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THE PROBLEMS OF TEACHING AND LEARNING GENETICS IN SECONDARY SCHOOLS IN ENUGU SOUTH LOCAL GOVERNMENT AREA OF ENUGU STATE

Ezechi Nnenna Grace, Ph.D
Department Of Biology Education, Enugu State College of Education (Technical), Enugu ezechinnenna@gmail.com

Abstract: *The research work is on problems of teaching and learning of genetics. The area of study is Enugu south local Government Area. The sample size of the study was one hundred (100) respondents. A structured questionnaire consisting of 20 items based on the research questions was used for data collection. The instrument was submitted to three experts, two lecturers in the Department of Biology Education and one lecturer in measurement and evaluation all form Enugu State College of Education (Technical), Enugu. Advice, criticisms, re-arrangements and corrections given by these experts were considered in producing the final copy of the instrument. The test-retest reliability method was adopted by the researcher. The correlation coefficient obtained using the Crombach methods of estimating reliability was 0.71. This indicates that the research instrument was of a high level. Mean was used to answer the research questions. The findings revealed that the areas of genetics teachers and students find difficult teach and learn are structure of DNA and RNA, genetic crossing among others. Nature of difficulty teachers and students experience in genetics include lack of teaching aids, lack of qualified teachers among others. Causes of teaching and learning difficulties include method of teaching used by the teacher; and inadequate time allotted for teaching of genetics among others. The researcher recommended among others that teachers should be encouraged to attend conferences, seminars and workshops. This will help them to learn new things, methods and acquire new skills in teaching difficult genetic concepts.*

Keywords: Problems of Teaching and Learning, Learning Genetics, Enugu State

INTRODUCTION

Genetics is the study of heredity. Heredity is a biological process where a parent passes certain genes onto their children or offspring. Every child inherits genes from both of their biological parents and these genes in turn express specific traits. Some of these traits may be physical for example hair and eye color and skin color. On the other hand some genes may also carry the risk of certain disease and disorders that may pass on from parents to their offspring. (Creswell, 2013).

According to Davar, (2012), genetic information lies within the cell nucleus of each living cell in the body. The information can be considered to be retained in a book for example. Part of the book with the genetic information comes from the father while the other part comes from the mother.

According to Moll and Allen (2014), genetics is the study of genes, genetic variation, and heredity in living organisms. It is generally considered a field of Biology. The father of genetics was Gregor Mendel, a late 19th-century scientist and Augustinian monk. Mendel studied traits inheritance and the way traits are handed down from parents to offspring. He observed that organisms inherit traits by way of discrete unit of inheritance.

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Trait inheritance and molecular inheritance mechanisms of genes are still primary principles of genetic in the 21st century, but modern genetic has expanded beyond inheritance to studying the function and behavior of genes. Gene structure and function, variation, and distribution are studied within the context of the cell, the organism (e.g. dominance), and within the context of a population. Genetics has given rise to a number of subfields, including epigenetic and population genetics. Organisms studied within the broad field span the domain of life, including bacteria, plants, animals, and humans. Genetic processes work in combination with an organism's environment and experiences to influence development and behavior, often referred to as nature versus nurture. The intracellular or extracellular environment of a cell or organism may switch gene transcription. (Dillon, 2013).

Genetic is one of the topics taught in biology at senior secondary school level. The topic covers the following aspects: variations, mitosis and meiosis, monohybrid crossings, sex-determination, co-dominance and mutation etc. Previous studies in Nigeria have shown that genetics is perceived as a challenging topic for some students and teachers. For example in a study by Rugumayo (2012), teachers cited genetics as one of the topics they needed help in order to teach it effectively.

Haambokoma and Mwale (2008) found that students at two national technical schools rate of the view that teachers had difficulties teaching genetics effectively and therefore, student found it difficult to learn in the same study. Teaching of genetics as one of the area they needed further professional development. Genetics was also one identified as challenging topic for female students by a group of teachers at a planning workshop for girls' science camp in August 2012 (Zambia National Commission For UNESCO, 2012).

Furthermore, reports of the chief examiner for the Biology theory paper also indicated that candidates have had difficulties in answering questions on genetics in examination. For example the chief examiner's report of Enugu State 2011 stated that candidates seemed not to know genetic terminologies and also lacked understanding of the usage of genetic symbols. Although genetics has been identified as a difficult topic to learn among secondary school students, the nature and causes of learning difficulties in this topic have not been investigated. It is hoped that this study would generate information which curriculum developers, textbook writers, and biology teachers could use to improve the learning of genetics.

Statement of the Problems

Academic achievement of students in biology has been poor over the years. (Frederick, 2010). This poor achievement has been attributed to students poor understanding of difficult concepts in biology in which genetics is one. It has been noticed that, the challenges that students and teachers perceive in learning and teaching genetics, are not isolated problems. Students face problems representing genetics texts into schemes and symbols, and vice versa in reading schemes and symbols. Knowledge of the extensive genetic terminology is required for understanding a classical genetic problem. Moreover, they have to do mathematical calculations with those symbols in solving the problem. Students have poor understanding of the genetic relationships, and encounter difficulties in linking the different concept.

Research Questions

The following research questions guided the study:

1. Which areas of genetics do teachers and students find difficult to teach and learn in secondary schools in Enugu South Local Government Area?
2. What is the nature of difficulties teachers and students experience in genetics in secondary schools in Enugu South Local Government Area?
3. What are the causes of learning difficulties experience in genetics in secondary schools in Enugu South Local Government Area?

Methodology

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Survey design was used for this study. The area of the study is Enugu South Local Government Area. The population of the study was 3,681 science students and 68 science teachers in all the 15 Secondary Schools in Enugu South Local Government Area of Enugu State. Simple random sampling technique was used to draw the sample. The strata were rural and urban, located schools. Three schools were selected from the urban while two schools were selected from rural; the researcher selected 15 students and five teachers from each school. Therefore, the sample size of this study was one hundred (100) respondents. A structured questionnaire consisting of 20 items based on the research questions was used for data collection. The instrument was submitted to three experts, two lecturers in the Department of Biology Education and one lecturer in measurement and evaluation all form Enugu State College of Education (Technical), Enugu. Advice, criticisms, re-arrangements and corrections given by these experts were considered in producing the final copy of the instrument. The test-retest reliability method was adopted by the researcher in which the research instrument was administered to secondary school teachers and students in Enugu North Local Government Area of Enugu State. Two weeks after the initial administration, the instrument was administered again to the same group of respondent. The correlation coefficient obtained using the Crombach methods of estimating reliability was 0.71. This indicates that the research instrument was of a high level of reliability. The researcher distributed one hundred questionnaires directly to the respondents and collected them back immediately after filling, without misplacement. Mean was used to answer the research questions.

Results

Research Questions 1

Which areas of genetics do teachers and students find difficult to teach and learn in secondary schools in Enugu South Local Government Area?

Table 1a: Mean Responses on areas of genetics teachers find difficult to teach.
N= 25 for teachers

S/N	ITEMS	SA 4	A 3	D 3	SD 1	N	ΣFX	$\bar{X}$	REMARKS
1	Structure of DNA and RNA.	10	12	-	3	25	67	2.68	Agree
2	Process of meiosis	12	13	-	-	25	87	3.48	Agree
3	Genetic crossing	3	17	2	3	25	70	2.80	Agree
4	Sex-determination	4	18	2	-	25	74	2.96	Agree
5	Teaching of albinism and haemophilia.	5	16	2	2	25	74	2.96	Agree

The above items from items number 1, 2, 3, 4 and 5 had mean ratings of 2.68, 3.48, 2.80, 2.96 and 2.96 respectively; hence all the teachers agreed that all the items are areas of genetics Teachers find difficult to teach in secondary schools in Enugu South Local Government Area.

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Table 1b: Mean Responses on areas of genetics students find difficult to learn.
N= 75 for students

S/N	ITEMS	SA 4	A 3	D 3	SD 1	N	ΣFX	$\bar{X}$	REMARKS
1	Structure of DNA and RNA.	35	20	5	15	75	225	3.00	Agree
2	Process of meiosis	23	37	5	10	75	223	2.97	Agree
3	Genetic crossings	33	32	4	1	75	237	3.16	Agree
4	Sex-determination	28	22	10	15	75	213	2.84	Agree
5	Teaching of albinism and haemophilia.	15	40	8	12	75	208	2.77	Agree

The above items from 1, 2, 3, 4 and 5 had mean ratings of 3.00, 2.97, 3.16, 2.84 and 2.77 respectively; hence all the students agreed that all the items are the areas of genetic students find difficult to learn in secondary schools in Enugu South Local Government Area.

Research Questions 2
What is the nature of difficulties teachers and students experience in genetics in Enugu South Local Government Area?

Table 2a: mean responses on nature of difficulties teachers experience in genetics.
N = 25 for teachers

S/N	Items	SA 4	A 3	D 2	SD 1	N	ΣFX	$\bar{X}$	REMARKS
6	Lack of teaching and learning aids such as video tapes, charts etc	3	17	2	3	25	70	2.80	Agree
7	Some teachers that teach biology are not qualified and find it difficult to teach genetics	6	14	3	2	25	76	3.04	Agree
8	Negative attitudes of teachers and students towards genetics	11	8	3	3	25	77	3.00	Agree
9	Difficulties in learning genetics due to teachers' inability to explain genetics concepts adequately during lessons.	9	8	5	3	25	76	3.04	Agree
10	Teachers find it difficult to teach crossing in genetics.	8	7	5	5	25	68	2.72	Agree

The above item from 6, 7, 8, 9 and 10 had mean ratings of 2.80, 3.04, 3.00, 3.04 and 2.72 respectively, thus teachers agreed to these items as the nature of difficulties that teachers experience in genetics.

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Table 2b: mean responses on nature of difficulties students experience in genetics.
N = 75 for students

S/N	Items	SA 4	A 3	D 2	SD 1	N	ΣFX	$\bar{X}$	REMARKS
6	Lack of teaching and learning aids such as video tapes, charts etc	33	32	4	1	75	237	3.16	Agree
7	Some teachers that teach biology are not qualified and find it difficult to teach genetics.	33	17	8	17	75	216	2.88	Agree
8	Negative attitudes of teachers and students towards genetics	20	40	10	5	75	225	3.00	Agree
9	Difficulties in learning genetics due to teachers' inability to explain genetics concepts adequately during lessons.	45	20	5	15	75	265	3.55	Agree
10	Teachers find it difficult to teach crossing in genetics.	37	23	5	10	75	237	3.16	Agree

The above item from 6, 7, 8, 9 and 10 had mean ratings of 2.80, 3.04, 3.00, 3.53 and 3.16 respectively, thus students agreed to these items as the nature of difficulties that students experience in genetics in Enugu South Local Government Area.

Research Questions 3

What are the causes of teaching and learning difficulties experienced in genetics in Enugu South Local Government Area?

Table 3a: Mean Responses on causes of teaching difficulties experienced in genetics.
N = 25 for teachers

S/N	ITEMS	SA 4	A 3	D 2	SD 1	N	ΣFX	$\bar{X}$	REMARKS
11	Teachers had difficulties teaching genetics effectively	12	13	-	-	25	87	3.48	Agree
12	Method of teaching used by the teacher.	12	13	-	-	25	87	3.48	Agree
13	Lack of suitable teaching aids for use in the teaching of genetics makes learning unrealistic, boring and creates no desirable impact on the mind of the peoples	20	1	3	1	25	77	3.00	Agree
14	Too many terms: terms such as phenotype, genotype, heterozygous, homozygous, etc	4	18	2	-	25	74	2.96	Agree
15	Time allocated to teaching and learning of genetics not adequate	11	8	3	3	25	77	3.00	Agree

Items number 11, 12, 13 14 and 15 had mean ratings of 3.48, 3.48, 3.00, 2.96 and 3.00 respectively; hence all the teachers agreed that all the causes of teaching difficulties experienced in genetics in Enugu South Local Government Area

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Table 3b: Mean Responses on causes of learning difficulties experience in genetics.
N = 75 for students

S/N	ITEMS	SA 4	A 3	D 2	SD 1	N	ΣFX	$\bar{X}$	REMARKS
11	Teachers had difficulties teaching genetics effectively	23	37	5	10	75	223	2.97	Agree
12	Method of teaching used by the teacher	23	37	5	10	75	223	2.97	Agree
13	Lack of suitable teaching aids for use in the teaching of genetics makes learning unrealistic, boring and creates no desirable impact on the mind of the peoples	50	20	3	2	75	296	3.16	Agree
14	Too many terms: terms such as phenotype, genotype, heterozygous, homozygous, etc	28	22	10	15	75	213	2.84	Agree
15	Time allocated to teaching and learning of genetics not adequate	20	40	10	5	75	225	3.00	Agree

Items number 11, 12, 13, 14 and 15 had mean scores of 2.97, 2.97, 3.16, 2.84 and 3.00 respectively; hence all the students agreed that all the causes of learning difficulties experienced in genetics in Enugu South Local Government Area.

Discussion of findings

From the Research question 1, the teachers and students agreed that all the items are areas of genetics students find difficult to learn in secondary schools in Enugu South Local Government Area. This is in line with the findings of Rugumayo (2012) who discovered that difficult areas in genetic include crosses; genetic terms; mutation; mitosis and meiosis; sex determination.

From the research question 2, teacher and student agreed that all the items as nature of difficulties experience in genetics. This is in line with the findings of Moll &Allen (2014), who discovered that overloaded biology curricula, the abstract nature of genetic concepts are the factors preventing students from learning genetic effectively.

From the research question 3, the teachers and students agreed that all the items as the causes of learning difficulties experienced in genetics. This study revealed that; lack of teaching aids, teaching methods of the teacher among others are causes of learning difficulties experienced in genetics. This is in line with the findings of Ezechi (2014) that teachers method of teaching is one of the factors that affect students' achievement in biology.

Conclusion

The following conclusions were drawn based on the findings of the study.

1. The areas of genetics teachers and students find difficult to teach and learn are structure of DNA and RNA, meiosis, genetic crossing, sex determination, albinism and haemophilia
2. Nature of difficulties teachers and students experience in genetics include lack of teaching aids, lack of qualified teachers among others.
3. Causes of teaching and learning difficulties include method of teaching used by the teacher, lack of suitable teaching aid, and inadequate time allotted for teaching of genetics among others

Recommendations

Based on the findings, the following recommendations were therefore made:

1. All the topics in genetic which are practically oriented should be taught in the laboratory, using all the necessary equipment.
2. The teachers should be encouraged to attend conferences, seminars and workshops. This will help them to learn new things, methods and acquire new skills in teaching difficult genetic concepts.
3. There should be more periods on the time-table for practical on genetics.

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