# INTERACTION EFFECT OF FACEBOOK AND SIMULATION INSTRUCTIONAL STRATEGIES ON STUDENTS' ATTITUDE AND ACHIEVEMENT IN BIOLOGY IN SENIOR SECONDARY SCHOOLS IN FCT-ABUJA

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ABSTRACT: Interaction effect of facebook and simulation instructional strategies on students' attitude and achievement in senior secondary Biology was investigated. Quasi-experimental design was adopted with population of 12719 and a sample of 247 senior secondary two biology students. Data were generated using Germination Achievement Test (GAT) and Student' Attitude to Biology Questionnaire (SABQ). GAT and SABQ were subjected to reliability analysis using Kuder-Richardson formula 21 and Cronbach Alpha formula yielding coefficients of 0.75 and 0.68 respectively. Data were analyzed using graphs and Analysis of Covariance for testing the hypotheses. The results revealed no significant interaction effect of strategies and gender on mean attitude ratings of students towards seed germination; there is significant interaction effect of strategies and gender on mean achievement of students in seed germination. It was recommended that teachers should involve male and female students in learning activities to avoid gender stereotyping and create equal opportunities for male and female learners.

**KEYWORDS:** Simulation instructional strategy, facebook instructional strategy, achievement in biology, attitude towards biology, seed germination, gender, interaction effect.

# **INTRODUCTION**

Biology is a branch of science that deals primarily with living things, such as plants and animals; where they live, why they live there, how they live where they are found and their interactions with each other and their surrounding environment. Osuafor and Okoronkwo (2013) viewed Biology as a science of life that plays a very important role in the life of every human being. The study of Biology, according to Onvegegbu (2008), results in the production of not just the medical doctors and research scientists of the future but also, a biologically literate citizenry. The subject, biology as reported by Heather (2018), arouses intellectual curiosity, increases awareness of the ecosystem, stimulates critical thinking, increases understanding of living systems and allows one to consider the systems in relationship to one's self and other organisms in the natural environment. In recent times, biology plays a key role in sustainability of the global environment and economic growth. Biological principles and processes are applied in developing bioresources for a more environment-friendly bioeconomy (Thomas, Jan, Considering the importance of biology, it becomes very Jan and Joachim, 2018). necessary to have it included in curriculum to be taught as a subject right from the secondary school level.

Unfortunately, the teaching and learning of biology in Nigerian secondary schools are fraught with many problems that always attract attention of scholars over the years as have been variously reported. One of such perennial problems associated with the teaching and learning of Biology is students' achievements that have been persistently reported to be low. For instance, Achor (2001) and Anyigbo (2005) recorded in their separate studies that students' achievement in sciences appears to be more encouraging except for Biology that is offered by science and non-science students. In the same vein, Ibe (2013) made it clear that one of the science subjects which the students perform poorly and in which the situation calls for adequate attention is Biology. To buttress the case above, Ibe emphatically reported that in the past twenty years, for instance, not more than 41.25% of candidates who participated in the senior school certificate examination attained credit and above in Biology. Abimbola (2013) as well reported that candidates' performance in Biology, precisely from 1991 to 2011 never rose above 50%. The average success rate of students in ordinary level Biology in West African Secondary Schools' Certificate Examination (WASSCE) compared with subjects like Physics, English, Mathematics and Chemistry from WASSCE of 2008-2012 as reported by Sakiyo and Badau (2015) is as follows: - Physics - 56.01%, English - 52.52%, Mathematics – 47.44%, Chemistry – 46.30% and Biology – 37. 27%. This, perhaps, according to Abimbola (2013), is because non science students use to register for Biology as a core subject. This clearly shows that students have difficulties in passing Biology well at the secondary school level.

Many reasons have been adduced to students' perceived poor achievement in O-level Biology examination over the years. Some of the reported reasons include structuring of the curriculum, inability to make correct deductions from graphs, drawing, poor spelling of technical/scientific terms, inadequate teaching method, teachers' methods, among others. Such methods been the main focus of this study are the facebook and simulation strategies. The aforementioned lapses can no doubt be impediments to students' attitude and achievement in Biology among other factors related to achievement in secondary school Biology examination.

Attitudes can be described as a state of readiness, a tendency to act or react in a certain way. In general, it refers to a learned disposition or tendency on the part of individual to respond positively or negatively to a situation or another person. Ahmad and Asghar (2011) opine that attitudes play a major role in the understanding of Biology concepts. Malin and Gulnur (2014) maintains that attitude towards Biology deals with the beliefs, interest; perception and aspiration, practicing habits, persistence and self-concept of students in dealing with Biology. Agbile (2015) opines that attitude influences how well students adjust and how they behave. The enthusiasm with which students enter into any learning activity is determined by their attitude to that particularly activity. Students seem to learn more efficiently those things that appear to interest them. The attitude and result of learning efficiency of male and female students in project-based e-learning such as facebook and simulation strategy may be different, hence the issue of gender achievement in Biology.

Researchers have shown that difference in academic achievement due to gender has caused a lot of concern to educators, (Hussani, Kamar & Foong, 2015; Ahmad &

Asghar, 2015). According to Agogo and Naakaa (2014), gender is a socially ascribed attribute that differentiates feminine from masculine. Abidemi (2014) found that there is a significant difference in the achievement of students and attitude to Biology. Students' achievement in Biology with respect to gender has continued to be of interest to researchers. This brings about the search for result-oriented methods of teaching Biology that are gender friendly and which potentially can influence attitude of learners and achievement in biology at this level.

In the same perspective, simulation also allows for types of experimentation that cannot take place in the real environment. The simulation method involves the use of models, game formats, structured role plays, or an interactive computer or video programme (Ezeudu & Ezinwanne, 2013). To initiate a simulation, the teacher presents an artificial problem, situation, or event that represents some aspects of reality. This is because, any complication that may be associated with the real-life phenomenon is removed. In addition, the level of abstraction or complexity is purposefully reduced so that students may become directly involved with underlying concepts (Yusuf, 2015). Yusuf further notes that during simulation activities, students become active participants in the learning process. A variety of learning objectives may be associated with the simulation. Some focus on the application of previous knowledge, skills and abilities, while others emphasize the acquisition of new knowledge, understanding, insights and appreciations. Many simulation activities promote and develop critical and creative thinking or involve interactions which develop interpersonal and social skills, attitudes and values as well as enhance students' academic performance (Olivares, 2015).

On the other hand, Dolphin (2017) noted that facebook is a social networking website where users can post comments, share photographs and post links to news or other interesting contents on the web, chat lives and watch short form videos. Facebook according to Pappas (2015) is the world's largest social networking site. Khan (2015) stressed that students probably spend more time on facebook than they do studying or completing homework/assignments. Today, the popularity of the site has made it accessible to anyone who has internet access. Facebook is operated by creating a personal profile which help users connect with friends all over the world. As a teacher, the question then becomes, how can facebook be utilized maximally in the classroom as teaching/learning strategy? This assertion becomes pertinent when one considers that with the invention of the internet and its everyday accessibility, accessing knowledge is made easier. According to Limayem, Rouis and Esmail (2011) the facebook instructional strategy is a teaching booster to enhance learning and interest of learners towards learning. This therefore stresses the need for practical teaching and learning of Biology using facebook instructional strategy, hopefully to enhance the students' attitude towards Biology and achievement in biology.

Considering the importance of biology and the students' persistent poor performance in the subject with respect to gender, there is the need to examine the interaction effect of the strategies employed by teachers in biology classes. This is because the way and manner, in which concepts are presented influence how students think, tackle questions and may be a significant factor in students' attitude towards biology and achievement in seed germination content of biology. Therefore, interaction effect of instructional

strategies and gender on students' attitude and achievement in Biology in Senior Secondary schools needs to be investigated in this study to verify the extent of the claim that achievement is a function of attitude.

## **Research Questions**

The following research questions guided the study:

- 1. What is the interaction effect of instructional strategies and gender on students' attitude towards seed germination?
- 1. What is the mean interaction effect of instructional strategies and gender on students' achievement in seed germination?

## **Hypotheses**

The following null hypotheses were tested at 0.05 level of significance.

- 1. There is no significant interaction effect of instructional strategies and gender on the mean attitude ratings of students towards seed germination.
- 2. There is no significant interaction effect of instructional strategies and gender on the mean achievement of students in seed germination.

#### **Theoretical Framework**

## Judd (1908) Generalized Principle Theory of Transfer:

In a classic experiment Judd (1908) demonstrates that generalized principles, laws and specific skills could be transferred from one situation to another. Knowledge about the general in his theory elements of the learning situation is considered more important than knowledge about identical elements. Knowledge of principles becomes more important about identical elements. Knowledge of principles becomes more important as the specifics of the related tasks become increasingly different. Judd (1908) provides laboratory demonstrations of the learning to learning phenomenon by employing both monkeys and children as subjects and finds that individuals improve in their experiences with other similar or related tasks, termed a learning set. Practice on one kind of learning problem leads to faster learning on a different kind of problem.

The different perspectives of transfer theory provide that, the more knowledge and skills one acquires the more likely it is that new learning will be shaped by past learning. Transfer of learning is thus a critical aspect of life and a central component in human adaptive capabilities. Transfer effects may be positive (when practice of one skill facilitates a second) or negative (when practice of one skill impedes another). Transfer may actually take place by identical elements as well as by general principles.

Using simulations to conduct practical Biology, students confront realistic approximations of real-life situations similar to those in traditional laboratory environments. The interaction with the simulation gadgets provides students with access to multiple representations of phenomena, the opportunity to manipulate the environment and carry out experimental procedures using apparatus. In the process, such skills as identification of variables, observation, measuring interpreting and designing experiments are developed. Since individuals improve in their experiences with other similar or related tasks it can be assumed that knowledge or skills attained

in conducting simulation experiments can impact on the students' achievement in Biology. Through the use of facebook as a medium to teach the students Biology, transfer effects may be positive. Thus, this theory will serve as a guide to investigate the comparative effects of the usage of facebook and simulation on senior secondary students' achievement and attitude towards Biology.

#### **METHODOLOGY**

The design of this study was quasi-experimental. Specifically, it was a pre-test post-test control group design. The main trust of this experimental design according to Emaikwu (2013) is to establish cause-and-effect. Such a design enables the production of the data to be observed under the control of the researcher in order to investigate cause-effect relationship. The design was also chosen because it is not possible to have a complete randomization of subjects. Therefore, intact classes were used so as not to disrupt the already existing setting in the schools. Emaikwu (2013), Iortimah and Aligba (2011) stated that intact classes should be used only where it is not possible to assign subjects to experimental and control groups randomly. This reason justified its use for the study. The study was carried out in Abuja the Federal Capital Territory, Nigeria. The choice of this area was based on the fact that less research work has been conducted in this area on the topic. Abuja has many institutions of learning including numerous secondary schools. The population of the study comprised of 12,719 senior secondary school two Biology students in Federal Capital Territory of Abuja (Research and Statistics Unit of Secondary Education Board Abuja, 2018). The sample consists of 247 SS 2 Biology students made up of 125 boys and 122 girls in six public senior secondary schools selected for the study. Purposive sampling technique was employed in the selection of the schools which have computers for the study. This is because attention was focused on the schools that fulfill certain criteria necessary for inclusion in the study. Two instruments were constructed for use in this study. The instruments were: Germination Achievement Test (GAT) and Students Attitude to Biology Questionnaire (SABQ). The GAT consists of forty multiple choice questions. One correct response and three detractors were given. The test items were developed by the researcher using WAEC past question papers and Biology textbooks based on the contents to be taught in the lessons. The SABQ was a five-point Likert type questionnaire consisting of forty items. The 5-point Likert Scale of Strongly Agree (SA-5), Agree (A-4), Undecided (U-3), Disagree (D-2) and Strongly Disagree (SD-1). Some of the items are negative while some are positive.

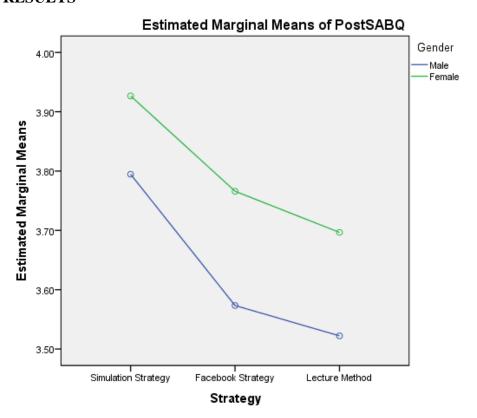
In order to determine the reliabilities of the items of GAT and SABQ, the researcher administered the instruments on 40 SS 2 Biology students of Government Secondary School Kwali. The reliabilities co-efficient of the instruments were determined using K-R (21) reliability Coefficient for GAT and Cronbach alpha for the SABQ. It was calculated to be 0.75 and 0.68 respectively. The researcher visited the schools and sought for permission from the principals of the schools. One research assistant was trained in each of the six schools and was used in administering the instruments. The total period that was used for study was seven weeks. The first week was allotted for training of the research assistants and six weeks for the actual experiment.

In the first week of the experiment, a pre-test was administered to all the students in the two groups. At the end of the treatment session, post-tests were administered to the students for the study. The researcher took the following measures to reduce external influences in the course of data collection.

- 1. Lesson Plan: Lesson plans for experimental and control groups were prepared by the researcher and handed over to the teachers to reduce teachers' effect on the lesson preparation.
- 2. Hawthorne Effect: Care was made to ensure that students were taught by their own teachers whom they were familiar with and were not told that is an experiment. This enabled the researcher reduce the effect on students' achievement as a result of consciousness of the fact that they were involved in an experiment.
- 3. Subject Interaction: Subjects in the experimental and control groups belonged to different schools not close to each other. This was to ensure that there was no interaction of subjects across experimental and control groups.
- 4. Effect of Pre-test on Post-test: The period between the pre-test and post-test was 6 weeks. This was assumed to be enough time to prevent the pre-test from affecting the result of the post-test.
- 5. Pre-test and Post-test items were the same items but different in arrangement.
- 6. Only mixed schools were used in the experiment.

A graphical illustration was used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The choice of ANCOVA is because it was a pre-test post-test design.

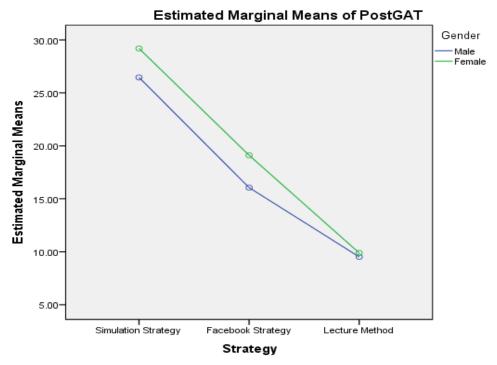
# **RESULTS**



Covariates appearing in the model are evaluated at the following values: PreSABQ = 3.4143

Figure 1: Interaction Effect of instructional Strategies and Gender on Students' Attitude towards Seed Germination

Figure 1 presents the profile plot showing the interaction effect of instructional Strategies and gender on students' attitude towards seed germination. The interactive pattern shows that the plots for male and female students did not intercept and are not parallel. However, there is no likelihood of an interaction effect between methods and gender in SABQ especially when the two lines are not crossed. That is when the plot is extrapolated the intersection could only be at infinity, which means that the interaction effect between methods and gender may be unattainable in this case.



Covariates appearing in the model are evaluated at the following values: PreGAT = 7.3320

**Figure 2:** Mean Interaction Effect of Instructional Strategies and Gender on Students' Achievement in Seed Germination

In Figure 2, the profile plot/graph shows the interaction effect of instructional Strategies and gender on students' achievement in seed germination. The interaction pattern shows that the plots for males and females do not intersect though not parallel lines. This indicates that there is likelihood of an interaction effect between methods and gender in GAT for lecture method. But when the plot is extrapolated the intersection could only be at infinity, which means that the interaction effect between methods and gender may be tenable in this case.

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|             |                |              |                |

| Source            | Type        | III |     | Mean   | F      | Sig. | Partial |
|-------------------|-------------|-----|-----|--------|--------|------|---------|
|                   | Sum         | of  | Df  | Square |        |      | Eta     |
|                   | Squares     |     |     |        |        |      | Squared |
| Corrected Model   | $4.797^{a}$ |     | 6   | .800   | 4.391  | .000 | .099    |
| Intercent         | 77.780      |     | 1   | 77.780 | 427.10 | .000 | .640    |
| Intercept         |             |     |     |        | 3      |      |         |
| PreSABQ           | .088        |     | 1   | .088   | .482   | .488 | .002    |
| Strategy          | 2.779       |     | 2   | 1.390  | 7.630  | .001 | .060    |
| Gender            | 1.679       |     | 1   | 1.679  | 9.222  | .003 | .037    |
| Strategy * Gender | .039        |     | 2   | .019   | .106   | .899 | .001    |
| Error             | 43.707      |     | 240 | .182   |        |      |         |
| Total             | 3472.432    | 2   | 247 |        |        |      |         |
| Corrected Total   | 48.504      |     | 246 |        |        |      |         |

a. R Squared = .099 (Adjusted R Squared = .076)

**Table 1:** ANCOVA of Interaction Effect of Instructional Strategies and Gender on the Mean Attitude Ratings of Students towards Biology

Table 1 reveals that F(2,246) = 0.106; p = 0.899 > 0.05. The null hypothesis is therefore not rejected. This implies that there is no significant interaction effect of instructional strategies and gender on the mean attitude ratings of students towards seed germination. Thus, it can be concluded that based on evidence from data analysis there is no significant interaction effect of instructional strategies and gender on the mean attitude ratings of students towards seed germination. The partial Eta square of 0.001 was obtained for the gender meaning that only 0.1% of the biology students' attitude ratings can be attributed to interaction effect of strategies and gender.

| Source            | Type III Sum           |     | Mean      | F       | Sg       | Partial |
|-------------------|------------------------|-----|-----------|---------|----------|---------|
|                   | of Squares             | df  | Square    |         |          | Eta     |
|                   |                        |     |           |         |          | Squared |
| Corrected Model   | 14309.900 <sup>a</sup> | 6   | 2384.983  | 168.302 | .00      | .808    |
| Intercept         | 10269.918              | 1   | 10269.918 | 724.722 | .00      | .751    |
| PreGAT            | 1.275                  | 1   | 1.275     | .090    | .76<br>4 | .000    |
| Strategy          | 13364.778              | 2   | 6682.389  | 471.560 | .00<br>0 | .797    |
| Gender            | 252.963                | 1   | 252.963   | 17.851  | .00<br>0 | .069    |
| Strategy * Gender | 86.914                 | 2   | 43.457    | 3.067   | .04<br>8 | .025    |
| Error             | 3400.999               | 240 | 14.171    |         |          |         |
| Total             | 102784.000             | 247 |           |         |          |         |
| Corrected Total   | 17710.899              | 246 |           |         |          |         |

a. R Squared = .808 (Adjusted R Squared = .803)

**Table 2:** ANCOVA of Interaction Effect of Instructional Strategies and Gender on the Mean Achievement of Students in Seed Germination

Table 2 reveals that F (2,246) = 3.067; p = 0.045< 0.05. Thus, the null hypothesis is therefore rejected. This implies that there is significant interaction effect of instructional strategies and gender on the mean achievement of students in seed germination. Thus, it can be concluded that based on evidence from data analysis there is significant interaction effect of instructional strategies and gender on the mean achievement scores of students in seed germination. The partial Eta square of 0.025 was obtained for the gender meaning that only 2.5% of the biology students' achievement can be accounted for by interaction effect of strategies and gender and this effect is weak.

### **DISCUSSION OF FINDINGS**

The study examined the interactive effect of facebook and simulation instructional strategies and gender on students' attitude and achievement in seed germination contents of Biology in senior secondary schools.

Finding on the interaction effect of instructional strategies and gender revealed that there is no significant interaction effect of strategies and gender on the mean attitude ratings of students towards seed germination content of biology. Abidemi (2014) claimed that attitude of students to Biology or germination determined their participation level in the subject. The author further emphasized that attitude of students towards Biology or germination plays a crucial role in the teaching and learning process of biology. Attitude is a determinant factor by which Biology teachers using appropriate teaching method could find out how school environmental factors, home, societal and peer influence students learning in schools. Therefore, the adoption of simulation and facebook instructional strategies could help arouse a favourable attitude of students towards biology in order to enhance their attitude in the subject. An effective teaching method is expected to raise students' achievement scores in the subject and retain what is learnt in the class.

Finding on the interaction effect of instructional strategies and gender revealed that there is significant interaction effect of strategies and gender on the mean achievement of students in seed germination contents of Biology in senior secondary schools. This means that the use of facebook, simulation instructional strategies and lecture method is gender sensitive. The implication of the findings is based on male and female students' resultant difference in their achievement in seed germination contents of biology. The findings agree with that of Adeyemi and Ajibade (2011) that there is a significant interaction effect of treatment and gender on students' achievement in social studies.

Simulation in its broadest sense is simply imitation or abstractions of reality that is made known and real during this experimentation in Biology class and shared on facebook by students irrespective of their gender. Here simulation was used as the process of creating a model of seed germination which was shared with all class members using facebook as an instructional strategy. This is because simulations instructional strategy is the specific application of models to arrive at some outcome. Models can be simple images of things or they can be complex, carrying all the characteristics of the object or process they represent which is the stages of seed

germination as content in biology. This was found to have significant interaction effect on the mean achievement of students in the study. A complex model will stimulate the actions and reactions of the real thing (Institute for Simulation and Training, 2011).

## **Educational Implication of the Findings**

The findings of this study have obvious educational implication.

- 1. The use of simulation and facebook instructional strategies along with a control group in a mixed gender sample does not produce significant interaction effect on students' attitude towards Biology. Therefore, biology teachers could employ simulation and facebook instructional strategies during biology lessons in coeducational schools.
- 2. The use of simulation and facebook instructional strategies along with a control group in a mixed gender sample resulted in significant interaction effect on students' achievement in biology. This implies that biology teachers should be cautious when employing simulation and facebook instructional strategies during biology lessons in coeducational schools.

#### CONCLUSION AND RECOMMENDATION

Based on the findings of the study, it was concluded that the use of simulation and facebook along with a control group in a mixed gender sample produces significant interaction effect on students' attitude towards Biology. On the other hand, the use of simulation and facebook instructional strategies along with a control group in a mixed gender sample produces no significant interaction effect on students' achievement in biology.

It is recommended that teachers should involve male and female students in active learning activities to avoid gender stereotyping and create equal opportunities for male and female learners.

#### **Future research**

- 1. A study on perception of teachers and students towards the implementation of facebook and simulation strategies can be carried out.
- 2. Researchers could use longitudinal studies to investigate the influence of facebook and simulation strategies on students' achievement and attitude towards biology using a wider scope.

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