A SURVEY OF THE FACTORS AFFECTING GIRLS IN LEARNING OF 'O' - LEVEL CHEMISTRY AND THEIR EFFECTS ON ACHIEVEMENT IN CHEMISTRY IN SOME SELECTED SECONDARY SCHOOLS IN TETU DIVISION OF NYERI DISTRICT.

A REPORT SUBMITTED TO THE FACULTY OF EDUCATION IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION (CHEMISTRY) OF KENYATTA UNIVERSITY.

BY

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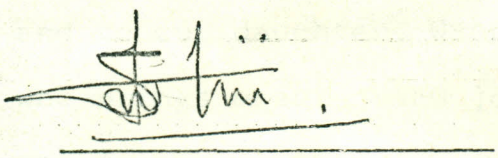
SEPTEMBER, 1987

DECLARATION

This project report is my original work and has not been presented for a degree in any other University.



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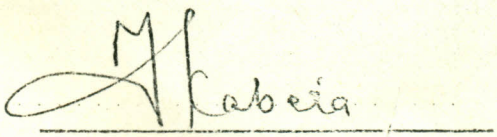
This Project report has been submitted for examination with my approval as University Supervisor.



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DEDICATION

To Wanjiku;

and to our daughter, Wangeci,

who brings meaning and joy to our lives,

and to our parents,

who made all this possible.

ACKNOWLEDGEMENTS

I have pleasure in acknowledging the contributions of those who helped in the preparation and writing of this study. I sincerely thank Dr. Festus Kaberia for his great interest, encouragement and recommendations he gave me that led to this final report.

We had a very useful discussion in the initial stages of this study with Mr. Wahome (Headmaster, Chinga Boy's High School). Mr. Ndegea (Headmaster, Kimathi Secondary School) gave me special assistance during the selection of the sample. I am very thankful to these two gentlemen.

I am very grateful to all the headteachers, chemistry teachers (Mr. Kibuthu among them) and the students in the sampled schools for providing the data and without whose assistance this study would not have been a reality.

Thanks too to my parents and my colleagues who have served as sources of great inspiration. My wife for proofreading the manuscript and to Jane Muchene for typing the report in such a short time.

Sincere gratitude to my daughter for tolerating my absence during the preparation of this report.

Wachanga, S. W.

A B S T R A C T

This study aimed at investigating the factors that affect girls in the learning of chemistry especially at O-level. The effects of those factors on the achievement in chemistry were also looked into. The study was based in Tetu division of Nyeri district. It probed into:-

i) The attitudes of girls towards chemistry
ii) The teacher's role in encouraging girls to learn chemistry.
iii) Teaching aids available to girls for learning chemistry.
iv) The textbooks used in chemistry teaching.
v) The role of parents in encouraging girls to learn chemistry.
vi) Guidance and counselling in relation to girl's interest and performance in chemistry.

In gathering of information the researcher employed a sample survey type of research in which he relied on observed information, informal interviews with chemistry teachers and the data gathered by the student's and teacher's questionnaires.

Five schools in the division all of which were co-educational were involved in the research. To get the sample of student respondents, the girls in form four chemistry classes in these schools were randomly selected. The total

sample involved eighty one girls and six teachers.

The findings of the study revealed that:-

a) Majority of the girls had positive attitude towards chemistry but this attitude was negatively affected by;

(i) poor teaching methods.

(ii) the involvement of mathematical manipulation in chemistry.

b) Some teachers had negative attitude towards the girls in their chemistry classes. Such teachers were of the view that girls were generally slow learners. This attitude seriously lowered the girl's performance in the subject.

c) Most schools gave information on careers to the girls thus enhancing their interest in chemistry.

d) Majority of the girls lacked confidence in handling laboratory apparatus due to lack of enough practice.

e) Most of the schools had a variety of chemistry textbooks but majority of the girls found the language used in those books difficult to follow. This lowered their achievement in chemistry.

f) A large number of parents encouraged their daughters to learn chemistry hence boosting the girls interest and achievement in the subject.

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CHAPTER ONE

INTRODUCTION

1.0 BACKGROUND TO THE STUDY

One of the major and perhaps the most embarassing problem still facing African populations today is hunger. This condition has been blamed on many factors such as climate, environmental degradation and inefficient traditional agricultural methods. Another very crucial but often ignored reason why hunger is prevalent in Africa is the disregard of the role of women who are the main food producers in Africa, in efforts to promote agricultural development. Unless women are fully included in the development process, the food problem in Africa will deteriorate even further.(1)

For women to participate fully in the development process, they have to be adequately represented in all educational areas. Science education is an area where women are severely under represented. Of the science subjects, the physical sciences which include physics and chemistry have fewer number of girls pursuing them when compared to other science subjects such as biology. According to Vetter (1973), women average less than 10% in all the sciences combined but vary from as much as 25% in the social sciences to about 13% in the biological and life sciences, about 5% in chemistry and less that 2% in physics and engineering.(2) This situation is not different in Tetu division.

Tetu division is one of the administrative divisions in Nyeri district, the others being, Othaya, Mukurwe-ini, Mathira, Kieni East and Kieni West. Tetu division also bounders with Nyeri Municipality.

In Tetu division, very few girls pursue physical sciences which include chemistry. This means that very few of them will be able to take up jobs with chemical bias. This research study therefore addresses itself to the factors that affect girls in learning of O-level chemistry in secondary schools in Tetu division. The study employed a sample survey type of research and targeted itself to the current factors and problems the girls face with a view to identifying those that affect their achievement in chemistry.

The researcher is convinced that the findings of this study will be very useful to chemistry curriculum developers, teachers of chemistry and the Ministry of Education in trying to solve the identified problems.

The current outlook of chemistry as a "subject for males" may change so that it becomes a subject for all.

1.1 STATEMENT OF THE PROBLEM

The Kenya National Committee on Educational objectives

and policies of 1976 reported that in Kenya, the majority of educated women have tended to go into nursing, secretarial and teaching careers.(3) The committee recommended that, this restrictive trend needed to be evaluated and the desirability of encouraging women to go into other careers be determined.

Ann Njenga has conducted a recent research study through the Bureau of Educational Research of Kenyatta University. She found that those women who have became engineers, veterinary doctors and agriculturalists from the University of Nairobi are doing well and their sex is no barrier to their professional advancement. However, although women do well in these professions,very few are inclined to enter them because the popular belief is that science and technology are a male domain. The main drawback lies in primary and secondary schools where girls are not encouraged to study mathematics and science, the subjects that ultimately lead to technological and scientific careers.(4)

In general, the enrolment of girls into secondary and post secondary institutions has been poor compared to the enrolment in primary school. The Kenya National Committee on Educational objectives and policies (1976) noted that the factors underlying this situation include the reluctance of many parents to educate girls when faced with the choice between educating them and their brothers. To many parents

education of boys is a better investiment than that of girls for whom primary education is often considered sufficient as its completion coincides with biological maturity for marriage.(5) Although the enrolment of girls in secondary and post secondary institutions is poor, their enrolment in science subjects including chemistry is even poorer.

Tsuma (1987 noted that boys at the age of twelve have already decided to join "masculine" jobs like engineering while girls believe they should take"feminine" jobs like nursing. This influences their subject choices especially in high school where the boys continue pursuing mathematics and physical sciences. On the other hand girls tend to go for biological sciences and arts. This is supported by the enrolment figures for the 1985/86 academic year of theUniversity of Nairobi. During that year, out of 516 students enrolled in the faculty of engineering, only 12 were women. In agriculture, only 116 women were enrolled out of 400 students and in veterinary medicine, out of 262 students only 46 were women.(6)

In Tetu division, the number of girls pursuing chemistry subject in further education is significantly small compared to their male counterparts. This is shown by the fact that the schools offering physical science in the division are mainly mixed schools and the boys are mainly

the ones who take physical science. In view of this the researcher was interested in finding out the factors that affect girls in learning chemistry and their effect on achievement in chemistry.

1.2 AIM OF THE STUDY

In this survey, the researcher attempted to find out the factors that affect girls when learning chemistry at 'O' - level in Tetu division (Nyeri District). The factors were categorised into two main areas; (i) biological factors or innate traits and (ii) environmental factors which include the factors related to the home, the school and the society.

The study was limited to the environmental factors. The areas probed into included:

(i) the attitudes of girls towards chemistry as a subject, their attitudes towards the teaching facilities and those towards the methods of instruction.

(ii) the attitudes of teachers towards chemistry as a science subject and their attitudes towards girls who study chemistry.

(iii) the teachers working conditions.

(iv) the availability of laboratory equipment and the use made of them.

(v) parents role in encouraging or discouraging girls from learning chemistry and the availability of role models at home.

(vi) Textbooks were investigated under the following:

(a) their availability

(b) the language level used in them.

(c) the attitudes that books instill in students towards science.

From the above areas the researcher was interested in drawing some conclusions and making some recommendations on how the situation can be improved so that we have more girls studying chemistry. The researcher will also suggest areas which require further research.

1.3 SIGNIFICANCE OF THE STUDY

In the Kenya National Committee on Educational objectives and Policies report, it is noted that:

> "About half of the human resources required for national development consist of women. Furthermore, women in a developing country like Kenya are directly responsible for most of the productive activities, especially in agriculture and general family and community welfare. Yet it is well known that the general status of the education and skills of women has lagged far behind that of men." (7)

Kenya needs to develop its full potential of manpower resource thus it can no longer afford to ignore the role of women in development. For women to adequately contribute to nation building, they have to be adequately represented in all areas.

One area where women are not adequately represented is the area of science and technology. Keino asserts that;

> "Despite the fact that the Kenya Government has emphasised science education especially in upper secondary school and University boys have proportionately greater access to schools offering science courses and their schools have stronger science programmes." (8)

Keino's statement is especially true in Tetu division and so it is important to find out ways of correcting the

situation so that girls get greater access to science and chemistry in particular.

One of the aims of studying chemistry is to help the student to relate and be able to apply the discovered knowledge in everyday life.[9] This means that the student does not have to become a chemist but he or she needs to be a well informed citizen.

The student also needs to be able to solve problems in daily life. We therefore need to find out why girls drop chemistry and attempt to change the situation.

This study will be carried out in Tetu division and will be aimed at identifying the factors that affect girls during their course of studying chemistry. The implications of these factors on achievement in the subject will be identified. This will be very useful to curriculum developers and teacher training colleges in formulating solutions which will solve the problems that girls face when learning chemistry. More women will therefore be able to take up careers in chemical field.

To improve the examination grades in physical science, the negative attitude towards chemistry has to change. This can be attained by knowing the factors which make the girls

to have negative attitude towards chemistry. Hence the findings of the study are worthy in that they will guide the direction of action, especially so with the introduction of the 8-4-4 education system where chemistry and physics will be taken as physical science in all secondary schools in Kenya. We need to encourage girls to like chemistry so as to improve their examination grades in physical science.

1.4 THE HYPOTHESES

In order to identify the factors that affect girls during their course of learning chemistry and how these factors affect their performance in the subject, the following hypotheses were offered.

1.4.1: Girls have negative attitude towards chemistry leading to poor achievement in the subject.

1.4.2: The attitude of teachers towards girls who study chemistry and their working conditions result in girls having negative attitude towards the subject.

1.4.3: The absence of appropriate chemistry textbooks in girls schools discourage the girls from studying chemistry.

1.4.4: Girls lack confidence in handling equipment, tools and materials and hence they don't make maximum use of the available laboratory equipment.

1.4.5: Parents do not encourage their daughters to study science hence the poor enrolment in chemistry.

1.5 LIMITATIONS OF THE STUDY

The following limitations were encountered while undertaking the study.

1.5.1 Limitation of Common Examination Grades in Chemistry

This project is part of M.Ed. (TDC) course requirement, the time allocation being from May to August 1987. During this time, the students in form four class will not have sat for a common examination in chemistry. They will be sitting for a common mock examination at the end of July. Chemistry grade comparisons will therefore be based on each school individually.

1.5.2 Limitation of time

The time allocated for the project was short for a thorough and detailed work bearing in mind that the

schools were closing for holidays at the end of July. Due to this shortage of time some shortcomings may have come up in the study.

1.5.3 Limitation of choice of Schools

Most secondary schools in Tetu division are Harambee schools. Due to lack of laboratory facilities in these schools, they offer general science instead of physical science in the curriculum.

There are no girls schools in Tetu division which offer pure chemistry. The researcher was therefore limited to the schools which offer physical science in their curriculum.

1.5.4 Limitation of Sample Selection

Since the study was based on mixed schools which offered physical science, the selection of sample of respondents was limited by the choice of schools and also by the number of students available at the time of administration of the questionnaires.

During the period of the research there were no form three's in secondary schools. Forms one and two students were in the 8-4-4 education system so the sample selection was based on form four students only. In some schools, the number of girls who were taking physical science was very small such that all the girls in such schools participated in the research. In other schools where the number of girls taking physical science was large, sample selection of the respondents was carried out.

1.5.5 Limitation of pilot testing of the questionnaire

Due to the limitation of time, the teacher's and students' questionnaires were not pilot tested with the same population before administration for the study. In view of this, the reliability and validity of the questionnaire were assertained by having the questionnaire read by several experienced people. By using their comments, the necessary corrections were made before the questionnaires were used in the study.

1.5.6 Limitation on Methodology

The study involved the administration of questionnaires to chemistry teachers and their students. The study would have been more complete if headteachers and parents of the girls involved were interviewed. However due to the shortage of time and funds, this was not possible.

1.5.7 Limitation of Literature on Sex differences in Chemistry Learning

The literature available on this subject is broad as it tackles science in general and in Kenya as a whole. Literature on sex differences in chemistry learning in Tetu division is non-existent.

1.6. ORGANIZATION OF THE STUDY

In this section, a brief summary of what is reported in each chapter is given.

Chapter I

This is an introductory chapter which discusses the background to the study and the statement of the problem. It also highlights areas which were investigated in the study.

Chapter 2

The Chapter contains the review of literature on science education and women. Literature on areas which affect the learning of chemistry is reviewed. The areas included are, the attitudes of girls towards

chemistry, the teacher's role, the role of teaching aids and textbooks and finally the parents role in encouraging girls to learn chemistry.

Chapter 3

This chapter discusses the methodology and research design which was employed for data collection. The methods of data analysis to be employed are discussed.

The type of research instruments and how they are administered to the respondents is also discussed.

Chapter 4

The aim of this chapter is to give an analysis and description of the findings of the study. Tabulated data is given where applicable.

Chapter 5

This chapter follows from chapter four in that it gives the conclusions and summary drawn from the data analysed. Discussion in this chapter is based on the hypothesis given earlier.

The chapter will also contain the researchers recommendations and suggestions on areas for further research.

1.7 DEFINITION OF TERMS AND ABBREVIATIONS USED

In this section, the meaning of abbreviations and special terms is explained.

i) Factors:- This refers to something such as an element, circumstance or influence that contributes to the observed girls performance in chemistry. This includes the problems that girls face when learning chemistry.

ii) 'O'-level:- Refers to the ordinary level of Education offered from forms one to four in Kenyan secondary schools.

iii) 'A'-level:- This refers to the advanced level of education which is offered in forms five and six in Kenyan High Schools.

(iv) K.C.E.:- Kenya Certificate Examination. Candidates sit for this examination after completing four years of secondary education at 'O'-level. The examination is administered by the Kenya National Examinations Council.

(v) K.I.E.:- Kenya Institute of Education, a body whose responsibility is to develop school curricula in Kenya. This involves producing and developing school syllabuses.

(vi) UNESCO:- Implies the United Nations Educational, scientific and cultural organisation.

(vii) 8-4-4 System:- Is an educational system which was recently introduced in Kenya in which the first eight years are devoted to basic or primary education, the next four years are for secondary education and the last four years are for University education.

(viii) KNEC:- The Kenya National Examinations Council is the body charged with formulating, administering and scoring of national examinations in Kenya.

FOOTNOTES

1. Mwaniki,N. Women's Self-Help Groups in Mbere. in Africa Journal of International African Institute. International African Institute Vol 56.No.2 1986 p.210.

2. Vetter,B.M. The outlook for women in Science in The Science Teacher. Journal of the National Science Teachers Association Vol. 40 No. 9 Washington D.C. 1973 P. 22.

3. Gachathi,P.J. (Chairman) Kenya National Committee Educational Objectives and Policies Report (Gachathi Report). Government Printer Nairobi - 1976. P.45.

4. Nation Reporter "Are those Scientific Jobs for Men only. Nation Newspapers Ltd. 7/3/87. Nairobi P. 11.

5. Gachathi,P.J. Op. cit. (1976) P. 45.

6. Nation Reporter Op. Cit. (7/3/87) P.11.

7. Gachathi,P.J. Op. Cit. (1976) P. 47.

8. Keino,E. "Opportunities for Females in Technical Training in Kenya, A focus on Primary, Secondary and Post-Secondary Levels of Training" Kenya Journal of Education. Vol.2 No.1 1985 Bureau of Educational Research, Kenyatta University P.5.

9. Kenya National Examinations Council. KCE Regulations and Syllabuses 1984.Kenya National Examination Council Nairobi. 1984 P. 126.

CHAPTER TWO

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 INTRODUCTION

That women are under - represented in professional and scientific communities is a disturbing but undisputed fact. Research work which has been carried out has shown that women are under-represented in some careers in which men dominate.

Researches in Kenya (Eshiwani 1983, Omar 1976) point to the fact that women end up being under-represented especially in fields related to science. These discrepancies are explained by researchers on the basis that there exists sex differences which are argued to have their origin in both innate (genetic) and environmental factors. Willerman (1979) though states that:

> "The fundamental problem guiding research in sex differences is what proportion of observed behavioural differences is "built in" through the genetic program and what proportion is acquired postnatally through learning."(1)

Powerful social forces in the environment are noted to contribute to boys having greater interest in science than do girls. In Kenya for example, science subjects,

including chemistry have acquired a "male" image so female students could consciouly or sub-consciously, be affected by this "intrusion" into the male domain, such that they lack the necessary confidence to do well in the subject.(2)

Newberry and Koelsche (1971) in their study of the relationship of certain variables and science interest of children concluded that the factor of sex is a signficant discriminator among the science categories of children. This was supported by Layton's (1975) suggestion that sex is perhaps the single most important variable related to attitudes towards science.

The differences between boys and girls in the subjects they go for are reflected in the University of Nairobi enrolment. A recent study on access of females to higher educatien found the following distribution of females in the various faculties: engineering 2.2 per cent; veterinary medicine 13 per cent; education 50 per cent; science 8.4 per cent and arts 39 per cent.(3)

Evidence available shows that the formal school system differentiates male and female learning. Rather than adequately preparing females for the posts in technical

programmes, they are encouraged to pursue courses that emphasise their domestic roles.(4)

Although girls shy away from science subjects, the ones that are hard hit are chemistry and physics. In a study on the dependence of 'O' and 'A' level results on the sex of examinees the major results revealed that:-

(a) At O - level, males showed superior performance as compared to females and

(b) At A - level, females showed superior performance as compared to males in all subjects except in chemistry and physics(5)

The O - level chemistry course can be broadly divided into two halves. The first half which consists of elementary chemistry can be viewed as a complete two year introductory course which forms a basis for Kenya Certificate of Education (KCE) chemistry and physical science. The second half is taken in years three and four. It constitutes a deeper and more theoritical treatment of the topics introduced in elementary chemistry.(6)

Like other subjects chemistry has aims for teaching it in Kenyan secondary schools some of which are:

> "----to help the student to appreciate the importance and the application of chemistry in everyday life ..... and to assist the student to learn how to think critically in any given learning situation ... and to guide the student to discover knowledge from known to unknown, using a practical approach."(7)

To attain these aim and objectives, the Ministry of Education formulates the syllabus of chemistry which is sent to schools for interpretation and implementation by teachers in terms of classroom and outdoor activities.

As discussed above, girls do not perform well in chemistry and hence they are under-represented in the subject. The discussion in the following sections is a summary of the factors which make girls drop chemistry. The literature review in these sections will be devoted to those variables which affect the learning of chemistry. These include:

i) Attitudes of girls towards chemistry.

ii) Teacher's role in encouranging girls to learn chemistry.

iii) Teaching aids available to girls for learning chemistry.

iv) Textbooks in chemistry.

v) Parents role in encouraging girls to learn chemistry.

2.1 REVIEW OF PREVIOUS RESEARCH

Research studies within and outside Kenya show that there are few women who study sciences. Some of these studies have concentrated on the sex differences in achievement in science. The low achievement in general of females in science has been attributed to biological factors; which has received extensive research in the western contries,[8] and socio-cultural factors. In the biological aspects, emphasis has been on the spatial ability which to some researchers is the key factor in scientific thinking and tends to favour the boys.[9] Still, this has been found to be an incomplete explanation as Vetter puts it, neither intelligence nor aptitude tests scores explain the proportions of women in science.[10]

Those researchers who emphasise sociological interpretation argue that the social and cultural forces work to create differences in experiences and expectation for boys and girls. They communicate to the boys and girls.

what is considered appropriate for each gender. Thus, the "masculine image" of science and scientists suggests that science is an endeavour for boys and not for girls.(11)

In Kenya, the research which has been done is mainly by Eshiwani (1983) which covered the sex differences in mathematics and science education. Thus, the factors which affect girls in learning of chemistry has not been researched into.

The factors that can be attributed to poor achievement by girls in physical science include the girls social background, the experiences in the previous primary school attended, the teachers, the girls' attitude towards science, school practices and policies, parents influence, sex-role stereotyping and mathematical abilities.(12)

2.2 ATTITUDES OF GIRLS TOWARDS CHEMISTRY

In a recent speech by the Minister of Education, he said that it was becoming more difficult to get students who had passed well in science at the Kenya Certificate of Education (KCE). This was due to the negative attitude of students towards subjects.(13) Clarke (1972) noted that boys showed more favourable attitude towards science than girls. Consider the definition of an attitude.

> "... an attitude is mental or neural state of readiness organised through experience exerting a directive or dynamic influence upon the individuals responses to all objects and situations with which it is related"(14)

From the definition, we note that the attitude of a student plays an important role in learning. Eshiwani (1983), in his attitude hypothesis suggested that students who are positively motivated work harder than those who are negatively motivated and this helps them to achieve higher. It follows that the low achievement observed among girls in science and mathematics could be explained partly on the basis of their attitudes towards the two subjects.(15) This supports the fact that girls attitude towards science in general and specifically towards chemistry determines the extent to which the girls will go in learning the subject. Negative attitude will adversely affect the learning of the subject and hence the achievement in it.

Eshiwani further suggests that most of the girls in Kenyan Secondary Schools lack self-confidence in the sciences, especially physical science.(16) This in conjuction with negative attitude results in poor performance.

2.3 TEACHERS ROLE IN ENCOURAGING GIRLS TO LEARN CHEMISTRY

Teachers have the special role of controlling all the learning instructions and situations in the classroom. Not only are they charged with the teaching but they are also supposed to show the application of what they teach in daily life because this connects the academic work to the real life situation where the students will live in. On top of this, teachers are also expected to guide the students into the careers open to them especially in the case where a school does not have a careers master.

Eshiwani has indicated the importance of teachers by recommending that appropriate instructional methods in science for girls' schools should be developed and introduced in the preservice and inservice courses for science teachers.(17) In suggesting this Eshiwani implies that the instructions given to girls should be different from those given to boys. Some support to this has been given by teachers in Britain who have suggested that girls are likely to give answers only when they have the right answer, while boys are more willing to give opinions or to guess. It therefore follows that a good teaching method for female students would be to start with simple

situations which are familiar to them and gradually work towards more complex situations. Of course this is a good general teaching principle but the transitions in the case of female students should be rather more gradual than with male students.(18) In the Kenyan situation, separate instruction to boys and girls is difficult because a good number of our schools are co-educational thus boys and girls will be found in the same class. Although this is the situation, it is important for teachers to bear in mind that boy's contributions in class are more highly valued both by other boys and by girls than the girl's contribution.(19) Teachers in mixed classes therefore should compensate for this imbalance.

The other area where teachers are involved is in career guidance. In it's report, the Kenya National Committee on Educational objectives and policies recommended that the careers guidance programme in the schools especially for girls should be improved.(20) A similar recommendation was made by Eshiwani when he recommended that career guidance and counselling in the girls schools in relation to science and technology should be strengthened and improved.(21) Although the career guidance programmes in schools have generally improved, emphasis has not been made in girls' schools as recommended above. The importance of career guidance is stressed by the following:-

> "In countries where the free enterprise system operates, the laissez-faire approach seems to prevail in vocational guidance: The student chooses his course of study according to the career he wishes to take up, this decision seldom being based on the needs of the society. He may even choose a sector in which there are no openings at all thus raising the problem of graduate unemployment". (22)

If teachers are going to succeed in encouraging girls to study chemistry in further studies, they have to make sure that girls are given career guidance in chemistry related fields. At the same time chemistry teachers should inculcate positive attitudes towards the subject.

2.4. TEACHING AIDS FOR LEARNING CHEMISTRY

For science to be learned effectively it must be experienced. In the UNESCO sourcebook for science teaching, it is stressed that:

> "... science is somewhat different from most other subjects in that it is not effectively learned by children unless they experience it. Children must observe and experiment if their science learnings are to be permanent." (23)

As concerns the 'O' - level chemistry examination, the Kenya National Examinations Council rightly puts it that:

> "Examination candidates will be at a considerable disadvantage if the teacher has not adopted an approach based on practical work."(24)

This means that chemistry teaching in any secondary school is quite inadequate unless it is supported by a supplementary course of laboratory experiments. Such a laboratory course would be impossible unless some basic equipment are available. Mbiti (1983) pointed out that:-

> "... among the many explanations that may be advanced for the apparent under-representation of girls in science is lack of facilities for science education in girls schools. The schools find it difficult to meet certain requirements to enable them to offer biological and physical science subjects. (25)

Eshiwani noticed this and recommended that laboratory facilities in girls schools should be improved.(26) It seems that,not only should the laboratory facilities be improved in girls schools but the facilities need to be exceptionally good compared to those in boys schools. According to Maritim, the difference in performance between boys and girls in 'A' level when compared to the performance in 'O' level is because most 'A' level schools have good teaching learning facilities since most of them are government maintained schools. Most 'O' - level schools are community schools which have very poor teaching-learning facilities. Maritim found that the

performance variance attributed to the above variable is of disadvantage to girls. This means that for girls to succeed at 'O' - level, the teaching learning facilities must be exceptionally good.

Chemistry teachers should use teaching aids when teaching the subject and they should improvise simple aids whenever the recommended ones are not available. This will inculcate confidence in girls for handling laboratory equipment.

2.5 TEXTBOOKS IN CHEMISTRY

Textbooks in general are important in guiding students to the depth expected in a subject. They should also instill positive attitude towards the subject in question. Inspite of this, various textbooks have been found to instill different attitudes between boys and girls. Fox example, various studies of children's literature reveal that boys repeatedly cast to "adventure" "explore", "find a way", and "have a new idea". Little girls in stories most frequently "need help", "get lost", "do their job to gain approval" and "help mother and father". The kind of activities that books show as interesting are traditionally different for boys and girls.(27)

Like other books, chemistry textbooks give direct experience to the students. The content and its sequence guides the student into the depth required at that particular level. Chemistry textbooks also give solved examples which help in the understanding of chemical principles and concepts. Some texts in addition contain test papers and questions at the end of the topics or chapters to test the mastery of the topic.

Although chemistry textbooks are very important instruments for learning, they have been criticised for potraying a negative picture of girls which reinforces the view that girls cannot do well in science and technology.

Like the story books mentioned above, a survey of science and mathematics textbooks by the Kenya Institute of Education found that the books potrayed men as enterprising and inventive while girls were potrayed as passive. This tends to mislead young people about sex roles with girls being indoctrinated that they cannot take up serious responsibilities.(28)

Inspite of the shortcomings mentioned above, the availability of appropriate chemistry textbooks is an important factor in determining the student's interest in

a subject and hence the performance in it. A shortage of chemistry textbooks will therefore adversely affect the learning of the subject.

2.6 ROLE OF THE HOME ENVIRONMENT IN ENCOURANGING GIRLS TO STUDY CHEMISTRY

A traditional society sees girls with no or little education as more obedient to their parents and husbands. In African traditional set up, where school fees are a problem, it is not unusual to witness parents withdraw their daughters from school and force them into marriage in order to use the resulting bride price to pay for the education of their sons.[29] In close relation to this is the tendency for girls to be given many chores in the house than boys thereby reducing the time they spend studying compared to boys.

These sort of attitudes can be disturbing to capable and determined girls to advance in their education and incredibly lower their morale not only in society but also in their education. One non-school influence that discourages a girl from considering a career as a scientist is a lack of role models. Hardin and Dede put it this way;

> "... but the extreme scarcity of women scientists is a reality. Much of a child's picture of herself or himself is determined by the adult examples he or she is exposed to. Attempting a career in which a woman has no models to follow becomes very difficult."(30)

More over, the few women now in science may not present models of success to female students. There are forces which hold down the productivity and achievement of women in the scientific professions.

Like other subjects, the learning of chemistry by girls will be affected by the environment that the girl is exposed to at school and at home. Studies which have been carried in the socio-cultural effects on sex differences in academic achievement and cognitive abilities have focussed on socialisation variables such as cultural expectations, sex-role stereotypes, task assignment, interest and parental identification.

In her study of fear of success, Horner showed that American women perform poorly in subjects they perceive as incongruent with their sex role.(31) However, there is cultural variation on the subjects that are considered as masculine or feminine.

Finally, parents serve as useful guides to the academic fields which their children can pursue. If the parents belief in giving equal educational opportunities to male and female children, then they are likely to encourage their daughters to study scientific courses, chemistry included.

FOOTNOTES

1. Willerman, L. The Psychology of Group and Individual differences. Freeman San-Francisco, 1979 P. 366.

2. Brook,D. W. The learning of A-level chemistry in Kenya. M.Sc. Thesis, University of New York, 1983. P. 132

3. Keino, E. Opportunities For females in technical training in Kenya. A Focus on Primary, Secondary and levels of training. Kenya Journal of Education Vol. 2. No. 1 (1985) Bureau of Educational Research. Kenyatta University P 6.

4. Ibid P. 6.

5. Maritim, E.K.A. The dependence of 'O' and 'A' level results on the sex of examinees. Kenya Journal of Education. Vol. 2 No. 1. 1985. Bureau of Educational Research. Kenyatta University. P. 21.

6. Kenya National Examinations Council. Regulations and syllabuses for Kenya Certificate of Education. 1984. Kenya National Examinations Council. Nairobi. 1984. P. 126.

7. Ibid P. 126.

8. Eshiwani, G.S. Women's access to Higher Education in Kenya: With Special Reference to Mathematics and science Education. Nairobi 1983 P. 48.

9. Erikson,G. and Lynda, E. "Females and Science achievement" Science Education. Vol.68. No. 2, 1984. PP. 74-75.

10. Vetter, B.M. "The outlook for women in science" in, The Science Teacher Journal of the National Science Teachers Association Vol. 40. No. 9 National Science Teacher's Association. Washington D.C. 1973. P.22.

11. Erikon, G. and Lynda, E. Op. cit. (1984) P. 76.

12. Eshiwani, G.S. Op.cit (1983) PP. 49-50

13. Nation Reporter "Science Students not enough- Aringo Nation Newspapers Limited. Nairobi. 3/4/87 P. 12.

14. Munguti, B.K. A Survey of the Factors affecting the teaching and learning of Mathematics in Primary Schools in Mbooni Education Division in Machakos District in Kenya. (M.Ed.) project) Nairobi. 1984. P. 17.

15. Eshiwani, G.S. Women's access to Higher Education in Kenya. A Study of the Opportunities and attainment in Science and Mathematics Education. Journal of East African Research and Development. Vol. 15 1985 P. 105.

16. Eshiwani, G.S. Op. Cit. (1983) P. 48.

17. Eshiwani, G.S. Op. cit. (1985) P. 109.

18. Brook, D.W. Op. cit. (1983) P. 133.

19. Hardin, J. and Dede, C.J. Discrimination against Women in Science Education. in The Science Teacher. Journal of the National Science Teachers Association Vol. 40 No. 9 National Science Teacher's Association. Washington D.C. 1983 P. 19.

20. Gachathi,P.J. (Chairman) Kenya National Committee on Educational Objectives and Policies Report. (Gachathi Report) - Government Printer. Nairobi. 1976. P. 47.

21. Eshiwani, G.S. Op. cit. (1985) P. 109

22. UNESCO New Trends in Chemistry Teaching. Vol. IV, UNESCO Press. Paris. 1975 P. 18.

23. UNESCO Source Book for Science Teaching UNESCO. Paris 1962. P. 29.

24. Kenya National Examinations Council Op. cit (1984) P. 126.

25. Eshiwani, G.S. (Ed.) Report of the National Seminar on Women's access to Higher Education in Kenya Women's bureau. Ministry of Culture and Social Services. Naivasha. 1983. P. 5.

26. Eshiwani, G.S. Op. cit. (1985) P. 109.

27. Hardin, J. and Dede, C.J. Op. cit. (1973). P. 19.

28. Nation Reporter, Are these Scientific Jobs for men only? Nation Newspapers Limited. Nairobi. 7/3/87 . P. 11.

29. Twoli, N. W. Sex difference in Science Achievement Among Secondary School Students in Kenya. Ph.D. Thesis. Flinders University of South Australia. 1986. P. 218.

30. Hardin, J. and Dede, C. J. Op. cit. (1973) P. 19.

31. Horner, M. S., "Motive to avoid Success and changing aspirations of women" in Bardwick J. (Ed). Reading on the Psychology of women. New York. 1972. P. 25.

CHAPTER THREE

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

This chapter establishes:- the selection of the sample, the instruments of research, the administration of questionnaires and the scoring of those questionnaires. In chapter four, one will find a discussion of the factors studied in the field.

In Tetu division, there are very few schools which offer chemistry as a single subject. On the other hand, general science which comprises physics, chemistry and biology is offered by most unaided secondary schools in the division. In view of this, the research sample was limited to those schools that offer chemistry with physics (physical science). Schools offering general science were left out because general science is not considered a science subject for admission into form five and for selection into professional training institutions.

The study involved a sample survey type of research in gathering information. Sample survey is a type of descriptive research in which survey data are obtained from respondents to test hypotheses concerning the status of some educational problem. In this case, the factors that affect

girls when learning chemistry were investigated so as to determine their effect on girls performance in the subject.

The researcher relied on observed information, informal interviews and the information gathered by the questionnaires.

3.1 SELECTION OF THE RESEARCH SAMPLE

Most of the secondary schools in Tetu division (Nyeri) are co-educational i.e. mixed schools. Many of them are also harambee schools. The schools that offered general science were not considered in the sample selection for the reason given above. The division had only one pure girls school which was offering physical science. This school was not included in the sample of schools as the researcher wanted to limit himself to those schools which were mixed and which offered physical science in their curriculum. There were five schools in Tetu division which fitted in this category. The researcher therefore intended to involve all of those schools in the research. The five schools were also found to be either partly boarding and partly day schools or they were purely day schools.

One of the schools in the division (Kiriti) which had only one girl in form four who was taking physical science was not involved in the research due to unavoidable

circumstances. Instead of this school, another school which strictly speaking is not in Tetu division was sampled. This school (Temple Road) is a mixed day school in Nyeri Municipality but it draws most of its pupils from Tetu division. This school was thus found to be representative; besides, it was the only urban school in the sample.

The total number of schools which were sampled therefore was five. These schools offered physical science to all or some of their form four students.

During the selection of the respondents, the researcher found out that some schools had very few girls in form four who were taking physical science. In such cases, all the girls who were taking physical science were involved in the research. In schools where the number of girls who were taking physical science in form four was large, random sampling of the respondents was carried out. The number of girls involved per school were:-

Kimathi Secondary School	-	14
Temple Road Secondary School	-	11
Dr. Kamundia Secondary School	-	14
Muruguru Secondary School	-	36

Giakanja Secondary School	- 6
Total number of student respondents	81

Form four students were chosen because the researcher felt that they would express themselves clearly and due to the fact that the other two classes in 'O' level were in the 8-4-4 education system. This new education system had different objectives from the old education system.

All the teachers who were taking physical science classes in form four in the sampled schools were involved in the research. One school (Kimathi) had two such teachers hence the total number of teachers in the sample was six. The total number of respondents (students and teachers) was eighty seven.

3.2 TOOLS OF RESEARCH

There were two types of questionnaires which were used; a student's and a teacher's questionnaire. Each group of respondents answered the questions in their questionnaire.

Each questionnaire was made up of two parts; part A was aimed at getting factual information while part B was aimed at getting the feelings of students and teachers.

The student's questionnaire had seventeen items in section A and nine items in section B. Section A contained both closed-response and open-response type of questions. The items in section B of these questionnaires had five responses to be selected from and only one response which agreed with the student's feelings was to be selected.

The teacher's questionnaire had fifteen items in section A and six items in section B. Section A of these questionnaires had open-ended questions which allowed the teacher to give detailed information about the problems girls face and also the facilities that were available in the school for chemistry teaching. Section B was aimed at getting the feelings of the teachers towards girls who study chemistry and the teacher's general working conditions.

In addition to the questionnares, the researcher carried out informal interviews with the chemistry teachers on their working conditions, the facilities available and the position of girls in their classes.

The researcher also noted the average marks for girls in chemistry relative to the whole class.

3.3 ADMINISTRATION OF THE QUESTIONNAIRES

The researcher visited each selected school in advance to make arrangements for the administration of the questionnaires to students and teachers who were respondents.

When final arrangements had been made, the researcher administered the questionnaires personally in all the five secondary schools so as to ensure correct answering of the questions.

The respondents to both questionnaires were asked in public to remain anonymous. This gave some students confidence to comment freely on certain parts of the questionnaire especially those that were related to their teachers. The researcher collected the questionnaires himself from the students.

3.4 SCORING OF THE QUESTIONNAIRES

(a) Section A of the questionnaires

The aim of this section was to provide factual information and had closed-ended

and open-ended responses. In the analysis of items in this section, they were divided into part I and part II where part I had the closed-ended items and part II had the open-ended responses. Summaries of these responses were tabulated using simple statistic methods.

The items were pooled in tables showing the proportion of the sample population for each item. The same was done for the teachers questionnaire by taking the responses and calculating the proportion of teachers for each item.

(b) Section B of the questionnaires

The data in this section was on the feelings of the students and teachers about girls who learn chemistry and the help they get from their teachers and parents. The responses for each statement were tallied for each category of the five responses, which indicated the intensity of feelings, which were selected.

In the analysis, the five categories were reduced to three only i.e. Agree, Undecided and Disagree. This means that strongly disagree and disagree became disagree while agree and strongly agree became agree. The percentage proportions for each statement were calculated for each response in both questionnaires. The percentages will indicate the importance of each factor in determining the girls performance in chemistry.

From the findings, the researcher made conclusions and appropriate recommendations in chapter five.

3.5 CODING OF THE SCHOOL SAMPLE

The secondary schools from which respondents were drawn were given the following code letters. These code letters are used in the study for convenience.

SCHOOL		CODE LETTERS
Kimathi Secondary School	-	SP
Temple Road Secondary School	-	SQ
Dr. Kamundia Secondary School	-	SR

SCHOOL		CODE LETTERS
Muruguru Secondary School	-	SS
Giakanja Secondary School	-	ST

Of these schools, Temple Road is the only private school. The others are partly government aided and partly harambee secondary schools except Dr. Kamundia which is purely harambee secondary school. None of these schools has A - level streams.

CHAPTER FOUR

CHAPTER FOUR

DATA ANALYSIS AND INTERPRETATION

4.0 INTRODUCTION

The findings of this study were mainly derived from the responses in both the student and teacher's questionnaires. Since the researcher had held some informal discussions with the teachers in the selected schools, some findings of the study will be based on those discussions and also on the observed student's marks in the teacher's records.

This chapter is devoted to the analysis and discussion of the information collected. The analysis of the data begins with the student's responses and then the teacher's responses. Each of the questionnaires has sections A and B. These sections will be analysed in sequencial order but the items in section A will be divided into open-ended and closed-ended type of questions.

4.1 ANALYSIS OF DATA FROM THE STUDENTS' QUESTIONNAIRES

4.1.1 Students' responses to section A

Reference will be made to the student's questionnaire (appendix 1) in the presentation and discussion of the students' responses in section A.

In section A of the students questionnaire there were seventeen items which comprised closed and open-ended types of questions. The responses to the closed-ended type of questions were selected from the choices given for each question while the open-ended questions required the students to write short answers.

Table 1 gives a summary of the student's responses to questionnaire items 1, 2, 3, 6, 7, 8, 9, 10, 12, 13, 14, 16, and 17 in section A. The responses to these items were regarded as section A part I. Similarly, items 4 and 11 were treated as section A part II and tabulated in table 2. It was difficult to tabulate responses to items 5 and 15 so the following is a summary of the responses to these two items.

Item 5:- Name any Chemistry textbooks used in your class

The chemistry textbook that was common in all schools was; "A New Certificate Chemistry" by Holderness and Lambert. The other book that was found in four schools was "Certificate Chemistry" by Atkinson, School SR was the only one which was not using this book.

A variety of other books were in use but these textbooks were found only in some schools. These books were:

(a) Junior Chemistry by Atkinson

(b) Chemistry for Today and Tomorrow by Artherton

(c) Test your Chemistry by Holderness

(d) A New Certificate Approach

(e) Chemistry by Concept

(f) Short Revision Notes

(g) SSP Chemistry Manual

(h) Modern Chemistry

The authors were not indicated for books (d) to (h)

Item 15:- What are the occupations of your Parents/Guardian?

i) More than half of the students reported that their parents were small scale farmers (61.7% of the student sample reported this).

ii) The next most common occupation was "teaching" with 14.8% of the students reporting that their parents were teachers.

iii) 7.4% of the students reported that their parents were doctors.

Other occupations mentioned by small percentages of the student sample were technicians, businessmen, agricultural extension officers and accountants.

Notes on table I

(i) The responses to some questionnare items were similar for students in a particular school. For example all the students in a school which had a science club answered item I in the affirmative.

(ii) Students in schools SQ and SS indicated that there were no career masters in their schools. They could not therefore answer item 17. A more appropriate percentage therefore is 91.2% which is based on a total of 34 students.

In the discussion of the responses to questionnaire items 4 and 11 reference will be made to table 2. This table shows the students responses to the open-ended items. It summarises the difficulties experienced by girls when learning chemistry in general and those that they face when performing experiments in particular. The proportion of the sample population having the stated problem is indicated adjacent to it.

TABLE I

A SUMMARY OF THE STUDENT'S RESPONSES TO THE CLOSED-ENDED QUESTIONNAIRE ITEMS (SECTION A - PART I)

	SP	SQ	SR	SS	ST	TOTAL	%
Students who indicated the presence of a science club in the school	14	0	14	0	6	34	42.0
Students who liked doing chemistry projects or discussing topics in chemistry in science clubs	1	9	8	10	2	30	37.0
Students who had problems in learning chemistry	14	7	13	29	6	69	85.2
No sharing of chemistry textbook. Each student has a copy to herself	2	11	1	10	3	27	33.3
Two students sharing one chemistry textbook	8	0	12	17	3	40	49.4
More than two students sharing one chemistry textbook	4	0	1	9	0	14	17.3

TABLE 1 (continued)

	SP	SQ	SR	SS	ST	TOTAL	%
Students who found the language used in their chemistry textbooks difficult	12	2	11	20	2	47	58.0
Students who found the examples given in their chemistry textbooks difficult to follow	11	5	12	13	2	43	53.1
Students who indicated that their teachers used strange examples in their chemistry lessons	8	0	11	8	1	28	34.6
Students who indicated that they perform experiments during their chemistry lessons	14	11	14	36	6	81	100.0
Students who reported that their teachers advised them on the careers they would enter after learning chemistry	2	7	0	32	5	46	56.8

TABLE I (continued)

	SP	SQ	SR	SS	ST	TOTAL	%
Students who received parental advice to study chemistry	8	6	13	29	3	59	72.8
Students who had a brother or sister who had studied chemistry at A-level	6	5	8	10	0	29	35.8
Students who indicated the presence of a careers master in their school	14	0	14	0	6	34	42.0
Students who admitted being advised by the careers master on chemical oriented careers.	14	0	12	0	5	31	38.3

NB: Total number of students, N = 81

TABLE 2

SUMMARY OF THE STUDENT'S RESPONSES TO QUESTIONNAIRE ITEMS IN SECTION A PART II (Open-ended questions)

	SP	SQ	SR	SS	ST	TOTAL	%
1. The main problems girls experience when learning chemistry.							
i) The teachers characteristics: i.e. poor approach to the subject, speed, absenteeism and negative attitude towards girls.	4	0	24	5	0	33	40.7
ii) The textbooks: i.e. lack of enough textbooks and difficult chemical language used e.g. chemical formulae.	6	1	5	14	4	30	37.0
iii) Problem of mathematics in chemistry e.g. calculation of moles and molarity and balancing of chemical equations.	10	6	0	18	3	37	45.7

TABLE 2 (continued)

	SP	SQ	SR	SS	ST	TOTAL	%
iv) Problems in practical work e.g. setting up of apparatus and making conclusions from experiments.	4	0	14	5	0	23	28.4
2. Problems faced by girls when performing experiments	.						
i) Problem of interpreting the experimental procedure and making observations	7	5	1	8	2	23	28.4
ii) Problems in making deductions after the experiment.	3	1	1	20	4	29	35.8

TABLE 2 (continued)

	SP	SQ	SR	SS	ST	TOTAL	%
iii) Lack of enough apparatus leading to large groups	4	0	5	1	1	11	13.6
iv) Difficulties in setting up the experiment due to:							
a) little experience in handling apparatus	6	1	11	15	0	33	40.7
b) poor guidance from the teacher							
c) fear of chemicals							

NB: Total number of respondents was 81.

4.1.2 Discussion and Conclusions for section A of Student's Questionnaire

The researcher arrived at some conclusions regarding the factors that affect girls in learning of O - level chemistry in Tetu Division from their responses to questionnaire items in section A. Table 1 shows the student's responses to questions relating to; the girls attitude, the textbooks availability and language used in them, the teachers approach to the subject and career guidance. The responses are shown for each school and finally for the whole sample in percentage form.

This study aimed at finding out the implication the factors studied had on performance. The researcher therefore went further to compare the girls average mark in chemistry to the overall class average mark in chemistry for each school. Table 3 thus gives the girl's mean mark in chemistry for three consecutive tests in chemistry compared to the overall class mean in chemistry per school.

TABLE 3

	Chemistry average mark for girls (%)	Average chemistry mark for whole class (%)
School SP	33.4	49.5
School SQ	47.0	45.1
School SR	23.3	40.8
School SS	34.0	43.0
School ST	34.3	59.0

From table 3, we note that except for school SQ, all the girls in the other schools were doing poorer than the overall class performance. The unusual performance by girls in that school was attributed to the fact that SQ was a private school which was situated in town. The chemistry teacher in that school argued that most parents in Nyeri town were not willing to send their girls into harambee

schools which were far from their homes. Instead, they chose to take their daughters into private schools which were nearby and in which the girls would be day scholars. The implication of this for school SQ was that the entry point in form one was higher for girls than for boys hence girls were generally better than boys in all subjects. Other reasons why this is the case in school SQ could be the fact that girls in this school showed a favourable attitude towards chemistry and the school was quite well equiped in textbooks and in laboratory facilities. The girls in this school also have a positive attitude towards their chemistry teacher and his teaching methods as will be seen in the analysis of questionnaire items in part B.

With reference to table I, the researcher arrived at the following conclusions:

(1) Question one indicated that three schools in the sample had science clubs but the percentage of girls in those schools who indicated that they would like to discuss chemistry projects in science clubs was 32.4%. The overall percentage of girls who indicated that they would like to discuss chemistry projects was 37.0%.

The fact that some schools did not have science clubs in their schools indicates that the importance of science clubs as avenues for bridging the theoritical work learned in class to reality has not been fully appreciated. Science clubs enhance the students creativity and increase the students interest in science education. Inspite of this, it seems that girls lack interest in chemistry related fields in science club discussions as shown by the low percentages. This could mean lack of interest in chemistry as a subject or lack of encouragement by their teachers or science club patrons.

It would be worthwhile to introduce girls to carrying out projects in chemistry by including such projects in chemistry lessons. In this way they might be able to use science clubs to boast their interest in the subject.

(2) 33.3 per cent of the student sample indicated that they do not share their chemistry textbooks with other students. 49.4 per cent of the sample indicated that they share one chemistry textbook between two students. The two categories of students therefore represent a total of 82.7

per cent. This shows that the number of chemistry textbooks is fairly adequate. The problem noticed about textbooks is that there is no single textbook that was supplied to all students. It seemed that each school chose its main chemistry textbook to use.

The problem of sharing of chemistry textbooks tends to vary from school to school and also from class to class. The sharing ratio is greater at lower levels of secondary education than at higher classes.

Due to the problem of access to libraries by secondary school students, the ideal situation would be where each student had her own copy of chemistry textbook. It is a serious situation where students in an examination class have to share chemistry textbooks in view of the intensive revision required. 17.3% of the student sample indicated that they share one chemistry textbook between more than three students. This sharing of one textbook by a large number of students affects the learning of

chemistry because an individual student cannot use a textbook to her satisfaction without inconveniencing the other students they share the book with. It is important therefore to increase the number of chemistry textbooks available to our girl students.

(3) Not only should students have enough textbooks to refer from but the textbooks themselves should have a language level which is appropriate to the level of the students. The examples that these books give should be presented in a way that the students follow but more than half of the students, 58.0% indicated that they find the language used in their chemistry textbooks difficult. 53.1% of the student sample found the examples in their chemistry textbooks difficult to follow.

This makes the learning of chemistry difficult in the sense that the students cannot completely comprehend what they read from textbooks on their own.

(4) The teaching methods employed by a teacher are important in determining the students interest in the particular subject. 34.6% of the students sample indicated that their chemistry teacher used strange examples in the chemistry lessons. The examples used by a teacher in class help to link theoretical work to practice as well as serving as a guide to solving examination questions. If the students do not follow the teacher's examples, it means that they are lost in that particular topic.

The other thing to note on this question is that the proportion of responses varied from school to school because the responses depended on the particular teacher in question. In school SQ for example none of the girls indicated that their teacher used strange examples in class. This goes further to explain the unusually good performance in chemistry for girls in school SQ.

Almost all the girls in the sample from school SR indicated that their teacher used strange examples in their chemistry lessons. The average performance for girls in this school reflects this as it was the lowest (table 3).

(5) Guidance and counselling is another important area from which a students interest in a subject is aroused if proper guidance is given. When students know where a particular subject will lead them to, they are likely to do better in that subject.

Students in three schools reported that there was a careers master in their school and out of the total number of girls sampled from these schools, 91.2% reported that the careers master provided information on chemical oriented careers. This was quite a high proportion.

Since the girls from two schools reported that there were no career masters in their schools, it means that the teachers were charged with the task of advising the girls on the careers open to them. Out of the total student sample, 56.8% reported that their chemistry teachers advised them on the careers they would enter after learning chemistry. Although this proportion is above average, it is important to note that all the girls in the sample from school SR reported that their chemistry teacher

did not advise them on chemistry related careers. This could be another reason that explains their low achievement in chemistry.

(6) Not only should the teachers advise the students on the subjects they teach but the parents or guardians should also support the efforts of the school. A good proportion of the parents seem to be doing this as 72.8% of the girls in the sample reported that they received parental advice to study chemistry inspite of this advice 85.2% of the girls reported that they had problems in learning chemistry. These problems vary from school to school and some of them will be discussed later.

(7) Another important factor that would encourage a girl to study chemistry is the availability of a role model; that is, another female who has studied chemistry successfully at a higher level. Such a person is a source of inspiration to the girls and the effect is even greater if she comes from the same family as the student in question. In the absence of such a woman, a brother would serve as someone to emulate if

he has successfully studied chemistry at a high level. In the student sample used in the survey, only 35.8% of the girls reported that they had a brother or a sister who had studied chemistry at A-level. We note further that such brothers or sisters may not have done well in their A-level chemistry hence they would not serve any positive purpose.

With reference to table 2, the researcher arrived at the following conclusions:

(8) Out of the whole student sample, 85.2% indicated that they had problems in learning chemistry (table I). These problems from the girls point of view are listed in table 2 with the most important one being that of mathematics in chemistry; that is, calculation of moles and concentrations and balancing of chemical equations. This problem was indicated by 45.7% of the sample. The origin of this problem may be a weak background in mathematics or poor teaching methods or just a negative attitude towards mathematics. As mathematical treatment of chemistry is inevitable, it would be wise to introduce appropriate teaching methods to counteract this problem.

The other problems mentioned by the girls are:-

a) Problems related to the teacher, that is, his poor approach to the subject, inappropriate teaching speed, absenteeism and teacher's negative attitude towards girls in chemistry classes. This problem had a proportion of 40.7%. From these remarks we note that girls are very sensitive to the teaching method and that they require alot of guidance from the teacher. They also seem to be extra sensitive to the teacher's attitude towards them.

(b) The girls cited problems related to textbooks such as lack of enough textbooks and difficult chemical language used in the books that are available.

(c) 28.4% of the sample reported that they had problems in practical work in setting the apparatus and making deductions after the experiments. This only supports the assertion that girls require alot of guidance in their learning.

(9) From table I, we note that all students in the sample reported that they performed class experiments during their chemistry lessons. Table 2 shows the problems that girls face when performing class experiment. The students admitted that they feared chemicals and that they had little experience in handling apparatus. They also said that they do not get enough guidance from the teacher. These points suggest that they lack confidence in handling laboratory apparatus.

The next most important problem was that of making deductions after the experiment. This was reported by 35.8% of the girls. This suggests that the girls would prefer to be told the deductions by the teacher rather than draw the conclusions themselves. It shows lack of independent thinking on their part.

28.4% of the girls reported that they had problems in making observations and 13.6% reported the problem of working in large groups due to lack of apparatus. The fact that only 13.6% of the girls reported this last problem suggests that a large majority of the girls do not mind working in groups and large ones

for that matter. The probable reason here is that in large experimental groups, most of the students play a passive role in the experiment which might be what many girls would prefer.

4.1.3 Students' responses to section B.

Reference will be made to the student's questionnaire (appendix 1) in the analysis of section B. The researcher used nine questionnaire items in this section in order to find out the feelings of girls towards the teaching and learning of chemistry. Table 4 shows the number of responses to questionnaire items per school while table 5 gives a summary of the student's responses to each questionnaire item and the corresponding percentages.

4.1.4 Discussion and conclusions from section B of students' questionnaire

From the students responses summarised in tables 4 and 5, the researcher was able to arrive at some conclusions pertaining to the girls feelings towards chemistry in Tetu division.

1) From the responses to questionnaire item numbers 1,2,5, and 7 the researcher found that most girls

had positive attitudes towards chemistry. Table 5 shows that 72.8% of the girls agreed that they liked chemistry lessons. 6.2% were undecided while 21.0% disagreed with the statement.

From item 2, 65.4% of the girls disagreed with the statement that chemistry a difficult subject while 25.9% of the girls said that chemistry was difficult. For item 5, there were no girls who were undecided. 96.3% strongly disagreed with the statement that boys were the only ones who should study chemistry. This large majority indicates that the girls felt that they were as able as the boys in learning chemistry. They do not belief that chemistry as a science suject can only be studied by boys only. The idea of sex-role stereotyping does not apply here.

Item 7 compares physics with chemistry in terms of the subject they would prefer to study. From table 4, we note that the subject that the majority of students preferred to study depended on the school. In school SP, majority of the girls preferred to study physics to chemistry while in

Section B:- Student Questionnaire

TABLE 4

A SUMMARY OF STUDENT'S RESPONSES TO QUESTIONNAIRE ITEMS PER SCHOOL

SCHOOL	SP			SQ			SR			SS			ST		
RESPONSE / ITEM	A	U	D	A	U	D	A	U	D	A	U	D	A	U	D
1	9	1	4	10	1	0	12	0	2	24	2	10	4	1	1
2	2	1	8	0	1	10	2	2	10	13	2	21	1	1	4
3	9	0	5	7	1	3	11	0	3	20	2	14	2	0	4
4	4	3	7	0	0	11	14	0	0	7	1	28	0	1	5
5	1	0	13	0	0	11	0	0	14	1	0	35	1	0	5
6	12	0	2	4	0	7	6	0	8	17	4	15	3	0	3
7	11	1	2	0	0	11	4	0	10	12	7	17	2	2	2
8	2	0	12	1	0	10	3	0	11	7	1	28	2	0	4
9	8	3	3	7	4	0	14	0	0	28	1	7	4	1	1

TABLE 5

SUMMARY OF STUDENT'S RESPONSES TO EACH QUESTIONNAIRE ITEM WITH CORRESPONDING PERCENTAGES

ITEM NO	TOTAL NUMBER OF RESPONSES			PERCENTAGES (%)		
	A	U	D	A	U	D
1	59	5	17	72.8	6.2	21.0
2	21	7	53	25.9	8.6	65.4
3.	49	3	29	60.5	3.7	35.8
4	25	5	51	30.8	6.2	63.0
5	3	0	78	3.7	0.0	96.3
6	42	4	35	51.9	4.9	43.2
7	29	10	42	35.8	12.3	51.9
8	15	1	65	18.5	1.2	80.3
9	61	9	11	75.3	11.1	13.6

NB: (i) A REPRESENTS AGREE

U " UNDECIDED

D " DISAGREE

(ii) TOTAL NUMBER OF GIRLS, N= 81

SQ, the majority of girls preferred to study chemistry to physics. This was the same case in school SR but the girls in school ST gave the two subjects equal weight in their preferences. There are several factors that may be attributed to this, namely, school traditions, teaching methods and the facilities available for teaching each subject. Of these, the teaching methods and the teacher's characteristics seemed to play the most important role in the choice of subject.

For item 7, the overall responses were as follows; 51.9% of the student sample preferred to study chemistry rather than physics, 35.8% of the sample preferred to study physics rather than chemistry and 12.3% were undecided on the two subjects. With these kind of percentages, it becomes difficult to say for sure that girls prefer to study chemistry rather than physics especially with the added fact that the choice depended on the school in question. From the data, we only note that there were slightly more girls preferring to study chemistry than those who preferred to study physics.

The four items discussed above show that girls had a positive attitude towards chemistry but we cannot neglect the fact that a good portion of them did not like the subject. The performance of such girls will be affected by that negative attitude. The factor of attitude thus plays a significant part in lowering the performance of girls in chemistry as shown in table 3.

An interesting thing is that a small propotion (3.7%) of the girls in the sample felt that chemistry is a subject for boys only. This shows that the socialisation factor of training children into sex roles is still prevailing in the society.

(2) From the girl's responses to item 3, the researcher concluded that the language level used in chemistry textbooks which the girls in the sample used was inappropriate for their level. 60.5% of the girls in the sample agreed that they did not understand some words in their chemistry textbooks even if they tried to understand. In responses to other questions in the questionnaire, the students had raised the problem of difficult

language used in their chemistry textbooks which reinforces the above conclusion.

(3) The responses to item 4 depended on the particular schools. All the girls in the sample from school SR agreed that their chemistry teacher made the subject difficult. The factor goes further to explain their very poor performance in chemistry as shown in table 3. On the other hand, all the girls in the sample from school SQ disagreed with the statement that their chemistry teacher made the subject difficult. There was a very good relationship between the teacher and the girl students in this school hence their very good performance when compared to the girls in the other schools.

On the overall, majority of the girls disagreed with the statement that their chemistry teacher made the subject difficult. 63.0% represented those who disagreed while 30.8% agreed with the statement. As seen earlier, the characteristics of the teacher are important in determining the girl's performance. The attitude of the

teacher towards the girls in particular is very important in determining their interest in the subject.

(4) One of the areas where girls have been found to be doing poorly is the area of chemistry that requires mathematical manipulation. In response to item 6, 51.9% of the girls in the sample agreed that they would like to learn chemistry were it not for the equations and formulae involved. This shows that slightly more than half of the girls felt that mathematical treatment in chemistry makes them do poorly in the subject.

The problem here may not be their hate for chemistry but their negative attitude towards mathematics in general. However, this is not a very serious problem because 43.2% of the girls disagreed with the statement. We need to note further that the responses to item 6 depended on the school; for example, majority of the girls in school SP agreed with the statement while majority of those in school SQ disagreed with with the statement. We can conclude here therefore that the attitude towards mathematics depends on the teaching methods and the school traditions.

(5) 80.3% of the girls disagreed with the statement that they don't like performing chemistry experiments in the laboratory. This majority shows that girls do not fear laboratory equipment as they like doing experiments which is contrary to the belief that they do not like performing experiments. There are other constraints though which come up such as lack of enough laboratory equipment which denies the girls the experience in handling equipment.

(6) Finally, item 9 required the girls to state whether their parents would like them to study chemistry if they were admitted for A-level. 75.3% of those girls agreed that their parents would like them to study chemistry. This represented about three quarters of the girls and hence showed that their parents were positive towards chemistry.

Nine girls were undecided on this statement and one of them asserted that her parents did not know what chemistry was all about. A good number of parents do not know much about the subjects studied in secondary school hence they are unable to advice their daughters on the

subjects to take.

13.6% of the girls disagreed that their parents would like them to study chemistry at A-level. Although this proportion is small, it is significant in that a student is unlikely to do well in a subject which her parents have no concern about.

4.2 ANALYSIS OF DATA FROM THE TEACHER'S QUESTIONNAIRES

4.2.1 Teacher's responses to section A

In the presentation and discussion of the teacher's responses to section A items, reference will be made to teacher's questionnaire (appendix 2).

In section A of the teacher's questionnaire, there were fifteen items which comprised closed-ended and open-ended types of questions. In the analysis, these two types of items will be discussed separately.

Table 6 gives a summary of the teacher's responses to questionnaire items 4,5,6,8,11,12,13,14 and 15 in section A. Responses to these items were regarded as section A part I and comprised the closed-ended items. Responses to the other items in section A were regarded as section A part II.

TABLE 6

SUMMARY OF TEACHER'S RESPONSES TO QUESTIONNAIRE ITEMS IN SECTION A PART I (closed-ended) Total number of teachers = 6

	TOTAL NUMBER	%
Teachers who found the chemistry textbooks used by the students sufficient	5	83.3
Schools where there was no sharing of chemistry textbooks	4	66.7
Schools where two girls shared one chemistry textbook	1	16.7
Schools where more than two girls shared one chemistry textbook	1	16.7
Teachers who indicated that the language in their students text-books was appropriate to student's level	5	83.3
Teachers who rarely used charts in their chemistry lessons	6	100.0
Teachers whose students performed class experiments	6	100.0
Teachers who had two students per group in the laboratory	3	50.0

TABLE 6 (Continued)

	TOTOAL NUMBER	%
Teachers who had three or more students per group in an experiment	3	50.0
Teachers who indicated that girls handled laboratory equipment with confidence	3	50.0
Teachers who indicated that their girl students volunteer to assist in class demonstrations	1	16.7
Teachers who indicated that their students got career guidance in chemistry related fields	5	83.3

4.2.2 Discussion and Conclusions from section A part I of the teacher's questionnaire

With reference to table 6, the researcher arrived at the following conclusions:

(1) Five out of the six teachers involved in the research reported that the chemistry textbooks used by the girls in their classes were sufficient. This was supported by their responses to the other questions which indicated that there was no sharing of chemistry textbooks in four schools while in one school, two girls shared one chemistry textbook. In the other school, more than two girls shared one chemistry textbook. We therefore conclude that apart from school SS, the textbooks used by the girls in form four were sufficient. This was supported further by the responses of the students to the items in their questionnaire.

(2) Five out of the six teachers indicated that the language level used in the chemistry textbooks was appropriate to the language level of their students. This was in disagreement with the student's responses because as seen earlier, 58.0% of the students reported that they found the language used in their chemistry textbooks difficult. 53.1% of the students found the examples given in the chemistry textbooks difficult to follow.

This indicates that the teachers do not understand their girl students fully which may be a cause for the girls' poor performance in chemistry. The fact that teachers think that their students understand the things written in their chemistry textbooks affects their teaching methods. All the chemistry teachers reported that they rarely used charts during their chemistry lessons. This was a sad situation especially in the light of the information that the girls do not fully follow the information in their chemistry textbooks. It is important to subsidise the information in the textbooks by using other visual aids which would make the concepts learned more clear.

Perhaps it is unfair to blame the teachers only for not using charts in their lessons because other factors may prevent them from using charts such as; the unavailability of materials needed for preparing the charts and the teaching load may be such that they would not get enough time to prepare the charts. Incidentally, from the informal discussions with the teachers none of them reported that they had problems getting the materials that they required for teaching.

(3) All the teachers in the sample reported that their students performed class experiments during their chemistry lessons. This is in support of the students response as all of them also reported that they performed class experiments. Three out of six teachers reported that they had two students per experimental group while the other three teachers reported that they had more than two students per group during class experiments. This distribution suggests that the equipment available in the laboratory is fairly adequate. The thing to note here is that the number of a certain kind of equipment for a particular experiment will vary from experiment to experiment. This means that the number of students per experimental group will also vary. It was noted earlier that some girls complained of working in large groups in some experiments such that some of them play only a passive role.

The researcher made an observation of the equipment available in the laboratories in the sampled schools. The finding was that the equipment was adequate for schools offering physical science.

(4) The laboratory equipment may be available but the girls may fail to make maximum use of it. Half of the total number of teachers in the sample reported that girls handled laboratory equipment fearfully. The girls themselves admitted that they were unable to set up experiments. This lack of confidence in laboratory work affects their performance in chemistry.

Five out of six teachers reported that their girl students did not volunteer to assist in class demonstrations because they were shy. One teacher in this group asserted that girls will never volunteer because they will be considered as "show offs" by the rest of the class. This statement on top of showing that the particular teacher has negative attitude towards girls also reinforces the idea that girls lack confidence in handling equipment hence they become shy when they have to perform infront of other students.

(5) Five out of the six teachers indicated that their students got career guidance in chemistry related fields. This is in support of the students as more than half of the students also reported this. As mentioned earlier, career guidance imparts valuable information to the students which helps to create more interest in a subject. It is very unfortunate to the girls in the school which does not realise this.

4.2.3 Summary and discussion of the teacher's responses to questionnaire items section A Part II (Open-ended).

Total number of teachers = 6

The items in section A part II were items 1, 2, 3, 7, 9 and 10. The following discussion pertains to the responses to these items.

(1) Items 1, 2, 3 and 7 concerned the textbooks used by the teachers and the students. On item 1, the teachers indicated that they used the following textbooks:

a) All teachers indicated that they used "Certificate Chemistry" by Lambert and Holderness.

b) The other textbooks used by the teachers were;

i) Modern Certificate Chemistry by Atkinson

ii) Junior Certificate Chemistry by Atkinson

iii) Model questions and Objective Questions

iv) Chemistry by Concept

v) Modern Approach to Chemistry by Store and Philips

vi) A New Certificate Approach by Bajah

vii) Combined Chemistry

and viii) Chemistry in Context by Holman

The authors for books (iii), (iv) and (vii) were not given. Apart from the books, "Combined Chemistry" and "Chemistry in Context", all the other books are meant for O-level chemistry.

On item 2, all the teachers indicated that the books they used were provided by the school. In response to item 3, the teachers reported that their students used the following text-books:

i) In four schools, the students used : Certificate Chemistry by Lambert and Hoderness.

ii) Other books used by the students were:-

a) Modern Certificate Chemistry by Atkinson

b) Junior Certificate Chemistry by Atkinson

c) O-level Certificate Chemistry by Walkley and Akusomba.

For item 7, the teachers reported that the chemistry textbooks had the following shortcomings:

i) One teacher said that organic chemistry part was too shallow. It required addition of more information.

ii) Another teacher reported that some apparatus recommended in the textbooks were not available locally hence they had to be improvised. The method of improvision varied from teacher to teacher.

iii) One other teacher suggested that the language used in the books was too deep for the students.

Other teachers did not offer any shortcomings.

The things that arise from this is that there is a wide variety of chemistry textbooks in use in the secondary schools in Tetu division. Most of these books are written by foreigners who may not be very conversant with the requirements in the local situation. Such authors may not be aware of the individual needs of the students hence the textbooks they write will only be appropriate for reference but not as class texts. No wonder the schools in Tetu division have

decided to use a variety of books.

The examples and problems given in textbooks reflect on the situation in the comtemporary society. A book that is written in a foreign society will therefore not reflect what is existing locally. Such examples and problems will thus put off students. There is need to come up with books written from a local set up.

Another thing is that most of the teachers use the same books as their students use when they are preparing their lesson notes. While this is advisable, it is important for the teachers to read slightly more advanced books than their class texts so that they will be able to guide their students further.

(2) Item 9 was on the problems that girls have in understanding chemistry concepts.

i) Two teachers felt that girls were weak in grasping quantitative concepts in chemistry; that is, claculations and equations.

ii) Four teachers reported that the problems arise from negative attitude towards chemistry as some of the girls openly confess that they are less able.

iii) One teacher felt that girls were generally slower learners than boys while another one felt that girls were weaker than boys in handling apparatus.

All these points have been mentioned before, that: girls have problems with mathematical concepts in chemistry, that they lack interest in the subject due to poor teaching methods, and that they lack enough confidence in handling materials and apparatus due to inadequate experience.

(3) Question 10 was aimed at getting the reasons that girls give for dropping chemistry when choosing KCE subjects in case there is choice.

i) Three teachers indicated that girls say that chemistry is a difficult subject which should be taken by boys only.

ii) One teacher reported that girls fear chemicals and gases.

Two teachers did not indicate any reasons.

It is interesting to note that half of the teachers said that girls found chemistry to be difficult while majority of the girls in their questionnaire asserted that they did not

find chemistry to be very difficult and that it was not a subject for boys only. However, we cannot rule out the fact that the girls feel inferior when they compare themselves to the boys because in most of the schools in the sample, the girls are admitted into the harambee classes while some boys are admitted into the government aided classes. This means that the entry point for boys is generally higher and hence they may be brighter than the girls. It is the duty of the teacher to remove the attitude in girls that chemistry is difficult in order to improve their performance in it.

4.2.4 Responses to section B of the teacher's questionnaire

There were six items in this section. In the discussion of the responses to items in section B, reference will be made to table 7. Since the total number of teachers in the sample was small, table 7 gives a summary of the teacher's responses for each questionnaire item with corresponding percentages.

TABLE 7

SUMMARY OF TEACHER'S RESPONSES FOR EACH QUESTIONNAIRE ITEM WITH CORRESPONDING PERCENTAGES

ITEM NUMBER	TOTAL NUMBER OF RESPONSES			PERCENTAGES %		
	A	U	D	A	U	D
1	2	o	4	33.3	0.0	66.7
2	2	0	4	33.3	0.0	66.7
3	0	0	6	0.0	0.0	100.0
4	1	0	5	16.7	0.0	83.3
5	1	0	5	16.7	0.0	83.3
6	0	1	5	0.0	16.7	83.3

NB: (i) A = Agree U = Undecided D = Disagree

(ii) Total number of teachers, N = 6.

4.2.5 Discussion and Conclusions from the teachers responses to section B items

(1) From the responses to items 1 and 2 of the teachers questionnaire, the researcher was able to arrive at some conclusions regarding text-books. Majority (66.7%) of the teachers disa-greed with the statement that the content in some chemistry textbooks used by the students was irrelevant to the course objectives.

Two thirds of the teachers again disagreed with the statement that the chemistry textbooks used by the students was too difficult for the students. The responses to these two questions supported the textbooks as being appropriate.

(2) All teachers disagreed with the statement that chemistry is a difficult subject so girls should be discouraged from studying it. This meant that they had the positive attitude that girls are quite able to learn the subject.

(3) Five out of the six teachers disagreed with the statement that girls required more guidence than boys when they were performing experiments. This implies that teachers do not belief that

girls are less able in handling laboratory equipment.

(4) Majority of the teachers (83.3%) disagreed with the statement that the shortage of laboratory equipment made it very difficult to teach chemistry meaning that they found the equipment available to be adequate. This supports the findings mentioned earlier.

(5) Five out of the six teachers disagreed with the statement that parents discouraged girls from learning chemistry. From this response we cannot conclude that parents encourage girls to learn chemistry but at least we can say that from the teachers point of view, the parents do not discourage their daughters from learning chemistry.

A summary of the above discussion and conclusions will be given in chapter five.

CHAPTER FIVE

CHAPTER FIVE

CONCLUSIONS, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

5.0 SUMMARY

The major purpose of this study was to investigate the factors that affect girls during their course of learning chemistry. The areas probed into included:

1) The attitudes of girls towards chemistry as a science subject, their attitudes towards the teaching facilities and those towards the methods of instruction.

2) The attitudes of teachers towards chemistry and their attitudes towards girls who study chemistry.

3) Guidance and counselling in relation to girl's interest and performance in chemistry.

4) The availability of laboratory equipment and the use made of them.

5) The availability of textbooks their language level in relation to the girls language ability.

6) Parents role in encouraging girls to learn chemistry and the availability of role models at home.

The study involved a sample survey type of research where the researcher relied on information gathered by using questionnaires as well as information gathered from teacher's records and from informal discussions with those chemistry teachers.

The student sample was drawn from form four students in the sampled schools in Tetu division. All the chemistry teachers who were taking those students at the time of the study were involved in the research.

The analysis of the data obtained involved simple descriptive statistics from which conclusions were made.

5.1 CONCLUSIONS

To begin with the researcher would like to note that poor achievement in chemistry cannot be attributed to one factor. A variety of many factors some of which are above the scope of this study interact to bring about the present situation found in Tetu division.

From the data analysis, the following conclusions were made:-.

1) Majority of the girls had positive attitude towards chemistry. Most of them believed that chemistry was not too difficult such that they could learn it just like boys could. There were a few girls though, who thought that chemisty was a difficult subject which was meant for boys only.

The positive attitude towards chemistry depended on the school. When the girls were faced with a choice between physics and chemistry their choice varied from school to school. This was attributed to different school environments, different teaching methods because the teachers were different and a varying amount of facilities available for the teaching of each subject. Of these variables, the teaching methods and the qualities of the teacher were found to play the most important role in the choice of subject. On the overall, slightly more girls preferred to study chemistry rather than physics.

It was found that girls lack interest in discussing chemistry topics in science clubs which shows that girls are not encouraged to discuss chemistry projects. This is supported by the fact that two out of the five schools in the sample did not have science clubs. Science clubs serve as avenues for bridging classwork to reality as well as enhancing creativity and interest in the particular subject. Negative attitude towards a subject can be changed by involving students in projects in science clubs. Chemistry teachers should therefore encourage girls to participate in chemistry projects in science clubs.

Another factor related to girls attitudes is that one involving mathematical abilities. Majority of the girls reported that one of the problems they face in chemistry was the mathematics in chemistry such as calculations of moles and concentrations. We therefore conclude that girls lack the necessary abilities for mathematical manipulations hence they perform poorly in topics that involve quantitative chemistry. The origin of the problem could be a poor mathematical background, poor teaching methods or negative attitude

towards mathematics. It would be useful if the teacher adopted teaching methods which would counteract this problem as well as co-ordinating with mathematics departments in schools in an attempt to arrest the problem.

2) It was found that some teachers had negative attitude towards girls who studied chemistry. Such teachers were of the point of view that girls had a negative attitude towards chemistry and that girls in general were slow learners. These remarks only prove that some teachers were of the opinion that girls were less able than boys in handling chemistry and such an attitude seriously lowers the girl's morale and hence the performance in the subject. In responses to other questions, majority of the teachers reported that girls did not need more guidance than boys but a number of girls reported that they do not get enough guidance from the teachers especially in practical work. On the whole, girls were found to be extra sensitive to the teaching methods. If they thought that the teacher ignored them, they gave up easily in the subject.

Chemistry teachers should always remember to teach from known to unknown and to be more gradual with girls in the teaching process. The examples they give in class should always be aimed at helping the students to comprehend the learned ideas.

3) Majority of the girls reported that they received information on careers which were open to them after learning chemistry. In schools which did have career masters, the teachers were found to be filling that gap by advising the girls on the careers open to them.

Most schools seem to have realised the importance of guidance and counselling in determining the interest and performance in chemistry. Unfortunately a few schools have neglected this area completely since they don't have a careers master or mistress and at the same time the subject teachers do not take the role of advising the girls on careers.

4) All the sampled schools had science laboratories which were adequately equiped for physical science. Inspite of this, it should be noted that not all

kinds of pieces of equipment were adequate. This led to the girls performing class experiments in large groups which obviously lowered their participation in the experiment. The types of equipment in the laboratories should be well balanced so as to cater for all topics.

Further, it was found that some teachers did not use class experiments for teaching as frequently as possible. This resulted in the students lacking enough experience in handling apparatus. Girls therefore lacked confidence in handling laboratory apparatus and some of them even feared chemicals. They needed much more guidance and practice so as to improve.

5) About a third of the girls in the sample reported that they did not share their chemistry textbooks because each one of them had a copy. Approximately one half of the sample reported that they shared one chemistry textbook between two students. From this, we conclude that chemistry textbooks are fairly adequate. Inspite of the books being adequate, there are other things concerning chemistry textbooks that inhibites the learning of chemistry.

i) Majority of the students were unable to fully understand the language used in their chemistry textbooks. They also found the examples in the textbooks difficult to follow. On the contrary, majority of the teachers indicated that the language level in the chemistry textbooks was appropriate for their students. This indicates a serious problem; that most of the teachers have not recognised this shortcoimg in the chemistry textbooks. The implication of this is that the teachers do not undertake remedial measures to compensate for the shortcoming because they do not think that it is necessary. As a result, the girls are seriously affected in their performance in chemistry.

ii) It was found that the number of chemistry textbooks varied from school to school and from class to class. Therefore, although the books may have been fairly adequate in form four classes, there was a shortage in the lower classes. The other thing is that there was a wide variety of chemistry textbooks in the schools in Tetu division such that there was no single book that could be referred to

as the class text. This in a way is good because students get a chance of reading materials from various books but on the other hand, there is lack of uniformity from school to school.

Most of the textbooks were written by foreigners for use in a foreign set up. The books therefore may not necessarily be completely appropriate for the local environment. There is need to write books which reflect the situation in which they will be used.

6) About two thirds of the girls in the sample reported that they got parental advice to learn chemistry and 75.3% of those girls felt that their parents would like them to study chemistry at advanced level. This represents three quarters of the girls which implies that the parents were encouraging girls to learn chemistry.

We conclude therefore, that many parents would like their daughters to learn chemistry but unfortunately many of the parents were not conversant with some subjects offered in secondary schools. This prevented some of them from serving as advisers to their daughters in chemistry

and related fields. Further to this, the parents occupations did not allow them to serve as role models to their daughters because majority of the parents were small scale farmers.

35.8% of the girls reported that they had brothers /sisters who had studied chemistry at advanced level. Majority of the girls therefore did not have such brothers or sisters. When this is coupled with the fact that there is extreme scarcity of women who have studied chemistry successfully at advanced levels, then we conclude that the girls do not have role models whom to emulate.

5.2. RECOMMENDATIONS

Due to the shortage of secondary schools for girls, the current tendency has been to admit girls into harambee classes in existing boy's schools. The entry point for girls in such schools has been lower than that for boys. This has resulted into girls feeling inferior to boys in such mixed schools. To avoid this, it is necessary to build more secondary schools for girls to compensate for the current shortage. It is also advisable to admit pupils of similar abilities into mixed schools so that girls stop feeling that they are academically less able than the boys.

It is also recommended that parents should be enlightened more on secondary school curricula. Through adult literacy classes and radio programmes, the parents should be educated on the importance of giving their daughters enough time for homework instead of giving them too much responsibilities such that their school work is affected.

To increase the girls interest in the sciences, it is recommended that all secondary schools should have science clubs. Girls should be encouraged to join and to participate in such clubs. Teachers should organise field trips to places where student's interest in science would be aroused.

As concerns the chemistry textbooks, efforts should be made to produce a standard testbook which would be more relevant to the local situation. Since one of the problems that girls have is the understanding of language in the chemistry textbooks, it is important to emphasise English language from the primary school level in an attempt to improve the student's understanding of the language and hence the chemistry literature.

Girls are poor in mathematical manipulation in chemistry. Appropriate teaching methods should be adopted as a corrective measure to improve on this. If necessary, chemistry teachers who teach girls should have special inservice courses so as to improve the way they handle chemistry concepts in class.

Each school should have strong and literate parent - teacher association (PTA) and board of governors who will look into research reports and apply corrective measures. Such bodies should involve the District Developemnt Committees (DDC) in the improving of laboratories and equipment.

5.3 SUGGESTIONS FOR FURTHER RESEARCH

More detailed studies should be undertaken in other areas to check whether the findings of this study hold in those areas. Such studies should involve larger sample sizes It is generally felt for example that students prefer chemistry to physics but the use of larger sample sizes would remove the doubt on this issue.

The aspects which were not probed into in this study should also be investigated such as:-

i) The effect of the gender of the teacher on the performance of girls in chemistry. It would be interesting for example to find out what female teachers feel about the girl's ability to handle the language in their chemistry textbooks as compared to the feelings of male teachers.

ii) The effect of the girls attitudes toward mathematics on the performance in chemistry should be investigated.

A study involving the interviewing of school administrators (headteachers) and parents should be carried out in order to find out what they have to say about girls who study chemistry.

Finally, a study should be carried out on the effect of biological factors on the learning of chemistry concepts.

BIBLIOGRAPHY

Brook, D. W. The learning of A-level chemistry in Kenya. M.Sc. Thesis. University of New York. 1983

Erikson, G. and Lynda, E., "Females and Science achievement". Science Education. Vol. 68 No. 2, 1984.

Eshiwani, G.S. A Study of Women's acess to higher education in Kenya with special reference to mathematics and science education. Bureau of Educational Research. Nairobi, 1983.

Eshiwani, G. S. (Ed) Report of the National Seminar on women's acess to higher education in Kenya. Women's Bureau Ministry of Culture and Social Services. Naivasha. 1983

Eshiwani, G. S. Women's acess to higher education in Kenya. A study of the opportunities and attainment in science and mathematics education. Journal of East African Research and development. Vol. 15. 1985

Gachathi, P.J., (Chairman) Kenya National Committee on Educational Objectives and Policies Report. (Gachathi Report). Government Printer. Nairobi. 1976

Hardin J. and Dede, C.J., Discrimination against Women in science education. In, The Science Teacher. Journal of the National Science Teachers Association Vol. 40 No. 9 National Science Teacher's Association. Washington D.C. 1973.

Horner, M.S., "Motive to avoid success and the changing Aspirations of women". In, Barkwick J. (Ed). Reading on the Psychology of Women. New York. 1972.

Idewa, D., A study of sex differences in the perception of science related careers among standard seven primary school pupils in Northern Division of Busia District. (M.Ed. Project). Nairobi. 1985

Keino, E. "Opportunities for females in technical training in Kenya. A focus on Secondary, Primary and Post-Secondary Levels of training Kenya Journal of Education Vol. 2 No. 1. Bureau of Educational Research. 1985.

Kenya National Examination Council. KCE Regulations and Syllabuses, 1984. Kenya National Examinations Council, Nairobi. 1984.

Koelsche, C. K. and Newberry, S.L. " A Study of the relationship between certain variables and the science interest of children". Journal of Research in science teaching. Vol. 8, 1971 pp 237 - 241.

Maritim, E.K.A., "The dependence of 'O' and 'A' level results on the sex of examinees. Kenya Journal of Education. Vol. 2 No. 1 Bureau of Educational Research, 1985.

Munguti, B. K., A survey of the factors affecting the teaching and learning of mathematics in primary schools in Mbooni Division of Machakos District in Kenya. (M.Ed.project) Nairobi. 1984

Mwangi, J. T., A study of the quality of facilities that exist for the teaching of 'O'-level chemistry in some selected secondary schools in Mbiri constituency of Murang'a district. (M.Ed. project) Nairobi . 1986

Mwaniki, N., Women's self-help groups in Mbere. in Africa Journal of International African Institute. International African Institute. Vol. 56. No. 2. 1986

Nation Reporter " Are those scientific jobs for men only". Nation Newspapers ltd. 7/3/87, Nairobi.

Nation Reporter "Science Students not enough - Aringo" Nation Newspapers Ltd. 3/4/87, Nairobi.

Sax, G., Foundations of Educational Research. Prentice - Hall Inc. Englewood Cliffs. New Jersey. 1979

Stollberg, R., The education of elementary school teachers in science. Kuslan and Stone 1969

Torongey, P. K., "Survery of the problems experienced by girls in learning physics at 'O'-level and their implications on girls interest in the subject in Kericho District. (M.Ed. project) . Nairobi. 1986

Twoli, N. W., Sex differences in Science Achievement Among Secondary School Students in Kenya. Ph.D. Thesis, Flinders University of South Australia. 1986

UNESCO New Trends in Chemistry Teaching Vol. IV, UNESCO press. Paris . 1975

UNESCO Source Book for Science Teaching UNESCO. Paris. 1962.

Vetter, B. M. The Outlook for Women in Science in The Science Teacher. Journal of the National Science Teachers Association. National Science Teachers Association Vol. 40. No. 9 Washington D. C. 1973.

Willerman, L., The Psychology of Group and Individual differences. Freeman. San Francisco . 1979.

APPENDICES

APPENDIX I

STUDENT'S QUESTIONNAIRE

Instructions

Read the following instructions carefully.

i) This is not a test

ii) Do not write your name anywhere on this paper

iii) The questions to be answered are about chemistry.

iv) Attempt all questions in both section A and B.

v) Please be specific and honest in your answers as the information you give will be treated as confidential.

vi) Your co-operation is highly appreciated.

SECTION A

Attempt all questions in this section.
Write your answers on the spaces provided.
Short answers are sufficient.
Where choices are provided, choose the most appropriate in your own view by ticking (✓) in the corresponding box.

1. Is there a Science Club in your School?

Yes ☐ No ☐

2. If you are/were a member of the Science Club, what topic/projects would you like to discuss/do?

Physics oriented	☐
Chemistry oriented	☐
Biology oriented	☐
None of the above	☐

3. Do you have any problems in learning chemistry?

Yes ☐ No ☐

4. If your answer in 3 is yes, what are your main problems? List them in priority.

_____

_____

_____

5. Name any chemistry textbooks used in your class.

_____

_____

_____

6. If you share any chemistry textbook in your class, how many other students do you share with? _____

7. How do you find the words in your chemistry textbooks?

Very difficult	☐	Easy	☐
Difficult	☐	Very easy	☐
Undecided	☐		

8. How do you find the examples given in the chemistry textbooks in your class?

Very difficult to follow	☐
Difficult to follow	☐
Undecided	☐
Easy to follow	☐
Very easy to follow	☐

9. What type of examples does your teacher use frequently in the chemistry lessons?

Strange to me	☐
Familiar to me	☐

10. Do you perform any class experiments during your chemistry lessons?

Yes ☐ No ☐

11. If your answer in 10 is yes, list any problems you face when performing the experiments.

.....

.....

.....

12. Does your teacher advice you on the type of careers you would enter after learning chemistry?

Yes he/she does ☐
Very rarely ☐
No he/she does not ☐

13. Do your parents or guardian advice you to study chemistry?

Yes they do ☐ No they don't ☐
Very rarely ☐ They don't care ☐

14. Do you have a brother or sister who has studied chemistry in an A - level school?

Yes ☐ No ☐

15. What are the occupations of your parents/ guardian?

16. Is there a careersmaster in your school?

Yes ☐ No ☐

17. If your answer in 16 is yes, does he/she advice you on the type of careers you would enter after learning chemistry?

Yes he/she does ☐
Very rarely ☐
No he/she does not ☐

SECTION B

In this section, read each statement carefully, then write at the end of it a letter corresponding to the choice which best indicates what you feel about the statement.

The choices from which only one is to be selected for each statement are:-

A : Strongly agree

B : Agree

C : Undecided

D : Disagree

E : Strongly Disagree

1. I like chemistry lessons _____

2. Chemistry is a very difficult subject _____

3. I do not understand some words in my chemistry textbook, even if I try to understand _____

4. Our chemistry teacher makes the subject difficult _____

5. Boys are the only ones who should study chemistry _____

6. I would like to learn chemistry were it not for the equations and formulae involved _____

7. In the physical science, I would prefer to study physics rather than chemistry _____

8. I don't like performing chemistry experiments in the laboratory _____

9. My parents/guardian would like me to study chemistry if I was admitted for A - level _____

APPENDIX 2

TEACHER'S QUESTIONNAIRE

Instructions:

i) Do not write your name anywhere on this paper.

ii) There are two sections A and B.

iii) Please attempt all the questions in both sections.

iv) The questions are about chemistry and the responses you give will be treated with strict confidence.

v) Thank you for your co-operation.

SECTION A

Write your answers in the spaces provided.

Please be as specific as possible.

1. Which chemistry textbooks do you use when preparing your lessons (name them).

_____

_____

_____

2. Are these textbooks personal or they are provided by the school?

3. Which chemistry textbooks do your students use (name them)

4. Are these books sufficient or insufficient?

5. How many students share one chemistry textbook in your class.

6. Is the language used in the textbooks appropriate to the level of your students?

7. What shortcomings do the textbooks used by the students have in your view?

_____

_____

_____

8. How many times do you use charts in your chemistry lessons in a week?

Rarely ☐ Always ☐

9. From the students feedback in class, what do you think are the main problems girls have in understanding chemistry concepts?

_____

_____

_____

10. What reasons do the girls give for dropping chemistry when choosing KCE subjects (if the option is there)?

_____

_____

_____

11. Do your students perform any class experiments?

Yes ☐ No ☐

12. If your answer in 11 is yes, how many students do you have per group?

Two ☐
Three ☐
Four ☐
More than four ☐

13. How do the girls handle and manipulate laboratory equipment in an experiment; with confidence or fearfully?

_____

14. In a class demonstration, do the girls volunteer to assist in the practical or you appoint them to assist because they are shy? _____

15. Do your students get career guidance in chemistry related fields?

Yes ☐ No ☐

SECTION B

In this section read each statement carefully, then indicate with the letter corresponding to the statement which indicates what you feel about the statement.

Only one choice is to be made from the following:

A : Strongly agree
B : Agree
C : Undecided
D : Disagree
E : Strongly disagree

1. The content in some chemistry textbooks used by my students is irrelevant to the course objectives. _____

2. The content in the chemistry textbooks used by the students is too difficult for my students _____

3. Chemistry is a difficult subject, girls should be discouraged from doing it _____

4. Girls require more guidance than boys when they are performing experiments _____

5. The shortage of laboratory equipment makes it very difficult to teach chemistry _____

6. In my view, parents discourage girls from learning chemistry _____

APPENDIX 3

KENYATTA UNIVERSITY

DEPARTMENT OF EDUCATIONAL ADMINISTRATION, PLANNING
AND CURRICULUM DEVELOPMENT

P.O. Box 43844
Nairobi, Kenya
Telephone: 817356
803375

Date 5th June, 1987

TO WHOM IT MAY CONCERN

Please kindly assist Mr. Samuel Wambugu Wachanga I.D. No. 4840720/67 who is a 1st year M.Ed (TDC) student in this University.

Mr. Wachanga has applied for a research permit but there seems to be a delay in getting it, probably due to the bureaucratic procedures.

He however needs to interview Forth Formers before they embark on their mock examinations and become too busy.

I would appreciate your most kindly cooperation. His topic of Research is "Factors that Affect the Overall Achievement of Girls in Chemistry".

Please Expedite.

Yours Faithfully,

DR. PAMELA E. WANGA
COORDINATOR
M.ED (TDC) PROGRAMME