

# **The implementation of action research for the improvement of the teaching of genetics In South African high schools**

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## **Abstract**

The downward trend in the learners' performance and the quality of passes obtained in genetics hence in Life sciences as revealed by the matric result analysis in Life science since inception of NCS in 2008 till date is a clear indication that there is a serious problem in the teaching and learning of genetics in the high schools. Even though there has been steady decrease in the pass rate and quality of passes in genetics during the outcome based education system (OBE) but, the downward trend became more noticeable since 2008 at the inception of the NCS system when genetics assumed an important position in the curriculum.

Over the past years since genetics assumed an important position in the new NCS syllabus for the matric class (grade 12), I have been having very serious concerns on the downward trend in the performance of my learners in genetics. They have more difficulties answering questions from genetics than other topic areas in Life Sciences. I currently teach Life Sciences in the matric class (Grade 12) in a high school in Mpumalanga province.

The present and future severe consequences of this problem triggered the design of this study. The aim of the study is to identify the different problems militating against the teaching and learning of genetics in South African High Schools (case study of Mpumalanga Province) using action research. The problem needs immediate attention because it is posing serious threats to the development of the country's economy. This is because; the problem constitutes a major barrier to a number of learners who would have pursued careers in Sciences, Science education, Medicine, Agriculture and Engineering.

The study is carried out at Nkomazi municipality, with ten (10) selected high schools (4 private and 6 public respectively), ten grade 12 life sciences teachers and 100 grade 12 learners from Malelane and Nkomazi west circuit in Ehlanzeni district, Mpumalanga department of Education. The study is designed to address the following research question: What are the problems militating against the teaching and learning of genetics in High Schools in Mpumalanga Province in South African and how can action research be used to solve these problems to foster better teaching and learning?

Qualitative method is adopted for use in the study and the instruments for data collection are interview and observation. Questionnaire is used as an interview instrument for data collection in conjunction with observations. The questionnaire comprised of the list of relevant questions or general topic that the researcher would explore. It is a structured questionnaire designed (with open-ended, fill in the blank, Binary and scaled response

question formats) for data collection. Therefore, inductive method of analysis will be adopted for the analysis of data in this research, meaning that the critical themes emerge out of the data.

This study will draw experiences from information collected as basement to develop a strategy for addressing the identified problems. The effectiveness of the developed strategy will also be tested. In addition, the information gathered from this study will be of tremendous help to the Department of Education for the improvement of the syllabus in genetics.

Keywords: Genetics, Life sciences teachers, learners, high schools, Strategy effectiveness, action research, teaching, learning, science education.

### **Introduction**

This is Action research which focuses on the improvement of the teaching of genetics in South African secondary school. Genetics is one of the most interesting yet very technical aspects of life sciences where learners face challenges such as problem solving, terminologies used in trait inheritance, crosses, genetic modification and cloning. Moreover, genetics is aligned as a main topic in science programs and science curriculum or projects around the world (SS&C, 1999).

Genetics is becoming more and more important for societies (Banet and Ayuso, 2003). It is stepping in our life for example the rapid advancement of genetic science, fuelled by Human Genome project and other related initiatives. This promises a new kind of public health practice based on pre-detection of disease according to the calculation of genetic risk (Bunton, 2001) or curing virulent diseases by gene therapy. Latest advances in genetics field, such as cloning and GMOs, are miseries to all people around the world.

Genetics is an aspect of life science that has contributed immensely to Nation building and survival of individuals in our society today. Through genetic counseling, pregnant women are made to carry out amniocentesis, a test that detects genetic disorder in the unborn babies. Many of such cases are treated at the early stage and others are simply averted through termination. Furthermore, from above hint about GMOs, genetics is now seen as great succor to the world's food shortage problem through genetically modified food (GMF) helping to meet the food demand of the rapidly growing world population.

In the new National curriculum statement (NCS) genetics occupies an important position, which means that more attention must be given to the teaching and learning of genetics especially at the secondary school level in order to lay a solid foundation for the learners in preparation for university and professional trainings. The facts above have been enumerated in order to show how important and vital genetics is in the field of life science. Therefore, it means much cognizance should be given to improvement of the teaching and learning of genetics in various institutions of learning at all levels especially at the FET level in the secondary schools.

Although, genetics is an interesting and very useful aspect of life sciences which should capture the interest of both learners and teachers: the reverse is the case in the South African high schools today because results have shown that genetics is one of the topic areas posing a lot of challenges to learners especially in grade 12 which has led to poor performance in the matric examination continuously especially since the inception of the new NCS programme where genetics assumed an important position in the syllabus.

Moreover, the above claim was made evident in the matric result analysis document in life science for Mpumalanga province {the site of this research}. It is the usual practice of the Education department of Mpumalanga province {each year after the release of matric result} to make available {for all educators} the result analysis per subject for the province which as well includes the overall analysis for the nation at large. Extracts from the analysis document for Life Science since inception of NCS in 2008 is as revealed in the table below:

ITEM ANALYSIS ON THE LEARNERS AVERAGE PERFORMANCE (%) PER QUESTION FOR LIFE SCIENCES PAPER 1 FROM 2007 to 2011

	2007	2008	2009	2010	2011
DNA structure and functions.	55.3	56.4	56.9	58.4	68.4
PROTEIN synthesis	47.3	33.8	40.5	46.2	57.2
MEIOSIS and significance.	44.6	31.6	46.2	53.7	61.5
GENETICS.	23.8	12.8	12.3	13.1	18.3
HUMAN REPRODUCTION	66.2	64.7	68.4	68.8	66.8
PLANT REPRODUCTION	42.8	48.9	51.3	61.5	59.6

Even though there has been steady decrease in the pass rate and quality of passes in the paper 1 of Life sciences especially in the aspect of genetics during the outcome based education system (OBE) but, the downward trend became very noticeable since 2008 at the inception of the NCS system when genetics assumed an important position in the curriculum.

Recently, a research report (aiming at improving the performance of the South African schooling system in sciences) was submitted by professor Charles Simkins (published in September 2010) commissioned by the centre for development and enterprise (CDE). The research revealed that poor teaching and socio-economic factors associated with schools are strongly correlated with their performance. Notably, Dinaledi schools (partly designed to offset historical imbalances in education) did not achieve significantly better results due to these same militating factors among many others. One of the major challenges is inability of the learners to understand genetics when they are been taught in the classroom due to

poor teaching and which led to their poor performance. All these triggers the interest of the researcher to carry out this study to identify the different problems in the teaching and learning of genetics and as well find possible solutions that will enhance its improved teaching in the high schools.

### **STATEMENT OF THE PROBLEM**

Over the past years since genetics assumed an important position in the new NCS syllabus for the matric class (grade 12), the downward trend in the performance of my grade 12 learners in genetics has been serious concern to me. They have more difficulties answering questions from genetics than other topic areas in Life Sciences and this was made evident in their internal summative evaluations comprising of home works, class works, class tests, controlled tests and preparatory exams over the years.

Even though the steady decrease in the pass rate and quality of passes in genetics has been during the outcome based education system (OBE) but, the downward trend became more noticeable since 2008 at the inception of the NCS system when genetics assumed an important position in the curriculum. This was enumerated in the matric result analysis in Life science {since inception of NCS in 2008 till date} as shown in the table above which is a clear indication that there is a serious problem in the teaching and learning of genetics in the high schools.

Furthermore, my analysis per topic areas of the learner's performance in the summative assessments (particularly tests and exams) over the recent years is also a strong evidence that substantiate the proof that learners perform better and are quite progressive in other topic areas in Life Sciences compared to genetics. I discovered that some of the areas they find most difficult to understand (areas of challenge) in genetics are problem solving, terminologies used in trait inheritance, crosses, genetic modification and cloning. This constitutes a major cause in the downward trend of the learners' performance and the quality of passes obtained in Life sciences in matric examination over the years.

The poor performance poses a serious challenge to me because grade 12 is where learners are expected to be prepared for the public examination (matric) which is a pre-requisites to gaining admission into colleges, technicons and university. But, as a matter of fact I am publicly accountable for my learner's achievement results.

Sequel to above, as educator, I felt that some of my educational and professional values are negated in my practice. I considered this to be a real challenge that needed to be given a required and urgent attention because the problem constitutes a major barrier to a number of learners who would have pursued careers in Sciences, Science education, Medicine, Agriculture and Engineering after matric.

. I therefore see a great need to:-

- Find out what the actual problem is?
- Think on what I could do about it?

- Look for the kind of evidence I could collect to help me make some judgments about the problem?
- See how best I would collect such evidence?
- Plan how I would check that my judgment about the problem is reasonable, fair and accurate?

The problem needs immediate attention because it is posing serious threats to the development of the country's economy. This is because; the problem constitutes a major barrier to a number of learners who would have pursued careers in Sciences, Science education, Medicine, Agriculture and Engineering.

Severe consequence of the barrier constituted by this problem will be the continuous shortage of skills in the field of Sciences, Science education, Agriculture, Engineering and technology in South Africa. Currently, many public hospitals in the country have shortage of expert doctors and other medical professionals. Many high schools around the country especially in the rural areas do not have mathematics and science teachers. Each year, the national office of the education department advertise vacant teaching posts in the public schools around the country and at least 85% of the total posts advertised are for science teachers.

Findings by Life Science curriculum designers/developers and implementers around the country also attribute the problem in genetics to the practice of Life science teachers: **“Teachers are in the centre of the problem hence, they must also be part of the solution finding process”**.

More so, the country's population is increasing on daily basis then, more farmers, agriculturists {plant and animal breeders} and genetic engineers are needed for mass food production to meet the food demand of the growing population. Shortages of these skills will automatically results in food shortage and starvation in the country. If the problem persists without tangible things done to find possible and lasting solutions to it, the future consequences may be more devastating to the country's economy and the existence of individual citizen.

The above stated facts, it can be deduced that the problem faced by learners in genetics stemmed from how it is been taught in the classroom. This is a serious challenge that must be given adequate attention. All above suggest necessity of significant improvement in the teaching and learning of genetics in the high schools, so this research is originated to identify causes as well as proffer possible solutions.

All these triggered my interest to carry out this action research as a collaborative study by involving a team of my colleagues (Life Sciences teachers) from other schools and communities within the site or territory of this study. We saw the need to change our existing practice and develop a new and better strategy to improve our teaching of genetics so that our learners can understand the topic more clearly and have their problem fully solved.

## **PURPOSE OF THE SYUDY**

This is a collaborative action research which is carried out within the context of our (the teacher's) environment—that is, with our students and at the school in which we work—on questions that deal with educational matters at hand. The research focuses on the improvement of the teaching of genetics in South African secondary school. The purpose of the research therefore, is to identify the actual challenges in the teaching and learning of genetics in high schools in Mpumalanga province as a means of finding solutions to them in the following order;

- Identify or trace the root of the problem i.e. how we teach genetics in the classroom i.e. teaching methodology;
- Imagine a solution to the problem;
- Act in the direction of the solution;
- Evaluate the outcomes of my actions;
- Modify my problems, ideas and actions in the light of my evaluations.

This we hope will turn the situation around for better in genetics. According to the basic concepts of collaborative action research; “we are educators working in our own environment, with our own learners, on problems that affect us directly. We are at the place where research and practice intersect and real change can occur. Results of our actions can be seen first-hand, and we can build on this information. Practitioners develop skills in analyzing their own teaching methods”.

It means after having gathered enough information on the problems associated with teaching and learning of genetics, strategy for solving the problems will be developed through experiences gained from the information collected and will be tested to see if it addresses the problem effectively.

The information gathered from this study will be useful to the Department of Education for further refining the Life Science curriculum.

Precisely, this research is looking at how teachers could be best assisted in order to improve their teaching skills especially in the area of genetics for better understanding by the learners.

However, there are agreements among some researchers that genetics is quite difficult for student to learn {Johnstone and Mahmond, 1980, Finley et al., 1982, cited in Kindfield 1994; Moll and Allen, 1987; Banet and Ayuso, 2000} because it is domain that requires learners to use multilevel thinking and reasoning that is central to higher-order thinking.

## **RESEARCH QUESTION**

The central research question is:-

What are the problems militating against the teaching and learning of genetics in High Schools in Mpumalanga Province in South African and how can action research be used to solve these problems to foster better teaching and learning?

Specifically, this study shall answer the following questions:-

- (a) What roles do practical investigations in genetics play in making learners to understand the topic?
- (b) What impact does teachers "teaching methodology" has on the teaching and understanding of genetics in the classroom?
- (c) Is there any relationship in the way teachers plan their lessons in genetics and the level of learners understanding of the topic when taught?
- (d) What impact does teachers' content knowledge in genetics has on the teaching of genetics and the understanding of the learners?
- (e) What role does availability of relevant instructional materials and infrastructure play in the teaching and understanding of genetic?
- (f) How do teachers' qualifications and subject of specialization affect their level of performance in the teaching of genetics?
- (g) How do learners' perception and content knowledge in genetics affect their level of understanding?
- (h) What roles do the various types of summative assessments and feedbacks play in the learners understanding of genetics?
- (i) How should learner's misconceptions in genetics be dealt with or handled by the teachers in order to facilitate better understanding of the topic?

## **REVIEW OF RELATED LITERATURE**

### CONCEPTUAL FRAMEWORK

This is Action Research in Education which is meant to solve a particular identified problem in the teaching of genetics in South African secondary school. Drawing from several reviews, action research is defined as 'systematic inquiry by practitioners to improve teaching and learning.

Stephen Corey at Teachers College at Columbia University was among the first to use action research in the field of education. He believed that the scientific method in education would bring about change because educators would be involved in both the research and the application of information. Corey summed up much of the thought behind this fledgling branch of inquiry.

We are convinced that the disposition to study...the consequences of our own teaching is more likely to change and improve our practices than is reading about what someone else

has discovered of his teaching. (Corey, 1953, p. 70) Corey believed that the value of action research is in the change that occurs in everyday practice rather than the generalization to a broader audience. Carr and Kemmis (1986) describe action research as being about:

- the improvement of practice;
- the improvement of the understanding of practice;
- the improvement of the situation in which the practice takes place.

Action research can thus be used to:

- help teachers feel in control of their own professional situation.
- understand one's own practice;
- understand how to make one's practice better;
- understand how to accommodate outside change in one's practice;

It is now often seen as a tool for professional development, bringing a greater focus on the teacher than before (Noffke & Stevenson, 1995). Action research can be a worthwhile pursuit for educators for a number of reasons. Foremost among these is simply the desire to know more. Good teachers are, after all, themselves students, and often look for ways to expand upon their existing knowledge.

Genetics has been thought as one of the most important topics for biology study {Stewart 1982 and Tolman 1981, cited in Moll and Allen, 1987; Kindfield, 1994}. Stating understanding genetics does not only mean that knowing how one generation of living organism transfers its traits to the next one and so on, but it is basic conceptual framework to understand another biological phenomena also, such as reproduction of living things, evolution and biodiversity {Johnstone and Mahmond, 1980; Finley et. Al., 1982, cited in Kindfield, 1994; Banet and Ayuso, 2003, Chi-yan and Treagust, 2003}. These all indicate the universal significance of understanding genetics.

Action research has been utilized in three domains of science education: teacher education and professional development; research on science learning; and curriculum development and implementation. Moreover, in all cases teachers are in the role of researcher. Action research has been use in both pre-service and in-service teacher education, and a way for teachers to collaborate with one another to improve practice.

Hewson and colleagues (1999) use action research to help prospective teachers become reflective about what it means to teach for conceptual change. Science FEAT was a three year teacher enhancement project (Spiegel , 1995) funded by the National Science Foundation (NSF) in which middle school Science teachers studies their own teaching. The project for Enhancing Effective Learning (PEEL) was an action research program aimed at improving the teaching and learning of science by encouraging teachers to inquire into how their students learn (Baird and Mitchell 1987). Solomon and colleagues (Solomon, Duveen, & Scot, 1992) used action research as a means of collaborating with middle school science

teachers to gather data about classroom learning. Minstrell has for 20 years conducted research in his classroom how students learn physics. His efforts demonstrate how a classroom teacher who is part of a community of researchers can add substantially to the knowledge base on science learning (Feldman & Minstrell, 2000; Minstrell, 1992).

Action Research has its foundation in the writings of Dewey, the great American educational philosopher of the 1920s and 30s, who believed that professional educators should become involved in community problem solving. Action Research is “learning by doing”- a group of people identify a problem, do something to resolve it, see how successful their efforts were and if not satisfied, try again.

#### CURRICULAR CONTENT OF GENETICS (PAST AND PRESENT REVIEW):-

Before 2008, Outcome based Education system (OBE) was been practiced in South African. In the OBE curriculum, genetics was not given a deserved preference and much cognizance in the Life Science curriculum because its curricular content did not carry much weight. In 2008, OBE system was replaced with the new National curriculum statement NCS system where genetics was given much preference as it was made to occupy a central role/position in the Life Sciences curriculum. The NCS syllabus for Life Sciences exhumes appreciable contents of genetics in the curriculum. This arrangement and many others made NCS a better system than OBE. With the present level of curriculum contents of genetics in the Life Science syllabus, solid foundation is laid for learners against their tertiary education pursuance in Sciences, medical and related courses.

#### TEACHERS TEACHING PERFORMANCE IN GENETICS:-

However, there are agreements among some researchers that genetics is quite difficult for student to learn {Johnstone and Mahmond, 1980, Finley et al., 1982, cited in Kindfield 1994; Moll and Allen, 1987; Banet and Ayuso, 2000} because it is domain that requires learners to use multilevel thinking and reasoning that is central to higher-order thinking {Chi-Yan and Treagust, 2003}, so it is generally found that the traditional teaching strategy cannot promote genetics understanding. By traditional teachings, students learn by rote, in short duration they just can recall facts cannot apply knowledge to new experiences {Okebukola, 1990} and many students contain alternative conceptions as same as they had before stepping into classroom such as those collected in research report of Banet and Ayuso’s {2000, 2003}. Beside that teachers also engage difficulties in planning their teaching in order to promote students understanding {Banet and Ayuso, 2000; Banet and Ayuso 2003}.

#### INTERACTIVE SURVEY APPROACH TO FINDING SOLUTIONS TO EXISTING PROBLEMS:-

A research aiming at improving the performance of the South African schooling system in sciences was conducted recently by professor Charles Simkins (published in September 2010) commissioned by the centre for development and enterprise (CDE). The research revealed that poor teaching and socio-economic factors associated with schools are strongly correlated with their performance. Notably, Dinaledi schools (partly designed to offset historical imbalances in education) did not achieve significantly better results due to these

same militating factors among many others. One of the major challenges is inability of the learners to understand genetics when they are been taught in the classroom due to poor teaching strategies and which led to their poor performance.

#### APPRAISAL

Sequel to the above therefore, and the evidence gathered from FEAT research project and other similar research projects, it was quite evident that action research is in no doubt considered best viable, and most effective method for change and improvement for the classroom teachers. Hence it will be adopted for the study under consideration here as the outcome will assist life sciences teachers to improve practice on the teaching of genetics for a better understanding by the learners.

Action research has been implemented extensively to solve a lot of peculiar problems in the field of Education. Also, this study will draw experiences from information collected as basement to develop a strategy for addressing the identified problems. The effectiveness of the developed strategy will also be tested.

### **RESEARCH DESIGN**

#### METHODOLOGY AND PROCEDURE

This is Action Research in Education which is meant to solve a particular identified problem in the teaching of genetics in South African secondary school. Hence, the type of research design considered to be most appropriate for use in carrying out this study is qualitative design. In this study, the reasons for choosing qualitative research method for this study are as follows:

- Qualitative research is naturalistic inquiry, because the data collection strategies used are interactive to discover the natural flow of the events and processes. Most qualitative research deals with people's individual and collective social actions, beliefs, thoughts, and perceptions.
- Data collected in qualitative research is usually rich in detail and is collected by the researcher Therefore; the researcher will ensure to guard against imposing own perspectives, thoughts, ideas and so on in order to reduce bias.
- Qualitative method is used to gain insight into people's motivations, aspirations and concerns. This study was triggered by concerns for the challenges encountered by teachers and learners in the teaching and learning of genetics. So, gaining insight into these problems is a stepping stone to the solution finding process.
- Qualitative research seeks out the 'how' of its topic through the analysis of unstructured information; things like interview transcripts, open ended survey responses, field notes, feedback forms, photo and video. It does not just rely on statistics or numbers which are the domain of quantitative researchers.

- Qualitative research is a method of inquiry mostly employed in many academic disciplines because it categorizes data into patterns as the primary basis for organizing and reporting results.

Sequel to above stated reasons; qualitative research method is considered most suitable for this study in order to achieve credible results.

#### SAMPLE FOR THE STUDY

The sample for this study comprised of grade 12 Life Science teachers and ten learners each from ten selected high schools in the Nkomazi Municipality in Mpumalanga province. The ten secondary schools are selected from the Malelane and Nkomazi East circuit of Ehlanzeni region in Mpumalanga department of Education. Four of the schools are urban schools (advantaged schools) of which one is a private school. While the other six are in the rural areas (disadvantage schools). Eight of the schools used are public while two independent schools. Grade 12 teachers and learners are most suitable as the sample for this study because genetics is included in the matric syllabus and taught only in grade 12 in the high schools.

#### SAMPLING TECHNIQUE

The sample for this study comprised of ten grade 12 life sciences teachers (one teacher per school) from the ten selected high schools in Malelane and Nkomazi East Circuit in Ehlanzeni region, Mpumalanga Province. The Circuits are located in the Nkomazi municipality in Mpumalanga province. Each teacher selected ten grade 12 learners among his/her learners as participants in the study. Both old and young experienced teachers that are computer literate were selected for the study.

The learners are selected according to their academic performance as made evident in their continuous assessment records(CASS) i.e. three from above average level (70 – 100%), three from average level (40 – 69%)and four from below average level (0 – 39%). This brings the sample size to 110 participants.

The sampling technique considered to be most appropriate for this research is Purposeful sampling. This sampling technique will best suit the purpose of this study due to the following reasons:

- In qualitative research, the research sites and participants are selected following a strategy called **purposeful sampling**. Purposeful sampling, in contrast to probabilistic sampling, is "selecting information-rich cases for study in depth" ([Patton](#), 1990, p. 169)
- Despite the fact that it is the dominant strategy in qualitative research such as this, purposeful sampling seeks information rich cases which can be studied in depth (Patton 1990). Size and specific cases depend on the study purpose.

#### DATA SOURCE.

This is an educational action research and according Lincoln and Guba (1985) “*humans have been identified as instrument of choice*” for naturalistic enquiry or data collection.” This is because humans are responsive to environmental cues, and able to interact with the situation; they have the ability to collect information at multiple levels simultaneously; they are able to perceive situations holistically; they are able to process data as soon as they become available. Sequel to above facts therefore, the major data source in this research will be the researchers and the participants.

#### INSTRUMENTATION

The instruments for this study will be interview and observation. According to (Bogdan and Biklen, 1982) an interview guides (questionnaire) comprising of the list of relevant questions or general topic that the researcher would explore. Structured interview by means of structured interview questionnaire (with open-ended, fill in the blank, Binary and scaled response question formats) is adopted for use in this research.

Another instrument for use in this research is observation. According to Patton (1990), the classic form of data collection in naturalistic or field research is observation of participants in the context of a natural scene. Observation can lead to deeper understanding than interviews alone, because it provides knowledge of the context in which events occur and may enable the researcher to see things that the participants themselves are not aware of, or that they are unwilling to discuss.

#### **INSTRUMENTATION VALIDITY AND RELIABILITY:**

Based on the two instruments chosen to be used for data collection in this research, the following will be ensured in order to ascertain their validity and reliability:

- ✚ The structured questionnaire will comprise only of relevance questions that will be directly related to the purpose of the study and have a good probability of yielding the kind of data desired.
- ✚ Questionnaires will be administered to the participant (right respondents) only. Teachers will be trained in administering the questionnaire.
- ✚ The questions will be made relatively easy to answer and would not create embarrassment for or an undue burden on the interviewee.
- ✚ The researcher will work to minimize his presence among the participants during the study having been fully aware that such can introduce a distortion of the natural scene.
- ✚ Stability of observation shall be ensured by making sure that all observation and interpretation are done in a similar manner. Interviews will be conducted in the same manner. Group discussions will be held regularly with the participants both formally and informally.
- ✚ All the sources of bias in way to research design will be blocked. The research shall be design in such a way to control as many extraneous variables as possible. It will

correctly address problems such as, instrumentation effects, selection bias etc. in order to achieve high internal validity.

- ✚ External validity will be ensured by selecting the sample in such a way that will make it a perfect recuperative of the population in question.
- ✚ The study will simulate the real world as closely as possible. the conditions and situations of the study will be seen as normal , depicting the usual reality of the participants i.e. not making them to behave differently due to their participation in the research
- ✚ I will try as much as possible to get the trust of the participants (teachers and learners).
- ✚ Researcher's bias will be recognize as the case may be; verbatim observation and interview (questionnaire) data will be used..
- ✚ In any case, the researcher will put into consideration the legal and ethical responsibilities associated with naturalistic observation. Tape recorders will be used only at the participant's consent.
- ✚ Lastly, the researcher work cooperatively with the supervisor (who is also a co-researcher) when collecting and reviewing data and as well triangulate varied data sources.

#### METHOD OF DATA COLLECTION

A content enrichment workshops on genetics were conducted for the teacher participants where in the purpose of the research was unveiled. At the workshop, emphasis was laid on lesson plans, lesson delivery in the classroom, using of instructional materials, and designing of practical investigations in genetics as means to improve their teaching skills on genetics. A common and convenient venue was arranged for regular meetings and workshops. Work schedule on genetics (according to NCS syllabus) to be used for the research was handed to all the teachers who in turn also intimated their selected learners for the study.

Relevant interview questionnaires were self-administered to the teachers who in turn administered to their respective learners under a free and fair atmosphere totally void of human influential factors towards the end of the study; record of which were kept as raw data. Class observations will be conducted for each teacher at regular intervals with tape recorder and jotter note during the research (without influencing or obstructing the teaching and learning atmosphere) so that teachers can reflect on their performance for necessary corrections after been made to listen to the tapes.

#### METHOD OF DATA ANALYSIS.

Bogdan and Biklen (1982) define qualitative data analysis as “working with data”, organizing it, breaking it into manageable units, synthesizing it, searching for pattern, discovering what is important and what is to be learned, and deciding what you will tell others. The major challenge in qualitative analysis is to place the raw data into logical, meaningful categories; to examine them in a holistic fashion; and to find a way to communicate this interpretation to others.

Sequel to above stated fact therefore, qualitative analysis requires some creativity. Therefore, inductive method of analysis will be adopted for the analysis of data in this research. According to Patton (1990), Qualitative researchers tend to use inductive analysis of data, meaning that the critical themes emerge out of the data. The stage by stage analysis of the data will be as follows:

- **Open coding stage (as called by Patton (1990)):** Identification of the themes emerging from the raw data. At this stage, the researcher will identify and tentatively name the conceptual categories into which the phenomena observed will be grouped. Data will be broken down to small units of manageable chunks for easy handling. The goal is to create descriptive, multi-dimensional categories which form a preliminary framework for analysis. Words, phrases or events that appear to be similar will be grouped into the same categories which may gradually be modified or replaced during the subsequent stages of analysis.
- **Axial coding stage (as called by Strauss and Corbin, 1990):** At this stage of the analysis, the categories identified in the first stage will be re-examined i.e. compared and combined in new ways in order to determine how they are linked. The purpose of coding is to not only describe but, more importantly, to acquire new understanding of a phenomenon of interest.
- Qualitative research software like ‘**NVivo**’ will be used to manage, shape and make sense of data/information by providing a sophisticated workplace that enables researchers to work through their information. It has purpose built tools for classifying, sorting and arranging information and, gives more time to analyze materials, indentify themes, glean insight and develop meaningful conclusions.

## DATA INTERPRETATION

The last stage of the data analysis falls under data interpretation. This stage is referred to as translation stage by Strauss and Corbin, (1990). At this stage, the conceptual models from the analysis of the data will be translated into the story line that will be read and easily interpreted by others. The researcher will ensure that the analysis and interpretation of the research data are done in such a way that the research report will be a rich, tightly woven account that closely approximates the reality it represents. This infers a reasonable and meaningful conclusion from the data analysis.

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