonstration methods.

| Source of variance | Sum of squares | Df | Mean square | F | Significance level at 0.05 |
|--------------------|----------------|-----|-------------|--------|----------------------------|
| GPSM & DM (Group) | 3184.62 | 1 | 3184.62 | 61.47 | S |
| Group (Method) | 4880.385 | 2 | 2440.915 | 57.992 | S |
| Pretest | 187.029 | 1 | 187.029 | 3.61 | NS |
| Error | 12364.667 | 236 | 51.072 | | |
| Total | 20616.701 | 239 | | | |

* DM – Demonstration method * GPSM – Greeno problem solving method

In table 2 above, the calculated f-ratio in each row is compared with the table f-ratio at 0.05 level of significance to find out if the hypothesis is accepted or not. Comparing the experimental method (GPSM) with control method (DM), the calculated f-ratio was 61.47 and the table f-value at df 1 and 236 at 0.05 level of significance was 24.4. This therefore shows that a significant difference existed between the performance of students from the experimental and control groups. On the whole, the null hypothesis formulated was therefore rejected and the alternative that there was a significant difference in the mean test scores of students taught with the two methods of

teaching agricultural science was therefore accepted. This shows that students in the experimental group (GPSM) performed better than those in the control group (DM).

Research Questions 2

What are the male and female students' mean achievement scores in the Agricultural Science Achievement Test (ASAT) when taught agricultural science with greeno problem solving and demonstration methods? Data analysis presented in table 3 are used to answer this research question.

Table 3: Mean achievement scores of male and female students taught agricultural science with greeno problem solving and demonstration methods.

| Gender | Teaching method | Symbol | Pretest | Post test | Mean gain difference |
|--------|---|-----------|---------|-----------|----------------------|
| Male | Greeno problem method (experimental method) | N | 70 | 70 | |
| | | \bar{X} | 44.52 | 75.80 | 29.48 |
| | | SD | 3.66 | 5.34 | |
| Female | Greeno problem solving method (experimental method) | N | 50 | 50 | |
| | | \bar{X} | 48.05 | 67.88 | 19.83 |
| | | SD | 4.07 | 7.59 | |
| Male | Demonstration method (control method) | N | 66 | 66 | |
| | | \bar{X} | 47.52 | 70.30 | 22.78 |
| | | SD | 4.52 | 5.36 | |
| Female | Demonstration method (control method) | N | 54 | 54 | |
| | | \bar{X} | 48.04 | 62.44 | 14.40 |
| | | SD | 4.35 | 7.98 | |

N = Number of subjects, X = Mean, SD = Standard Deviation

Table 3 above, shows that the pretest mean scores of students taught with greeno problem solving and demonstration methods were found to be 44.52 and 47.52 for male and 48.05 and 48.04 for female respectively; while the post test result shows 75.80 and 70.30 for male and 67.67 and 62.44 for female respectively. These results show there is a difference between the students' pre-test and post-test scores in each method of teaching. The difference is higher

with the greeno problem solving being the experimental method followed by the demonstration being the control method. The mean gain difference for male and female for the experimental method (29.48; 19.83) is higher than those of the control method (22.98; 14.40). These results further show that the difference in post test mean scores is higher among both male and female students taught with the experimental method than those taught with the control method.

Table 4: Analysis of covariance of mean achievement scores of groups of students taught agricultural science with greeno problem solving and demonstration methods based on gender.

| Source of variance | Sum of squares | df | Mean square | F | Significance level at 0.05 |
|--------------------|----------------|-----|-------------|-------|----------------------------|
| GPSM & DM (Group) | 2123.724 | 1 | 2123.724 | 36.31 | S |
| Group (gender) | 128.263 | 2 | 64.131 | 1.696 | NS |
| Pretest | 974.742 | 1 | 974.742 | 16.66 | NS |
| Error | 41879.556 | 239 | 58.491 | | |
| Total | 45106.285 | 239 | | | |

GPSM – greeno problem solving method, DM – demonstration method.

Table 4 above shows that the calculated f- ratio between the experimental (GPSM) and control (DM) methods was found to be 36.31 and the table f value at df 1 and 239 at 0.05 level of significance was 24.4. It therefore means that the hypothesis of no significant difference between the performance of students taught agricultural science with GPSM and the DM was rejected. The students taught with the GPSM (experimental) therefore performed higher than those taught with DM (control). From the analysis too, it was clearly observed that there was no significant difference between the performance of male and female students when they were separately taught with either greeno problem solving and demonstration methods.

MAJOR FINDINGS

The major findings of the study based on the research questions and the hypotheses are as follows:

1. Both group of students taught with greeno problem solving and demonstration methods recorded higher mean scores in the post treatment test than the pre-treatment test,
2. Students taught agricultural science with the GPSM ($X = 72.27$) had higher mean scores than those taught with the Dm ($X = 66.57$) in the post treatment mean scores.
3. Students in the experimental group taught with GPSM performed better than those in the control group taught with Dm.
4. Both male and female students taught with the experimental method (GPSM) recorded higher mean scores than those taught with the control method (DM).
5. Male students taught with the experimental method (GPSM) performed higher than their male counterparts taught with the control method (DM).
6. Female students taught with the experimental method (GPSM) performed higher than those taught with the control method (DM).
7. There was no difference between the performance of male and female students separately taught with the greeno problem solving (GPSM) and demonstration methods (DM).

DISCUSSION OF FINDINGS

The students that were taught with the greeno problem solving method were found to have high achievement in the ASAT than their counterparts in the control group that were taught with the demonstration method of teaching. This finding agrees with Musa (2007) when he stated that adoption of good and thought provoking teaching methods, under a conducive learning environment, facilitate better learning and mastery of the learnt materials by students and consequently students'

performance. He further added that different methods of teaching have different impact and influence on students learning process.

Students taught with the GPSM performed significantly better than those taught with the DM as they had a mean score of 72.37 in the ASAT as against 66.57. This shows the positive impact of the GPSM in the learning of agricultural science over the control method (DM). This finding is in agreement with Pekene (2002) and Orji (2006) when they observed that the GPSM being an activity and student centred approach has greater impact on students' achievement in physical sciences and other related practical science subjects.

The results of hypothesis one revealed that the mean achievement scores of the different groups of students taught with GPSM and Dm differed significantly. The test scores recorded by students depend greatly on the teaching methods employed by the agricultural science teachers. This therefore agrees with Mundi (2006) when he found out that the performance recorded by students in agricultural science lessons is solely dependent on the nature of the method(s) employed by teachers of agriculture.

Comparing the two methods (GPSM and DM) the male students performed higher than their female counterparts: the GPSM group had the higher mean score. This is in agreement with the studies conducted by Arigbulu and Mji (2005) and Daluba and Adu (2005) and Adeyinka and Mutula (2006) when they observed that difference existed between the performance of male and female students in the science and other science related courses like agricultural science.

Furthermore, Orji (2006) observed that students with GPSM are more likely to be more interested and exposed because of the student-centred activity and interactive nature of the approach as compared to the DM. Categorically, male students taught with the GPSM performed better than the female group showing that GPSM increase students' interest and understanding and consequently promoting high achievement rate.

Results of hypothesis 2 revealed that there was no significant difference in effect between male and female students mean achievement scores agricultural science. The non significant differential effects may be that gender has not exerted any impact on students' performance in agricultural science not minding the type of method(s) employed. This finding agrees with Ibitoye (2000) and Pekene (2002) when they found out that different teaching methods exert different impact on the students' academic achievement not minding the gender of the students.

CONCLUSION

Secondary school students performed differently when taught with greeno problem solving and demonstration methods. Students' performance in the experimental group (GPSM) is higher than that of the control group (DM). Male students performed better than their female counterparts when taught with both the GPSM and DM. Generally, greeno problem solving method (GPSM) is more effective in promoting students' mean achievement scores in agricultural science than the demonstration (DM) method. Finally, there was no significant effect between method and gender on students' mean achievement scores in agricultural science.

RECOMMENDATIONS

Based on the findings and conclusion of this study, the following recommendations were made:

1. The government should encourage and intensify teachers' effort to aggressively adopt GPSM in agricultural science teaching in all classes at the junior and senior secondary school levels with the intension to promote students' performance.
2. Curriculum developers should as a matter of priority, be reviewing agricultural science curriculum on a continuous basis with a view to incorporate GPSM as one of the strategies for teaching the course. This will help to promote the performance of students in senior school certificate examination in agricultural science.
3. Textbook authors should it necessary to include in their texts, the uses and application of the GPSM in the teaching and learning of agricultural science so that the teachers and learners should apply it when the need arises.
4. Finally, government and professional bodies should sponsor further research and organize conferences, workshops and seminars for agricultural science teachers on the importance and technicalities of different teaching approaches including greeno problem solving method. This will help to widen the horizons of teachers in the introduction of such teaching approaches in their classrooms.

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