

## Relative Efficacy of Guided and Unguided Inquiring Instructional Methods on Students' Academic Achievement in Animal Nutrition

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### Abstract

This study sought to determine the relative efficacy of guided and unguided inquiry instructional methods on students' achievement in animal nutrition. Two research questions and two null hypotheses guided the study. The study adopted quasi experimental research design specifically pre-test and post-test non-equivalent group. The population of the study included 1887 SS1 students in Nsukka education Zone. A sample of 105 SS1 students was drawn for the study using multistage sampling procedure. One instrument was used for data collection, namely "Animal Nutrition Achievement Test" (ANAT). The instrument was validated by three experts: two from biology unit and one from Measurement and Evaluation Unit. The reliability of the instrument was obtained using Kuder Richardson K-R 20, and a reliability Coefficient of 0.79 was obtained. Data collected were analysed using mean and standard deviation to answer the research questions, while Analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The findings revealed that Students that were taught animal nutrition using guided inquiry method had higher mean achievement score than those taught with unguided inquiry method. Gender has no significant influence on mean achievement score of students in biology. It was recommended that Biology teachers should embrace the innovative instructional teaching method such as guided inquiry method, as it has been found to enhance students' achievement in this study.

**Keywords:** Guided inquiry, unguided inquiry, Students' achievement, Animal nutrition

### Introduction

The scientific development of any nation is dependent on the quality of science education it has. To acquire such knowledge, science subject such as physics, chemistry, biology, agriculture etc are needed to help students achieve the required skills for national development. Biology is one of these science subjects offered in senior secondary schools in Nigeria. Biology is the study of life. It is the study of the structure, function, heredity and evolution of all living things: micro-organisms, fungi, plants and animals (Okenyi, 2012). According to Ishaku (2015), Biology is defined as one of the branches of science that involves the study of living things ranging from microscopic cellular molecules to the biosphere which encompasses the earth surface. According to Nigeria Education Research and Development Council (NERDC), (2012), Biology as a subject in secondary school is subdivided into themes viz organization of life, organism at work, organism and its environment and continuity of life. Organism at work as a theme in biology has different topics which include Reproduction, Excretion, Photosynthesis, and Animal Nutrition.

Animal nutrition is a branch of biology that focuses on the study of how animals obtain and process nutrients to support their growth, development, and overall health. Surai (2017) define Animal nutrition as a branch of biology that focuses on the study of how animals acquire, process, and utilize nutrients for their growth, development, reproduction, and overall physiological functions. . It encompasses the study of various aspects of animal feeding behaviour, nutrient requirements, and the physiological and biochemical mechanisms involved in nutrient utilization. They can be classified into six major categories: carbohydrates, proteins, lipids (fats), vitamins, minerals, and water. Each of these nutrients plays a specific role in the body and is required in different amounts. In spite of the importance of animal nutrition in lives, West African Examination Council (2020-2023) Chief Examiner's report indicated that students still find it difficult to understand the concept of animal nutrition which contribute to the poor performance in animal nutrition. Several research findings have shown that teachers' use of inappropriate instructional methods which does not place the students at the centre of instruction

is the major reason for the poor achievement. Researchers have advocated the use of innovative instructional method in contrast of the old lecture method. The innovative instructional method require students to be active participant in the process of teaching and learning. The use of innovative teaching method is absent in school and might be the reason for lack of understanding and poor achievement. Based on these perceive lapses, the study will adopt the use of inquiry instructional method.

Inquiry instructional method is a teaching method that encourages learners to apply scientific process to explore and construct meaningful knowledge and skills. However, this study is interested in the two types of inquiry methods namely; guided and unguided inquiry. These methods were chosen because the Nigerian Science Educational Curriculum recommends guided inquiry teaching method as one of the innovative teaching methods that is needed for science teaching and learning because it contrasts the traditional lecture/expository methods.

Guided inquiry teaching method is a teaching method that enables students to acquire knowledge on their own under the tutelage of a teacher. Guided inquiry is a method used by teachers and instructors to connect to students' world by creating an environment called "Third Space" which is the gap between what the students know and what the curriculum expects them to know (Kulthau, 2010). Guided inquiry Method is defined by Dajal, Mohammed and Adamu (2019) as an approach to teaching in which students are guided by the teacher to find facts by themselves. It is a method that gives students the opportunity to investigate, use their discretion, contribute to knowledge, and get information individually or collectively to find a solution to a given task. Ukamaka (2013) revealed that guided inquiry teaching approach is a superior teaching approach in facilitating students' achievement in basic science. Similarly, Anayo (2014) and Musa (2015) in their investigate revealed that students taught light waves in Physics using guided inquiry approach achieved higher than their counterparts. In addition, the results of Ugwuadu (2014) observed that inquiry approach of instruction proved more effective in enhancing students' academic achievement in physics. Hence the study intends to investigative the relative efficacy of guided and unguided inquiry instructional methods

Unguided inquiry is an instructional process by which questions or problems and procedures for investigation are carried out by the students with little or no form of assistance from the teacher; in which case the questions are open-ended and less structured.

Bilgin (2015) defined unguided/open inquiry as a student-centered approach to learning that begins with students designing questions, conducting an investigation and communicating results to others. Bilgin (2015) noted that unguided inquiry is intellectually challenging for learners and difficult to implement by teachers but has the benefit of making students not to perform experiments in a routine-like fashion but actually think about the procedure and the results they obtained and what the results mean (conclusion). Shittu, (2010) in his investigation revealed that students taught physics using unguided inquiry achieve higher than their counterpart.

The goal of both guided and unguided inquiry teaching approach is to establish science process skills in the students and also enhance learning through students' active participation and investigation. Both guided and unguided inquiry method has been prove to be effective in other areas, therefore the researcher intends to employ these methods in biology to see its effectiveness in teaching and learning of animal nutrition. The study therefore seeks to determine the relative effect of guided inquiry and unguided inquiry instructional method on students' achievement in animal nutrition.

Academic achievement is the extent to which a student or teacher has attained their short or long term educational goal. According to Oleabhie (2011), academic achievement is the success and accomplishment of an academic task by a student or teacher over a specified period. Literature is replete with evidence of poor students' achievement in Biology. For example, WAEC Chief Examiners' Report (2020-2023) revealed poor students' achievement in animal nutrition in biology. Fatima (2019) emphasised on the poor achievement of students in Biology at the senior secondary certificate examinations, positing that it was as a result of the poor achievement in animal nutrition topics. More so, students avoid questions on animal nutrition or treat the questions haphazardly (Spinath, 2012). These findings make it imperative to investigate/ determine the appropriate teaching methods for animal nutrition. However, students' achievement may be influenced by gender.

Gender is the state of being male or female in relation to the social and cultural roles that are considered appropriate for men and women. The United Nation Office for the Coordination of Humanitarian Affairs (OCHA) (2012) defines gender as the social attributes and opportunities associated with being male and female, the relationship between woman and man. However, the issue of gender in biology achievement is not yet skewed to any direction. There are different findings on gender

issues, some in favour of males, others in favour of females and sometimes no gender differences are found in biology. Studies like (Nnorom, 2019) showed that boys achieve better than girls in Biology. While in the studies carried out by Awoniyi (2011) it was found that female students achieved better than their male counterparts in animal nutrition. Contrary to these findings, Eze (2019) found no significant difference in the achievement between male and female students in animal nutrition. These views appear to be inconclusive making it imperative for further investigation on the issue concerning the influence of gender on students' achievement in animal nutrition with respect to guided and unguided inquiry instructional method.

### Research Questions

1. What are the mean achievement scores of students taught animal nutrition using the guided inquiry and those taught using the unguided inquiry instructional methods?
2. What is the influence of gender on the mean achievement scores of students in animal nutrition?

### Hypotheses

The following null hypotheses guided the study and was tested at a probability level of 0.05

**Ho<sub>1</sub>:** There is no significant difference in the mean achievement scores of students taught animal nutrition using the guided inquiry and those taught using the unguided inquiry instructional methods.

**Ho<sub>2</sub>:** There is no significant influence of gender on the mean achievement scores rating of students in animal nutrition.

### Method

This study employed quasi-experimental research design, specifically pre-test and post test the non-equivalent groups design. The population of this study comprised 3079 SS1 students in the 61 Government secondary schools in Nsukka Education zone. Purposive sampling technique was used to select two schools, because the study concentrated on gender. And simple random sampling for selection of two intact classes consisting of 105 students. To

make sure every students has equal chance of being selected. They were 55 students in the experimental group I(guided inquiry) and 50 students in the experimental groupII (unguided inquiry) 50 male students and 55 female students. Animal Nutrition Achievement Test (ANAT) was the instrument used and was developed by the researcher. To determine the content validation of ANAT, a test blue print was prepared for the ANAT, based on the modified Bloom's taxonomy. The ANAT has two sections A and B. Section "A" sought for the demographic information of the respondents such as gender, name of school, while section "B" contained 30 multiple choice questions, with four response options, A, B, C, and D for each item. Each of the questions in the ANAT carried one mark. ANAT was vetted by three experts, two from Biology unit, one from Measurement and Evaluation unit; both from Department of Science Education. The reliability coefficient of the ANAT was determined using Kuder Richardson Formula 20 (K-R 20). Kuder Richardson was used because the items were dichotomously scored. An internal consistency reliability coefficient score of 0.77 was obtained, and this was considered high enough for the study.

The sampled school were visited, and permission granted by appropriate authorities before commencement of study. The researcher trained the Biology teachers that were teaching the classes sampled on how to teach the content using the lesson plans developed by the researcher. These teachers were used as research assistants. The training was done separately for the teachers handling guided inquiry and unguided inquiry methods in the sampled schools. The research assistants taught in their respective classes, to avoid experimental bias. After training the research assistants handling guided inquiry, the researcher used them to administered the ANAT(pre test) to their students which constituted experimental group 1, and the same process was taken after training the research assistants handling unguided inquiry, for the experimental group 11. The students in both experimental group 1 and experimental group 11 were taught the topics by their regular Biology teachers (research assistants). After the treatment, the post-test which is the reorganized form of ANAT were administered to the students, and were collected on the spot.

## Results

**Table 1:** Mean and Standard deviation of achievement scores of students taught animal nutrition using the guided inquiry and those taught using the unguided inquiry instructional method

Treatment	N	Pre-test		Post-test		Gain Score
		Mean	SD	Mean	SD	
Guided inquiry	55	16.17	4.22	40.07	3.00	23.90
Unguided inquiry	50	14.78	2.95	37.53	3.32	22.75

The result in Table 1 shows that the students taught animal nutrition using guided inquiry had a pre-test mean achievement score of 16.17 with a standard deviation of 4.22 and a post-test mean achievement score of 40.07 with a standard deviation of 3.00. While those taught animal nutrition using unguided inquiry had a pre-test mean achievement

score of 14.78 with a standard deviation of 2.95 and a post-test mean achievement score of 37.53 with a standard deviation of 3.32. Mean difference of 23.90 and 22.75 for the Guided and unguided groups respectively imply that students taught using guided inquiry had a higher mean achievement gain score.

**Table 2:** Analysis of Covariance (ANCOVA) of students' achievement in animal nutrition.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	516.876 <sup>a</sup>	4	129.219	19.488	.000	.438
Intercept	520.503	1	520.503	78.497	.000	.440
Pretest	332.582	1	332.582	50.157	.000	.334
Treatment	85.059	1	85.059	12.828	.001	.114
Gender	2.569	1	2.569	.387	.535	.004
treatment*gender	1.836	1	1.836	.277	.600	.003
Error	663.086	100	6.631			
Total	160729.000	105				
Corrected Total	1179.962	104				

The result in Table 2 shows that an F-ratio of 12.83 was obtained with associated exact probability value of 0.01 with respect to the mean achievement scores of students taught animal nutrition using guided inquiry and unguided inquiry approach. Since the associated probability value is 0.01 and is less than 0.05 level of significance, the null hypothesis ( $H_{01}$ ) which states that there is no significant

difference in the mean achievement scores of students taught animal nutrition using the guided inquiry and those taught using the unguided inquiry instructional approach is therefore rejected. Thus, inference drawn is that, students taught animal nutrition using guided inquiry achieved significantly more in animal nutrition than those taught using unguided inquiry.

**Table 3:** Mean and Standard deviation of achievement scores of male and female students in animal nutrition

Gender	N	Pre-test		Post-test		Gain Score
		Mean	SD	Mean	SD	
Male	50	14.52	3.39	38.64	3.35	24.12
Female	55	13.89	4.12	39.33	3.39	25.44

The result in Table 3 above shows that the male students have a pre-test mean achievement score of 14.52 with a standard deviation of 3.39 and a post-test mean achievement score of 38.64 with a standard deviation of 3.35. The mean gain score for the male

students is 24.12, while the female students have a pre-test mean achievement score of 13.89 with a standard deviation of 4.12 and a post-test mean achievement score of 39.33 with a standard deviation of 3.39. The mean gain score for the female students

is 25.44 while that the males is 24.12. This shows that the female students had slightly higher achievement mean gain score than the male students after being exposed to the treatments.

Table 2 shows that in the mean achievement scores of male and female students taught animal nutrition using guided inquiry and unguided inquiry approach, an F-ratio of 0.39 was obtained with associated probability value of 0.54. Since the associated probability value of 0.54 is greater than 0.05 level of significance, the null hypothesis ( $H_{04}$ ) which states that there is no significant influence of gender on the mean achievement scores ratings of students in animal nutrition is not rejected. Hence, the inference drawn is that, there is no significant difference in the mean achievement scores of male and female students in animal nutrition. This result shows that gender is not a significant factor affecting students' achievement in animal nutrition when taught with either guided inquiry or unguided inquiry method.

### Discussion

The findings from the study reveal that students exposed to Guided inquiry had higher mean achievement in animal nutrition more than those taught using the unguided inquiry. The test of hypothesis reveal that there is significant difference in animal nutrition achievement score of Guided inquiry group as compared to unguided inquiry group. It indicates that guided inquiry method has more positive effect in enhancing academic achievement in animal nutrition in senior secondary schools. The result of the study may have been significant due to the fact that students' were actively involved while interacting with varieties of instructional materials, and responding to questions posed by the teacher. The finding is in agreement with the study carried out by Mwenda and Ndayambaje (2021) who stated that the guided inquiry method improved students' achievement in biology. This also agrees with Adeuya, (2020) who found that the use of guided inquiry method is statistically significant in improving students' achievement and in biology. This agreements may be as a result of students participation in using the teaching method. The findings also indicate that the female students had a slightly higher mean achievement gain score in animal nutrition after being exposed to the methods than their male counterparts but the difference in mean achievement scores between male and female students in animal nutrition was not statistically significant. This result equally showed that gender is not a significant factor influencing students' achievement in animal nutrition when taught with

either guided or unguided inquiry method. The findings of this study is in agreement with the finding of Oluwatayo and Fatoba (2010), Alabi (2011), who in their different studies found out that there is no significant difference between male and female students mean achievement scores in biology when exposed to their different treatments. It also disagrees with Bello and Abimbola(2012) and Uzor (2019) who revealed that there is significant difference between male and female students mean achievement scores in biology when exposed to treatment. The no significant difference between male and female students mean achievement scores in biology may be attributed to the teaching method being gender friendly.

### Conclusion

In view of the research findings, Students that were taught animal nutrition using guided inquiry method achieved higher than those taught with unguided inquiry method. Hence guided inquiry method enhances students' academic achievement in animal nutrition than the unguided inquiry method. Guided inquiry method provided equal achievement for both male and female students.

### Recommendations

Based on the findings, the researchers recommended that

1. Biology teachers should embrace the innovative instructional methods, such as guided inquiry method as it have been found to enhance students' achievement and in this study.
2. To ensure that Biology student-teachers grasp the tenets of the use of this innovative method, the government and curriculum planners should include guided inquiry method in the biology special method course contents in Colleges of Education and Faculty of Education in the Universities
3. Federal and State Ministries of education, in conjunction with professional bodies such as STAN and CON, should organise seminars, workshops and conferences on the use of guided inquiry method for serving teachers, teacher educators, in the universities and Colleges of Education, to keep them abreast of the method since it has proven that the method is effective

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