

EFFECT OF COMPUTER GRAPHICS INSTRUCTIONAL MODE ON MALE AND FEMALE SECONDARY SCHOOL STUDENTS' INTEREST AND ACHIEVEMENT IN GENETICS IN ANAMBRA STATE OF NIGERIA

¹OKOLI, STELLA O. & ¹OKEKE, S.O.C.

¹Department of Science Education, Nnamdi Azikiwe University, Awka,
Anambra State, Nigeria.

Abstract

There is a perceived trend of poor academic achievement and retention of students in genetics in Nigerian Secondary schools today. This situation has been attributed to many factors one of which is poor method of teaching. It is against this background that this study determined the effects of computer graphics instructional mode on secondary school male and female students' interest and achievement in genetics. Four hypotheses were tested at 0.05 level of significance. The research design was quasi – experimental. Two groups (one experimental and one control) made up of 135 senior secondary one (SS1) students were drawn from a population of 2,608 SSI students. Purposive and simple random sampling were used to select three public secondary schools from Aguata Education Zone of Anambra State. Two instruments were used for data collection namely- Genetics Interest Scale (GIS) and Genetics Achievement Test (GAT). Three experts validated the instruments. The instruments were trial tested and the GIS gave a reliability coefficient of 0.85 while the GAT gave a reliability coefficient of 0.89. Before treatment was given, the students were pretested with the GIS and GAT. After five weeks of teaching they were post-tested with GIS and GAT though the items were reshuffled to make the instrument look different from the pretest. Analysis of Co-variance (ANCOVA) was used to test the null hypotheses. The findings indicated that computer graphics instructional mode had significant effect on the mean interest and achievement scores of students in genetics. Based on the findings, it was recommended among others that biology teachers should adopt computer graphics in the teaching of genetics in order to enhance the interest and performance of students in genetics. Government and education authorities should sponsor biology teachers to workshops and seminars to learn how to improve their teaching skills using computer graphics.

Keywords: Computer graphics instructional mode, interest, genetics

Introduction

The 21st century is characterized by advancement in science and technology. No nation of the world will attain its zenith in technological development without giving proper attention to the teaching and learning of science. Biology is a branch of science that deals with life. Biology has many topics some of which are abstract and difficult for students to understand. Nzelum (2010) identified genetics, homeostasis,

evolution, nervous co-ordination, ecology, cellular respiration among others as difficult topics in secondary school biology curriculum. In addition, Cimer (2012) noted that there are five topics in biology that are most difficult which are matter cycles, endocrine system and hormones, respiration, cell division, genetics and evolution.

Genetics is an important aspect of biology that deals with heredity and variation. Umeh (2010) defined genetics as the science that deals with questions and answers on inheritance. An understanding of genetics is necessary for the diagnosis, prevention and treatment of hereditary diseases, the breeding of plants and animals and the development of industrial processes through the use of micro-organisms. Genetics can be called a science of potentials since it deals with the transfer of information from parents to offspring. Genetics gives answers to such problems as incompatibility of blood groups, hereditary diseases like sickle cell anaemia, leukemia and others. Thus, the study of genetics gives students the opportunity to explain most naturally occurring phenomenon like birth of twins, sex determination, crops and livestock failures which were hitherto explained through superstition.

Despite the importance of genetics to man, it is one aspect of biology that most teachers find difficult to teach and students find it difficult to learn because of its abstract nature. This is because it deals with inheritance of traits that can be visibly seen but the explanation is not always clearly understood. As a result, students perform poorly in genetics in both internal and external examinations. The method used by teachers in teaching genetics has been blamed for poor interest, achievement of knowledge by the students. Studies have shown that secondary school students are exhibiting low interest in genetics (Esiobu, 2015). This low interest of students has resulted in poor achievement in examination questions on genetics. Ibitoye and Fape (2017) held that poor achievement in biology could be traced to poor usage of instructional resources for biology teaching and learning, poor state of infrastructural facilities, large class size, poor teaching method, use of faulty assessment practices and inadequacy of quality. Anyaegbunam (2012) indicated that many science teachers prefer the conventional method of teaching and shy away from innovative, activity-oriented, learner-centered methods or strategies.

Computer graphics has been found effective in the teaching and learning of arts subjects like Christian Religious Knowledge. Computer graphics is the creation, storage and manipulation of drawings and pictures with the aid of computer system (Adekoya & Adekoya, 2002). Computer graphics offer the potential to increase the challenges and curiosity of tasks, as well as encourage students to be creative and use their imaginations.

Interest is an important variable in the teaching and learning of biology. This is because when one student becomes interested in an activity, one is likely to be more

deeply involved in that activity. Interest, according to Imoko and Agwagah (2006) is a subjective feeling of concentration or persisting tendency to pay attention and enjoy some activities or content. It can also be regarded as the condition of being eager to know or learn about something. Okigbo and Okeke (2011) held that though some children may be intellectually and physically capable of learning, they may never learn until their interest is stimulated.

Achievement is the act or process of finishing something successfully. Achievement is used synonymously with success. According to Ezeh (2009) achievement could be referred to as something very good or difficult which was carried out successfully. Despite the fact that various methods such as discovery, guided inquiry and expository method among others have also been in use, the Chief Examiner's annual reports and comments in biology shows that students' performance in biology have not improved appreciably (WAEC, 2019). Thus this study is geared towards finding out if Computer Graphics Instructional modes can enhance students' interest and achievement in genetics.

Gender constitutes the characteristics that distinguish the male from the female. Nworgu (2015) saw it as certain characteristics of men and women which are culturally and socially determined. Those that are biologically determined are regarded as sex. Gender influence on achievement is still inconclusive. Hence gender will be considered as an intervening variable in this study. Gender is the different socio-cultural stereotyped roles and responsibilities expected of men and women. According to Eze (2008), gender is parallel and socially unequal division into masculinity and femininity. Biases and misconceptions about women and science is that science is a male enterprise and this has remained the main focus of concern among science educators. In Nigeria, gender bias is still prevalent. It has persisted even within the science classroom. The issues of gender have generated a lot of concern for science educators in achievement. For instance, Anagbogu and Ezeliora (2007) found that females achieved better than males in science subjects while Kost, Pollock and Finkelstein (2009) found that males achieved better in science. Okoli and Okoli (2014) found that there is no statistically significant difference in the mean achievement scores of male and female students in biology. Thus, there is no consensus as to whether gender influences achievement, interest and retention in science or not. The present study therefore, is challenged with the dearth of research studies on the effect of computer graphics instructional mode in secondary school male and female students' interest and achievement in genetics in Anambra State, Nigeria.

Statement of Problem

Despite the importance of biology, available statistics from the West African Examination Council (WAEC, 2015 - 2019) recorded very poor performance at SSC examinations. Poor achievement in biology has been blamed on a number of factors

such as ineffective instructional strategies adopted by biology teachers and difficulty in understanding some topics in genetics. Cimer (2012) noted that there are five topics in biology that are most difficult which are matter cycles, endocrine system and hormones, respiration, cell division, genetics and evolution.

Students' poor achievement in genetics is because the topics are complex and deals with inheritance of traits that can be visibly seen but the explanation as to how the process takes place is always abstract. Consequently, students find it difficult to comprehend and retain what they were taught. To understand and perform well in genetics students must be made to be interested in the learning of the concepts. Research reports on the status of science in schools in Nigeria showed that science classroom activities are still dominated by teacher-centered method (conventional method) which have been found to be ineffective in promoting science learning at primary and secondary levels (Cimer, 2012).

Despite the fact that various methods such as discovery, guided inquiry and expository method among others have also been in use, the WAEC Chief Examiner's annual reports and comments on biology still show that students' performance in biology have not improved appreciably (WAEC, 2019). There is therefore, the need to find out if Computer Graphics Instructional modes can enhance students' interest and achievement in genetics. The study also would consider the influence of gender on students' interest and achievement in genetics.

Purpose of the Study

The main purpose of this study was to determine the effects of computer graphics and computer animation on students' interest and achievement in the learning of genetics. Specifically, the study determined the:

- (1) difference in the mean interest rating scores of male and female students taught genetics using computer graphics and those taught using conventional method.
- (2) difference in the mean achievement scores of male and female students taught genetics using computer graphics and those taught using conventional method.
- (3) interaction effects of gender and method (computer graphics and conventional method) on students' mean interest scores in genetics.
- (4) interaction effects of gender and method (computer graphics and conventional method) on students' mean achievement scores in genetics.

Hypotheses

1. There is no significant difference between the mean interest rating scores of male and female students taught genetics using computer graphics and that of those taught using conventional method.

2. .There is no significant difference between the mean achievement scores of male and female students taught genetics using computer graphics and that of those taught using conventional method.
3. There is no significant interaction between gender and the use of computer graphics and conventional method on students' mean interest rating scores in genetics.
4. There is no significant interaction between gender and the use of computer graphics and conventional method on students' mean achievement scores in genetics.

Methodology

The study adopted quasi-experimental design. Specifically, the study adopted a non-randomized pre-test, post-test, control group design. The area of this study was Aguata Education Zone of Anambra State. Aguata Education Zone consisted of three Local Government Areas namely: Aguata, Orumba South and Orumba North. Aguata Education zone has two tertiary institutions and 43 co-education secondary schools. The people of the area are predominantly farmers and traders. The population of the study was all the Senior Secondary year one (SS1) biology students in the 43 government owned co-educational secondary schools numbering 2,183 SSI students in Aguata Education Zone of Anambra State. The population was made up of 1,080 males and 1,103 females. Purposive and simple random sampling techniques were used to get a sample size of 135 SS1 students.

Two instruments were used for data collection, namely: Genetics Interest Scale (GIS) and Genetics Achievement Test (GAT). The GIS is a 20- item interest scale developed by the researcher with a 4- point Scale response options. The students indicated their extent of agreement or disagreement on the twenty statements (10 positive and 10 negative), The GAT was used for the pre-test and post- test. The selection of the items was based on a well-planned test- blue print to ensure even coverage of the content. The reliability of the instruments (GIS and GAT) was established through trial testing in the schools not used for the study but have homogenous environment with the schools used. Cronbach Alpha was used in determining the coefficient of the GIS and 0.85 was obtained while Kuder Richardson formula 20 (K-R 20) was used in determining the reliability coefficient of GAT and 0.87 was obtained. The research questions were answered using mean and standard deviation while the hypotheses were tested at 0.05 level of significance using ANCOVA.

Research Procedure

The regular teachers in the schools were employed as research assistants. They were given adequate orientation on the use of the instructional strategies and were given the lesson plans. The same topics were given to the experimental and control groups. The only difference was that the experimental group was taught using computer

graphics instructional mode while the control group was taught using conventional method. Before the treatment, the research subjects in the two groups were given pre GIS and pre GAT. After the pretest, teachers commenced the treatment and after five weeks, the post GIS and the post GAT were given. The post GAT had the same test items as the pre GAT but the items were rearranged. Data on the students' GIS and GAT from the two groups were recorded and used to answer the research questions and test the hypotheses.

RESULTS

Hypotheses Testing

Hypothesis 1: There is no significant difference between the mean interest rating scores of male and female students taught genetics using computer graphics and those taught using conventional method.

Table 1: Summary of ANCOVA Test of Difference Between the Mean Interest Rating Scores of Students' Taught Genetics Using Computer Graphics and Those Taught Using Conventional Method

Source	SS	Df	MS	F	P-value	Decision
Corrected Model	37.103 ^a	4	9.276	83.902	.000	
Intercept	1.856	1	1.856	16.788	.000	
Pretest_Interest	32.385	1	32.385	292.929	.000	
Method	2.531	1	2.531	22.894	.000	*S
Gender	.145	1	.145	1.310	.256	**NS
Method * Gender	.181	1	.181	1.638	.204	NS
Error	9.176	83	.111			
Total	853.350	88				

*Significant **Not Significant

In Table 1, the analysis shows that there is a significant difference in mean interest scores of male and female students taught genetics using computer graphics and those taught using conventional method, $F(1,83) = .256P < 0.05$. However, there is no significant difference between the male and female students taught genetics in both the computer graphics and conventional method groups. Therefore, the null hypothesis which posited no significant difference between the two groups is upheld.

Hypothesis 2: There is no significant difference between the mean achievement scores of male and female students taught genetics using computer graphics and those taught using conventional method

Table 2: Summary of ANCOVA Test of Difference Between the Mean Achievement Scores of Students’ Taught Genetics Using Computer Graphics and Those Taught Using Conventional Method.

Source	SS	D f	MS	F	P- valu e	Decisi on
Corrected Model	4358.758 ^a	4	1089.690	31.510	.000	
Intercept	6857.611	1	6857.611	198.298	.000	
Pretest_Achievement	1409.941	1	1409.941	40.771	.000	
Method	2639.476	1	2639.476	76.324	.000	S
Gender	7.326	1	7.326	.212	.647	NS
Method * Gender	30.966	1	30.966	.895	.347	NS
Error	2870.333	83	34.582			
Total	315448.000	88				
Corrected Total	7229.091	87				

As shown in Table 2, there is a significant difference in the mean achievement scores of students taught genetics using computer graphics and those taught using conventional method, $F(1,83) = .647P < 0.05$. However, there is no significant difference in the mean achievement scores of both male and female students taught genetics in both the computer graphics and conventional method groups. The null hypothesis of no significant difference between the two groups was upheld.

Hypothesis 3: There is no significant interaction effect of students’ gender and method (computer graphics and conventional method) on students’ interest in genetics. As revealed in Table 1, there is no significant interaction of gender and method on students’ mean interest scores in genetics, $F(1,83) = .204, P < 0.05$. The null hypothesis is therefore not rejected.

Hypothesis 4: There is no significant interaction effect of students’ gender and method (computer graphics and conventional method) on students’ achievement in genetics. As shown in Table 2, there is no significant interaction of gender and method on students’ mean achievement scores in genetics, $F(1,83) = .347, P < 0.05$. The null hypothesis is therefore not rejected.

Discussion

The combined effects of computer graphics and gender on students’ interest in genetics studied was obtained by comparing the mean interest scores of male and

female students taught with computer graphics and conventional method. The ANCOVA result in table 1 $F(1,83) = .256, p < 0.05$ showed that there was no significant difference between the mean interest rating scores of male and female students taught genetics using computer graphics and those taught using conventional method. This means that both male and female students tended to have interest in genetics when taught using computer graphics and conventional method. The result is in line with Okoli, Akuezulo and Okoli (2015), Ugwuadu (2011) and Egbunonu (2012) who all found out from their respective studies that gender has no effect on students' interest. However, the finding is contrary to Iweka's (2006) who found out that the interaction effect of instructional technique and gender on students' interest was significant.

The combined effects computer graphics and gender on students' achievement in genetics was obtained by comparing the mean achievement scores of male and female students taught with computer graphics and those taught with conventional method. Table 2 shows that there was no significant difference in the mean achievement scores of students taught genetics using computer graphics and those taught using conventional method where $F(1,83) = .647, p > 0.05$. This means that both male and female students tended to have almost the same achievement scores in genetics when taught using computer graphics and conventional method. The implication is that the relative efficacy of the instructional strategies was consistent across gender levels.

Gender as a main factor is not significant on students' achievement in genetics. Consequently, the null hypothesis of no significant difference between pre-test and post- test mean achievement scores of male and female students taught genetics using computer graphics and conventional method was accepted.

This means that both male and female students tended to have increase in achievement in genetics when taught using computer graphics and conventional method. These findings are in line with the studies of Falode et al (2016); Okoli and Okoli (2014) and Egbunonu (2012) who agreed that once equal educational and learning experiences are provided for both male and female students, achievement will be even for both sexes.

The interaction effect of method (computer graphics and conventional method) and gender on students' overall cognitive interest in Table 1 was not significant in genetics $F(1,83) = .204, p > 0.05$. The null hypothesis of no significant difference between the interaction effect of students' gender and method on students' achievement in genetics was therefore accepted. This implies that the relative efficacy of the instructional mode was consistent across gender level. The present study is in line with the findings of Okoli & Okoli (2014), Egbunonu (2012) which

revealed that the interaction effects of instructional technique and gender on students' achievement was not significant.

The interaction effect of method (computer graphics and conventional method) and gender on students' overall cognitive achievement in Table 2 was not significant in genetics $F(1,83) = .347, p > 0.05$. The null hypothesis of no significant difference between the interaction effect of students' gender and method on students' achievement in genetics was therefore accepted. This implies that the relative efficacy of the instructional mode was consistent across gender levels. The present study is in line with the findings of Okoli and Okoli (2014) and Egbunonu (2012) which revealed that the interaction effects of instructional technique and gender on students' achievement was not significant.

Conclusion:

On the basis of the findings, it was established that there was a significant difference in the mean interest and achievement scores of male and female students taught genetics using computer graphics and those taught using conventional method. However, there was no significant difference in the mean interest and achievement scores of both male and female students taught genetics in both computer graphics and conventional method. Also there was no significant interaction effect in the mean interest and achievement scores between the two groups

Recommendations

Based on the findings of this study, the following recommendations are proffered:

1. Teachers, especially those teaching biology should always adopt the computer graphics instructional mode that will enable them to cater for the diverse learning styles of students in their classrooms and hence, captivate their interest and improve their achievement in genetics.
2. Teacher education programmes should include computer graphics instructional mode in biology method course content. This will ensure that the biology teachers are adequately trained on how to use computer graphics instructional mode in the teaching and learning of genetics
3. Ministries of Education, both state and Federal should organize workshops and seminars and sponsor teachers to attend in-service courses on how to use computer graphics instructional mode to improve their teaching skills which are found by this study to be effective in promoting students' interest and achievement
4. Biology teachers should pay attention to the issue of gender-related differences in the classroom. Such gender-related differences which are known not to be innate could be minimized if not eliminated through curricular restructuring or use of appropriate teaching techniques such as computer graphics instructional mode.

5. Students should be encouraged to be serious to embrace this activity-oriented and student-centered approach which will enable them carry out independent or group work such as assignment and project given to them by the biology teachers and also make their instructions authentic by relating what they have learnt to their personal experiences or real world situation.

REFERENCES

- Anagbogu, M.A., & Ezeliora, B. (2007). Sex differences and scientific performance. *Women Journal of Science and Technology*, 4, 10-20.
- Anyaegbunam, N.J. (2012). *Effect of constructivist theatre instruction on students' knowledge of HIV, AIDS and sexual behaviour in Enugu State of Nigeria*. (Unpublished Ph.D Dissertation), Department of Science Education, University of Nigeria.
- Cimer, A. (2012). What makes biology learning difficult and effective: Students' view. *Educational Research and Review*, 7(3), 61-71.
- Esiobu, P.U. (2015). *Introduction to national science -1-* Revised Edition. Enugu: EnyiCo. Nigeria.
- Ibitoye, B. & Fape, J.A. (2017). Teaching and learning resource availability and teachers' effective classroom management and content delivery in secondary schools in Huye District, Rwanda. *Journal of Education and Practice* 5(9) 111-122- Retrieved from www.11ste.org.
- Kost, L.E., Pollock, S.J. & Finelstein, N.D. (2009). *Characterizing the gender gap in introducing physics* (EJ826790). *Physics Education Research*, 5(1), 1-14.
- Nwosu, A.A. (2007). Gender and acquisition of science process skills among secondary school students: Implication for science teaching 42nd annual conference proceeding of the Science Teachers Association of Nigeria (STAN), 206-209.
- Nzelum, V. N. (2010). *STEM Journal of Anambra State* (STEMJAS) Amaka Dreams Ltd. Awka.
- Okigbo, E.C., & Okeke, S.O.C. (2011). Effects of games and analogies on students' interest in mathematics. *Journal of Science Teachers Association of Nigeria (STAN)*, 46(1), 101-112.
- Okoli, J.N. & Okoli, S.O. (2014). Multiple intelligence-based instructional approach on secondary school students' achievement in the learning of difficult biology concepts. *IOSR Journal International Organisation of Scientific Engineering Researcher*, 5(2), 88-94.
- Okoli, S.O., Akuezuiilo, E.O. & Okoli, J.N. (2015). Multiple intelligence-based instructional technique (MIBIT) on students' interest in the learning of difficult biology concepts. *IOSR Journal International Organisation of Scientific Researcher*, 5(2), 32-39.
- West African Examination Council (2015; 2017; 2018 and 2019) Chief Examiners Report, Lagos: WAEC.