EXPECTATIONS OF HANDICAPPED STUDENTS AND THEIR TEACHERS
IN THE LEARNING AND TEACHING OF SCIENCE SUBJECTS
IN KENYAN SPECIAL SECONDARY SCHOOLS FOR THE
PHYSICALLY HANDICAPPED

BY

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DECLARATION

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

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DEDICATION

This work is dedicated to my wife Naomi and son Derick, in love and understanding.
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The study focuses on the expectations of handicapped students and their teachers in the learning and teaching of Science subjects in Kenyan Special Secondary Schools. Science subjects in this case include Physics, Chemistry, and Biology.

The choice of the topic under study was influenced by the increasing concern for the underprivileged people in the society, especially when the issue of equal opportunities in education is over emphasized. Since the society is becoming technologically-oriented, there was need, therefore, for awareness of the expectations of the handicapped students in Sciences since Sciences are the basis of any technological improvement.

In carrying out the study, a questionnaire based on the five point Likert scale was used such that the respondents either strongly agreed, agreed, were not sure, disagreed or strongly disagreed. The same questionnaire was used both for students and teachers except in section I where personal and general information was sought. An interview using a structured schedule was conducted with the heads of the institutions and also the heads of Science departments. Through this means, more issues affecting the learning of Sciences in special schools were discussed. The responses
given were then coded and their means (averages) calculated to show the degree of either agreement or disagreement. The expectations of different groups i.e. male and female teachers and boys and girls at different class levels were compared using the \( \chi^2 \) technique.

In the study six aspects of the sciences were investigated; role of the teacher in teaching sciences, role of the student in learning sciences, the content and context of sciences, teachers' and students' image of a scientist, the academic and professional background of science teachers and sex differences in the subject areas. Each aspect was analysed and discussed separately and the expectations of different groups compared accordingly.

The findings showed no significant differences in expectations between boys and girls, male and female teachers and form 2 and form 4 students. Preference in learning context was in the order laboratory, field, classroom, home and the office. The traditional methods of teaching sciences were still in force, though the students expected to learn the process skills. Both students and teachers had a positive image of a Scientist. Roles of the teachers were well articulated, teachers were professionally qualified but not qualified to handle the handicapped students and the students
were comfortable being in special schools except for boys who thought they could survive in regular schools.

The implications of these findings to the study of the sciences among the physically handicapped were discussed and recommendations made to teacher educators, examiners, students, donors and policy makers among which was a call to all parties to review their roles with an aim of bringing the handicapped students in the mainstream of learning the sciences.
CHAPTER ONE

PROBLEM AND ITS COMPONENTS

1.1 BACKGROUND TO THE PROBLEM

Concern for the needs of the disabled individuals surfaced during the Renaissance. However, social reforms directed towards improving the quality of life for the disabled did not begin until the nineteenth century (Martin, 1986). World Wars I and II provided the impetus to develop rehabilitation programmes to improve the functions of disabled persons. Focus on upgrading the opportunities for the physically handicapped became a reality in the 1960s. In America, for example, a national effort to provide school and community services for all the handicapped persons began with the Rehabilitation Act of 1975 (Kirk, 1979). The legislation mandated appropriate educational programmes and opportunities to participate in intra-murals and inter-scholastic sports for the handicapped citizens of school age (Hewett, 1984).

In Kenya, special education programmes began around the 1940s, particularly to cater for the victims of the second world war and in particular those who had become blind and crippled in the course of their duties (Momanyi, 1992).

Prior to independence, special education was mainly in the hands of individuals, missionaries and volunteer
organizations which concentrated on the provision of health services, rehabilitation services and material support for those with physical impairments. The services were in the form of custodial care, using the model seen in Europe (Abila and Kang’ethe 1991).

In the post-independence era the government has shown great concern in the provision of education services to improve the welfare of the disabled. The Government’s effort has then led to the creation of two kinds of schools; regular schools which cater for students who are perceived as "normal" and special schools, which offer special education for the handicapped students. Special education is a sub-system of regular education and its purpose is to provide appropriate educational experiences to students who are perceived as being different from other students in some way (Ysseldyke and Algozzine, 1984).

Regular education teachers may find a "culture gap" between special and regular education (Martin, 1986). Special education has developed an educational sub-culture of techniques, behaviors, language and perception of students. Martin (1986) calls for the assimilation of the special education sub-culture into the regular education. He contends that special education should;

(a) view the learners as having strength as well as needs,
(b) realize that some "deficits" do not need immediate remedy,
(c) group students flexibly rather than by labels, and
(d) rely on professional judgement as well as the test results.

He suggests that regular educators and special educators assess individual needs, select materials in response to students characteristics, and adapt these materials accordingly (Martin, 1986).

The cultural gap between special and regular schools could have some impact in the teaching and learning of the sciences (Allan and Bacon, 1979). The researcher therefore felt the need to address this gap by looking at the expectations of the handicapped students and their teachers in the teaching and learning of science subjects in the Kenyan situation.

1.2 STATEMENT OF THE PROBLEM

Many studies have been done on the teachers' expectations (Comber and Keeves 1973; Steinkamp and Maehr; 1983, Njoroge and Benaars, 1986; , Iraki, 1996); on problems affecting both teachers and students (Young, B,L, 1979; Flegg, 1981; Abidha, 1982; Kariuki 1988) and the factors affecting the teaching and learning of science subjects (Sifuna, 1974; Eshiwani, 1982;
Kyalo, 1984; Twoli, 1986). However, there exists a gap; no study has been done in Kenya to explore the expectations of the physically handicapped students and of their teachers in the learning of science subjects. Resulting from this gap, there might be difficulty in implementing the science curriculum to the handicapped since no special consideration of their special needs has been made.

This study contended that the gap was to be addressed with reference to the following aspects:-

i) Academic and professional background of the science teachers

ii) The role of the students in the learning of sciences

iii) The role of the teachers in the teaching of sciences

iv) The content and context of Sciences

v) Students' and teachers' image of a scientist

vi) Gender differences in the above-mentioned aspects (i to v above)

1.3 RESEARCH QUESTIONS

The study endeavoured to explore the above-mentioned aspects with a view to establishing the expectations of the physically handicapped students and their teachers in the learning and teaching of science subjects in Kenyan special secondary schools. It specifically attempted to answer the following questions.
1. In what conditions do the physically handicapped students prefer to be taught science subjects?

2. Do these students expect to take science-related careers on completing school?

3. What expectations do these students have of their role in learning the sciences?

4. What is the image of a scientist from both the physically handicapped students’ and the teachers’ perspectives?

5. What are the professional and academic qualifications of teachers who teach secondary school science in special schools?

6. What facilitation should teachers give to the handicapped students to promote their learning of the sciences?

7. Is there any gender difference in the students’ and teachers’ expectations of the sciences.

1.4 OBJECTIVES

The main objective of the study was to find out the expectations of handicapped students and their teachers in science subjects. The specific objectives of the study were:-

1.4.1 To find out what are the favourable conditions for handicapped students to learn sciences in special schools.
1.4.2. To find out the students' expectations of who should learn the sciences.

1.4.3. To find out if the students expect to take science-related careers after school

1.4.4. To find out the extent to which process skills are applied in the learning of science subjects.

1.4.5. To find out the image of a scientist from the disabled students' and the science teachers' perspectives

1.4.6. To find out the academic and professional qualification of science teachers in special schools.

1.4.7. To find out if gender and experience plays a major role in the expectations of handicapped students in science subjects.

1.5.0 SIGNIFICANCE OF THE STUDY

1.5.1 Teacher and Teacher Educators

Since the purpose of the study was to explore the expectations of handicapped students and their teachers in science subjects, it is expected that the findings will be useful in a number of ways or areas:-
i) The selection of science teachers in teacher-training institutions and undergraduate courses will be possible since their expectations will be known.

ii) A course based on the findings can be developed for in-service training of science teachers of the handicapped.

1.5.2 Examiners

With the expectations of the handicapped students already known, it is supposed that the Kenya National Examinations Councils (KNEC) will make necessary adjustments in their examinations with particular attention paid to practicals and practical-oriented questions.

1.5.3 Students

Since the expectations of handicapped students are already known then these expectations should be used by teachers to build the former's confidence and in the selection of scientific careers by students. These expectations should be used to popularise the sciences among the handicapped students.

1.5.4 Ministry of Education

Since the expectations of the handicapped are now known, the Ministry of Education should make the necessary policy adjustment so that the country can have enough special schools
catering for the various needs of the handicapped. Teachers can also be sensitised on the various learning context available.

1.5.5 International Bodies and Donors

International bodies such as UNESCO, USAID, FAWE and other donors such as the British Council should be more prepared to implement their educational projects of the handicapped students, basing their criteria on some of the findings of this study. Other donor agencies, church organizations and Non-Governmental Organizations (NGOs) will be in a better position to direct their resources as per the identified needs i.e. the need for more special schools, laboratories, classrooms and the provision of school vans/trucks. Scholarships should also be made available to some of the teachers so as to enable them become better teachers and managers of learning resources.

1.6 ASSUMPTION

The study was guided by one major assumption:-

Handicapped students and their teachers have a working concept of science subjects. Constructivism has shown that students have their pre-constructed knowledge as they enter formal education and that this competes with the knowledge the teacher gives (Osborne and Freyberg, 1985; Driver, 1986).
1.7 SCOPE

The study covered physically handicapped students in all special secondary schools and their science teachers and excluded physically handicapped students in ordinary schools. It specifically focussed on physics, chemistry and biology.

1.8 DEFINITION OF TERMS

EXPECTATIONS: The art or state of expecting or looking forward to what is likely to come, happen or be; supposing something. Expectations are usually a product of our experiences.

HANDICAPPED: The state of having a physical impairment of some body organs which prevents one from acting and living as most people do. Special attention on those with mobility problems.

SPECIAL EDUCATION: UNESCO (1983) defines Special Education as a form of education provided for exceptional children who would otherwise not benefit from regular educational programmes. In essence, special education should be seen as an effective teaching method which takes into account the child's special needs.
The exceptional learner is an individual who, because of uniqueness of sensory, physical, neurological, temperamental or intellectual capacity, requires an adaptation of a special school programme in order to maximize his/her functional level.

The period in Europe between the 14th and 17th centuries, when the art, literature and ideas of ancient Greece were re-discovered and widely studied, causing the rebirth of activity in all these fields.

United Nations Educational Scientific and Cultural Organization.

United States Agency for International Development.

Forum for African Women Educationalists.
CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This Chapter contains a review of literature relating to the goals of teaching the sciences, trends in special education, and emerging concerns for the development of the sciences in special schools. It also looks at the issues affecting special education. Among these issues are:-

i. Training and placement of teachers.

ii. Teachers' influence on students' expectations.

iii. Learning context and its implication to the child's education.

iv. Sex differences in the sciences.

Literature review was carried out for various reasons. First to provide the rationale and strategy for the study, then to provide insights and suggestions into the methods to be used in the study and finally to provide the importance or purpose of the study.

2.1 Goals of Teaching Science

It has been accepted internationally (Baez, 1986) that science teaching should be carried out in such a manner as to help the learner to:-
i. Understand man's environment and apply the accumulated knowledge and experience to deal with the problems posed by it; heighten his/her curiosity of scientific enquiry as well as his imagination, initiative and involvement; appreciate the place of science in the world at large and form and develop a scientific view of it.

ii. Understand the methods of science such as the use of data and the practice of logical, objective, analytical and critical thinking.

iii. Utilize experimental approaches and acquire the ability to device and carry out experiments, observe and record data, reach conclusions, draw generalizations and test them.

iv. Use plain and concise language to clarify and evaluate information, employing mathematics where necessary.

v. Improve his/her capacity to learn from experience, criticize his/her own work, admit error and respect the point of view of others.

vi. Learn the system of concepts, skills and applications of the various scientific disciplines and inter-relations among them.

vii. Understand rather than memorise by rote.

viii. Utilize scientific models and appreciate their powers and limitations.
ix. Enlarge his/her interest in science in order to choose a useful and meaningful career in science technology and related fields.

x. Comprehend the philosophy and the history of science and its contribution to the development of the modern world.

xi. Apply scientific knowledge and methods in daily life and tackle practical problems at individual, local and national levels.

xii. Develop a sense of social responsibility.

The researcher contended that the extent to which a number of these goals are achieved in special schools could be assessed by looking at the students' and their teachers' expectations in science with reference to learning content and context and the roles of both pupils and teachers and the image of a scientist from the pupils' and teachers' point of view.

2.2.0 Trends in Special Education

The emerging trends in special education can be explained by looking at the history of special schools and the emerging concern for a science curriculum for special learners both at international and national levels.

2.2.1 History of Special Schools
Although the concept of exceptionality is relatively recent in education, dating from the latter half of the 19th Century, an awareness of the existence of the handicapped persons and of differences in abilities is older than history (Gulliford, 1973). One of the oldest references to the gifted is in Plato's Republic, where positions, authorities and responsibilities were assigned according to each individual's abilities to discharge them (Hewett, 1984). However, man was well into the 20th Century before anything resembling a systematic attempt was made to identify the handicapped and to construct an educational programme for them (Martin 1980).

The treatment of the handicapped is dealt with in many early writings including the Bible. It has varied markedly from time to time and from one age to another depending on the prevalent philosophy. In many early societies, handicapped persons were rejected for reasons of group survival or because they were thought to be possessed by devils. In 355 B.C.; Aristotle wrote:

Let it be a law that nothing imperfect should be brought up (Aristotle, 355 B.C.).

It appears that this imperfection and Aristotle's pronouncement led to the destruction of many handicapped persons by the Spartans, Athenians and Romans (Moores, 1978).
In the Middle Ages many handicapped persons found their way into the courts of noble men and kings, where they acted as personal servants or as jesters providing entertainment and diversions (Durant and Durant, 1965). In later periods, they were often imprisoned in asylums and provided with minimum care. In some societies, as among the American Indians, the mentally retarded or emotionally disturbed were considered children of the gods. As such they could move freely from tribe to tribe, were safe from attack, and were freely provided for (Moores, 1978).

None of the above-mentioned ways of treating the handicapped was in any way educational, and none recognized the value of the handicapped as individuals. In general they were considered to be sub-human and devoid of feelings, with little or no potential for contribution to either their own or the common welfare (Hewett, 1984).

The notion of educating the handicapped has its ultimate source in the philosophical theory of the worth and equality of all men (Kirk, 1972). This belief, which first appeared in the Middle Ages, led to the rejection of the idea of the divine right of kings and rulers and to the revolutions that took place in France, Germany, Italy, and other Western European countries as well as the Americas. One of the natural consequences was the development of educational programmes for handicapped children. Only through education
could the worth of handicapped individuals be demonstrated, and only by appropriate training could the handicaps be offset. Education was the road to equality (Gulliford, 1973).

The intellectually superior did not profit by this philosophical movement. No special educational programmes were designed for them as such programmes would only enhance their abilities to apply their intelligence and would thus accentuate their deviations from the norm (Hewett, 1984).

2.2.2 Programmes for the Handicapped

Not all the handicapped groups received educational attention simultaneously. However, educational programmes for the mentally retarded and for children with physical or sensory disabilities all originated within a 50 to 100 year period beginning in the later half of the 18th Century. During this period, Louis Braille developed his methods of reading and writing for the blind, methods of teaching the deaf people to use and understand speech were developed into a systematic instructional approach and foundations were laid for training programmes for the mentally retarded (Allan and Bacon, 1979).

French educators and physicians figured importantly in the early developments of the programme for the physically handicapped, although contributions were also made by the Belgians, the Swiss, the Italians and others. These
movements for the physically handicapped spread quickly from one country to another. Institutions for educating the physically handicapped appeared in the United States in the 1860s and broad laws relating to the care and treatment of this group began to be passed in the United States and in England early in the 20th Century. By this time the public schools were also assuming responsibility such that before World War I almost every large metropolis offered programmes for most of the handicapped groups (Hewett, 1984). State and federal departments of education began to institute bureaux for handicapped children to provide leadership in developing and administering these programmes. Along with these organizations came standards to determine admission to the programmes and allotment of special support funds (Barsh, 1968).

After World War I, programmes for the physically and sensory handicapped increased rapidly. Public school programmes increased rapidly and legislation was passed to provide the handicapped with such added services as vocational, and rehabilitation counselling. However, not until World War II was there rapid growth of programmes for the physically handicapped and for those having other types of handicaps (Cohen, 1976).
2.3.1 Special Schools in Kenya

In Kenya special education programmes began in the 1940s, particularly to cater for victims of the second World War and in particular those who had become blind and crippled in the course of their duties (Abilla, 1991).

Prior to independence, special education was mainly in the hands of individuals, missionaries and voluntary organizations, which concentrated on the provision of health and rehabilitation services and material support to those with visible physical impairments. These services were in the form of custodial care, using the model seen in Europe (UNESCO, 1974).

In the post colonial era, the government has shown great concern in the provision of educational services to improve the welfare of the disabled. Soon after independence, the Government appointed a committee under the Chairmanship of E. N. Ndewga, the then Minister for Labour and Social Services, on the "Care and Rehabilitation of the Disabled" (Momanyi, 1992). The major tasks of the Committee included:-

i. To study and advise on facilities for educational training and employment of the handicapped persons.

ii. Formulation of a broad programme for training and placement of the disabled.
The proposals of the Committee contained in Sessional Paper No. 5 of 1968 provided the framework of Government policy on disabled persons. As a result of the Committee's recommendations, the Department of Vocational Training and Rehabilitation in the Ministry of Culture and Social Services was established. The Committee further recommended the appointment of an inspector of schools to oversee the educational welfare of disabled persons. The effort was to supplement what the missionaries had already done. By 1946, the Salvation Army had established a School for the Blind in Thika. In 1958, the Catholic Church established its first school for the blind at Egoji in Meru. The concern for the deaf necessitated the formation of the Kenya Society for the Deaf in 1959 (UNESCO, 1974).

All the major Government commissions that have been set up to review the country's education system with a view of making it respond to the country's changing needs have highlighted special education. The Gachathi Report of 1976 gave consideration to special education with reference to integration. The Report recommended a policy of integration where the handicapped has been adequately compensated for by special education facilities (Gachathi, 1976).

This was further expounded by the Kamunge Report of 1988 which expanded the concept of exceptional learners to include the gifted and talented and called for the setting up of
centres of excellence to meet the needs of these children. The Kamunge Report of 1988 is now the blueprint of Special Education growth and development (Abila, 1991).

2.3.2 The Establishment of the Kenya Institute of Special Education (K.I.S.E.)

The idea of setting up an institute of special education was conceived way back in 1970 following thorough negotiations between senior education officials of the Kenya Government and Danish advisors and a formal agreement was signed in August 1983 by both parties, stating that KISE would be established. It was then constructed with the assistance of the Danish Agency for International Development (DANIDA) (KISE, 1987).

Legal Notice No. 17 of 14th February 1986 stipulated the aims, objectives and activities of the institute. These are:-

- Training teachers and other personnel work in the field of special education and to cater for all kinds of handicaps.
- Conducting research with an emphasis on special education.
- Providing, producing, maintaining and repairing appropriate special education materials and equipment.
• Functioning as a resource centre for the production and dissemination of information on handicaps to personnel involved in special education and to the general public.
• Offering educational and psychological assessment for children with handicaps and training teachers on these skills.
• Running distant education courses.

In May 1986, the first group of students was admitted and the full range of activities offered at KISE were underway.

By 1987 all the training programmes in special education had been transferred to KISE. The institute now prepares teachers in four major areas of handicap namely physical, mental, visual and hearing besides providing a wide range of exposure to the general field of special education (KISE, 1992).

Until recently, the institute has been the only training institute for special education teachers where 80 trainees are admitted annually. Since KISE offered training upto a diploma level, the need arose to train teachers to a higher level. Due to this disparity Kenyatta University started offering a Bachelor of Education (B.Ed) programme in 1995 for special learners and the first graduates are expected in the field in 1999.

The demand for special education teachers is far too great particularly when compared to the number of children
assessed so far as being in need of special education services which stands at about 50,000 (Kang’ethe 1992).

2.4 Emerging Concern for Special Learners

The emerging concern is whether to have special schools for the handicapped or to integrate these children in regular schools. From the earliest days of formal education, it was assumed that some children were "special" in the sense that they could not benefit from ordinary schooling and so segregated educational establishments were gradually provided. (Stow and Selfe, 1988).

The Special schools have some advantages. Gulliford, (1973) supports this view by noting:-

One of the most important advantages of a special school or class is that it provides an environment in which the child's difficulties are understood, accepted and allowed for, so that the child is less likely to experience the insecurity and sense of strain which would be an additional burden for a child who is already handicapped (Gulliford, 1973:8).

He (Gulliford) further emphasized the need for special schools by noting that:-

Special schools are most obviously required when there is need for special treatment (physiotherapy, nursing, care), special education or modified buildings, established method of teaching (teaching the deaf, braille, special methods for the intellectually handicapped) or the creation of a particular kind of environment for the maladjusted and some kinds of learning disability (Gulliford, 1973:10).
The need for special schools was further supported by Stow and Selfe (1988) who wrote:

Special schools would still be required for some children where integration was impractical (Stow, 1988:35).

Special schools facilitate the concentration of equipment and resources. They also facilitate the economical use of medical, psychological and other specialists, such as speech therapists who can visit them regularly. Despite the observed advantages of special schools, they have come under heated criticism in recent years. Kirk (1979) had noted that:

Even though a special school provides an opportunity for thorough training, certain disadvantages of an institutional setting become apparent - routine, formality, segregation, lack of family life and so forth (Kirk, 1972:12).

Herwett and Forness (1984) concur with Kirk (1972) on the issue of special schools and note that:

The special schools not only segregate the handicapped but also stigmatise them as having needs different from those of ordinary people. (Hewett, 1984:310).

In regard to formative age and integration in society Herwett and Forness pointed out that:

The handicapped person being away from his community during the formative years of his life not only finds himself unable to adjust socially when he finally joins the wide society after school, the society finds it difficult to accept, understand and give him an opportunity to
participate in social economic or political life (Hewett, 1984:314).

In the 1960s and 1970s there was increasing unease about the growth of special education. In particular the fundamental philosophy of establishing segregated provision for certain groups of children was questioned and it was generally believed to be wrong as a matter of principle, to segregate children from their ordinary peers. Hence the integration of handicapped children in regular schools was encouraged. (Forness, 1980)

In Kenya, the Gachathi Report (1976) recommended as follows on the issue of integration:

To follow a policy of integration where the handicapped has been compensated for by special education and facilities (Gachathi, 1976: Recommendation 166).

The notion of integration was further supported by UNESCO (1989) which said that:-

Integration of disabled children in ordinary schools stems from the ideal of equal rights of citizens, with the contention that while disabled children are ordinary citizens with special needs, the delivery of services to meet those needs must take place under the least restrictive of circumstance (UNESCO, 1989:14).

Such a contention does not preclude the role of special schools which must be maintained to cater for complex cases which require specialized treatment through the resources available in such schools.
2.5 Issues Affecting Special Education

2.5.1 Training of Special Education Teachers in Kenya

It has been noted that there is poor staffing and provisions for special schools (Bogonko, 1992). Karugu (1985) has observed that:

Lack of relevant trained manpower has been quite a bane for special education in Kenya (Karugu, 1985:115)

Supporting the view of poor staffing, Abila (1988) stressed the point when she wrote:

One of the major factors which has hindered the progress of special education in Kenya is the shortage of qualified teachers in the field (Abila, 1988:41).

However, Abila (1991), expressing the progress that had been made by the government to solve the problem of poor staffing in primary schools, disclosed that:

"A correspondence course geared at imparting elements of special education to primary school educators with a view of helping the handicapped children in a regular class was introduced in September of the same year (Abila, 1991:43)."

The above findings show that the state of specially trained teachers is poor. Proposing a way to alleviate the problem, the Special Education Draft Policy Paper (1981) recommended the strengthening of the teaching of the special education component with the professional studies syllabus of regular teacher training programmes.
Owing to the fact that most of the physically handicapped children could easily manage in ordinary schools, special education teacher training has not been given emphasis. This may explain why there are only two special secondary schools for the physically handicapped in the Republic of Kenya, namely Joytown secondary in Thika town and Mombasa secondary for the physically handicapped.

By 1985, Kenya had trained a total of 329 teachers for special schools. This was mainly done at regular training colleges such as Siriba, Highridge and Kamwenja, (Kamunge, 1988). By 1987 of the 780 special education teachers, 372 (47.7%) were untrained. Of the trained teachers 230 were for the hearing impaired, 135 for the mentally handicapped and 43 the for physically handicapped. (Bogonko, 1992).

In the Country's effort to improve the training of specialist teachers, the Kenya Institute of Special Education (KISE) started training teachers in May 1986. All other specialist courses that were offered in other colleges were moved to KISE where resources were concentrated. This helped the trainees to undergo a comprehensive course in different areas of handicaps namely mental, visual, hearing and physical handicaps. (KISE publications, 1987).
2.5.2 Teacher's Influence on Students' Expectations

There is a substantial evidence that teachers make a difference in students' achievement, attitude formation and aspirations (Twoli, 1986). The often quoted review of teacher process-product studies by Roshenshine and Furst (1971), which analyzed 42 (mostly correlational) studies identified 11 teacher processes that were strongly and consistently related to student achievement or attitude and aspirations. The five strongest characteristics included clarity, variability, enthusiasm, task orientation and student opportunity to learn.

Teachers interact with boys and girls differently in a process which is mainly directed by the teachers' cognitive expectations (which is an instructional dimension) and normative expectations based on social control dimension, (Twoli 1986). In most social situations, teachers more often disapprove of the behavior of boys than of girls (Williams, 1976). In the environment of learning science, however, teachers have been known to pay more attention to boys than to girls (Smail, 1985; Whyte, 1984). Good, Sikes and Brophy (1973) have demonstrated that the differential disapproval of students on the basis of their sex does not interact with the sex of the teacher. That is both male and female teachers show more disapproval of the behavior of boys than of girls in social context. In the final analysis, girls often "gain" on social issues but "lose out" in academic interactions where
the boys enjoy a lot of approval from teachers. These different interaction patterns, based upon teachers' expectations of students, can in turn not only affect the expectations of students but also their achievement in science (Twoli, 1986).

There is some evidence with regard to the effect of different characteristics of science teachers on the attitudes of their students. For instance, there is a great deal of evidence to suggest that the "competence" of the teacher is the most important factor in students' expectations in their science subjects. "Well-trained teachers" and "effective teaching", have been cited as important factors affecting interest in science (Brandwein, 1951, Kelly, 1989).

2.5.3 Learning Context and Its Implications to the Child's Education

Teachers frequently talk about "classes" rather than "Students" as if their students were quite similar with differences that fall to the wayside when considered as a group. However, each student develops an inseparable part of an ecological system composed of the child, the family, the school, the neighborhood, and the community. By viewing the development of students from the perspective of their inter-relationship with the environment (ecological context) in which they interact, and by accepting each other as unique,
the development of students may be completely understood and appreciated (Allan and Bacon, 1989). The researcher sought to understand the development of the physically handicapped students by looking at their expectations of the learning context of science work.

Using the ecological perspective, the term development means more than increasing complexity through natural growth. In this context, the development is a continual adaptation of the student and environment to each other; individuals progressively learn to accommodate the changing environment in which they live (Allan and Bacon, 1989). Development occurs through "the person's evolving conception of the ecological environment and his relation to it as well as the person's growing capacity to discover, sustain or alter its properties" (Bronfenbrenner, 1979). How does the handicapped student feel about being in a special school? Do the expectations of the students change as they move from one class to another?

In the ecological context, the term congruence describes the "match" or "goodness of fit" between the individual and the environment. Thurman (1977) suggests that individuals whom we judge to be normal are operating in a congruent ecology; the individual's behavior is consistent with the norms of the environment. He maintains that when there is lack of congruence, the individual is viewed as deviant (inconsistent with norms) or incompetent (lacking necessary
behavior). Congruence between the individual and the environment results in maximum competence and acceptance (Allan and Bacon 1989). To maintain congruence in school, students must behave consistently with the teachers' expectations, (Mouhr, 1977).

2.5.4 Sex Difference in Science

To what extent do the expectations and subject area relate to gender among the handicapped students? A number of studies report a pattern in sex differences in science achievement. In the overall achievement, boys do better than girls in sciences (Walberg 1967; Comber and Keeves, 1973; Gadner, 1975; Rawlands 1976; Kelly, 1981; Steinkamp and Maehr, 1983). These studies indicate differential performance in Biological and Physical sciences (Chemistry and Physics) with males greatly out-performing the females in physical sciences. For example, Comber and Keeves, (1973), after their study in nineteen countries, concluded:

...... in general, the boys out-performed the girls in all branches of sciences covered by the tests, the difference was considerably less in Biology than in Physics and practical aspects of the subject with Chemistry occupying an intermediate position (Keeves, 1973: 291).

This agrees with the results of a quantitative analysis by Steinkamp and Maehr (1983) as part of a comprehensive review
of literature on sex differences in effect, ability and science achievement.

Twoli (1986) confirmed this problem for the Kenyan situation by noting a big gap in science achievement between boys and girls. Eshiwani (1982) and Muya (1993) observed that girls are under represented in the sciences. Obura (1991) explains this absence of girls in mathematics and sciences in terms of culture, which inclines girls to "soft" subjects and jobs, poor role models, lack of facilities and the use of textbooks which are "negative" to girls.

The study intended to find out if there is any gender differences in science subjects among the physically handicapped.
CHAPTER THREE
DESIGN AND METHODOLOGY

3.1 The sample

The population of the study comprised all science teachers (physics, chemistry and biology) and the selected students in special secondary schools for the physically handicapped.

The sample specifically consisted of science teachers, form two and from four students in the only two special secondary schools for the physically handicapped learners in the Republic, namely: Joytown in Thika and Mombasa School for the Physically Handicapped. Form twos were selected on the basis of the fact that they have had some learning experience in physics, chemistry and biology and have some exposure, just enough to respond to the basics in the questionnaire, from the time they left primary school where there was only "science" and not physics, chemistry or biology. They were considered the "lowest safe" group to give views on these subjects. The form fours were chosen because they had had a great deal of experience in these subjects as compared to other students. Being at such variant levels allowed comparisons of students' expectations based on experience (represented by the class levels). It was felt
that science teachers were the experts in their area of specialization, and so their expectations could not be ignored since they are the ones who have imparted most of the scientific ideas to their students.

3.2 Sampling Procedure

At the time of conducting the research (1996) there were only two (2) secondary schools in the Republic of Kenya which were offering special education for the physically handicapped. These were: Joytown Secondary School in Thika and Mombasa School for the Physically handicapped in Mombasa town. Hence purposive sampling was used such that both of these schools were used.

All physics, chemistry and biology teachers in the two schools were involved in the study. They were nine (9) in number. All form 2 and 4 students were involved in the research. However after the research, only 74% of the total sample had fully completed the questionnaires. This is the sample that was finally used in data analysis. The Headteachers of the two schools and their respective heads of science departments were interviewed by the researcher.

Table 3.1 gives a summary of the sample used in the study.
### Table 3.1. Sampling Grid

<table>
<thead>
<tr>
<th>INSTITUTION</th>
<th>STUDENTS</th>
<th>TEACHERS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BOYS</td>
<td>GIRLS</td>
<td>SCIENCE TEACHERS</td>
</tr>
<tr>
<td></td>
<td>F2 F4</td>
<td>F2 F4</td>
<td>F2 F4</td>
</tr>
<tr>
<td>1</td>
<td>8 8 7 7</td>
<td>5 1 36</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>15 15 0 0</td>
<td>4 1 35</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>23 23 7 7</td>
<td>9 2 71</td>
<td></td>
</tr>
</tbody>
</table>

#### 3.3 Research Instruments

Considering the nature of the problem, the instruments used were questionnaires and interviews.

#### 3.3.1 Questionnaires

According to Kindred (1976), the use of a questionnaire in measuring public opinion, either from the school's personnel or the community members' side, is one of the most appropriate methods. It also has the advantage of collecting information from many respondents within a limited time and the respondents are free to offer information because they are assured of their anonymity.

The questionnaires, (Appendix A and B) with a five point Likert scale, were administered to both students and their teachers so that their views could be compared. The only difference between the students' and teachers' questionnaire was in Section I where personal and general information was sought.
The questionnaire covered the students' and teachers' views on science content, learning context, role of the pupil in learning sciences, role of the teacher in teaching science and both teachers' and students' image of a scientist.

3.3.2 Interviews

An interview helps the investigator to understand and learn about educational problems and practices, and each individual's attitude towards education (Osten, 1955). An interview can produce in-depth data not possible with the questionnaire, and the reasons for a particular response can be determined (Gay, 1976). By the use of the interview, the same result can be achieved by talking to a small, representative group of people in the school than by surveying a large group by questionnaire (Kindred, et.al, 1976).

In the study, the structured interview schedule had written guidelines that indicated what questions were to be answered and in what order and what additional prompting or probing questions were required (see Appendices C and D).

The interview for the headteacher focused on:-

- General information about the headteacher and the school.
- Teachers' expectations about sciences.
- Students' participation in science clubs and science congress.
Students' attitude towards laboratory work.
Problems that arise while working with science teachers.

The interview with the head of science department focused on:-
Basic information about the interviewee.
Problems encountered in teaching sciences.
General trends of students' performance in sciences in the last four years.
Opportunities provided by the school to learn sciences.

3.4 Piloting

An intermediate class (Form 3) in one of the secondary schools for the physically handicapped was selected for piloting. Since there were only two such schools, it was felt that there was need to use both of them in the study. To avoid pre-emptying the information before the actual research was done, an intermediate class was therefore chosen for piloting purposes hence leaving the two schools intact for the actual data collection. All the students (22) in form 3 were involved. The main objectives of piloting were:-
(a) to check the suitability and level of language
(b) to test the reliability of the instruments
(c) to gain basic administrative experience in conducting the research in preparation for the large group survey.
In piloting, the students responded to all the questions. The time taken was between 30 to 40 minutes. The teachers helped in clarifying some of the responses which helped in removing ambiguity and hence the validity of items was ensured. This was fed into the final instrument.

After piloting the results were analyzed and the reliability coefficient was calculated using the Spearman Brown formula

\[
\alpha = \frac{2r}{1 + r}
\]

where \(\alpha\) = reliability coefficient

\(r\) = actual correlation between halves of instrument

Where 'r' was calculated using the pearson product moment formula

\[
r = \frac{\sum xy}{\sqrt{(\sum x^2)(\sum y^2)}}
\]

where

\[x = X - \bar{X}\]
\[y = Y - \bar{Y}\]

where X stood for boys' score and Y stood for girls' score, and \(\bar{X}\) and \(\bar{Y}\) were their respective means.
The reliability coefficient of 0.88 was felt to be good enough.

3.5 Administrative Procedure

The researcher paid a visit to each school and arranged with the administrators (headteachers) and their deputies when it would be most appropriate to administer the questionnaires to the students and also the time for interviews. In both schools the headteachers asked for the permit and other details but none refused the researcher the opportunity to conduct the research.

The headteachers in both schools suggested after classes as the best time to conduct the interview. The researcher was assisted by the deputy headteacher in the administration of questionnaires. The presence of the teacher might have reduced the Hawthorne effect. In both cases, these teachers were not science teachers. It was felt that the presence of a science teacher would affect the students' responses.

The teacher started by introducing the researcher briefly (to reduce the impressionistic factor). The researcher then explained to the students the purpose of the study and then administered the questionnaires. In all cases, there was an attempt to make students relaxed by giving them an example on how to complete the questionnaire. On completion, the
researcher thanked the students and the teacher for their help.

The teachers were left with the questionnaires which were collected at agreed dates. Some teachers had to be reminded but in both cases all teachers except one responded on time.

3.6 Data Analysis

As mentioned earlier, this study dealt with the identification of the present situation of the handicapped students and their teachers in science subjects in special secondary schools. Hence, being a descriptive study, the existing expectations were reported in raw form.

One of the commonly used methods in reporting descriptive surveys is the use of frequency distribution, calculating the percentages in whole numbers and then tabulating them appropriately (Gay, 1976). The answers given by both students and their teachers were tallied showing the number of Form 2s and form 4s, boys and girls, trained and untrained teachers who either agreed, were not sure or who disagreed with the given statements. Coding and decoding was done and then their mean (averages) were calculated according to the Likert Scale to show the strength of agreement where a score of three (3) stood for not sure, \( 3 < x \leq 5 \) showed the strength of agreement and \( 1 \leq x < 3 \) indicated the strength of disagreement.
The expectations of different groups were compared using the Chi-square formula.

\[ \chi^2 = \sum \frac{(f_o - f_e)^2}{f_e} \]

Where \( f_o \) stands for the observed frequencies and \( f_e \) stands for the expected frequencies.

The outcome of each \( \chi^2 \) test was discussed.
4.0 Introduction

The Chapter analyses and discusses the handicapped students' and their teachers' expectations of science subjects on the following aspects: role of students in the learning of sciences; role of the teacher in teaching sciences; the content and context of sciences; their image of a scientist; teachers' academic and professional qualifications and gender differences in science subject areas.

This chapter is divided into seven sections, each focussing on one aspect of science subjects. Section 4.1 focusses on what the students and teachers expect the learning context or environment to be; Section 4.2 focuses on who should learn sciences; Section 4.3 discusses the importance of sciences; Section 4.4 discusses students' and teachers' expectations on their roles in the learning and teaching of sciences; Section 4.5 focusses on the students' and teachers' expectations of a scientist; Section 4.6 focusses on the teachers' academic and professional qualifications while section 4.7 discusses emerging points of concern as discussed by the headteachers and heads of science departments.
In all sections, the analysis will be in two areas. The first is on the level of the students' and teachers' expectations as measured on a five (5) point Likert scale. In this section the means of various groups were compared using the mean score where the highest score is five (5) for 'strongly agree', the least score is one (1) for 'strongly disagree' while three (3) stands for 'not sure'. Anything above three (3) will stand for 'agree' and any score below three (3) stands for 'disagree'. The second aspect involved comparing the expectations of the two groups (boys and girls) and male and female teachers at different levels and this was done using the chi-square technique. A summary of each section was done by use of a histogram.

4.1 Expectations on the Learning Context of Sciences

This section analyses and discusses the students' and teachers' expectations of the learning context.

Table 4.1 gives a summary of the student and teachers expectations of the learning context of the sciences.
Table 4.1 Students' and Teachers' Expectations of Science Learning Context

<table>
<thead>
<tr>
<th>Area of Preference</th>
<th>FORM 2</th>
<th>FORM 4</th>
<th>TEACHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys (X)</td>
<td>Girls (Y)</td>
<td>X²</td>
</tr>
<tr>
<td>a. Classroom</td>
<td>4.10</td>
<td>3.154</td>
<td>2.143</td>
</tr>
<tr>
<td>b. Laboratory</td>
<td>4.90</td>
<td>3.308</td>
<td>0.000</td>
</tr>
<tr>
<td>c. Field</td>
<td>2.90</td>
<td>3.462</td>
<td>5.083</td>
</tr>
<tr>
<td>d. Home</td>
<td>3.20</td>
<td>3.154</td>
<td>4.083</td>
</tr>
<tr>
<td>e. Office</td>
<td>3.40</td>
<td>2.923</td>
<td>0.000</td>
</tr>
<tr>
<td>f. Special School</td>
<td>4.9</td>
<td>4.00</td>
<td>0.417</td>
</tr>
<tr>
<td>g. Ordinary School</td>
<td>2.33</td>
<td>3.154</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>N = 30</td>
<td>N = 30</td>
<td>N = 9</td>
</tr>
</tbody>
</table>

CV = 5.991; p = 0.05 where X and Y refers to mean score.

Where CV refers to Critical Value

In all cases, the value of the $X^2$ calculated (see table 4.1) was less than the critical value of $X^2 = 5.99$ at .05 level of confidence at 2 degrees of freedom. This implies that the expectations of both girls and boys in terms of learning context is not statistically significant at both levels.
It was found out that on average for boys in Form 2, the order of preference of the learning context was laboratory \((x = 4.90)\), classroom \((x = 4.100)\), office \((x = 3.40)\), home \((x = 3.20)\) and finally field \((x = 2.90)\) (Table 4.1.). This shows that their preference was the laboratory and this is in line with the expectations of other students in regular schools (Allan and Bacon, 1989). They also agreed that sciences should not be done in the field \((x = 2.90)\). From the interview conducted with the headteachers and the heads of science department, it was noted that lack of finances led to situations whereby field trips were rarely undertaken. Since these students are physically handicapped they would consider it a burden going to the field and therefore prefer localised activities in the laboratories. A study carried out by Karanja (1994) in Kenya showed that the handicapped students have low self concept and this might explain why they shy off from field work which is challenging to them.

However, the trend was different for form 4 boys where their preference was laboratory \((x = 4.833)\), classroom \((x = 3.667)\) and field \((x = 3.667)\), office \((x = 3.33)\) and home \((x = 2.167)\). It can therefore be noted that the handicapped students prefer to be taught sciences in the laboratory. This was further confirmed by the analysis of the role of students as discussed in section 4.40 where the most preferred skill was experimenting which is best done in the laboratories.
Fig: 4.1. Students’ Expectation on Learning Context

KEY:
Spec Sch = Special School
Ord = Ordinary

[Bar chart showing students' expectations in various learning contexts]
From Fig. 4.1, it becomes clear that the most preferred place to learn sciences is the laboratory. This implies that though they are handicapped in one way or another, they compare themselves very well with other students in regular schools. This is encouraging. Though these students are physically handicapped, they expect to handle the apparatus albeit with difficulties.

4.1.2 Teachers' Expectations on Learning Context

The male teachers preference for learning context was laboratory \((x = 5.00)\), field \((x = 4.00)\), office \((x = 1.750)\) while that of female teachers was laboratory \((y = 4.750)\), field \((y = 3.750)\), classroom \((y = 3.25)\), home and office \((y = 1.000)\) in both cases.

Teachers preferred to teach sciences in the laboratory. This is encouraging since science learnt best in the laboratory if the goals of teaching sciences are to be achieved (Baez, 1986). It is in the laboratory that all the process skills can be incorporated.

Surprisingly, teachers gave preference to the field after the laboratory and, not the classroom as in the case of students. This might explain why their mode of preference in teaching method is practicals which is best done in the laboratory followed by discussions which could be done in the field where applicable. It is in the field where students go to
see science in real life or in its natural setting. None of the teachers preferred the use of demonstrations though field work was preferred. Some teachers complained that students had little exposure to real life situations. This explains why field work was preferable, though not practised due to lack of resources i.e. lack of finances and means of transport. Hence teachers should be sensitized on the fact that field work does not necessarily mean taking a long trip outside the classroom environment and that the surrounding area could also make a field area where naturalistic observation could be made.

Fig. 4.2 gives a summary of the teachers expectations on the learning context.
Fig: 4.2. Teachers' Expectation on Learning Context

KEY:
spec Sch = Special School
Ord = Ordinary
Teachers see the laboratory as the most suitable environment for teaching science. Given that teachers in other schools indicate the same, then the preference might have little to do with physical conditions of the learners but the context in which it is taught. They also indicated that the physically handicapped students are more suited being in special schools than in ordinary schools. This is because in special schools, the students' difficulties are understood, accepted and allowed for (Gulliford, 1973).

### 4.2.0 Expectations of who should learn sciences

This section analyses and discusses the students' and teachers' expectations on who should learn sciences. A summary of the analyses is presented in table 4.2 below.

<table>
<thead>
<tr>
<th>Form 2</th>
<th>Form 4</th>
<th>Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Boys</strong></td>
<td><strong>Girls</strong></td>
<td><strong>$X^2$</strong></td>
</tr>
<tr>
<td>(X)</td>
<td>(Y)</td>
<td></td>
</tr>
<tr>
<td>a. Boysonly</td>
<td>1.520</td>
<td>1.300</td>
</tr>
<tr>
<td>b. Girsonly</td>
<td>1.300</td>
<td>1.300</td>
</tr>
<tr>
<td>c. Both Girls &amp; Boys</td>
<td>4.500</td>
<td>4.650</td>
</tr>
<tr>
<td>d. Avrg. Students only</td>
<td>2.650</td>
<td>2.538</td>
</tr>
<tr>
<td>e. Non-handicapped students only</td>
<td>1.000</td>
<td>1.000</td>
</tr>
</tbody>
</table>

\[ CV = 5.991. \]
4.2.1 Students' Expectations

When asked whether science should be learnt by both boys and girls, the results indicated strong agreement that sciences should be done by both boys and girls where $x_2 = 4.500$, $y_2 = 4.650$, $x_4 = 4.350$ and $y_4 = 5.000$ for form 2 boys, form 2 girls, form 4 boys and 4 girls respectively. This implies that both boys and girls should be treated equally by the teachers when learning sciences.

The calculated value of $X^2$ for both girls and boys was 0.000 for form 2s and 2.325 for form 4s. This is very low compared to the critical value of 5.991 at 2 degrees freedom at .05 confidence level meaning that the difference in expectations of both boys and girls at the two levels (form 2 and 4) are not statistically significant.

In all cases the mean value was less than three (3) when the students were asked whether sciences were to be learnt by handicapped students only. This implies that both boys and girls expect that sciences should be learnt by all students, irrespective of being handicapped or not.

When asked if science is meant to be learnt by above average ability students, only, all the answers given had a score of less than three (3) (Table 4.2). This shows attachment to the value of sciences i.e. that even if one may be considered as being below average, one should still learn sciences either for general awareness or for future application in daily life. This was further confirmed by the
analysis of the importance of sciences as discussed in section 4.3.

Fig. 4.3 gives a summary of the Students' View of who should learn the Sciences.
Fig. 4.3: Students' view of Who should learn sciences

KEY:
G = Girls; B = Boys; Avg = Average.
N-Han Stu = Non handicapped students
From Fig. 4.3, it becomes clear that handicapped students, expect sciences to be learnt by both boys and girls. This agrees with the expectations of Unesco who urge sciences to be taught to all for the purpose of general awareness and for problem solving.

4.2.2 Teachers Expectations

Their calculated value of $X^2$ was 1.000 which was below the critical value of 5.991 at .05 level of confidence and at 2 degrees of freedom. Good, Sykes and Brophy (1973) demonstrated that the differential disapproval of students on the bases of their sex does not depend on the sex of the teacher. This seems to be the trend even in special school. Hence teachers influence on the students' expectations in special schools is the same as in regular schools.

The teachers' expectations were the same as those of the students as exemplified by Table 4.2. However, the teachers' views were that only those above average students should be encouraged to take sciences. Teachers normally value their achievement by the students' performance in examinations (Good, 1973). This implies that they get discouraged when they get poor results continuously.

Both male and female teachers expect that sciences should not be for handicapped students only. Their mean was only 1.00. This could be explained by the general trend globally that as we move into the 21st Century, we are becoming
technologically oriented (Woolnough, 1985) and so there is need for all to be scientifically literate.

Fig. 4.4 summarises the teachers' view of who should learn the Sciences.
Fig. 4.4 Teachers' view of who should do Sciences

KEY:
- G = Girls
- B = Boys
- Avg = Average
- N-Han Stu = Non-handicapped Student
Teachers expect sciences to be learnt by both boys and girls, though they have high preference for above average students. This might be because the performance of the teachers is measured by what the students achieve in the examination and so most teachers will prefer students who will perform well in the examination and thereby boost their morale and status.

4.3 Expectations on the Importance of Science

This section analyses and discusses the importance of science to handicapped students and their teachers. A summary of the analysis is presented in table 4.3 below.

Table 4.3 Importance of Learning Science

<table>
<thead>
<tr>
<th></th>
<th>FORM 2</th>
<th></th>
<th>FORM 4</th>
<th></th>
<th>TEACHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>$X^2$</td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>b. Problem Solving</td>
<td>3.484</td>
<td>2.692</td>
<td>6.958</td>
<td>3.615</td>
<td>4.556</td>
</tr>
<tr>
<td>c. General Awareness</td>
<td>4.184</td>
<td>3.154</td>
<td>0.000</td>
<td>4.250</td>
<td>4.667</td>
</tr>
<tr>
<td>d. For Examinations</td>
<td>3.165</td>
<td>2.308</td>
<td>6.466</td>
<td>2.434</td>
<td>2.000</td>
</tr>
<tr>
<td></td>
<td>$N = 30$</td>
<td>$N = 30$</td>
<td>$N = 9$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$CV = 5.991$
Fig. 4.5 Students' preference in career choice

KEY:
Doc = Doctor; Eng. = Engineer
Cputer Anal = Computer analyst
Tchr. = Teacher; Mus = Music
Sec = Secretary; Ling = Linguistic
The best four (4) preferred career choices for boys are Computer Analyst, Lawyer, Engineer and Doctor in that order. Three of these need a scientific background. The career choices for girls are Secretarial work, Teaching, Doctor and Lawyer in that order of preference (Fig. 4.5) indicating that only one of these career choices (Doctor) requires a scientific background. This may imply that in special schools, boys have more preference for scientific careers than girls.

Teachers' Expectations

Teachers also expect sciences to be taught for career purposes, their mean being 4.000 and 4.250 for male and female teachers respectively. The calculated value of $X^2$ is 1.500 and this implies that both male and female teachers have almost the same expectations. This is encouraging since they are likely to advise the students in career matters accordingly in view of the substantial evidence that teachers make a difference in students' achievement, attitude formation and aspirations (Twoli, 1986).

4.3.2 Problem Solving

There was general agreement between both boys and girls that science is for problem solving. The only exception was form 2 girls whose mean score was 2.692 showing a disagreement. The calculated value of $X^2$ was 6.958 for form 2s at .05 level of confidence. This was statistically
significant when compared to critical value of 5.93. It therefore means that both boys and girls value the importance of science differently at low stages of their secondary life. This could be explained since it is known that informally boys have more exposure to science related experiences than girls at early stages (Twoli, 1986). Since boys are more "outgoing", then they are in a position to appreciate the role of science more than girls.

It is also known that teachers interact with boys and girls differently in a process which is mainly directed by the teachers' cognitive expectations (which is an instructional dimension) and normative expectations based on social control, (Twoli, 1986). In the environment of learning science, however, teachers have been known to pay more attention to boys than girls (Small, 1985; Whyte, 1984). Good, Sikes and Brophy, (1985) have demonstrated that the differential disapproval of students on the basis of their sex do not interact with the sex of the teacher. That is, both male and female teachers show more disapproval of the behaviors of boys than of girls in social contexts. In the final analysis, girls often "gain" on social issues, but "lose out" in academic interactions where the boys enjoy a lot of approval from the teachers. This seems to be the trend in special schools.

With more exposure of science subjects, girls start appreciating the importance of science just as much as the boys. Hence there is general agreement between boys and girls
in form 4 that science is for general awareness. Their means are 4.500 and 4.566 for boys and girls respectively.

Teachers' Expectations

Both male and female teachers had high expectations that science should be for problem solving, their mean being 4.500 in both cases. Hence, it is expected that this positive aspect is likely to be reflected in their teaching method, putting more emphasis on the application aspect. Both male and female teachers' expectations were not statistically significant, the calculated $X^2$ being 0.000 at .05 level of confidence.

4.3.3 General Awareness

The calculated value/mean for form 2 boys, form 2 girls, form 4 boys and girls were 4.100, 3.140, 4.250 and 4.667 respectively. This shows that in all cases the students expect to learn science for general awareness purposes. In both cases, the calculated value of $X^2$ was less than the critical value i.e. it was 0.000 for both form 2s and form 4s, showing that there is no significant difference in the expectations of form 2 and form 4s.

From table 3.2, the means for teachers' expectations were 4.600 and 4.000 for male and female teachers respectively. This implies that teachers take the teaching of science seriously even when they feel that students are not likely to take science-related careers. It was therefore not surprising
that most teachers preferred to use practicals when teaching sciences. This is encouraging especially if teachers can transfer those expectations to their students. Woolnough and Alsopp (1985) support this by suggesting that seeing science subjects in real life helps in demystification of science.

However, some questions arise; why is it that most teachers feel that students have negative attitudes towards science? If both students and teachers expect the use of learning the sciences to be general awareness, why are the teachers not putting more emphasis on relevant approaches like field work? Are the teachers aware that their expectations greatly affect their students' expectations?

4.3.4 Students' and Teachers' Expectations on the role of Examinations

Assessment occupies a big portion of the students' and the teachers' time in school. What feelings do the physically handicapped students and their teachers have towards examinations and the way they are done particularly with reference to science subjects? Do the class levels and gender affect the expectations students have on examinations? The data analysis and interpretation below sends more light on this.

Expectations of Students

From Table 4.3, the mean score for form 2 boys, form 2 girls, form 4 boys and girls were 3.165, 2.308, 2.434 and
2,000 respectively. Apart from form 2 boys, all the other students don't expect sciences to be taught for examination purposes. Why is it that most students do not expect to learn sciences for examinations purposes?

Most of these students are physically handicapped and so unable to take/handle the apparatus. Yet they are expected to pass in practicals in order to get at least a credit in the final examination, the Kenya Certificate of Secondary Examination (KCSE). This expectation could have killed their morale. Another reason behind the low score could be the importance examinations hold in people's lives (Salton and Hayson, 1974; Kempa, 1985). Examinations are used for selection into institutions of higher education, employment and professions. Most people therefore see examinations as a necessary evil, hence the low expectations shown by the students that were surveyed. Many know that the positions they will hold in life, (high or low) will depend on their performance in examinations.

Fig. 4.6 below gives a summary of the students' expectations on the importance of Learning the Sciences.
Fig 4.6 Students' expectations on the importance of Sciences

KEY:
Prob = Problem
Gen = General
Exam = Examination
From Fig. 4.6, it can be noted that order of preference of the importance of learning sciences are; first for general awareness, secondly for problem solving, then for career and finally for examination. Few students expect to take sciences for examination purposes.

Teachers' Expectations

Teachers also have very low expectations in examinations, their mean being 1.000 and 2.000 for male and female teachers respectively (Table 4.3). This low expectation is likely to affect not only their teaching methods but also their influence on the students' expectations. Once pupils enter secondary school, they might find the teaching of sciences "dry" and boring. Hence the need to demystify the terms used by the teachers (Embeywa, 1992).

Teachers had the same expectations as those of the students, where their preference was science for general awareness, for problem solving and for the career, but few of them expect sciences to be taught for examination purposes (Fig. 4.7).

4.4.0. Teachers' and Students' Expectations on Their Role in the Teaching and Learning of Sciences

This section discusses the students' and teachers' expectations of their role when learning and teaching the sciences. The first section analyses the process skills while
the second section analyses other roles played by science teachers.

Fig. 4.8 gives a summary of the students' and teachers' preference in the roles that should be undertaken by the students.
Fig 4.7 Teachers' expectations on the importance of Sciences

![Bar chart showing teachers' expectations on the importance of Sciences for different categories: Career, Prob solving, Gen Awareness, Exam. The chart compares male and female scores.]

**KEY:**
- **Male**
- **Female**

- **Prob =** Problem
- **Gen =** General
- **Exam =** Examination
Fig 4.8 Preference in the role of students

KEY:
Disc. = Discussing; Plan = Planning.
Info. = Informing.; Reco = Recording.
Apply = Applying; Eval = Evaluating.
Class = Classifying; Infer = Inferring.
Exper = Experimenting; Obser = Observing.
Hypo = Hypothesizing; Inter = Interpreting.
Inve = Investigating Pred = Predicting;
From the histogram (Fig. 4.8), the most commonly used practical skills are experimenting, followed by observation, then questioning and then discussing. It is only these four skills that scored above 50% while all others scored less than 50%. It was also noted that this was the trend for teachers. The teachers chose the common conventional skills that they are used to. Not employing other skills might be an indication of the lack of awareness of these skills. If this is the case, then it calls for in-servicing of teachers to aid them keep abreast with modern terms and approaches.

Table 4.4. Scores in Process Skills

<table>
<thead>
<tr>
<th>SKILLS</th>
<th>FORM 2</th>
<th>FORM 4</th>
<th>TEACHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>b. Recording</td>
<td>4.250</td>
<td>4.769</td>
<td>3.970</td>
</tr>
<tr>
<td>d. Informing</td>
<td>4.400</td>
<td>3.385</td>
<td>3.540</td>
</tr>
<tr>
<td>e. Applying</td>
<td>3.850</td>
<td>3.538</td>
<td>3.333</td>
</tr>
<tr>
<td>h. Experimenting</td>
<td>4.767</td>
<td>3.692</td>
<td>4.600</td>
</tr>
<tr>
<td>i. Hypothesizing</td>
<td>1.738</td>
<td>1.846</td>
<td>2.734</td>
</tr>
<tr>
<td>j. Inferring</td>
<td>4.134</td>
<td>4.385</td>
<td>4.530</td>
</tr>
<tr>
<td>m. Observing</td>
<td>4.488</td>
<td>4.769</td>
<td>4.300</td>
</tr>
<tr>
<td>n. Predicting</td>
<td>3.750</td>
<td>3.615</td>
<td>3.350</td>
</tr>
</tbody>
</table>

From table 4.4, it was found that both students and teachers expect all the aspects of the process skills to be
emphasized. The only exception was in hypothesizing whose score was below three (3) for all categories. This could be explained by the fact that students expect the teachers to know what is to be taught. At the same time, teachers follow the syllabus which is already prepared for them. Hence the notion that teachers should strictly teach what is already recommended for them, and so it is not their concern to come up with new knowledge. This leads to rote learning which has dominated the traditional science. However, there is need for the active participation of the learner in the acquisition of knowledge, which is the process-based science learning (Wellington, 1989).

This trend of objectives or topic based learning has led to the students' increasing apathy to science. Hence students see sciences as uninteresting, unmotivating and inspiring (Jevons, 1969). Those students judged as knowing by the examination can do little in the application of knowledge (Wellington, 1989).

From the findings, it appears that teachers might not be aware that the trend of teaching sciences is shifting from the traditional approach to process-based learning where the learners' participation in the acquisition of knowledge and skills is paramount. Might the approach to teaching have a bearing on little creativity as exemplified by students' performance in science congresses? Has the Ministry of Education done anything to explain to the science teachers that there is shift in the method of teaching sciences? How
are the teacher training colleges and the universities preparing teachers to handle these changes? These questions need to be addressed if the learning of the sciences among the physically handicapped is to be improved.

4.4.3. Role of the Teachers in Science Teaching

This section analyses and discusses the roles that the teacher is expected to play in the process of the learning and teaching of the sciences subjects.

<table>
<thead>
<tr>
<th>Table 4.5: Role of the Teachers in Science Teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORM 2</td>
</tr>
<tr>
<td>Boys</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>a. Give books/apparatus</td>
</tr>
<tr>
<td>b. Demonstrate an expt</td>
</tr>
<tr>
<td>c. Give details of books</td>
</tr>
<tr>
<td>e. Marking assignments</td>
</tr>
<tr>
<td>f. Help in homework</td>
</tr>
<tr>
<td>N = 30</td>
</tr>
</tbody>
</table>

CV = 5.991

Both boys and girls at the two levels were emphatic on the idea of teachers' giving out books and apparatus, demonstrating experiments, giving details of which books to be read, allowing students to study on their own and marking students' books. They also agreed that teachers should not help students in their homework. This trend is the same as that in regular schools (Allan and Bacon, 1979) and so the physically handicapped student should
not be treated as special when it comes to the learning of science. What should be emphasized is the time required to do the same job due to the degree of handicap but patience and understanding on the part of the teacher should be encouraged.

The teachers had the same expectations as those of the students (Table 4.5). They all agreed that teachers should not help students in doing their homework. In all cases the expectations of male teachers were the same as those of female teachers, the calculated value of $X^2$ being less than the critical value of 5.991 at .05 level of confidence, 2 degrees of freedom.

A summary of students expectations on the role of the teachers is given in Figure 4.9.

From Fig. 4.9. students expect the roles of the teachers to be; to demonstrate experiments, to provide details of which book to be read, to provide books and apparatus; to allow students to undertake personal study and also to mark the students' assignments. Very few students thought that the teachers should help them undertake their homework. From these findings, it seems that the use of the laboratory is still preferred, since experimentation scored the highest (Fig. 4.9). Hence more emphasis should be put on laboratory work in the teaching of the sciences in special schools.

Summary on the Role of the Teachers

Fig. 5.0. Summarises the roles of the male teacher as: demonstration of experiments, provision of resources, allowing students to undertake personal study, marking assignments and giving details of which book to be read. Very few teachers expect to help their students in doing homework. From these findings, teachers need to be sensitized on their expected roles so that the expectations of students and teachers do not vary (see section 1.6). The order for female teachers were; giving apparatus and books, demostrating experiments, giving detail of books to be studied, allowing personal study and marking assignment. They had very low expectations of helping students in their homework.
Fig 4.9 Students' expectations on the role of the teachers

KEY:
apt/bkts = Apparatus/Books
Demon Exper = Demonstrate experiment
bk dts = Book details; pers = personal
Mark Assign = Marking assignment
hwk = homework

Boys Girls
Fig 5.0 Teachers' expectations on their roles

![Bar chart showing teachers' expectations on their roles.](image)

**KEY:**
- **apt/bkts** = Apparatus/Books
- **Demon Exper** = Demonstrate experiment
- **bk dtls** = Book details; pers = personal
- **Mark Assign** = Marking assignment
- **hmwk** = homework

This graph illustrates the percentage of teachers who expect to perform various roles in their teaching. The roles are categorized by gender (Male and Female). The chart shows a comparison of the expectations across different roles, highlighting differences in the expectations of male and female teachers.
4.5 Teachers' and Students' Image of a Scientist

This section discusses and analyses the students' and teachers' image of a scientist and its implication to the learning of the sciences. A summary of the same is given in Table 4.6 below.

Table 4.6: Students and Teachers Image of a Scientist.

<table>
<thead>
<tr>
<th>FORM 2</th>
<th>FORM 4</th>
<th>TEACHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>a. Magician</td>
<td>1.700</td>
<td>1.538</td>
</tr>
<tr>
<td>b. Problem Solver</td>
<td>3.365</td>
<td>3.231</td>
</tr>
<tr>
<td>c. Problem Identifier</td>
<td>3.950</td>
<td>3.462</td>
</tr>
<tr>
<td>d. Problem Hooter</td>
<td>2.650</td>
<td>2.615</td>
</tr>
<tr>
<td>e. Leader of Society</td>
<td>2.715</td>
<td>2.200</td>
</tr>
<tr>
<td>f. Peace Maker</td>
<td>2.600</td>
<td>2.538</td>
</tr>
<tr>
<td>d. Destructive Agent</td>
<td>2.985</td>
<td>2.538</td>
</tr>
</tbody>
</table>

N = 30   N = 30   N = 9

4.5.1 A Scientist as a Magician

In all cases, the calculated value of $X^2$ was less than the critical value of 5.991 at .05 level of confidence, indicating that the expectations of boys and girls, male and female are not statistically significant.

All students and teachers had a very low mean which was less than two (2). This implies that they do not view a scientist as a magician, meaning that whatever a scientist does can be verified and understood. This could be explained by the fact that most of what the students learn is verified by practicals and some promulgated theories, which have been proved to be true. This helps the students and teachers to appreciate what has been done by the scientists, hence fulfilling some goals of teaching science (as
discussed in section 2.1). This implies that the traditional image of a scientist as a trickster or cheat does not exist among the handicapped students and their teachers and they are therefore able to acknowledge the advances made in the technological world by the scientists.

4.5.2 A Scientist as a Problem Solver

In all cases, both the students (boys and girls) and teachers "view" a scientist as a problem solver. Their scores in all cases were above three (3). This is understandable considering the teaching of science which emphasizes the application of knowledge. At the end of every topic in all sciences, some questions requiring problem solving techniques are given and some project work is suggested. This helps the learners to apply the knowledge acquired to solve problems in a real life situation.

4.5.3 A Scientist as a Problem Identifier

All the scores of students and teachers were above 3.000 implying that they "view" a scientist as a problem identifier. This implies that teachers explain the philosophy and history of science and its contribution to the development of the modern world, hence achieving one of the goals of teaching science (Baez, 1976). This ontological unification of the principles of science needs to be encouraged. Teachers should be encouraged to influence their students positively so that they may start seeing themselves as up-coming scientists. The students should be encouraged in problem identification and to participate in solving them. This could be achieved through debates, field trips and excursions, olympics and
olympiads, problem solving activities and the encouragement of naturalistic observation.

4.5.4 A Scientist as a Problem Shooter

Apart from form 4 boys who scored 3.383 all others scored below three (3.00) (see table 4.6). This implies that they do not perceive a scientist as a problem shooter. This is understandable; teachers know so much of the accomplishments of scientists that they "forget" their negative aspects. Infact all the topics in the sciences put more emphasis on the achievements of scientists than on their failures. Again, teachers in secondary schools specialize in only two teaching subjects, mostly their favourites. This may explain why teachers might not have time to reflect on the negative aspects of the scientists they already "know".

Form 4 boys indicated that to some extent a scientist is a problem shooter. Boys are known to be "outgoing" and they like exploring more. Infact they participate more in science congress than girls (Agufana, 1995). As the boys delve deeper into the history of scientific discoveries, they might have come across some negative contributions of scientists. It is in Form 4, for example, where topics like the atomic bomb and nuclear reactors are taught in Physics. Other topics like environmental degradation are taught in biology at the same level. Hence form 4 boys are likely to have taken keen interest and noted some of these problems.

Why is it that none of the teachers "see" a scientist as a problem shooter? Is it that they are too much pre-occupied in covering the syllabus that they fail to critically evaluate what
they teach or is it self defence? More role models are required in the society so as to boost the morale of the physically handicapped.

4.5.5 A Scientist as a Leader of Society

Again the scores of form 2 boys and girls and form 4 girls were less than three (3), their scores being 2.715, 2.200 and 2.889 respectively. Form 4 boys scored 3.165 indicating a weak agreement that scientists could lead the society. Why is it that most students do not see a scientist as a leader of the society? Could it be due to lack of role models of scientists not always becoming leaders (eg. President) or is it due to the lack of exposure to real life situations as some teachers contend?

4.5.6 A Scientist as a Peace Maker

Again the score in all cases was less than 3.000 implying that both students and their teachers do not see a scientist as a peace maker. This could be explained by the fact that through the media, people are becoming increasingly aware of the side effects of most achievements in science. As they watch the programmes and news on television, video and film, such episodes like the war in Bosnia, the Gulf War, accidents that kill people daily, etc as a result of scientists' achievements, then their misgivings about a scientist as a peace maker could be understood.

4.5.7 A Scientist as a Destructive Agent

In all cases, the scores were less than 3.00 (see table 4.6) implying that though both students and teachers do not perceive a scientist as a peace maker, they don't "see" him as a destructive
agent. This implies that they are able to appreciate the many achievements that scientists have made throughout the course of history. This view is supported by the fact that all of them (students and teachers) see a scientist as a problem solver.

In all cases the calculated value of $X^2$ was less than the critical value of 5.991 implying that the views held by both boys and girls, male and female teachers are not statistically significant.

Fig. 5.1 gives a summary of the students' image of a scientist.
Fig 5.1 Students' image of a scientist

KEY:
Magic = Magician; Prob sol = Problem solver
Prob ident = Problem identifier
Prob sht = Problem Shooter
sty = society; Pc mk = Peace maker
Destr = Destructive;
From fig. 5.1., it becomes clear that handicapped students have a positive image of a scientist where he/she is seen as a problem identifier, Problem Solver and Leader of Society. This positive image is likely to enhance their learning of the sciences and so motivate them to learn the sciences with the intention of becoming future scientists. However, they still had some misgivings about scientists where they were seen as problem shooters. This conflicting image of a scientist as being helpful and at the same time harmful is likely to affect their learning behaviour negatively.

Fig. 5.2 gives a summary of teachers' image of a scientist.
Fig 5.2 Teachers' image of a scientist

<table>
<thead>
<tr>
<th>Magic</th>
<th>Prob sol</th>
<th>Prob ident</th>
<th>Prob shr</th>
<th>Leader of sty</th>
<th>Pc mk</th>
<th>Destr Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Female</td>
<td>Male Female</td>
<td>Male Female</td>
<td>Male Female</td>
<td>Male Female</td>
<td>Male Female</td>
</tr>
</tbody>
</table>

KEY:
- Magic = Magician
- Prob sol = Problem solver
- Prob ident = Problem identifier
- Prob shr = Problem Shooter
- sty = society
- Pc mk = Peace maker
- Destr = Destructive
From Fig. 5.2., teachers view a scientist as a problem solver, leader of society and problem identifier. It is expected that the positive image of a scientist as held by the teachers will help them to influence the students accordingly (Rosenshine and Furst, 1971). There is evidence that the expectations of the teachers affect not only the expectations of the students but also the students' performance (Twoli; 1986). This seems to be the trend in special schools since the teachers and students have almost the same expectations (Fig. 5.0 and 5.1).

4.6.0 Teachers' Academic and Professional Qualifications

Nine teachers were involved in the study. Out of these, six had a Bachelor of Education degree while the others had a Diploma in Education; thus, all of them are professionally qualified to handle their subjects. However, only one teacher in each school had been trained to handle the physically handicapped students in their varying special needs. The other teachers have to teach through the trial and error method. Most teachers expressed the need to be trained so as to enable them handle the students more efficiently and help them understand their students' various needs.

4.7 Anecdotal Findings

This section discusses the emerging points of concern as discussed by the headteachers, heads of science departments and other teachers.
4.7.1 Role of the Teachers

When teachers were asked which role they played in teaching sciences, they said that they act as helpers in the learning process, organizers of learning experiences, sources of knowledge for pupils and also reference persons for pupils/students. This awareness of their roles is likely to enhance their teaching methods, because it will help them to set up clear-cut objectives which are easily achieved when clearly articulated.

4.7.2 Teaching Methods

The teaching methods most preferred by the teachers are; practicals, discussion, and lecturing. It was further established that the factors affecting teaching methods were the class size, the availability of resources, students' level of comprehension and the discipline of students.

4.7.3 Sources of Information

It was further established that the teachers use the following methods as a source of information for personal development; first by reading textbooks and manuals, then by reading science magazines. Other sources, which are rarely used by the science teachers are; first, participation in-science curriculum development projects, then attending in-service courses. None of the teachers went to Teachers' Advisory Centres (TACs) for any advice or information.
4.7.4 General Problems Encountered by Teachers

Teachers expressed concern that in the course of their teaching they experience the following problems:

• poor attitudes towards science by students which hampers the learning of the sciences.

• inability of students to handle apparatus due to different levels of handicaps which makes the learning of the sciences difficult.

• lack of facilities e.g. apparatus and means of transport for trips which is a great hindrance to field work which leads to poor image formation due to lack of environmental exposure and therefore the inability to grasp scientific concepts.

• poor learning styles of students due to poor preparation at primary level.

• poor communication skills by most students, most of whom are said to be unable to express themselves and so face problems in the discussion and answering of questions.

• slow learners with poor manipulative abilities which makes the teaching of sciences difficult and so teachers spend a lot of time explaining simple points.

• slow movement of students leads to wastage of learning time and so it becomes difficult to cover the syllabus. This further affects their performance in the national Examination which further affects the morale of both students and teachers and hence the increasing apathy in the teaching and learning of the sciences in special schools.

• students get tired easily due to their sitting positions and therefore they are not able to concentrate on learning for any
long period of time especially during a double period of eighty (80) minutes.

* teachers' inability to identify students having educational potential due to lack of training in special education makes the teachers feel inadequate when guiding and counselling the students.

4.7.5. Preference in Subject Areas:

It was found that the order of preference for subject areas is:

Boys: Prefer biology, chemistry and finally physics in that order.

Girls: Prefer biology, physics and finally chemistry. (See Table 4.7)

<table>
<thead>
<tr>
<th>Subject</th>
<th>% Score for Boys</th>
<th>% Score for Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>81.6</td>
<td>82.0</td>
</tr>
<tr>
<td>Chemistry</td>
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<td>71.9</td>
</tr>
<tr>
<td>Physics</td>
<td>77.5</td>
<td>76.8</td>
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</tbody>
</table>

Table 4.7 shows that both boys and girls prefer to learn the three (3) science subjects, but with varying degrees of interest. Biology is the most preferred by both boys and girls. Boys prefer Chemistry to Physics whereas girls prefer Physics to Chemistry.
CHAPTER FIVE

SUMMARY AND RECOMMENDATIONS

This chapter ties up the study by outlining the major conclusions that resulted from the data analysis and interpretations in chapter 4. Recommendations on the major factors in science teaching are also made in line with the conclusions.

The chapter ends with a list of suggestions for further study which addresses the areas the study could not address within the limits of the given time and resources.

5.1 Summary

1. It was noted that the students' preference of the learning context are:-
   ♦ laboratory
   ♦ field and
   ♦ classroom

Most students are fairly comfortable being in special schools and are not willing to move to regular schools. This is impressive considering the disability of the learners who would be experimenting with difficulty in the laboratory if they were to compete with able-students colleges.

2. Students and teachers expect science to be learnt for;
   ♦ Career choice
• problem solving
• general awareness

and not for examination purposes.

3. It was noted that most of the aspects of the process skills are incorporated in the learning of sciences. The only exception is in hypothesizing indicating that the traditional science is still in practice.

4. Students and teachers "see" a scientist as a;
• problem solver
• problem identifier.

They had misgivings of a scientist as a;
• magician
• problem shooter
• leader of society
• peace maker
• destructive agent.

5. Teachers expect their roles in teaching sciences to be:-
• to provide books and apparatus to students
• to demonstrate the experiments
• to mark students' books.

6. The teachers see themselves as;
• organizers of learning experiences
• helpers in the learning process
• reference persons for students
• motivators to learning
7. It was further noted that the teachers are professionally trained for regular secondary schools and not for special schools. Only two teachers, one in each school had been trained to handle the physically handicapped students.

5.2. Recommendations for Action

1. It was found that most of the students in special schools prefer their type of schools and not regular schools. This was especially emphasized by the girls who felt strongly that they need not be taken to regular schools where they may not be understood, especially considering the fact that they may not be able to cope with the challenges from their able-bodied colleagues. Girls put more emphasis on their physical outlook and this may explain why they would not want to be compared to other students. There is the need therefore for the government to not only consider setting up more special schools but also aim at integrating some non-handicapped students into these schools with a view to socializing the handicapped students with the non-handicapped ones. The construction of more schools will not only help many students to pursue secondary school education but also help the government to fulfil the Unesco’s requirement to have education for all (Unesco, 1974).

2. The findings indicated that most students do not expect to take sciences for examination purposes. The fact that they have to pass in practicals so as to get at least a credit pass in each science subject makes them feel disadvantaged in this area. Since they are physically handicapped, the process of handling the apparatus is tedious to them. Again it was noted that these students get tired
very fast because of their sitting positions. This discourages them further during national examinations which take long to finish. Hence the Kenya National Examination Council (KNEC) should consider giving more emphasis to the Continuous Assessment Tests (C.A.Ts) as recommended in Sessional Paper No. 6 of 1988.

3. The handicapped students prefer to learn the sciences in the laboratories for practical work and also go for field work. Unfortunately these schools do not have equipped laboratories and school vans to take them for field work. Hence they are disadvantaged due to lack of these resources. The laboratories to be constructed should be spacious enough to take care of their varying needs and should have movable benches which can be adapted for various uses by different students with varying degrees of handicaps. The government and donors should therefore consider channelling their funds to the construction and equipping of laboratories and classrooms and also availing school vans/trucks for use in field work. Special equipment like wheelchairs and crutches is useful so as to solve the problem of their mobility.

4. It was found that the traditional method of teaching science is still in force in the special schools. In this method the emphasis is on the behavioral objectives. Pre-specification of explicit goals and content prevents the teacher from taking advantage of the instructional activities that may occur in the learning context which could be interesting or related to the content. This tends to kill the morale/motivation of the learners. Again there is a fixed content which has to be
covered by all the learners, irrespective of its importance to the particular learners. This becomes undemocratic since it is difficult to know in advance exactly how the learners will behave. Hence the need to emphasize on the process skills which are organized under the concept of being learner-centred and emphasizing on activity and experience. Since this method views subject matter and discipline as resources and not a body of knowledge to be consumed, then the process of learning becomes meaningful and interesting to the students. There is need therefore for teacher trainers to re-assess their methods of preparing science teachers, with a view to inculcating the process skills in them.

5. The physically handicapped students are not able to learn at the same pace as the regular students because a lot of learning time is wasted due to their slow movements; for example, it takes quite some time for them to move from the classroom to the laboratories. In the final analysis they are not able to cover a good portion of the syllabus by the time they take their final examination, the Kenya Certificate of secondary Education (KCSE). It therefore becomes unfair when these students are given the same admission criteria into higher institutions of learning. The Ministry of Education should therefore come up with a clear policy on the issue of the selection handicapped students to higher institutions of learning.
6. It was found that most of those teaching in special schools have not been trained in special education. Some teachers explained that they had difficulties in identifying students with educational potential due to lack of training. There is the need therefore for the ministry of education to bridge this gap by organising in-service courses for these teachers so that they may be competent in special education matters.

5.3 Suggestions For Further Research

1. The study explored the expectations of the physically handicapped students who have problems in mobility. It did not cover other types of handicaps namely visual and the hard-of-hearing. There is the need to explore the expectations of these other types of handicapped students in the learning of sciences.

2. The study explored the expectations of the physically handicapped students in the learning and teaching of science subjects namely Biology, Physics and Chemistry. Their need to explore their expectations in other related subjects like Agriculture, Woodwork and Homescience and also find out if their expectations would be the same for the humanities subjects like history and religious studies.
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APPENDIX A (STQ)

STUDENTS' QUESTIONNAIRE

Instructions

We are interested in what you think and feel about science subjects (Physics, Chemistry and Biology). Answer the questions as honestly as possible.

The first section requires you to give some personal and general information. Answer the section by ticking (✔) in the appropriate box or filling in the spaces provided.

Section I (Personal and General Information)

1. Your sex: Boy [ ] Girl [ ]
2. Name of your school ..........................................
3. Your Class; Form 2 [ ] Form 4 [ ]

Section II

This section contains a number of statements. Study each of the statements and indicate with a tick (✔) whether you.
(a) Strongly Agree (S.A.)
(b) Agree (A)
(c) Not sure (NS)
(d) Disagree (D)
(e) Strongly Disagree (S.D)

Please mark each statement and tick in one box for each statement.
If you make a mistake, put a cross through the marked box and then tick in the correct box.

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<td>A</td>
<td>NS</td>
<td>D</td>
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<td>(c) field eg. Industries</td>
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<td>(e) Office i.e. discuss with the teacher</td>
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<td>A</td>
<td>NS</td>
<td>D</td>
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<td>3</td>
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<td>SA</td>
<td>A</td>
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<td>(b) Problem Solving</td>
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<td>A</td>
<td>NS</td>
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<td></td>
<td>(c) Biology</td>
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</table>
In a science class it is important to be
(a) Discussing
(b) Planning what to be done
(c) Recording observations and note taking
(d) Informing students/teachers about findings
(e) Apply old knowledge in solving new problems
(f) Classifying i.e. group similar things/objects together
(g) Evaluating i.e. give personal opinion
(h) Experimenting
(i) hypothesizing (giving reasons through guessing
(j) Inferring (giving reasons through observing
(k) Interpreting i.e. make own conclusions
(l) Investigating (find out new ideas
(m) Observing
(n) Predicting i.e. describe what is likely to happen
(o) Questioning

Which of the above 5 methods in Q5 do you enjoy doing most.
(Start with the most to least enjoyable)
(i)
(ii)
(iii)
(iv)
(v)
I think of a scientist as a
(a) Magician
(b) Problem solver
(c) Problem identifier
(d) Problem shooter
(e) Leader of society
(f) Peace maker
(g) Destructive agent i.e. makes destructive weapons.

In a science class, the teacher should not
(a) give books or apparatus
(b) Demonstrate an experiment
(c) Give details of which book to be read
(d) Allow students to study on their own
(e) Mark students books and give results immediately
(f) Help students to do their homework

It is better for handicapped students to be in
(a) Special schools
(b) Ordinary schools

10. Rank the following subjects from the one you like most to the one you like least.
Chemistry/Biology/Physics/Agriculture/Geography.

1.
2.
3.
4.
5.

(For students only)

11. Make 3 career choices from the following, in order of preference, which you are likely to take after finishing school.

Teacher
Lawyer
Doctor
Computer Analyst
Musician
Secretary
Engineer
Linguist

(i) .................................................................
(ii) ..............................................................
(iii) ............................................................
QUESTIONNAIRE FOR SCIENCE TEACHERS

This questionnaire is designed to obtain information on the teachers' expectations of science subjects (Physics, Chemistry and Biology). The information which you will supply will be treated as confidential and will not be used in any way against you. Ideas from various teachers will be combined in such a way that your identity will not be revealed.

This questionnaire consists of 2 sections, section I and section II. For each section, instructions are given on how to respond.

SECTION I

Put a tick (✓) in the box corresponding to your answer.

Name of the school......................................................

Teachers Sex: Male [ ] Female [ ]

1. Are you a trained teacher? Yes [ ] No [ ]

2. What is your highest educational qualification

   (a) KCE/EACE/GCE/KCSE [ ]

   (b) KACE/EAACE/HSC [ ]

   (c) B.Ed/B.Sc./BA [ ]

   (d) Other (Specify) ..............................................
3. What is your professional qualification?
   A. Graduate
   B. SI/Diploma
   C. PI
   D. Other Specify

4. What is your average teaching load? lessons per week.

5. Which is your major teaching subject?

6. What other subjects do you teach?
   (i)
   (ii)

7. Which 2 of the following methods do you commonly use to teach your subjects?
   (a) Lecture
   (b) Practicals
   (c) Discussion
   (d) Demonstration
   (e) Outdoor activities and field trips
   (f) Other (Specify)

8. Which one of the above teaching methods do you least use in class?

9. Which 2 of the following factors greatly influence your choice of teaching method?
   (a) Provision of required facilities, materials and text books
(b) Class size [ ]
(c) Teaching Load [ ]
(d) Emphasis on passing the National Exam (KCSE) [ ]
(e) Class Discipline [ ]
(f) Students' ability to perform experiments [ ]
(g) Other (Specify) ........................................

Give a reason for each factor selected
(i) .................................................................
(ii) .................................................................

10. In your opinion, what two roles do you play as a teacher in a science class?
A. A helper in the learning process [ ]
B. A source of knowledge for students [ ]
C. A reference person for pupils [ ]
D. An organiser of learning experience [ ]
E. Other (Specify) ...........................................

11. Have you ever attended an in-service course to up-date your ability to handle handicapped students?
Yes [ ] NO [ ]
(a) If yes, when was/were the course/s.............
.................................................................
(b) What was the aim of the course?..............
.................................................................
.................................................................
12. Which of the following sources of information do you use to keep yourself informed about science development?

(a) Participating in science curriculum development projects
(b) Reading textbooks and manuals
(c) Reading science magazines
(d) Attending in-service courses
(e) Teachers Advisory Centres (T.A.C.)
(f) Other (Specify)

13. Which 3 major problems do you face when teaching the handicapped students?

(i) .................................................................
(ii) .................................................................
(iii) .................................................................

SECTION II

This section contains a number of statements: Study each of the statements and indicate with a tick (✓) whether you

(a) Strongly Agree (SA)
(b) Agree (A)
(c) Not Sure (NS)
(d) Disagree (D)
Please, mark each statement, and tick in one box for each statement. If you make a mistake, put a cross through the marked box and then tick in the correct box.

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<td>(a) Classroom</td>
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<td>(e) Office i.e. discuss with the teacher</td>
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<td>17</td>
<td>I enjoy teaching</td>
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<td>(a) Physics</td>
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<td>(c) Biology</td>
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(a) Discussing
(b) Planning what to be done
(c) Recording observations and note taking
(d) Informing students/teachers about findings
(e) Apply old knowledge in solving new problems
(f) Classifying i.e. group similar things/objects together
(g) Evaluating i.e. give personal opinion
(h) Experimenting
(i) hypothesizing (giving reasons through guessing)
(j) Inferring (giving reasons through observing)
(k) Interpreting i.e. make your own conclusions
(l) Investigating (find out new ideas)
(m) Observing
(n) Predicting i.e. describe what is likely to happen
(o) Questioning
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</table>
| 19 | Which of the above 5 methods do you enjoy using most.  
(Start with the most to least enjoyable)  
(i),  
(ii)  
(iii)  
(iv)  
(v)  |
| 20 | I think of a scientist as a  
(a) Magician  
(b) Problem solver  
(c) Problem identifier  
(d) Problem shooter  
(e) Leader of society  
(f) Peace maker  
(g) Destructive agent i.e. makes destructive weapons.  |
| 21 | In a science class, a teacher should not  
(a) give books or apparatus  
(b) Demonstrate an experiment  
(c) Give details of which book to be read  
(d) Allow students to study on their own  
(e) Mark students books and give results immediately  
(f) Help students to do their homework  |
| 22 | It is better for handicapped students to be in  
(a) Special schools  
(b) Ordinary schools  |
INTERVIEW GUIDE FOR HEADTEACHERS

PART I (Personal Data)

1. Name of Institution
2. Title in the school
3. Highest Professional Qualification
4. Year of qualification as a Trained Teacher
5. Subjects trained to teach
6. Experience in teaching secondary school years
7. Experience as a Headteacher of secondary school years
8. (a) Have you received any special education training related to the physically handicapped?

(b) If yes
(i) What was the nature of the training?
(ii) When did you receive the training?
(iii) How long was it?
9. Other professional qualification or membership
PART II STAFFING OF THE SCHOOL

10. How many streams are there in the school?

   Form 1 .............
   Form 2 .............
   Form 3 .............
   Form 4 .............

11. (a) How many teachers do you have in the school?

        ..........................................................................

   (b) How many teachers in the school have been trained to teach
       physically handicapped students?

        ..........................................................................

12. How many teachers in the school can teach

   (i) Physics?
   (ii) Chemistry?
   (iii) Biology?

13. (a) Are/were the teachers trained to handle physically
       handicapped students?
   (b) How long was the training?
   (c) Is the training to help them handle physically handicapped
       learners in general? ........
       in subject area? .............
       Other? ..................

PART III TEACHING OF SCIENCES

14. How many laboratories are available in the school for
15 (a) How frequently do you organise for field trips for students in a year?

(b) Do you know of any former student from this school taking a science related career anywhere?

(c) If yes, how many?

16. From your own general assessment, do most students like taking sciences i.e. physics, chemistry and Biology?

YES [ ] NO [ ]

17. What complaints do you normally receive from students and teachers relating to science work?

Students .................................................................

Teachers ...............................................................
20. Are you satisfied with the current subject grouping to facilitate certification by KNEC? .....................

21. Give your opinion on the idea of future expansion of your school to cater for:-

(i) Both top and average students ......................
(ii) Integrating some regular students in the school

.................................................................

THANK YOU FOR YOUR PARTICIPATION
APPENDIX D

INTERVIEW GUIDE FOR HEAD OF SCIENCE DEPARTMENT

Part I (Personal Data)

1. Name of Institution ...........................................

2. Title in School ..............................................

3. Highest Professional Qualification .........................

4. Year of Qualification as a trained teacher ...............  

5. Subject trained to teach ....................................

6. Experience in teaching secondary school ........... years. 

7. Experience as Head of science in Special school ........

Years.

8. (a) Have you received any special training to handle the 

physically handicapped? 

.................................................................

(b) If yes,

(i) What was the nature of the training?

(ii) When did you receive the training ..........  

(iii) How long was it .........................

9. Other professional qualification or membership.

PART II TEACHING OF SCIENCE

10. (a) How many teachers in the school can teach

    (i) Physics? ...........

    (ii) Chemistry? ...........

    (iii) Biology? .............
(b) How many of these teachers have received special education training?

(i) Physics

(ii) Chemistry

(iii) Biology

11. Do you have enough laboratories to teach.

(i) Physics? .........................................................

(ii) Chemistry? .....................................................

(iii) Biology? ....................................................... 

12. What problems do you normally encounter when teaching these subjects?

.................................................................

.................................................................

.................................................................

13. (a) Do you have a science club in the school?

(b) What are some of the activities undertaken by the members?

14. What has been the general performance of students in KCSE in science subjects for the last four years?

1991 ................................................................. 

1992 .................................................................

1993 .................................................................

1994 .................................................................
15. Which methods do science teachers commonly use when teaching?

(i) Lecture

(ii) Practical

(iii) Discussions

(iv) Demonstration

(v) Outdoor activities and field trips

(vi) Other (specify)

THANK YOU FOR YOUR PARTICIPATION.
# APPENDIX E: BUDGET

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<td>300</td>
</tr>
<tr>
<td>Staples</td>
<td>200</td>
</tr>
<tr>
<td>Research Instruments</td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>500</td>
</tr>
<tr>
<td>Transport</td>
<td>5,000</td>
</tr>
<tr>
<td>Subsistence</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>11,310</strong></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Typing and Production of Thesis:</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>(i) First Draft for Examination</td>
<td>3,000</td>
</tr>
<tr>
<td>Typing (150 X 20)</td>
<td>4,050</td>
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<tr>
<td>Photocopying (150 X 3 X 9)</td>
<td>1,000</td>
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<tr>
<td>Binding</td>
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<tr>
<td>(ii) Final Draft as in (i)</td>
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</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>16,050</strong></td>
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</tbody>
</table>

| 4. Stationery                               |          |
|                                            | 1,000    |

| 5. Miscellaneous                            |          |
|                                            | 1,000    |

**GRAND TOTAL**                                **33,110**
## APPENDIX F: RESEARCH TIMETABLE

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date</th>
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</thead>
<tbody>
<tr>
<td>Problem Selection</td>
<td>July 1995</td>
</tr>
<tr>
<td>Reading on Problem</td>
<td>August - October 1995</td>
</tr>
<tr>
<td>Writing, Typing and Handing in of Research Proposal</td>
<td>November 1995</td>
</tr>
<tr>
<td>Preparation for Research</td>
<td>December, 1995</td>
</tr>
<tr>
<td>Collection of Data</td>
<td>January-February 1996</td>
</tr>
<tr>
<td>Analysis of Data</td>
<td>March- April 1996</td>
</tr>
<tr>
<td>Writing the Final Research Report and Submission of Thesis</td>
<td>April-May - 1996</td>
</tr>
</tbody>
</table>
OFFICE OF THE PRESIDENT
PROVINCIAL ADMINISTRATION AND INTERNAL SECURITY P.O. BOX 30510, NAIROBI.

Ref. OP/13/001/26C 7 (2) ................................. 16th January ......... 19.96

The Secretary,
National Council for Science and Technology,
P.O. Box 30623,
NAIROBI.

RESEARCH AUTHORIZATION

APPLICANT (S) EVANSON MURIUKI MURIITHI

The above named has been authorized to conduct research on

Expectations of Handicapped students and their Teachers in science

subjects in Kenyan special secondary schools

As indicated on the application form, this research will be conducted in

Central and Coast Provinces

For a period ending September 1996

Under the standing research clearance awarded to Kenyan Universities/Public Institutions.

I herewith enclose copies of his/her application for record purpose. He/she has also been notified that we will need a minimum of two copies of his/her research findings at the expiry of the project.

R. M. WANASAKAAMI

FOR: PERMANENT SECRETARY/PROVINCIAL ADMINISTRATION

cc:

P CS'

Coast province
Box 90424

MOMBASA

CENTRAL PROVINCE

BOX 33 NYERI

R. M. MURIITHI

P.O. BOX 43844

NAIROBI.
THIS IS TO CERTIFY THAT:

MR./MRS. EVANSON MURUKI MURITHI

of (Address) P.O. BOX 43844
NAIROBI

has been permitted to conduct research in

CENRAL AND COAST Province,

Expectations of Handicapped Students and Their Teachers in Science Subjects in Kenyan Special Secondary Schools

for a period ending SEPTEMBER 1996.

Research permit No. 0P/13/001/26C 7
Date of issue 16TH JANUARY 1996
Fee received 100 KSHS

R.M. WANASAKAANT
for Permanent Secretary
Office of the President

CONDITIONS

1. You must report to the District Commissioner of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.

2. Government Officers will not be interviewed without prior appointment.

3. No questionnaire will be used unless it has been approved.

4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.

5. You are required to submit at least four (4) bound copies of your final report.

6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice.

APPLICATION OF KENYA

RESEARCH CLEARANCE PERMIT

OPK SMS 4m 6/92

(CONDITIONS—see back page)