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Effect of Gagne's Nine Events of Instruction on Academic Confidence in Genetics among Secondary School Students in Kumbotso Education Directorate, Kano State, Nigeria

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Abstract

The study investigated the effect of Gagne's Nine Events of Instruction on academic confidence in genetics among secondary school students in Kumbotso Zonal Education Directorate, Kano State, Nigeria. Specifically, the study determined the difference in the academic confidence of students taught genetic concepts using Gagne's nine events of instruction and those taught using conventional method among biology students and also investigated the effect of Gagne's nine events of instruction on academic confidence between male and female students in genetics in Kumbotso Education Directorate, Kano State, Nigeria. A pretest and posttest quasi-experimental design was used. The study selected four equivalent schools (two male and two female) with a total sample size of 196 students. Data was collected using the Students' Academic Confidence Questionnaire (SACQ), which was validated by experts and has a reliability coefficient (r = 0.81). Mean was used to answer the research questions while Mann-Whitney was used to test the hypotheses at 0.05 level of significance. Findings reveal a significant increase in academic confidence among students taught genetics using Gagne's instructional model compared to those taught through traditional methods. Considering that Gagne's nine events strategy has proven to be an effective approach in fostering improved academic confidence and performance, it is logical to extend its application to examine its impact on other challenging areas in Biology or other scientific fields. The study recommends the integration of Gagne's Nine Events of Instruction into secondary school and teacher education curricula to foster students' academic self-assurance in science learning contexts.

Keywords: Gagne's Nine Events, Academic Confidence, Genetics, Instructional Design, Kumbotso

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Introduction

Science Education is crucial for empowering individuals with knowledge and skills to tackle real-world challenges, foster innovation, advance societal progress and this took a central place in the curricula of schools at all levels. According to Smith (2023), the overarching goal of science education is to empower learners to gain knowledge, skills, and attitudes essential for their future endeavors. Science education unlocks the wonders of the universe and helps to understand and improve our lives.

In this era of technological innovations, speedy progress and advancement, the improvement of science education is becoming the dire need of the nations. Science Education is considered to be a tool for developing scientific attitude among the students and help the learners to think like scientist. According to Marzano (2017), teaching strategy is the most critical factor in determining learning outcomes. Science Education encompasses a broad range of disciplines and teaching approaches. There are many branches of Biology such as Biochemistry, Physiology, Ecology, Genetics and Molecular biology that have made Biology a central focus in most human activities including problems like food scarcity, pollution, population, radiation, disease, health, hygiene, family life, management and conservation of natural resources as well as biotechnology and ethics.

The objectives of teaching Biology as a science subject are based on practical and experiment as are contained in the National Policy on Education (FRN, 2013). Also, included among others are to equip learners with meaningful and relevant knowledge of Biology, adequate laboratory, instructional material and field skills. It is only through utilization of Biology laboratory equipment and other instructional materials that the above objectives and goals can be achieved. A recent observation regarding the significance of Biology as a science subject and the concerning trend in grades achieved by candidates in the West African Examination Council (WAEC), particularly in Biology examinations, as highlighted by Adekunle, Ahmed and Yusuf (2023). According to the recent data from the West African Examination Council (WAEC) and the National Examination Council (NECO), a significant portion of candidates who took the West African Senior Secondary School Examination (WASSCE) between 2018 and 2022 failed to achieve a credit level in Biology. Specifically, the WAEC Zonal Coordinator noted that 57%

of the candidates fell below the credit threshold, aligning with the findings from the Registrar and Chief Executive of NECO, who reported a failure rate of 55.83% among candidates registered for science subjects.

Academic confidence according to Sander and Sanders (2005), is the student's belief about performing a task at a particular level in order to attain a specific academic goal and it reflects a strong belief or sure expectation of success in an academic field. Confidence plays a significant role in students' learning, with those possessing higher levels of academic confidence generally achieving greater success compared to their counterparts with lower academic confidence (Smith et al., 2023). Jones and Smith (2024), found that the child who perceives himself confident tends to exhibit higher levels of academic achievement, whereas a child who views themselves as worthless is often less confident and may not reach their full potential academically.

Genetics as a branch of biology that studies genes, heredity, and variation in living organisms encompasses a wide range of topics, including the structure and function of genes, genetic inheritance, genetic disorders, and the role of genetics in evolution and biotechnology (Kumar, Abdel-Ghany & Chelmanska-Aoyaya, 2019). A fundamental concept in genetics is DNA, or deoxyribonucleic acid, which contains the instructions for building and maintaining an organism. Genes are segments of DNA that encode specific traits, such as eye color or susceptibility to certain diseases.

Gender issue according to Miller and Jones (2024) has become a prominent topic in today's academic discourse. Gender is a specially constructed phenomenon that is brought about as society ascribes different roles, duties, behaviors, and mannerisms to the two sexes, The concept 'gender' could be discussed in terms of masculinity or feminist observed in an individual. UNICEF (2021), agreed that gender bias is very prevalent in Africa and particularly Nigeria. It argued that in Nigerian, harder tasks are assign to males while females are given the relatively easy and less demanding tasks.

Gagne (1974), defined nine events of instruction as an instructional design that aims to help, develop and deliver a class lesson. These instructional events according to Gagne (1977), should satisfy or provide the necessary conditions for learning and serve as the basis for designing instruction and selecting appropriate media. The nine events of instruction according to University of Florida (2018) are: 1) gaining attention, 2) informing the learner of the

objective, 3) stimulating recall of prior knowledge, 4) presenting the stimulus, 5) providing learning guidance, 6) eliciting the performance, 7) providing feedback about performance correctness, 8) assessing performance, and 9) enhancing retention and transfer. By the end of this overall process, Johnson and Smith, (2024) claimed that students would be able to draw upon what they had learned in a way that permits them to apply their knowledge to new situations. Al-Shammari (2020), reviewed a number of studies that attempted to validate nine events of instruction developed according to Gagne's principles and found that these events of instruction have a significant relationship with learners' performance and confidence. Therefore, the implementation of Gagne's instructional events can bolster students' academic confidence, leading to more effective learning outcomes.

Statement of the Problem

Academic confidence among senior secondary students in science subjects, particularly the topic of genetics in Biology, is a growing concern for educators and stakeholders. Reports of West African Examination Council (WAEC, 2020) Chief Examiner reveal that students are struggling with genetic concepts in Biology by demonstrating low academic confidence and performing below credit level in examinations such as WAEC (2020) and NECO (2022).

Several factors may have contributed to this issue, including inadequate instructional design and delivery methods as identified by Gagne (1985), insufficient understanding of cognitive and affective learning domains (Bloom, 1984), ineffective teaching strategies, and a lack of student engagement and motivation (Garcia et al., 2024). The alarming trend of poor academic performance in genetics is evident, with reports indicating significant difficulties among students in applying conceptual knowledge to practical problems in the subject.

Given these challenges, there is an urgent need to investigate the impact of Gagne's Nine Events of Instruction on enhancing academic confidence and in genetics among secondary students within this educational context.

Objectives of the Study

The main objective of the study is to investigate the effect of Gagne's Nine Events of Instruction on academic confidence in genetics among secondary

school students in Kumbotso Zonal Education Directorate, Kano State, Nigeria and the specific objectives are to:

I. determine the difference in the academic confidence of students taught genetic concepts using Gagne's nine events of instruction and those taught using conventional method among students in Kumbotso Education Directorate, Kano State, Nigeria.

II. investigate the effect of Gagne's nine events of instruction on academic confidence between male and female students in genetics in Kumbotso Education Directorate, Kano State, Nigeria.

Research Questions

This study will seek answers to the following research questions:

I. What is the difference in the academic confidence of students taught Genetic concept using Gagne's nine events of instruction and those taught using lecture method among students in Kumbotso Education Directorate, Kano State, Nigeria?

II. Is there any difference in the academic confidence of male and female students taught Genetic concept using Gagne's nine events of instruction in Kumbotso Education Directorate, Kano State, Nigeria?

Hypotheses

The following Null hypotheses were formulated and tested at 0.05 level of significance

I. There is no significant difference in the academic confidence of students taught Genetic concept using Gagne's nine events of instruction and those taught using lecture method in Kumbotso Education Directorate, Kano State, Nigeria.

II. There is no significant difference in the academic confidence of male and female students taught Genetics using Gagne's nine events of instruction in Kumbotso Education Directorate, Kano State, Nigeria.

Methodology

The study used quasi – experimental non-equivalent control group design involving the use of pretest and posttest as the participants in the experimental and control groups were not randomly assigned. The study used four schools (two experimental and two control) because all the schools in the study area are single sex schools and there is objective on gender. The population for the study consisted of nine thousand six hundred and seventeen (9,617) senior secondary students from Thirty-three (33) public schools of Kumbotso Zonal Education Directorate, Kano State (KSSSSMB, 2023). From this number, 5,815 (60.5%) were female and 3,802 (39.5%) were male. The students were typically between 15-18 years old and in their second year of senior secondary school. A total of 196 students were selected to participate in the study, comprising the sample size for the research. Simple random sampling using balloting was employed to select ten (10) schools (5 male schools and 5 female schools) from a total of 33 in the population. This method ensured that each school had an equal chance of being selected, making the sampling process fair and unbiased. The selected ten (10) schools were pretested and the pretest scores were subjected to statistical analysis using ANOVA and later to Scheffes' test. Based on the results, four (4) schools (two male and two female schools), with similar pretest scores were selected so as to ensure homogeneity among the groups. From the four (4) schools, one intact class of SSII was selected per school using simple random sampling technique, resulting in a total of four (4) intact classes for the study, with 196 students in total (104 males and 94 females). The schools selected were then randomly assigned into two experimental and two control groups,

Student's Academic Confidence Questionnaire (SACQ) consisting of 20 items was adapted from Sander and Sanders (2005), measured on a 4-point Likert-type scale involving Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) was used to measure the Students' Confidence levels. Each of the options carried weight in order of priority from 4 – 1 in positive confidence responses and reversed for negative responses (1- 4). Students were asked to freely indicate their confidence by ticking one of the response options that suits their interest**.**

The research questions were answered using mean and standard deviation, while the null hypotheses were tested using the Mann-Whitney U-Test at the

0.05 level of significance (as the data did not satisfy the assumption of normality required for parametric tests.

Results

Research Question 1: What is the difference in the academic confidence of students taught Genetic concept using Gagne's nine events of instruction and those taught using lecture method in Kumbotso Education Directorate, Kano State, Nigeria?

Table 1: Descriptive Statistics for Academic Confidence by Instruction Method

Group	N	Df	Mean Rank	Sum of Ranks	Mean Rank Diff.
Experimental	93		150.00	13950.00	98.00
Control	103		52.00	5356.00	
Total	196	194			

The result in Table 1 shows the academic confidence mean ranking of the Experimental Group exposed to Gagne's nine event of instruction and that of the Control Group exposed to lecture method. The Experimental group has mean rank of 150.00 while the Control Group has mean rank of 52.00. The mean rank difference between the experimental group and the control group stands at 98.00. This indicates that the academic confidence of the Experimental Group taught genetic concepts using Gagne's nine event of instruction is remarkably higher compared to that of the control group taught the same concept using lecture method. The corresponding hypothesis as whether the difference in academic confidence is significant or not is tested and presented in Table 2.

Table 2: Mann-Whitney U-test Analysis of academic confidence of Experimental Group (EG) and Control Group (CG)

Group	N	Mean Rank	Sum of Ranks	U Value	p-value	Decision
Experimental	93	150.00	13950.00	0	0.000	H_0 is Rejected
Control	103	52.00	5356.00			
Total	196					

Significant at $\alpha \leq 0.05$ level

The result in Table 2 shows the Man Whitney test analysis on academic confidence of students taught Genetic concept using Gagne's nine events of instruction and those taught using lecture method. A p-value of 0.000 which is lower than the 0.05 alpha level of significance was obtained. Based on the

decision rule the null hypothesis is rejected. This means that the differences in academic confidence between the two groups is statistically significant. The Experimental Group has a significantly higher mean rank, indicating greater academic confidence compared to the Control Group.

Research Question2: Is there any difference in the academic confidence of male and female students taught Genetic concept using Gagne's nine events of instruction in Kumbotso Education Directorate, Kano State, Nigeria?

Table 3: Descriptive Statistics for academic Confidence by Gender in Experimental Group

Experimental	N	df	Mean Rank	Sum of Ranks	Mean Rank Diff.
Male	48		47.51	2280.50	1.05
Female	45		46.46	2090.50	
Total	**93**				

The result in Table 3 shows the mean rank of the academic confidence of male and female students in the experimental group. The male students have mean rank of 47.51 while female students in the same group have mean rank of 46.46. The mean rank difference is 1.05. This implies that male students have a very slight difference in academic confidence over their female counterpart. The corresponding hypothesis to test if the gender difference is statistically significant is tested and presented in Table 4.

Table 4: Mann-Whitney U-test Analysis of Academic Confidence Mean Scores of Male and Female Students in the Experimental Group

Experimental	N	Mean Rank	Sum of Ranks	U Value	p-value	Decision
Male	48	47.51	2280.50	1053.50	0.84	H_0 is Not Rejected
Female	45	46.46	2090.50			
Total	**93**					

Significant at $\alpha \leq 0.05$ level

The result in Table 4 shows the Man-Whitney U-test analysis on academic confidence of male and female students in the experimental group. From the table, the computed p-value is 0.84 which is greater than 0.05 alpha level of significance. Therefore, the null hypothesis is not rejected. This means that there is no significant difference in academic confidence between male and female students in the Experimental Group. This result indicates that the level of academic confidence is similar across genders in this group.

Implications of the Result

The result of the study established that there is a significant difference in the academic confidence of students taught Genetic concept using Gagne's Nine events of instruction and those taught using lecture method in favour of the experimental group. This finding is in agreement with the finding of Oludipe and Oludipe (2018) that compared the Effectiveness of Gagne's Nine Events of Instruction and Lecture Method on Academic Confidence and Achievement of Students in Biology. The findings of the study revealed that students taught using Gagne's nine events of instruction had higher confidence levels compared to those taught using the lecture method. The finding of this study is in contrast to the finding of Adeyemi (2020), that studied the Effectiveness of Gagne's Nine Events of Instruction and Lecture Method on Academic Confidence and Achievement of Students in Science. The finding indicated that there is no significant difference in academic confidence between students taught Genetic concept using Gagne's nine events of instruction and those taught using lecture method. The structured and engaging nature of Gagne's nine events of instruction contributes to higher academic confidence among students by providing a supportive and adaptive learning environment.

The study also established also that there is no significant difference between the academic confidence of male and female students taught Genetic concept using Gagne's nine events of instruction. This finding is in agreement with the finding of Mohammed and Al-Mansour (2020) which found out that both male and female students had similar levels of academic confidence when taught using Gagne's nine events of instruction. This finding is in contrast with the finding of Singh and Kumar (2022) that Exploring Gender difference in Academic confidence: A comparative study of Gagne's nine events of instruction and Traditional teaching methods. Their finding showed that there is a significant difference in academic confidence between male and female students taught using Gagne's nine event of instruction. Male students showed higher academic confidence than female students when taught using Gagne's nine events of instruction. The current study indicates that Gagne's nine events can create a fair learning environment that equally supports the confidence of both genders.

Conclusion

Based on the findings, conclusions can be drawn regarding the effectiveness of Gagne's nine events of instruction in enhancing academic confidence among students learning genetics concepts. Firstly, when properly implemented, Gagne's instructional model significantly improves the academic confidence of students, as evidenced by the first hypothesis, which shows that those in the experimental group achieved notably higher mean performance scores compared to their peers taught through the traditional Lecture Method. Furthermore, this instructional approach benefits both male and female students equally, as indicated by the second hypothesis; both gender in the experimental group exhibited significantly higher confidence with only slight variations between them, suggesting that Gagne's model is gender-friendly.

Recommendations

Based on the findings of this study, it is recommended, that:

I. Integration of Gagne's Nine Events of Instruction into secondary school teaching practices and teacher education programs to foster students' academic self-confidence in science learning by education planners.

II. Organizations such as the STAN, the NERDC should incorporate Gagne's nine events into teacher professional development programmes, like seminars, workshops and conferences for Biology teachers at the secondary school level for better implementation and utilization of the method.

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