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# EFFECTS OF ADVANCE ORGANIZER AND GUIDED INQUIRY TEACHING STRATEGIES ON SENIOR SECONDARY SCHOOL STUDENTS' INTEREST IN ECOLOGY IN ZONE C OF BENUE STATE

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**Abstract**

*The study focused on the effect of advance organizer and guided inquiry instructional strategies on SSI students' in Ecology in Zone C, Benue State. Quasi experimental research design of non-randomized pre-test, post- test was used for the study. The population comprised of all SS 1 students in the Zone. Using purposive sampling technique, four schools were selected and a total of 146 students participated in the study. Student Interest Inventory (SII) was used for data collection. The reliability coefficient of SII on 50 students after trial testing using Cronbach alpha was found to be 0.82. Mean and standard deviation were used to answer the research questions while the hypotheses were tested at 0.05 significant level using ANCOVA. The study found mean difference between interest ratings of students taught with advanced organizer and those taught with guided inquiry strategy in favour of those taught with guided inquiry. The study also revealed that gender has significant effect on interest ratings of students in ecology using the two teaching strategies. It was recommended that ecology should taught using guided inquiry for students to be in control of learning and to arouse their interest of male and female students in ecology.*

**Key Words:** Advanced Organizer, Guided Inquiry, Interest, Ecology, Biology.

**Introduction**:

Biology is one of the subjects in senior secondary school science curriculum needed for the nation's technological breakthrough and national development. It is a science subject that deals with the study of living things. Biology equips learners with knowledge and skills that helps them to face challenges in the society especially issues relating to common disease (Mwenda & Ndayamaje, 2021). It is a prerequisite subject for those studying medicine, pharmacy, agriculture, nursing and other related courses in tertiary institutions. Apart from the vocational interest of students, Biology exposes learners to explore other opportunities that will enhance meaningful and healthy living as the concepts, principles, and theories relating to life are learnt in the process. Without sound knowledge of Biology the much desired technological advancement may be a mirage as its' knowledge plays significant roles in manufacturing and processing industries, pharmaceuticals, agriculture, among others. However, review of students' performance in Senior Secondary School Certificate Examination (SSCE) in the subject has been

low (Okoye,2018; Onanuga & Saka 2020; Iroriteraye-Adjekpvu & Silama, 2020). This is capable of depriving the society of the multiple benefits the subject stands to offer unless there is improvement in students' performance.

Ecology is the branch of biology that deals with the relationship or interactions of living organisms with each other and their environment. The knowledge of ecology helps us to understand the distribution of organisms and factors responsible for it. Among the different challenges facing mankind, ecological issues such as flooding, desertification, ozone layer depletion, pollution among others, are predominate. The knowledge gained from ecology helps in predicting the dynamics of ecological problems and the attendant global effects on the environment. Ecology is a dominant theme in biology which comprises of ecological concepts such as aquatic and terrestrial habitats, management of ecosystem, functional ecosystem and ecology of population, Ecology and evolution according to Oyarole in Yahaya (2023) are reported different areas in biology that are perceived difficult to understand and findings revealed that this contributed to poor academic performance in biology (Achor & Amadu; 2015 Etoboro. & Fabinu, 2017). The abysmal performance in the subject is traceable to weakness in ecology which eventually forms the bulk of the questions in all biology examinations (Benson-Ogbu, Abonyi, Aja & Ogboega, 2022). According to West Africa Examination Council (WAEC) Chief Examiners' reports, (2016 - 2019) students' weaknesses manifest in their inability to attempt questions in ecology and poor illustrations in questions drawn from the area. The under-performance in biology especially in ecology, is traced to teaching methods , especially lecture method that is not student centred and therefore, innovative strategies such as constructivist approach that is student-centred is recommended (Achor, Wude & Duguryi, 2014; Yahaya 2023,).Apart from teaching methods, Ogbona(2017) and Onyeabor(2017) in their different studies identified lack of interest as one the reasons for students' under performance. It has been established that there is significant effect of teachers' instructional strategies on students' interest in learning subjects and academic performance (Lee & Boo, 2022). It was further stated by Tanjung, Saragih and Pulungan (2021), that teaching method used is capable of influencing students' interest in learning which has impact on their performance. Danjuma (2017) pointed out that inquiry instructional method enhance students' interest in ecology. The study conducted by Obodo and Ani on interaction effect of gender and teaching method on academic performance and interest of basic science students in upper basic education revealed that there was no significant interaction effect of teaching method and gender on the mean interest scores of students in Basic Science. The study therefore, considered the use of advance organizer and guided inquiry as innovative strategies capable of improving students' interest in ecology.

Advance organizer is the information presented by the instructor or teacher that helps the learner or students organize the new incoming information (Oyeniyi & Awolabi, 2020). Advance organizer as a framework, enables students to learn new ideas or information and meaningfully link these ideas to the existing cognitive structures. It is the written or unwritten form of information or materials presented to the learners prior to the learning activities that would enable them to properly organise and interpret

information. Advance organizer has its anchor in David Ausuble's subsumption theory of meaningful learning and retention where it is considered a pedagogic strategy (Ausubel, 1960). Meaningful learning when described in terms of reception learning is where content of the learning task is presented to the learners instead of discovering it by themselves and this is a deductive instructional strategy.

Guided inquiry, according to Akerson, Hanson and Cullen (2017), is a student-centred activity- oriented teaching strategy in which the teacher guides students through problem – solving approach to discover answers to instructional topics. Guided inquiry involves careful planning, close supervision, on-going assessment and targeted intervention by an instructional team of teachers through the inquiry process that gradually leads students towards independent learning (Adeuya, 2020). The teacher with minimal guidance the learners seek to discover and provide answer to given problem through diligent search (Nanze, 2016). Guided inquiry helps the learners to understand the information, make it meaningful and then apply it in real life situations. Guided inquiry provides opportunity for students to learn and experience biology first hand by taking the role of scientist investigating problems in attempt to provide solutions (Hezekiah, 2023). Ozioko (2015), also pointed out that guided discovery teaching strategy increases learners' interest. This was collaborated by study conducted by Nnorom (2017) and Owolade, Salami, Kareem and Oladipupo (2022) which revealed that guided inquiry enhances students' performance and interest in biology. Yalams in Owolade (2022) stressed the importance of guided inquiry as being capable of increasing students' attention, confidence, innovation and problem solving abilities as products of the engendered interest in the subject by the teaching strategy. The primary objective of guided inquiry therefore, is to promote learning through students' investigation.

Interest is described as a psychological state of attention given to a particular object with an unending predisposition to re-engage over time. Interest is a very powerful psychological motivational process capable of boosting learning and guides academic career trajectories (Renninger & Hidi, 2016) teachers' teaching approach is identified as one of causes of lack of interest in learning process (Apochi, Umoru & Onah, 2018) and students who are interested in their chosen subjects tend to excel both in academics and career. Toli and Kallery (2021) in their study established that there is relationship between interest and learning outcomes' This is true when once students' interest is is guaranteed with commendable learning outcomes. Besides ability, personal preference students have for a particular subject is based on interest. This therefore, underscores the importance of interest in the teaching and learning process.

Researchers (Godspower & Ihenko, 2017) view on the effects of gender on in science subjects has mixed findings. However, gender is considered an important factor affecting students' interest in learning science (Azman, 2014). This was corroborated by Godspower and Ihenko (2017), that gender has a significant effect on students' interest in science. It was also

reported that boys have higher interest in basic technology than girls (Nwosu, Monday & Chukwudi, 2017). According to Odukwe and Nwafor (2022), the interest of boys over girls in chemistry was due to gender stereotyping which encourages boys to show overt in the subject. Conversely, gender was found to have no effect on students' interest in science (Ajiboye, 2015; Ajayi, Agamber & Angura, 2017). Against the inconsistency of these findings, the study investigated effect of advance organizer and guided inquiry instructional strategies on male and female senior secondary school students' interest in Ecology

**Statement of the Problem**

Interest is a veritable motivational experience that gingers up learning and is capable of enhancing students' performance in schools. One of the greatest challenges in teaching and learning process is how to gainfully enhance students' learning as represented by interest and academic performance. Lack of interest is capable of causing students' poor performance and low enrolment in science subjects. Factors such as subject's characteristics, teacher's instructional strategies, students' individual differences among others, have been identified as affecting students' interest. Instructional strategies such as lecture method, has been used without desirable effect on students' interest but rather makes them to become bored and passive in the learning process. Despite the recommendations that other teaching strategies than lecture method be used in teaching biology, students' interest continued to dwindle leading to poor performance in the subject. This has resulted in students' hatred for learning leading to drop- outs from school with adverse effect on the society. This has necessitated the quest for teaching strategies capable of creating interest in the learners. The problem of this study is therefore: what is the effect of advance organizer and guided inquiry instructional strategies on senior secondary school students' interest in Ecology?

**Research Questions**.

The following questions guided the study

1. What is the difference between the mean interest ratings of students taught ecology using advance organizer and those taught using guided inquiry strategy?
2. What is the difference between the mean interest ratings of male and female students taught ecology using advance organizer?
3. What is the difference between the mean interest ratings of male and female students in ecology using guided inquiry strategy?

**Hypotheses**

The following null hypotheses were formulated and tested at 0.05 significant level.

**Ho1** There is no significant difference between the mean interest ratings of students taught ecology using advance organizer and students taught using guided inquiry strategy.

**Ho2** There is no significant difference between the mean interest ratings of male and female students taught ecology using advance organizer.

**Ho3** There is no significant difference between the mean interest ratings of male and female students taught ecology using guided inquiry strategy.

**Methodology**

The study ascertained the effects of advance organizer and guided inquiry on students' interest in ecology in senior secondary school. The study used quasi-experimental design of non- randomized pre-test and post-test type design as it was not

possible to have a complete randomization of subjects. All SS1 students in Benue Zone C constitute the population of the study. Purposive sampling technique was used in selecting four participating schools. Two schools each were randomly assigned as experimental group one (Advance organizer) and group two (Guided inquiry). The sample size of the study was 146 SS1 students taken from four secondary schools comprising of 88 male and 58 female students respectively. The sample was made of 65 and 81 students for experimental groups 1and 2 respectively. The experimental group 1(Advance Organizer) was made up of 42 male and 23 female students while the experimental group two (Guided Inquiry strategy) was made up of 46 male and 35 female students. The Hat and draw method was used in selecting the arms of SS1 where applicable and intact classes were used throughout the study. The students in experimental group one were treated with advance organisers while the students in experimental group two were taught with guided inquiry strategy. An instrument called Students Interest Inventory (SII) constructed by Fennema and Sherma, was adapted and used for data collection. The SII was a 20 interest rating instrument and Likert Scale type of interest inventory. The structural and statements adjusted were the major changes in the instrument to enable the researcher use it for the study. It has 20 items in statement forms with five response categories (Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree) which the respondents were requested to choose according to their opinions. The instrument was validated by two experts in test and measurement, and was trial tested on 50 students with reliability coefficient of 0.82 through Cronbach alpha as the instrument was not dichotomously scored. The study lasted for six weeks and at the beginning of the study, SII was administered as pre-test and post-test at the end of the sixth week. Mean and standard deviation were used to answer the research questions while the hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA).

## Results

### Research Question 1

What is the difference between the mean interest ratings of students taught using Advance Organizer and those taught using Guided Inquiry strategies?

**Table 1:** *Mean and Standard Deviation of Interest Ratings of Students Taught using Advance Organizer and Students Taught using Guided Inquiry Strategies*

| Group | Sample (n) | Pre SII | | Post SII | | Mean gain |
|---|---|---|---|---|---|---|
| | | Mean | Std. D. | Mean | Std. D. | |
| Advance Organizer | 65 | 2.67 | 0.81 | 3.72 | 0.30 | **1.05** |
| Guided Inquiry | 81 | 2.72 | 0.77 | 4.33 | 0.23 | **1.62** |
| **Mean Difference** | | **0.05** | | **0.61** | | **0.57** |
| **Total** | **146** | | | | | |

Table 1 shows that 65 students were taught ecology using advance organizer while 81 students were taught ecology using guided inquiry teaching strategies. The table indicates that the mean interest rating of students taught ecology was 2.67 with a standard of deviation of 0.81 during pre-test while the post test scores was 3.72 with a standard deviation of 0.30. While the students taught using guided inquiry strategy had mean interest rating of 2.72 with a standard deviation of 0.77 during pre-test and 4.33 with a standard a standard deviation of 0.23 in post-test. Table 1 further shows that the mean gain of students taught ecology using advance organizer was 1.05 and those taught using guided inquiry strategy was 1.62. The mean difference between the mean performance scores of students taught ecology using advance organizer and those taught using guided inquiry teaching strategy was 0.57 in favour of students taught ecology using guided inquiry.

**Research Question 2**

What is the difference between the mean interest ratings of male and female students taught ecology using advance organizer?

**Table 2:** *Mean and Standard Deviation of Interest Ratings of Male and Female Students Taught using Advance Organizer*

| Group | Sample (n) | Pre SII | | Post SII | | Mean gain |
|---|---|---|---|---|---|---|
| | | Mean | Std. D. | Mean | Std. D. | |
| Male | 42 | 2.67 | 0.85 | 3.83 | 0.27 | **1.16** |
| Female | 23 | 2.68 | 0.73 | 3.53 | 0.25 | **0.85** |
| **Mean Difference** | | **0.01** | | **0.30** | | **0.31** |
| **Total** | **65** | | | | | |

Table 2 shows that 42 male students and 23 female students were taught ecology using advance organizer method. The table indicates that the mean interest rating of male students taught of ecology using advance organizer strategy was 2.67 with a standard deviation of 0.85 during pre-test while the post-test rating was 3.83 with a

standard deviation of 0.27. While the female students taught using advance organizer strategy had mean interest rating of 2.68 with a standard deviation in post-test 0.73 during pre-test and 3.53 with a standard deviation of 0.25 in post-test. Table 3 further shows that the mean gain of male students was 1.16 and that of their female counterpart was 0.85. The mean difference between the mean performance scores of male and female students was 0.31 in favour of male students.

**Research Question 3**

What is the difference between the mean interest ratings of male and female students in ecology using guided inquiry strategy?

**Table 3:** *Mean and Standard Deviation of Interest Ratings of Male and Female Students taught using Guided Inquiry teaching strategy*

| Group | Sample (n) | Pre SII | | Post SII | | Mean gain |
|---|---|---|---|---|---|---|
| | | Mean | Std. D. | Mean | Std. D. | |
| Male | 46 | 2.80 | 0.81 | 4.31 | 0.20 | **1.51** |
| Female | 35 | 2.49 | 0.65 | 3.86 | 0.51 | **1.37** |
| **Mean Difference** | | **0.31** | | **0.45** | | **0.15** |
| **Total** | **81** | | | | | |

Table 3 shows that 46 male students and 35 female students were taught ecology using guided inquiry teaching strategy. The table indicates that the mean interest rating of male students taught ecology using guided inquiry teaching strategy was 2.80 with a standard deviation of 0.81 during pre-test while the post-test rating was 4.31 with a standard deviation of 0.20.While the female students taught using guided inquiry strategy had mean interest rating of 2.49 with a standard deviation of 0.20 in post-test. Table 5 further shows that the mean gain of male students was 1.51 and that of their female counterpart was 1.36. The mean difference between the mean performance scores of male and female students was 0.15 in favour of male students.

**Hypothesis One**

There is no significant difference between mean interest ratings of students taught ecology using advance organizer and students taught using guided inquiry strategies.

**Table 4:** *ANCOVA of Mean Interest Ratings of Students using Advance Organizer and Students Taught with Guided Inquiry strategies*

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 13.722[a] | 2 | 6.861 | 98.75 | .000 |
| Intercept | 186.834 | 1 | 186.834 | 2.689 | .000 |
| PreSSI | .006 | 1 | .006 | .082 | .775 |
| Strategy | 13.720 | 1 | 13.720 | 197.45 | .000 |
| Error | 9.936 | 143 | .069 | | |
| Total | 2434.650 | 146 | | | |
| Corrected Total | 23.654 | 145 | | | |

a. R Squared = ( Adjusted R Squared = .574)

Table 4 reveals that F(1,143) = 197.474; p = 0.000<0.05. Thus, the null hypothesis ones is therefore rejected. This implies that there is significant difference between mean interest ratings of students taught ecology using advance organizer and students taught using guided inquiry strategy. Thus, it can be concluded that based in evidence from data analysis there is significant difference between mean interest ratings of students taught using advance organizer and students taught using guided inquiry strategy.

**Hypothesis Two**

There is no significant difference between mean interest ratings of male and female students taught ecology using advance organizer.

**Table 5:** *ANCOVA of Mean Interest Ratings of Male and Female Students Taught using Advance Organizer*

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 1.330[a] | 2 | .665 | 9.720 | .000 |
| Intercept | 69.245 | 1 | 69.245 | 1.012 | .000 |
| PreSSI | .030 | 1 | .030 | .433 | .513 |
| Gender | 1.302 | 1 | 1.302 | 19.402 | .000 |
| Error | 4.240 | 62 | .068 | | |
| Total | 905.810 | 65 | | | |
| Corrected Total | 5.57 | 64 | | | |

a.R Squared = .239 (Adjusted R Squared = .214)

Table 4 reveals that F(1, 62) = 19.402; p = 0.000<0.05. Thus, the null hypothesis two is therefore rejected. This implies that significant difference exists between the mean interest ratings of male and female students taught ecology using advance organizer strategy. Thus, it can be concluded that based on evidence from data analysis that when advance organizer method was used significant difference exists between mean interest ratings of male and female students taught ecology.

.**Hypothesis Three**

There is no significant difference between mean interest ratings of male and female students taught ecology using guided inquiry strategy.

**Table 6:** *ANCOVA of Mean Interest Rating Scores of Male and Female Students Taught Ecology using Guided Inquiry Strategy*

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 4.812[a] | 2 | 2.406 | 18.939 | .000 |
| Intercept | 113.888 | 1 | 113.888 | 896.415 | .000 |
| PreSSI | .720 | 1 | .720 | 5.671 | .200 |
| Gender | 4.365 | 1 | 4.365 | 36.480 | .000 |
| Error | 9.910 | 78 | .127 | | |
| Total | 1386.190 | 81 | | | |
| Corrected Total | 14.722 | 80 | | | |

Table 6 reveals that F (1,78) = 36.480; p = 0.000<0.05. Thus, the null hypothesis three is therefore rejected. This implies that there is significant difference between the mean interest ratings of male and female students taught ecology using guided inquiry strategy. Thus, it can be concluded that based on evidence from data analysis when guided inquiry method was used, significant difference existed between mean interest ratings of male and female students taught ecology.

**Discussion of Findings**

The findings on the effect of advance organizer and guided inquiry teaching strategies on SS I students' interest in ecology show that students taught with guided inquiry teaching strategy developed more interest than those taught with advance organizer. The test of hypothesis showed that there was a significant difference in interest rating between students taught using advance organizer and those taught with guided inquiry Participation in inquiry-based instruction enhances Senior Secondary Students" interest in learning of Biology. This finding is in agreement with Tanjung, Saragih and Pulungan (2021) who posited out that teaching method is capable of enhancing student's interest. The result also corroborated the findings of Ozioko (2015) and Danjuma (2017) that inquiry instructional method being student- centred increases interest in science.

The findings on the effect of advance organizer on male and female students interest ratings revealed that rate of male students' interest is higher than their female counterpart taught ecology. The test of hypothesis indicated that there is significant difference between male and female students interest ratings taught ecology. This finding is in agreement with Godspower and Ihenko (2017) that gender has significant effect on interest of students in science.

The also revealed that male students have high interest rating than their female

counterpart. This finding is in agreement with Nwosu, Monday and Chukwudi (2017) who pointed out that male students are attracted to science than female students who prefer Arts subjects due to influence of African culture and tradition. Despite this disparity, Guided inquiry helps the learners to understand the information, make it meaningful and then apply it in real life situations. Guided inquiry provides opportunity for students to learn and experience biology first hand by taking the role of scientist investigating problems in attempt to provide solutions (Hezekiah, 2023).

## Conclusion and recommendations

Advance organizer and guided inquiry teaching methods have produced effects on student's interest in ecology the study revealed that there is a significant difference between mean interest rating between students taught with advance organizer and those taught with guided inquiry in favour of those taught using guided inquiry. There is a significant difference between the mean interest rating between male and female taught using advance organizer. From the study, male students taught using advance organizer and guided inquiry have higher interest ratings than their female counterpart. Based on the findings it is recommended that:

1. Biology teachers should use guided inquiry teaching strategy in teaching ecology.
2. Female students should be motivated to participate in the teaching - learning process in order to boost their interest in ecology.
3. African culture and tradition should be revolutionized by recognising display of skills and talents at the expense of gender.

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