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# Effects of Concept Mapping and Demonstration Method on Senior Secondary Two Biology Students' Achievement in Genetics in Jos North, Plateau State

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**Abstract.** This study examined the effects of concept-mapping and demonstration on senior secondary two Biology students' achievement in genetics in Secondary Schools in Jos North Local Government Area of Plateau State. The population/sample for the study was sixty (60) Biology students comprising of 32 males and 28 females were randomly drawn from one of the secondary schools in Jos North Local Government Area of Plateau State. Three (3) research questions were answered in the study and two (2) hypotheses were tested at a significant level of 0.05. The instrument used to collect relevant data from the students is GAT (Genetics Achievement Test). Mean, standard deviation and t-test statistical analysis were used to analyze the two hypotheses formulated for the study. The result of the analysis revealed that: there is significant difference between the post-test mean scores of students taught genetics using concept-mapping and those taught using demonstration method. The results also showed that there is no significant difference between the post-test mean scores of male and female students taught genetics using cooperative method. The recommendations derived from this study includes; Biology teachers should adopt the used of concept-mapping method in the teaching of genetics in the secondary schools. Curriculum planners should incorporate concept mapping in the curriculum and Teachers should be train and re-trained on how to effectively use the concept mapping method in the teaching of genetics and biology in general.

**Keywords:** Effects, Concept-mapping, Demonstration, Achievement, Genetics

## 1. Introduction

The usefulness of Biology as a subject cannot be over emphasized. Biology is very necessary for the management of our natural resource, provision of good health facilities for the masses, adequate food supply and favorable life environment.. Biology is an important science subject and a requirement for further learning of number of science related professional courses like medicine Pharmacy, Nursing etc. According to general biology wiki books (2013) the word Biology means" the science of life. The main objective of teaching Biology as stated in the national Policy on education include providing students with: adequate laboratory techniques, meaningful and relevant knowledge, ability to apply science knowledge to everyday life in matter of personal and community health and agriculture, reasonable and functional scientific attitude (Federal Republic of Nigeria,2008). Biology curriculum covers topics like Ecology variation, evolution, genetics etc.

Genetics is a branch of biology that concerned with the study of variability caused by inherited characteristics It covers the following aspects: Variations, Mitosis and meiosis, Monohybrid and dihybrid crosses, sex-liked character, co-dominance and mutation. Genetics is an important topic to learn in this days and age where it's applications are relevant to everyday life (Knipprels, Waarlo and Boersma,2005). In addition, Venville, Gribble and Donovan (2005) stated that in our modern biotechnological world an understanding of the basic genetics is for effective scientific literacy for future citizens. Many researchers for example Ayodele (2006) and Williams et. al (2011) have shown that students have serious misunderstanding, even after instruction hence students depend on rote learning to pass examination. Despite the effort of some science educator such as Danjuma (2005) and Jibrin and Abba (2011) towards finding a suitable instructional strategy for effective teaching of genetics in secondary school, there still exist some reports of poor academic performance in public examinations result such as NECO and WAEC in Biology (Lakpim, 2007; Ogbenevwele, 2010; Adebayo, 2011).

Ogunniyi (2009) asserted that of the most persistent and compelling problem facing academic achievement in Nigeria is poor quality teaching. Most biology teachers prefer to use methods like chalk or lecture method because science is broad in nature which makes it easier and faster to cover the syllable within the stipulated time. Ayodele (2006) identify the in appropriate or non-effective teaching methodology as a major factor hindering students understanding and achievement in genetics. Several methods are used to teach science, notably among them as viewed by various authorities are: Laboratory, demonstration, lecture, enquiry e.t.c. Agbo (2000) is of the view that science teachers and/or in fact, any other teacher must be acquainted with teaching methods that will assist students to achieve their learning objectives. Agbo mentioned seven specific methods of science instruction to include, lecture, demonstration, questioning, concept mapping, field trips, co-operative learning, project, and laboratory.

Concept mapping is the strategy that help learners organized their cognitive frameworks into powerful interactive patterns. Concept mapping according to John, Igwe, Anaja, Wusle, Istifanus, Christopher, Nuhu,Modebe and Kwaranga (2017) is a graphical representation of ideas, information and knowledge of a topic in a given subject. Is also a schematic device for representing a set of concept meaning embedded in a hierarchical diagram that illustrates the interconnections between and among concepts. It can be deduced that concept map provide a visual road map, showing a pathway a learner can take to construct meaning of concepts.

Demonstration involves showing by reason or proof, explaining or making clear by use of examples or experiment. In teaching through demonstration, students are set up to potentially conceptualized class materials more effectively. Demonstration often occurs when students have a hard time connecting theories to actual practice or when students are unable to understand application of theories. In view of the foregoing, this study will examine the effects of concept-mapping and demonstration on students' achievement in genetics in Jos North, Plateau state.

## 2. Statement of the Problems

The poor academic achievement of students in biology is of great concern to all stakeholders in the educational sector. WAEC (2013) report that the general performance of students in May/June 2012 WASSCE biology examination was very poor compared to that of 2011. This poor performance has reduced the number of students that qualify for further studies in the science related professional courses such as Medicine, Agriculture, Pharmacy, Nursing and Teaching. The Chief examiners' report from biology theory paper 2 in WAEC 2008 revealed that students did not respond well to question on genetics in the final school certificate exterminations. It was reported that the question on genetics was attempted by very few candidates. Furthermore, most of the students that attempted gave wrong responses.

In the teaching of genetics as reported by Odunbummi (2005), Idubuizu (2005) and Ibifiri (2005) that achievement is poor and that it is not unconnected to teaching method such as the use of traditional lecture method. It is in view if this that the researchers decided to carry out a study on the comparative effects of demonstration and co-operative method in the teaching of genetics in secondary schools in Jos North, Plateau state.

## 3. Research Questions

The following research questions are to guide the researchers in the study:

- What is the level of students' achievement in genetics, using concept-mapping and demonstration method?
- What are the differences between the post-test mean scores of students taught using concept-mapping and demonstration method?
- What difference exist in the post-test mean scores between the male and female students taught genetics using concept-mapping method?

## 4. Hypotheses

These hypotheses were tested at in the study.

- There will be no statistically significant difference in the post-test mean scores of students taught genetics using concept-mapping and demonstration methods.
- There will be no statistically significant difference in the post-test mean scores between the male and female students taught genetics using concept-mapping method.

## 5. Research Methodology

A quasi- experiment design was adopted in this study. It employed a pre-test/ post-test quasi experimental design with the experimental and control group. The pre-test was initially administered to the biology students in the two groups before the treatment with the help of a research assistant. The treatment was administered after teaching the students by the researchers for six weeks. One research instrument called Genetics Achievement Test (GAT) was used for the study .it consists of 50 close ended questions. The 50 questions carry one mark each.

The instrument was prepared using Past, West African Extermination Council (WAEC) over a period of 10 years (2007-2016) to obtain an unbiased result on students' achievement in Genetics. questions.

The population of the study comprises of all the SS2 biology students from all the Senior Secondary Schools in Jos North Local Government Area of Plateau State. The sample used for this study is the intact class of Senior Secondary 2 Biology students from the schools selected.

## 6. Results

**Research question 1:** What is the level of students' achievement in genetics using demonstration method and concept mapping,?

Table 1: Mean ($\overline{X}$) and Standard Deviation (SD) of Pre-test and Post-test mean scores of students taught genetics using demonstration and concept mapping

| Method | N | Pretest | | Posttest | | Gain Score |
|---|---|---|---|---|---|---|
| | | $\overline{X}_1$ | $SD_1$ | $\overline{X}_2$ | $SD_2$ | $\overline{X}$ |
| **Demonstration method** | 20 | 16.20 | 3.29 | 25.00 | 4.18 | 8.80 |
| **Concept mapping method** | 20 | 18.10 | 4.24 | 31.50 | 5.08 | 13.40 |

Table 1 showed that the posttest mean scores of students taught genetics using demonstration and concept mapping method are 25.00 and 31.50 and and their standard deviations are 4.18 and 5.00 respectively. Meanwhile the gain mean scores of students taught genetics using demonstration and concept mapping method are 8.80 and 13.40 respectively. These show that students taught genetics using concept mapping achieved better than those taught genetics using the demonstration.

**Research Question 2:** What are the differences between the post-test mean scores of students taught using concept mapping and demonstration method?

Table 2: Mean ($\overline{X}$) and Standard Deviation (SD) of students' Pre-test and Post-test mean scores of students taught genetics usingconcept mapping and demonstration method.

| **Method** | **N** | **Pretest** | | **Posttest** | | **Gain Score** |
|---|---|---|---|---|---|---|
| | | $\overline{X}_1$ | $SD_1$ | $\overline{X}_2$ | $SD_2$ | $\overline{X}$ |
| **Demonstration method** | 20 | 16.20 | 3.29 | 25.00 | 4.18 | 8.80 |
| **Concept mapping method** | 20 | 18.10 | 4.24 | 31.50 | 5.08 | 13.40 |

Table 3 revealed that the post-test mean score of 25.00for students taught genetics using demonstration, while that of students taught genetics using concept mapping is 31.50. The difference between the gain score of students taught genetics using demonstration and concept mapping (13.40 –8.80) is 4.60. This showed that students taught using concept mapping achieved better than those taught genetics using demonstration method.

**Research Question 3:** What difference exists in the post-test mean scores between the male and female students taught genetics using concept mapping?

Table 3: Mean ($\overline{X}$) and Standard Deviation (SD) of Pre-test and Post-test mean scores of male and female students' taught genetics using concept mapping.

| **Concept mapping** | **N** | **Pretest** | | **Posttest** | | **Gain Score** |
|---|---|---|---|---|---|---|
| | | $\overline{X}_1$ | $SD_1$ | $\overline{X}_2$ | $SD_2$ | $\overline{X}$ |
| **Male** | 8 | 18.13 | 5.14 | 32.88 | 6.45 | 14.75 |
| **Female** | 12 | 18.08 | 3.79 | 30.58 | 3.99 | 12.50 |

Table 3 showed that the post-test mean scores of male and female students taught genetics using concept mapping are 32.88 and 30.58 respectively. The difference between the gain mean scores of male and female students taught genetics using concept mapping (14.75 – 12.50) is 2.25. This showed that male students achieved slightly better than female students when taught genetics using concept mapping.

## Hypotheses

**Hypothesis 1:** There will be no statistically significant difference in the post-test mean scores of students taught genetics using concept mapping and demonstration method of teaching.

**Table 4**: Inferential statistics of students taught using Demonstration and Concept mapping

| **Method** | **N** | **Posttest** | | **Df** | **t-cal** | **t-tab** | **Decision** |
|---|---|---|---|---|---|---|---|
| | | $\overline{X}_2$ | $SD_2$ | | | | Ho: 1 |
| **Demonstration method** | 20 | 25.00 | 4.18 | 38 | 4.422 | 2.021 | Rejected |
| **Concept mapping** | 20 | 31.50 | 5.08 | | | | |

The table shows mean scores of students taught genetics using demonstration and concept mapping in which were 25.00 and 31.50 with standard deviation of 4.18 and 5.08 respectively, t-calculated value = 4.422 and t-critical or table value = 2.021 at the 0.05 level of significance. Since t-calculated is greater

than t-tabulated we therefore reject the null hypothesis. Those taught using concept mapping achieved better than those taught using demonstration method.

**Hypothesis 2:** There will be no statistically significant difference in the post-test mean scores between the male and female students taught genetics using concept mapping.

Table 5: Inferential statistics of Concept mapping effect on gender

| **Concept-Mapping** | **N** | **Posttest** $\bar{X}_2$ | $SD_2$ | **Df** | **t-cal** | **t-tab** | **Decision** Ho: 3 |
|---|---|---|---|---|---|---|---|
| **Male** | 8 | 32.88 | 6.45 | 18 | 0.898 | 1.730 | Accepted |
| **Female** | 12 | 30.58 | 3.99 | | | | |

The table shows mean scores of male and female students taught genetics using concept mapping in which were 32.88 and 30.58 with standard deviation of 6.45 and 3.99 respectively, t-calculated value = 0.898 and t-critical or table value = 1.730 at the 0.05 level of significance. Since t-calculated is less than t-tabulated we therefore accept the null hypothesis; therefore, there is no significant difference between the post-test mean scores of male and female students taught genetics using concept mapping.

## 7. Discussion

The study showed that there was significant difference between the post-test mean scores of students taught genetics using demonstration and those taught genetics using concept mapping. That is, those taught using concept mapping achieved better than those taught using demonstration method. This is shown in the mean scores of students taught genetics using demonstration and concept mapping in which were 25.00 and 31.50 with standard deviation of 4.18 and 5.08 respectively, t-calculated value = 4.422 and t-critical or table value = 2.021 at the 0.05 level of significance. Since t-calculated is greater than t-tabulated, null hypothesis 1 was therefore rejected. This result is in line with Hall (2002) who stated that concept mapping increases recall of information in instructions in biology subject.

From the study, it was also seen that there was no significant difference between the post-test mean scores of male and female students taught genetics using concept mapping. The posttest mean scores of male and female students taught genetics using concept mapping in which were 32.88 and 30.58 with standard deviation of 6.45 and 3.99 respectively, t-calculated value = 0.898 and t-critical or table value = 1.730 at the 0.05 level of significance. Since t-calculated is less than t-tabulated, the null hypothesis was therefore accepted.

## 8. Conclusions

Based on the result of this study, the following conclusions were drawn:

- There is a significant difference in the post-test mean scores of students taught genetics using demonstration and those taught using cooperative learning method.
- There is no significant difference between the post-test mean scores of male and female students taught genetics using cooperative learning method.

## 9. Recommendations

- Biology teachers should adopt the used of concept mapping methods in teaching genetics and other topics in biology.
- Teachers should be train and re-trained on how to effectively use the concept mapping method in the teaching of genetics and biology in general.
- Curriculum planners should incorporate concept mapping methods in the curriculum.
- Authors of Biology textbooks should include concept mapping methods in the books.

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