Improving female students' perception and performance in science and technology through role models and study tours: a case of Accra Technical Training Centre

by

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DECLARATION

I hereby declare that this submission is my own work towards the Executive Masters Of Business Administration and that, to the best to my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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ABSTRACT

The study presents assessment of performance re-orientation and short-term project to effect a change in the perception and performance of the female technology students of Accra Technical Training Centre (ATTC). The study is an action research aimed at helping to correct the negative perceptions held by female students about science and technology and to improve their performance at ATTC. The purpose of the study was intended to find out the baseline situation of the perception and performance in science and technology subjects of female students at ATTC in order to effect an intervention to improve on the situation. Purposive sampling was used to select the entire first and the second year female students who were 25 in number. The duration for the study was six weeks, thus, first week for pre-intervention, second to fifth week for intervention and the last week for post-intervention. The data collection instrument for the study for both the pre-intervention and the post-intervention was a combination of questionnaire to analyse the perceptions of the respondents and a structured performance test to analyse their performance in the areas of the science and technology courses offered at ATTC. The same instrument was used at the pre-intervention stage as well as post-intervention stage. Simple percentages were used to analyse the perceptions of the female students' data whilst mean score and t-test were used to analyse the performance of the students. The main findings of this study were that performance re-orientation and short-term project

have greater influence in improving the perception and performance of the female students in science and technology. In view of this it was recommended that, there is the need to include interaction with successful female technologists in the training curricula.

DEDICATION

This dissertation is dedicated to Adamaline Tetebea Opare.

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TABLE OF CONTENTS

DECLARATION…….

….ii

ABSTRACT……

...iii

DEDICATION……

....iv

ACKNOWLEDGMENT……

…..v

TABLE OF

CONTENTS..……..vi

LIST OF

TABLES……...x

CHAPTER

ONE……....1

1

INTRODUCTION……

…..1

1.1 BACKGROUND TO THE STUDY……..1

1.2 STATEMENT OF THE PROBLEM…….5

1.3 PURPOSE OF THE STUDY…….....6

1.4 RESEARCH QUESTIONS……...6

1.5 SIGNIFICANCE OF THE STUDY……..7

1.6 DELIMITATION……

…...7

1.7 LIMITATION……

…....8

CHAPTER TWO……...9

2 LITERATURE REVIEW…….9

2.1 INTRODUCTION……

….9

2.2 THEORETICAL ISSUES IN SCIENCE AND TECHNOLOGY EDUCATION……9

2.2.1 SELECTION LEARNING……...…9

2.2.2 VOCATIONAL DEVELOPMENT……...10

2.2.3 PERSONALITY AND MODEL ENVIRONMENT…….10

2.2.4 CAREER EDUCATION…… 11

2.3 EMPERICAL LITERATURE REVIEW…….11

2.3.1 THE NEED FOR FEMALES TO EDUCATION AND TRAINING……11

2.3.2 STUDENTS' PERCEPTION OF THEMSELVES AND THEIR PERFORMANCE IN SCIENCE AND TECHNOLOGY……..14

2.3.3 INSTRUCTIONAL MATERIALS AND GENDER ISSUES……...17

2.3.4 SOCIAL FACTORS AFFECTING WOMEN'S PARTICIPATION AND PERFORMANCE IN EDUCATION AND TRAINING……...19

2.3.5 CONCLUSION…… …..22

3.0 CHAPTER THREE……..…..23

3 METHODOLOGY……... …23

3.1 INTRODUCTION…… ...23

3.2 POPULATION AND SAMPLING TECHNIQUES…….……..24

3.3 DATA COLLECTION PROCEDURE……25

3.4 RESEARCH INSTRUMENT……..27

3.5 RESEARCH DESIGN…….28

3.6 DATA ANALYSIS……..28

CHAPTER

FOUR……30

4 ANALYSIS, DISCUSSION AND REPRESENTATION OF

RESULTS…….30

4.1 INTRODUCTION……..……

…30

4.2 PERCEPTION OF FEMALE PARTICIPATION IN SCIENCE AND

TECHNOLOGY……

…..30

4.3 ANALYSIS AND DISCUSSIONS OF THE STUDENTS'

PERFORMANCE IN TEST

ITEMS……..36

4.3.1 TECHNICAL DRAWING TEST

SCORES……..…36

4.3.2 SCIENCE TEST

SCORES……....38

4.3.3 BENCH FITTING TEST

SCORES……..40

4.3.4 SCORES FOR ALL PRACTICAL

SUBJECT…….43

4.3.5 MEAN SCORES FOR THE PRE-INTERVENTION AND

POST-

INTERVENTION……
…..44
4.3.6 STANDARD DEVIATION CALCULATION SCORES FOR PRE-INTERVENTION AND POST-INTERVENTION SCORES……
…44
4.3.7 T-TEST CALCULATION FOR THE PRE-INTERVENTION AND POST-
INTERVENTION…….44

CHAPTER FIVE……..46

5 SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS...46

5.1 SUMMARY OF FINDINGS…..…….…46

5.2 CONCLUSIONS…..……..…

…50

5.3 RECOMMENDATIONS……..…

…53

5.4 DIRECTION FOR FURTHER RESEARCH……..54

REFERENCES…….

….55

APPENDICES……..……

…61

A. PERCEPTION AND PERFORMANCE INSTRUMENT……....61
B. MEAN SCORE CALCULATIONS FOR PRE-TEST AND POST-TEST……...63
C. MEAN AND STANDARD DEVIATION SCORE……...…67
D. CALCULATING THE T-TEST……69

E. DEFINITION OF

TERMS……..…72

F. POEM; WIVES OF

AFRICA……73

LIST OF TABLES

TABLE

PAGE

1 RESPONDENTS' PERCEPTION OF ON FEMALE PARTICIPATION

IN SCIENCE AND TECHNOLOGY AT

ATTC……..32

2 TECHNICAL DRAWING TEST SCORES…….….36

3 SCORES FOR SCIENCE TEST……...38

4 SCORES FOR BENCH FITTING…….…40

5 COMBINED SCORES FOR TECHNICAL DRAWING, SCIENCE AND BENCH FITTING TEST…….43

CHAPTER ONE

INTRODUCTION

1.1. BACKGROUND TO THE STUDY

Education may be considered as the backbone of every economy. This is because it is concerned with the provision of the required labour force to take up position at the labour front. Economic crises and competitions in the world markets have brought to the fore the need for the application of scientific methods to maximise production. This has also thrown light on the need for research to improve such scientific methods as well as their implementation. The Government of Ghana, seeing the need for science and technology, deemed fit to reform the hitherto, arts-biased educational system, to include more scientific, technological and vocational biased courses. The aim is to raise the needed manpower to lead in the nation's technological advancement.

Females who constitute about 51% of the Ghanaian population (Daily graphic, May 2011), are comparatively not involved much in science and technology in schools. Very few are involved in the technology sector. As a result the vital contribution of the female sector is grossly minimal, as one can count the number of women industrialists in Ghana on one's fingertips.

Researchers and writers in recent decades have identified the multiple benefits that accrue to females, their families and the nation as a whole as they delve into the

scientific and technological world. Aggrey (2003) indicated that, education and training make girls and women more creative, inventive and more self-confident. Participants in a conference on education and work opportunities for females in African countries in Morocco in May 1971 noted that, the African woman is an indispensable part of the human resources for national development. It was observed that apart from helping to raise the productivity levels of females so as to make them participate more effectively in economic processes, education provides other benefits to females such as making them acquire improved standards of health, nutrition and sanitation (UNDP No.13, 1985).

It is believed that when economic development and modernisation are not accompanied by social justice and fair distribution of national income, it places a greater burden on these sections of the population that were already disadvantaged. Women's unequal access to education thus constitutes a problem, which needs to be solved if developing countries like Ghana could achieve any meaningful socio-economic development. This is because if females are to be able to contribute meaningfully to the economic development of their communities, then they would be gainfully employed.

Dolphin (1987) notes that the economic situation of developing countries has compelled their women to engage in low income-generating activities to maintain their families. There is the need for women to acquire skills to raise their income generation capacity to supplement the family budget. In view of this, regardless of the fact that most women have to carry out their traditional roles of housekeeping

and childcare, if they could be gainfully employed they need to be educated and trained.

In the Ghanaian society women's roles are pre-defined as domestic. They are mothers, wives, homemakers, gathers of firewood, etc.. With the onset of formal education, professions such as nursing, teaching, secretarial and clerical occupations were considered the preserve of women, while others like engineering, mining, carpentry, masonry, etc., were considered "no go" areas for women. Such gender stereotypes have kept females from studying the science and technical subjects.

Haddad, Carny, Rineld and Ragar (2001) writing on education and development as evidence of new priorities noted that investing in female education tends to narrow the academic gap between males and females. They also observed that women represent an enormous potential source of human capital and of scientific and technical skills in both agriculture and industry. Therefore, the rate of return to investing in women's education in developing countries is as high as that of men. From the foregoing exposition by Haddad et al (2001) it could be argued that the lack of an educated female labour force would seriously hinder industrialising countries (with less female entrepreneur rate) from achieving any high rate of development.

In a report represented to UNESCO on "Access of Girls and Women to Technical and Vocational Education", Hecker (1968) remarked:

> "Since development in society require from women, besides family and domestic activities for which training can be given, a much wider participation in all types of occupations, the facilities for women and

> girls in technical and vocational education should be the same in importance and range as those offered to men. Men and women should have equal opportunity for and access to special effort should be made in order to give women the possibility of personal fulfillment in technical and vocational education. (p.48)"

However almost 43 years after this observation was made and despite the numerous benefits that education and training are known to provide to females and the nation as a whole, women's unequal access to and participation in technical education still remains a national problem. Right from birth, parents perceive and treat their male and female children differently. Boys and girls are given different toys, their rooms are arranged differently, play different roles in the home and so on.

This discriminatory treatment of male and female is not different in the educational set up. At the pre-school level, the males are given models of cars, car-tyres, screwdrivers and hammers, whereas their females are given models of baby dolls, ladle, coal-pot, saucepan, apron and others, to play with. At the basic and the senior high secondary schools, the teaching and the ancillary staff directly and indirectly encourage the male students to pursue the technical courses like Technical Drawing. Metal work, Woodwork, Blockwork and the female students to pursue courses like, Home Economics, Catering and Dressmaking. The teaching industry has very few female teachers handling science subjects and almost none in the technical subjects who could have served as role models to encourage the female students to pick up the challenge. In the technical institutes like Accra Technical Training Centre (ATTC) where there are very few females, it is common to find the male students

doing the laborious tasks whilst their female counterparts do the errands “holding of tools” during the groupings for practical lessons.

1.2 STATEMENT OF THE PROBLEM

Few female students pursue courses in science and technology and put in their maximum potentials to excel in these subjects at ATTC. It is estimated that out of a total of about 1000 students in 2010/2011 academic year less than 100 females were pursuing science and technology courses at the centre, giving male-female ratio of about 10:1 (2010/2011 students’ records, ATTC). The notion that science and technology subjects are unfeminine and women who read those courses are unattractive, coupled with the apparent perception of “low factor of safety” in some courses as well as “strength requirement”, are some of the major factors that undermine the level of attendance and performance of female students. Statistics available for the past few years at ATTC show that the erroneous perception that courses like Welding, Gas fitting, Electricals and Electronics, Engineering Science and Mathematics, Blockwork and Woodwork are strenuous activities, but which in reality are not so, highly affect the performance of the female students.

The government of Ghana and non-governmental organisations are making striding efforts to improve on the perception and the performance of females in Science and Technology and Mathematics Education (STME) clinics for girls and Women In Technical Education (WITED) as well as the institution of scholarship schemes for

girls. Yet the performance of these female students in science and technology could not match that of the male students at ATTC. The situation requires urgent attention aimed at addressing the problem so as to encourage females in the area of science and technology education. Therefore an action research aimed at improving the perception of teaching and learning of female students at ATTC through performance re-orientation appears to be warranted.

1.3 PURPOSE OF THE STUDY

The study was intended to find out the real status of the perception of female students at ATTC and their performance in science and technology in order to effect an intervention to improve on the situation. Specifically, the study aimed at finding out the baseline situation of the perception and performance in science and technology subjects of female students at ATTC. The students were then exposed to role models and engaged in field trips as well as short-term project work and after which their perception and the performance re-examined to find out whether the intervention did bring any improvement on the female students' perception and performance in science and technology.

1.4 RESEARCH QUESTIONS

The following research questions were formulated to guide the study:

1. Would interaction with role models change the female student's perception of science and technology?

2. Would interaction with role models affect the female students' performance in science and technology?
3. Would short-term project work improve female students' performance in science and technology?

1.5 SIGNIFICANCE OF THE STUDY

The study is an action research. It is therefore intended to find out how performance re-orientation and short-term project could affect the performance of the female students at ATTC. In view of this, the findings of the study would be of interest to the Curriculum Research Directorate Division (CRDD), the Council for Technical and Vocational Education and Training (COTVET), and the Technical Examination Unit (TEU) of the Ghana Education Service (GES). These departments are responsible for developing the curriculum for technical institutions in the country.

It is anticipated that the research findings would be useful to NGOs and organisers of WITED and STME clinics who have taken upon themselves to encourage girls and women to pursue science and technology education. Furthermore, it is hoped that the material would be useful to administrative, teaching and ancillary staff of technical institutions. These institutions are mostly responsible for educating and training of girls and women in science and technology. Finally, the findings of the study would also be of some benefit to other researchers conducting studies into education and women development.

1.6 DELIMITATION

The study would be confined to the Accra Technical Training Centre (ATTC). ATTC is a multifunctional technical institution, which is situated in the nation's capital, Accra. The institution trains both sexes in different programmes at different levels in science and technology. The study was limited to first and second year female students of ATTC only, since those in the third year were away for industrial attachment whilst those in the final year were preparing for their final project work.

1.7 LIMITATION

A noticeable limitation to the study is the fact that the third and the final year students did not take part in it since those in the third year were away for industrial attachment whilst those in the final year were preparing for their final project work. This situation coupled with purposive sampling used is likely to affect the generalising of the findings.

CHAPTER TWO
LITERATURE REVIEW

1.2 INTRODUCTION

This chapter provides the theoretical perspective and the empirical bases for the study. The theoretical perspective reviews theory on selection, learning vocational development, personality and model environment and career education. The empirical bases for the study also has to do with the reviews of empirical works on the need for females education and training, students' perception of themselves and their performance in science and technology, instructional and materials and gender issues, social factors affecting women's participation and performance in education and training. A number of issues are addressed in reviewing the literature on the theoretical perspective of the study.

2.2 THEORETICAL ISSUES IN SCIENCE AND TECHNOLOGY EDUCATION

2.2.1 SELECTION LEARNING

One of the major concepts influencing the present day teaching and learning of science and technology is the theory of selection learning proposed by Hull and Spencer (as cited by Bilodean, 1966). According to Hull and Spencer, complex learning can be achieved by building the foundation of simple principles. This implies that when the person discovers the basic principles in a learning situation, he or she can translate it into complex situations. Therefore acquisition of basic knowledge by the learner through selection of basic learning principles involving experiments will enable the learner to discover and build complex principles.

2.2.2 VOCATIONAL DEVELOPMENT

Grewal (1999) describes another theory relating to the present study, which was postulated by Super (1957). In this theory, vocational development is described as the developing and implementing of self-concept in the context of the world of work. The theory requires individuals to determine their capabilities as a means of recognising themselves as unique individuals and to realise their similarities with others. It is noted that the process of vocational development as dynamic synthesis is a result of the interaction of personal needs and resources of the individual and the economic and social demands of the culture. In explaining the role of the school as an environmental factor in the vocational development of the child, it is pointed out that exploration in the school through orientation courses and activities carried out through science, drama, farming as well as contact with peers and visitors to the school enhance the child's knowledge of the vocational world and will also be sources of vocational information and motivation.

2.2.3 PERSONALITY AND MODEL ENVIRONMENT

Zaccharria (1990) also cites another concept developed by Holland (1966) called the theory of Personality and Model Environment. By this theory, the postulation is that at the time of making vocational choice an individual is the product of the interaction of particular heredity with a variety of cultural and personal forces including peers, parents and significant adults and the physical environment. The theory emphasises the interactional effect of individuals' personal characteristics, the physical environment and the socio-cultural environment in determining their vocational choices.

2.2.4 CAREER EDUCATION

Another theory that provides theoretical basis for the study is Maslow's (1954) theory of Career Education as cited by Hoyt et al (1974). Maslow maintained that success in working life requires not only the skills needed to perform a job, but also the attitude, values and general abilities, which lead one to want to work productively, and which influence one's ability to function as a productive member of society over a lifetime. To Maslow, career education is the education that makes available all those pre-requisites, attitudes, knowledge and skills necessary to choose, prepare for and pursue a successful career throughout life. The school can and should constitute to fill in for, and attempt to remedy some of the shortcomings of other segments of the society. According to Hoyt, et al (1974) career education must increase the relevance of school by focusing on the learner's perception of work and of himself or herself as a worker. Career educationists are mindful of the fact that

some learners learn better from “hands-on” experiences and others from abstract concept.

2.3 EMPERICAL LITERATURE REVIEW

2.3.1 THE NEED FOR FEMALE EDUCATION AND TRAINING

Ghana like most developing countries faces an increasing problem of serious unemployment hence the need for science and technical education for females who constitute about 51% (Statistical service – Ghana 2011) to enable them develop skills that will encourage self-employment cannot be over emphasised.

Dolphin (1987) held the view that the economic situation in most developing countries has compelled the rural women and those living in the poorer areas of the urban centres to engage in some income-generating activities either to maintain the family as separated wives or to supplement family budgets. In view of this situation, the need to provide females with skills through education and training becomes imperative. The issue of female education and the development of their human resources have attracted the attention of educators, social scientists, governments and non-governmental organisations that are concerned with improving the quality of life of women.

Aggrey (2003) cited Briks et al, (1990) as sharing the view that education and training make girls and women more creative, inventive and more self-confident. Stromquist (1990) has also noted that women and girls become more self-assertive, self-esteemed and develop egalitarian beliefs through education. Participants in a conference on education and work opportunities for females in African countries in

Morocco in May, 1971 noted that the African woman is indispensable to national development. It was observed at the conference that apart from helping to raise the productivity levels of females so as to make them more effective in economic processes, education provides other benefits to females such as making them acquire improved standards of health, nutrition and sanitation (UNDP, 1983).

Examining ways of improving women's productivity and education and consequences for development in Peru, Herz and Khanker (1999) observed that women carry out the main responsibility for child care and heavily influenced family decisions on children's education. They also noted that the more educated parents become, the more willing they are to educate their daughters and sons. They added that improving opportunities for women can be a means to foster economic and social development and that an important way to expand women's opportunity is through human capital investment, notably, education beyond primary school level.

Haddad, Carnoy, Rineldi and Regal, (2001) writing on education and development as evidence of new priorities, have also noted that besides the reason that female education tends to narrow the gap between males and females, it is evident that when women receive low levels of education it hinders economic development and reinforces social inequality. Another exposition reiterating the importance of education for females is that of Hertz, Subbarao, Habib and Raney (1991). They also hold the view that education of women raises their productivity both at home and at the workplace whether in wage or self-employment. They also claim that education and training increase the earnings of women. Hallack (1990) also echoed the

importance of education and training in improving the quality of life for women. He noted that providing some form of education and training to mothers help improve their health, nutrition and socio-economic status as well as those of their immediate dependents. Hallack also noted that education and training of females serve as a key to population control and reduced infant mortality and "that each year of schooling for women means on the average 9 per 1000 fewer infant and child death".

Presenting a report on gender matters and education, Faanuye, Katoule and Kpimbomi (1999) on a study in the Upper West region of Ghana stated that the more educated a woman is, the less she is inclined to give her daughters out as housemaids and baby sitters. In another report presented at Science and Technology and Mathematics (STME) clinics, Awortwi and Korang-Okrah (2007) stated that the STME clinics, which is a form of educating female students in science, and technology, has boosted the morale of the girls and increased their level of creativity and discoveries. It has succeeded in breaking some of the myth surrounding mathematics, science and technology. In support of this, Quaisie (1999) also stated that the female education in science and technology increases the girls' horizon in choosing their future career. Thus reducing the stereotype or traditional profession which are inclined to white collar jobs like; secretary, receptionist, teaching etc..

2.3.2 STUDENTS' PERCEPTION OF THEMSELVES AND THEIR PERFORMANCE IN SCIENCE AND TECHNOLOGY

Students' attributes, which directly influence their performance, are of direct interest to all educators since occupational status is one of the most crucial indicators an individual's overall social welfare throughout life (Meyer as cited by Grewal, 1999). It as noted by Meyer (1975) and Harbison (1973) that individuals would perform better when placed in courses of their choice based on their potentialities and when provided with conducive working or study environment. Students' occupational desire is also a basic ingredient in their performance in an educational programme. According to Meyer and Harbison, personal factors which affect individual performance include: level of intelligence, aptitude, attitude, self-concepts, age and sex differences, value, student's career aspirations and expectations. These attributes act either singly or in combination with others to influence students' performance and course preference.

Several studies have established that students' perception of themselves contribute immensely to their performance in science and technology education, and that self-perception of female students themselves play a major role in their inability to excel in certain technical fields. Writing on factors, which contribute to inhibit women's performance in training, the International Labour Organisation (ILO, 1990) noted that some attitude of women lead to their limitation and under-performance.

The ILO report claimed that majority of the women seeking work are motivated by the need to earn quickly and that limits their possibility of following a training programme. In another related study on women in "technical trades" in nine African countries among which are Ghana, Gambia and Nigeria the ILO, (1990) it was

reported that the levels of participation and performance of girls in technical subjects at secondary school were limited by their poor background in mathematics and science. The ILO report also noted that women's attitude about their own roles and capabilities also influence their entry into certain technical fields and excelling in those fields. It stated that from an early age many females lack confidence in themselves and have negative attitudes towards science and technical subjects which consequently inhibit their performance in the technical subjects.

Kane (1990) also writing on the fate of the Ghanaian woman in technical and vocational training, observes that women prefer work which is respected and valued by the community as women's work, most of which is an extension of female domestic activities in addition to trading. According to Kane, women perceive the market as a place where if all else fails one can go and make money. She also noted that girls lack clear picture of how to achieve success in their occupational aspirations and do not have concrete and realistic ideas about occupation they are likely to get and how to excel. These personal perceptions she note, limit their aspiration in vocational and technical education, which affect the performance in those field.

Another exposition which reports the relationship between students' perception and their performance in technical aspects is that presented by Odugbesan (1990). In a survey conducted in two polytechnics in Ghana (Takoradi and Accra) to determine the level of participation and performance of women in technical education, training and employment, she reported that girls have pre-conceived ideas that mathematics

and science are difficult and therefore make little effort to study them. Their avoidance of science and mathematics makes it difficult for girls to perform very well in technical courses, which require some background knowledge in mathematics and science.

The academic self-concept of ability that students hold is seen as being critical for motivation and persistence and could affect their performance in various academic and vocational programmes. In a study of gender-related differences in self-referenced cognitions in relation to mathematics using 186 students (90 boys and 96 girls) from 20 schools in the urban regions of Leiden-Netherland, Seegers and Bockaets (1996), found that boys display higher level of competitive attitude in mathematics than girls. They also found that males showed higher learning in mathematics than females. From the works of Odugbesan (1990), and Seegers and Bockaet (1996), it is evident that the avoidance of mathematics and science subjects by girls because they perceive these subjects as being difficult, is a contributing factor to their poor performance in Technical courses since these subjects (mathematics and science) are pre-requisites for excelling in technology programmes.

2.3.3 INSTRUCTION MATERIALS AND GENDER ISSUES

Instruction materials, according to Sadka, Sadker and Klein (1991) teach far more than information and a way of learning and that the tone and development of the content and illustrations foster into the learner positive or negative attitudes about

self, life expectations, race ethnic and social groups, occupation, education and religion. They note that inadvertent bias in the use of these educational materials can influence the impact of educational programmes by reinforcing traditional sex role stereotyping which will ultimately affect their performance.

Powel and Garcia (1985) as cited by Whiteley (2005) when writing on gender issues in Carribean Science Education, argued that descriptions in science textbooks should depict society as it was, is and should be, when describing scientific ideas and theories. In their view the leaner should be provided with illustrations and accounts of individuals from all walks of life as being involved in science and thus provide female students with female examples of those directly involved in scientific professions and activities. This, they maintained, may result in less distortion and stereotyping, a more positive view of females in science and greater numbers of women aspiring to science related professions.

Brush (1995) argued that it could reasonably be assumed that girls derive some kind of message from the way women scientists were mentioned (or otherwise) in textbooks and that this message has some effect on their aspiration. Brush noted that in the few cases of women being mentioned, they were often portrayed in ways that would not be considered models of success by female students reading the materials. Taylor (1979) looked at three popular physics textbooks in Britain and observed a clear demonstration of bias towards male. He observed that whereas many references were made to males (youth and adult), there were very few references females and when girls or women were shown at all, they were not depicted in

activities of a scientific nature. He also noted, throughout the textbooks he studied, that the images of women were presented as a passive domestic being.

In another instance, King (1985) stated that exposure to manual skills at school seemed to be gender specific and that during the nursery and infant classes, the boys were easily tracked into playing with constructional materials using toys to make simple boxes, cars and lorries whereas the girls found themselves anticipating the future domestic crafts like cooking, sewing and dressmaking. These practices according to him affect their performance when the females at the later stage in their lives opt to study technical courses.

Herz and Khanker (1991) have also noted that textbook illustrations may be based towards portraying girls for low paying skills as knitting, sewing and secretarial services and cooking in the kitchen, carrying fuelwood, while the males were depicted as engineers, doctors, lawyers and other high status professions. In another related study, Weitzman and Rizzo (1984) analysed the depiction of sex-roles in picture books. In the sample analysed they observed that the ratio of males to females in illustrations was 11:1 and in about one-third of the books, there were no women. They also found pervasive sex-role stereotyping of characters with the male character being portrayed as independent and active while female characters were portrayed as passive observers.

Gaga and Berliner (1992) cited Decrow (1972) as having analysed the contents of ten (10) American publishers' textbook and found that the only woman they portrayed

outside home were nurses and teachers. In the same textbooks fathers were portrayed as drivers while mothers were portrayed as handling babies, cooking, and as passive observes who always watch their husband perform certain activities. It was also indicated that boys were portrayed as showing initiative, being creative with the girls being portrayed as fearful and dependent.

In analysis of some textbooks and headteachers' handbooks used in the Ghanaian schools, Awortwi and Korang-Okrah (2007) noted that most of the textbooks and headteachers' handbooks are not gender balanced, since most of them are based in favour of the male.

2.3.4 SOCIAL FACTORS AFFECTING WOMEN'S PARTICIPATION AND PERFORMANCE IN EDUCATION AND TRAINING

Several researchers have shown female education and training in most African countries to be highly affected by socio-cultural factors. Oppong (1987) has observed that the socialisation of females stresses on marriage and motherhood as the primary goals in life and as such they receive less encouragement than boys to embark on higher education. She also noted that females are more likely to be used as labour in the home. As a result of the African traditional view that whatever the level of education, a woman's place is in the kitchen and that girls would eventually get married and be dependent on their husband, parents tend to place a lower value on education for girls. An excerpt of conversation between a woman and her husband quoted in a handbook for improving girl's experiences in primary schools

titled Beyond Enrolment by O'Gana and Kendall (2000) gives a picture of what prevails in most traditional African societies.

A woman asked her husband;

Couldn't we send our girl to school too?

The husband responded;

What for?

There's nothing

She needs to learn there

That she can't learn at Home

Byrne (1990), in paper prepared for an international seminar on "Increasing the role of women in technical and scientific training and employment" observed that social factors filter out females from males. She noted that the labelling of disciplines as normal for one sex but abnormal for another and not in the context of gender neutrality was one major cause of low recruitment of females into disciplines like physics, mathematics and geology which were considered normal for males but abnormal for females.

Sex-role orientation and sex difference stereotyped have also been noted to influence the participation and performance of females in science and technology education. Sex-role orientation and sex-difference stereotype partition vocation into feminine and masculine. Appropriate or capable occupations and deviation from what seems to be a social norm was generally frowned upon by the society. The influence of sex role stereotype in participation and performance of females in certain vocations has

been reported by Camey and Wells (1987). According to them sex role stereotype have special influence on participation in technology education by determining the relationship between the sexes and their roles during the adolescent stage. This is because in some traditional societies, boys have been expected to assume leadership roles, develop mechanical, analytical and mathematical abilities and develop prowess in sports. As a consequence, boys have tended to take up these roles which have influenced their performance in science and technology education, later in life. Girls, on the other hand have been taught to take on complementary roles, concentrate on relationship and develop verbal and artistic skills. Concluding, they indicated that these divisions seem to be reinforced by teachers, peers and family members who normally claimed that these were realities of the working environment.

Wallace (1985) has also reported on the relationship between sex-stereotypes and performance in technical education. Writing on technical education in the United Kingdom he noted that fewer females than males opted for wood work, metalwork and technical drawing and that this under-representation which might have been caused by their performance was due primarily to sex-stereotyping and prejudice among members of the education community. In a related study of gender socialisation in Zambia, Kane (1990) cited Shifteran (1982) as having shown that in a survey of five secondary schools in Lusaka, the majority of girls and boys agreed that housecrafts was the most useful subjects for girls, while science was most useful for boys thus emphasising the influence of sex-difference stereotypes in participation and performance in science and technology.

Lipman-Blumen (1994) writing on education and gender roles in his book_Gender roles and Power noted that once socialization with its many facets and institutional barriers successfully tracks women and men into different fields of study, occupational segregation may occur. He noted that women who through the socialisation process avoided study mathematics and science in secondary schools and colleges faced monumental barrier in their quest to enter occupational fields requiring quantitative and scientific background. He also indicated that lack of women role models in professional and high administrative positions in medical, engineering as well as mathematics and science departments of university and other tertiary institutions does not create a leading example for which female students might emulate. He maintained that the absence of female role models in male intensive fields could convey a message to female students that such roles or occupation are not feasible for them.

2.3.5 CONCLUSION

The social factors discussed act as barriers and filter girls and women out of the educational and training system resulting in the low level of participation and performance of females in science and technical education. It is an undisputed fact that there are more males than females pursuing science and technology education in Ghana. However it is worthy to note that the female perception and performance could be improved to enable them match with male counterparts if measures are taken to address the imbalances. One such measure is performance re-orientation, which is the focus of the present study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. INTRODUCTION

This is a study intended to find out the perception and the performance of female students at ATTC with a view to helping to improve the situation through performance re-orientation. The chapter covers the following areas:

Population and Sampling techniques

Data Collection Procedure

Research Instruments

Research Design

Data Analysis

3.2 POPULATION AND SAMPLING TECHNIQUE

Thee targeted population was made up of all the female students pursuing different technology programmes at the various levels of ATTC. They numbered about 100 for both the full-time and part-time students. The full-time female students were about 54, with the rest of the females being in the part-time group.

The entire female students of ATTC were stratified into two major groups, namely, the full-time female students who attend the morning sessions and the part-time

students who attend the afternoon sessions. Purposive sampling was used to select the full-time group who attended the morning sessions since it was convenience sample for the study. This is because majority of the part-time students are workers and have limited time at their disposal and hence were likely to face some difficulties if they were to take part in the study. Again purposive sampling was employed to select all the first and the second year students who were about 25 in number. The third year students were having industrial attachment and were therefore not available at the time of the study while the final year students were preparing for their final project work and therefore would not have the time to participate fully in the study.

3.3 DATA COLLECTION PROCEDURE

3.3.1 PRE-INTERVENTION

The researcher organised the pre-intervention data collection to ascertain baseline information on the perception of the female' students on science and technology as well as their performance level in various course areas at ATTC.

The pre-intervention study covered a period of one week with one period per day for the five days (meetings). Each meeting lasted for approximately one and half hours.

The first four days were used for reviewing of selected topics that have already been treated. The researcher briefed the selected female students on the project after which the selected topics which involved application of lines in technical drawing,

some basic concepts in science and manufacturing processes in bench fitting were reviewed.

The fifth day of the week was used for answering the actual questionnaire and performance test in the three subjects. Answering of the questionnaire on perceptions lasted twenty minutes while the test lasted for one hour for all the subjects. Individual students were encouraged to do independent work. This was meant to enable the researcher to have a true picture of the students' perception and level of performance.

3.3.2 INTERVENTION PROCEDURES

Two major sets of intervention were administered, with one complementing the other, aimed at re-orienting the minds of the students and arousing their spirits for technical subjects. The exercise involved role modeling by exposing the students to documentary films on DVDs of female excelling in technical areas as well as films of some female technologists working in their industries and workshops such as; Exploring our potentials; Women in technical education, etc. which has been using in most STME clinics. These films involve females working on complex and difficult machines as well as taking up challenging tasks in their 'working gear' at their industries. In addition, fieldtrips were undertaken with them to see some female technologists at their workplaces. The places visited include VALCO and women artisans of Redeemer machinery and tools work at Tema where they carry out duties as casting, milling, grinding, lathe work etc. of metal into required shape. In addition

we went to Hallelujah Praise workshop, Dora Motors, Joyce Peprah (JOPEP) Motors, Aboagyawaa Carpentry shop as well as some individual technologies at Odawna industrial area all in Accra where females do autobody, automech, welding, motor rewinding and carpentry and joinery works.

The entire exercise was aimed at helping to disabuse the minds of the female students on the misconception held about technical courses in terms of their perceived limitations and female education and training in general.

The entire intervention process lasted for four weeks. The first week of the intervention was used for role modeling. This included showing films on DVDs of successful female technologists and going on field trips to the workplaces of some female technologists. This was aimed at disabusing from the minds of the female students, the perceptions of sex stereotyping roles in the society and the apparent wrong conceptions of difficulty involved in science and technology. The following week involved the use of practical approach to re-teach theory and graphic in technical drawing. This helped the students to present projects from initial idea through to final idea. The following week involved identification of physical properties of metal.

The last week for the intervention was used for practical lessons where each student was given a piece of metal plate and tools to produce the “final idea” which was an opener from a given piece of metal plate.

3.3.3 POST INTERVENTION

The questionnaire cum test instrument was re-administered during the last week of the study. This enabled the researcher to find out whether there had been positive improvement in the perception and performance of the female students in the selected areas in science and technology. Once again the student answered the questionnaire items first after which they answered the test items in various science and technology areas.

3.4 RESEARCH INSTRUMENTS

The data collection instrument for the study for both the pre-intervention and the post-intervention was a combination of questionnaire to analyse the perceptions of the respondents and a structured performance test in the form of supply answers on simple definitions and manufacturing processes to assess their performance. The instrument was in four sections (see Appendix A).

Section A comprised of a ten-item closed ended questionnaire in which the student was required to tick one of its corresponding responses according to her perception. Section B was a test in technical drawing and consisted of four-item questions to which the student was required to supply answers. Section C was a test in science consisting of five questions dealing with basic concepts in science. The student was required to use her own words to define given terms (concepts). Section D was a test in bench fitting which was structured in tabular form. In five steps the student was to state the five processes used to manufacture an opener and at every step the

student was required to list the tools used. This process embraced all the basic manufacturing processes involved in the practical course.

All the tests were aimed at helping the researcher to analyse the performance of the respondents in the various areas of the science and technology course offered at ATTC. The same instrument was used at the pre-intervention stage as well as post-intervention stage. This helped the researcher to analyse both the perception and the performance of the students at both stages in order to make a comparison between them.

3.5 RESEARCH DESIGN

The study is an action research aimed at helping to correct the negative perceptions held by female students about science and technology and to improve their performance at ATTC. This action research is a way of bridging the theory and practice gap. It is a systematic study that attempts to improve practice of groups of participants through their own practical actions and reflections on the effects of those actions. It was the purpose of the researcher to find out the perception and performance in science and technology of a sample of female students pursuing science and technology education at ATTC and to attempt an improvement on the situation through performance re-orientation.

3.6 DATA ANALYSIS

To facilitate analysis of the data, the various categories on the questionnaire section (section A) were coded according to the scoring key. The statements provided were given the following values: Strongly Agree (1), Agree (2) Disagree (3) and Strongly Disagree (4). The researcher analysed the responses of both the pre-intervention and the post-intervention data in Section A using simple percentage. This section assessed the students' perception. Section B, C and D which assessed respondents' performance were scored according to the following marks:

Section B	25 marks
Section C	25 marks
Section D	50 marks
Total	100 marks

The scores for each section of the test were recorded and used for calculating the mean, standard deviation and computing the T-test. The T-test was meant to find out whether there was any significant difference in students' performance at the test. The T-test for comparison of the mean for paired observations were used for statistical analysis. This was because the same students were used for both the pre-test and post-test.

CHAPTER FOUR

ANALYSIS, DISCUSSION AND REPRESENTATON OF RESULTS

4.1 INTRODUCTION

This chapter deals with the analysis of the information gathered from the questionnaire, items on perception as well as test scores obtained from class test. Comparison was made between the pre-intervention and post intervention data. This

was expected to reveal whether there had been a change in perceptions as well as performance of the female technology student during the period of study.

4.2 PERCEPTIONS ON FEMALE PARTICIPATION IN SCIENCE AND TECHNOLOGY

The perceptions of the female technology students for both the pre-intervention and post-intervention stages were analysed using simple percentages on item-by-item bases as presented in Table 1.

At the pre-intervention stage, the responses to item 1 indicated that 80% of the respondents showed the view that scientific concepts are mostly abstract and difficult, whilst 20% of the respondents disagreed. To the same statement at the post intervention stage, the percentage of respondents who previously agreed, was decreased to 64% whilst the percentage of respondents who disagreed were increase to 36% Odugbesan (1990) observed that girls seemed to perform not quite well in technical subjects because they have preconceived ideas that mathematics and science are difficult and therefore make little effort to study them. Hence to make a positive impact on their studies, there is the need to translate abstract concepts into experiments and demonstration. Thus the improvement in the response could be attributed to the intervention, which involved films on successful female technologists and field trips to some female technologists at their workshop.

The pre-intervention responses to item 2 indicated that 8% of the respondents agreed to the statement that science education is irrelevant to technical education while 92%

disagreed to the statement. The same percentage of respondents agreed and disagreed respectively for the post-intervention. This implies that the intervention did not influence their perception that, science education is relevant to technical education.

For the pre-intervention responses, 48% of the respondents agreed to the statement that technical drawing is not applicable to our everyday activities as stated in item 3, whilst 52% of the respondents disagreed to the statement. For the post-intervention responses, the percentage of respondents who agreed was decreased to 28% whilst those who previously disagreed to the statement increased to 72%.

At the pre-intervention stage, 72% of the respondents agreed to the statement that the use of the hacksaws to cut pieces of metal is difficult, whilst 28% of the respondents disagreed to the statement. After the intervention, the percentage of respondent who agreed was decreased 60% whilst the percentage of respondent who disagreed to the statement was increased to 40%. This implies that the perception that technical courses demand strength requirement courses as in pre-intervention was illusive.

TABLE

During the pre-intervention stage, 68% of the respondents agreed to the statement that the uses of machines are very dangerous and fearful whilst 32% disagreed to the statement. After the intervention, 80% of the respondents agreed to the statement whilst 20% of the respondents disagreed to the statement. The higher percentage of respondents on the agreement side confirms Decrow (1972) who also observed that boys portray initiative, creativity and boldness whereas girls are fearful and dependent. Hence, in the absence of their male counterparts most of the females were still afraid to use most of the tools (as in item 4) and machines in the workshop.

At the pre-intervention stage, 64% of the respondents agreed to the statement that some courses like metal work, woodwork, blockwork, etc., are meant for males only, whilst 36% of the respondents disagreed to the statement. However after the intervention, the percentage of respondents who previously agreed reduced to 20% whilst the percentage of respondents who disagreed was increased to 80%. The higher percentage of the respondents who agreed to the statement during the pre-intervention period confirms Wallace (1985) who noted that fewer females than males opted for woodwork, metalwork and technical drawing and that, this under-representation was due to sex stereotyping. However during the intervention where they had the opportunity to interact with some female technicians, there was a positive change in their perception of the statement.

During the pre-intervention stage, 80% of the respondents agreed to the statement that, technical courses are not safe for female with 20% disagreeing. At the post intervention the percentage of respondents who agreed to the statement was decreased 52% whilst the

percentage of respondents who agreed was increased to 48%. Weitzmen and Rizzo (1984) in analysis of some pictures found the pervasive sex-role stereotyping of character. With the male character being portrayed as independent and active and therefore ready to bear the risk involved while female characters were portrayed as passive observers, hence the influence of the female perception on the pre-intervention that technical course are not safe for females.

An item stated that women cannot rise high in the technology industries, since such industries are preserved for men. During the pre-intervention stage, 52% of the respondents agreed to this statement whilst 48% of them disagreed. For the post intervention, the percentage of respondents who agreed to the statement was decreased to 40% whilst those who disagreed to the increased 60%. An increase in the total percentage of respondents who disagreed to the statement confirms the observation of Lipman – Bluman (1994) that lack of women role models in professional and high administrative positions in medical, engineering as well as mathematics and science departments of the university and other institutions does not provide the avenue of creating the needing example which female students might emulate. Therefore the absence of female role models in apparent male dominated fields could convey a message to female students that such roles or occupations are not feasible for them. It was perhaps the interaction with some of the female technologists occupying higher position during the intervention changed their perceptions that female technologists cannot rise high in the technology industries.

During the pre-intervention period, 80% of the respondents agreed to the statement that, female technicians cannot compete with their male counterparts in the technology market, whilst 20% disagreed. After the intervention, the percentage of respondents that agreed to the statement was decreased to 48% whilst the percentage of respondents that disagreed was increased to 52%. Powell and Garcia (1985) argued that writers on gender issues in science and technology should depict society as it was, is and should be. For this reason writers should write on realities as pertains in the job market in terms of females competing for clients to have good income and not always on perception that woman are not quite good hence may have less income, which may be a mirage.

During the pre-intervention period, 56% of the respondents agreed to the statement that, "given another chance, you will change the science and technology course in future" whilst 44% of the respondents which was less than half of the sample disagreed to the statement. After the intervention the percentage of respondents who agreed previously to the statement was decreased to 28% whilst more than two-thirds of the respondents (72%) disagreed to the statement. The above comparisons of pre-intervention and post-intervention confirms the views of Meyer (1975) who observed that personal factors which affects individual vocational preference include, self-concepts, aptitudes, attitudes, level of intelligence, age and sex differences, value, student's carrier, aspirations and expectations. Therefore whenever there is a manipulation of these factors in terms of career information and re-orientation as carried out during intervention period of the study, it tends to positively affect the vocational preference, perceptions and performance of the student.

4.3 ANALYSIS AND DISCUSSIONS OF THE STUDENTS' PERFORMANCE IN TEST ITEM

The female technology students were tested to find their level of performance at both the pre-intervention and post-intervention periods of the study.

4.3.1 TECHNICAL DRAWING TEST SCORES

A section of the test was on technical drawing and Table 2 presents scores for the technical drawing section of the pre-test and post-test.

The table shows that out 25 students who took the test during the pre-intervention, none scored in the range 0 - 5; 9 (36%) scored in the range of 6 -1, 10 (40%) in the range of 11 – 15; 6 (24%) in the range of 16 – 20 and none in the range of 21 – 25

Table 2: Technical Drawing Test Scores

	Pre-intervention		Post-intervention	
Scores	Frequency	%	Frequency	%
21 – 25	0	0	0	0
16 – 20	6	24	11	44
11 – 15	10	40	12	48
6 – 10	9	36	2	8
0 – 5	0	0	0	0
Total	25	100	25	100

Source: Field data 2011

For the post-intervention stage, out of 25 students, none scored in the ranges of 0 – 5 and 21 – 25; 2 (8%) scored in the range of 6 – 10; (48%) scored in the range of 11 – 15 and 11 (44%) scored in the range 16-20.

A comparison of the pre-test and post-test scores for technical drawing shows a significant improvement in the female students performance in technical drawing after the intervention. Whilst in the pre-test 6 (24%) of the in the same range. This leap in the performance in technical drawing could be attributed to the intervention strategies applied.

For the technical drawing section of the pre-test conducted for the study, it was observed that whilst 16 (64%) of the students scored the above of 40%, as many as 9 (36%) of the class scored below 40%. For 9 (36%) of the class to perform as such means that more than one-third had problem with application of lines to translate working drawing into realization and also lack of the inability to be creative to enable them to present object in pictorial view.

Decrows (1972) observed that boys are always portrayed as showing initiative, being creative, with girls being portrayed as fearful and dependent. In addition ILO (1990) also noted that women' attitude about their own roles and capabilities influenced their performance in the technical fields and that from an early age many females lack confidence in themselves and have negative attitudes towards technical subjects which consequently inhibit their performance in the technical subjects. Thus, the females who were not able to make up the pass mark, lacked confidence and were not very sure of how they were to use line type to present their ideas on paper. Awortwi (2007) also observed

that education and training in workshops and science clinics boost the morale of girls and increase the level of creativity and discoveries and succeeded in breaking some of the myth surrounding science and technology.

4.3.2 SCIENCE TEST SCORES

Table 3 presents scores for the science section of the pre-test. The table shows that out 25 students who took the test, 4 (16%) scored in the range of 0 – 5; 6 (24%) scored in the range of 6 – 10; 4 (16%) scored in the range of 11 – 15; 9 (36%) scored in the range of 16 – 20, and 2 (8%) scored in the range of 21 – 24. After the intervention, none of the 25 students scored in the range of 0 – 5, 3 (12%) scored in the 6 – 10, 7 (28%) scored in the range of 11 – 15, 6 (24%) scored in the range of 16 – 20 and 9 (36%) scored in the range of 21 – 25.

Table 3: Scores for Science Test

	Pre-intervention		Post-intervention	
Scores	Frequency	%	Frequency	%
21 – 25	2	8	9	36
16 – 20	9	36	6	24
11 – 15	4	16	7	28
6 – 10	6	24	3	12
0 – 5	4	16	0	0
Total	25	100	25	100

Source: Field data 2011

A comparison of the pre-test and post-test scores of the science indicated an exceptional improvement in the students' performance in science. Whilst the pre-test scores revealed that 2 (8%) of the students scored in the range of 21 – 25, as many as 9 (36%) scored in the same range for the post-test. This impressive progress in the students' performance in science is likely to be due to the strategies used during the intervention.

The scores for the science section of the pre-test conducted for the study indicated that whilst 10 (40%) of the students scored below the 40%, 15 (60%) scored above 40%. This indicated that 40% of the class have problem with some basic concepts in science as related to their technology programme. ILO (1990) indicated that the participation and performance of girls in technical and science subjects at second cycle schools were limited by their poor background in science subjects at the basic level. Hence, the 40% of the students who could not perform well in some basic concepts in science was because they had poor background in science at their basic school.

Powell and Garcia (1985) observed that when female learners are provided with illustrations and accounts of individual females from different walks of life (i.e. role models) as being involved in science and are also provided with female examples of those directly involved in scientific activities and profession. It may result in less removing the distortion like stereotyping, and create a more positive view of females in science and motivate a greater number of women to aspire to science related professions.

Table 4: Scores for Bench fitting (score D)

	Pre-intervention	Post-intervention

Scores	Frequency	%	Frequency	%
46 – 50	0	0	1	4
41 – 45	0	0	2	8
36 – 40	0	0	8	32
31 – 35	2	8	5	20
26 – 30	4	16	1	4
21 – 25	5	20	6	24
16 – 20	7	28	2	8
11 – 15	3	12	0	0
6 – 10	4	16	0	0
0 – 5	0	0	0	0
Total	25	100	25	100

Source: Field data 2011

Table 4 presents scores for the Bench fitting section of the pre-test and post-test. The table shows that out 25 students who took the test at the pre-intervention stage, none scored in the range of 0 – 5; 4 (16%) scored in the range of 6 – 10; 3 (12%) scored in the range of 11 – 15; 7 (28%) scored in the range of 16 – 20; 5 (20%) scored in the range of 21 – 25; 4 (16%) scored in the range of 26 – 30; 2 (8%) scored in the range of 31 – 35; none scored in the following range: 36 – 40; 41 – 45 and 46 – 50.

At the post-intervention stage, out of 25 students none scored in the range of 0 – 5, 6 – 10 and 11 – 15; 1 (4%) scored in the range of 26 – 30 and 46 – 50. 2 (8%) scored in the range of 16 – 20 and 41 – 46; 5 (20%) scored in the range of 31 – 35; 6 (24%) scored in the range of 21 – 25 and 8 (32%) scored in the range of 36 – 40.

A comparison of the pre-test and post-test scores of the bench fitting indicated an exceptional improvement in the students' performance, whilst pre-test scores revealed that none scored in the ranges of 36 – 40; 41 – 45 and 46 – 50 as many as 8 (32%), 2 (8%) and 1 (4%) scored in the same ranges respectively. This impressive progress in the students' performance is likely to be due to the strategies used during the intervention.

Odugbesan (1990) observed that girls seemed to perform not quite well in technical subjects because they have preconceived ideas that mathematics and science are difficult and therefore make little effort to study them. This avoidance of science and mathematics make it difficult for girls to perform very well in technical courses, which require some background knowledge in science and mathematics Decrow (1972) also observed that boys were portrayed as showing initiative, being creative while girls are portrayed as fearful and dependent.

The scores for the bench fitting section of the pre-test showed that whilst 11 (44%) of the students scored above 40%. For 14 (56%) of the class to perform as such means that more than half had problem with scientific analysis and principles applied to engineering materials, such as the type of material used and the amount of load that it can withstand.

The above indicates that lack of good science background coupled with lack of confidence and creativity affect female student performance in bench fitting which is more practical inclined. Harbison (1983) observed that when provided with conducive working or studying environment, individuals would perform better when placed in courses of their choices based upon the student aspirations and occupational desire.

Table 5 presents the combined scores for the technical drawing, science and bench fitting pre-test and post-test. The table shows that of 25 students who took the test during the pre-intervention stage, no student scored in the range of 0 – 10, and 11 – 20. One person (4%) scored in the range of 21 – 30; 10 (40%) scored in the range of 31 – 40; 7 (28%) scored in the range of 41 – 50; 5 (20%) scored in the range of 51 – 60; 2 (8%) scored in the range 61 – 70, no student scored in the ranges of 71 – 80 90 and 91 – 100.

A comparison of the combined pre-test scores for technical drawing, science and bench fitting and the combined post-test scores indicated a striking leap in female students' performance on the post-test. Whilst in the pre-test, none of the students scored in the ranges of 71 – 80, 81 – 90, 91 – 100; 3 (12%); 3 (12%) and 1 (4%) of the female students scored in the same ranges respectively. This goes to show, without doubt that, the interventional strategies used for the study contributed immensely to the performance of the students on the post-test.

Table 5: Combined scores for Technical Drawing, Science and Bench Fitting Test

	Pre-intervention		Post-intervention	
Scores	Frequency	%	Frequency	%

91 – 10	0	0	1	4
81 – 90	0	0	3	12
71 – 80	0	0	3	12
61 – 70	2	8	7	28
51 – 60	5	20	9	36
41 – 50	7	28	1	4
31 – 40	10	40	1	4
21 – 30	1	4	0	0
11 – 20	0	0	0	0
0 – 10	0	0	0	0
Total	25	100	25	100

Source: field data 2011

4.3.3 MEAN SCORE FOR THE PRE-INTERVENTION AND POST-INTERVENTION

Appendix C shows the calculation for both pre-test and post-test scores. The pre-test scores showed a class mean of 44.5 as against 64.2 for the post-test indicating a gain difference of 19.7. Since the post-test mean was higher than the pre-test mean, it

indicates an improvement in their performance, a situation brought about, no doubt by the effect of the intervention. This goes to show that performance re-orientation and short-term project enhance students' performance in science and technology.

4.3.4 STANDARD DEVIATION CALCULATION SCORES FOR PRE-INTERVENTION AND POST-INTERVENTION SCORES

Appendix D shows the calculations for the pre-test and post-test standard deviation scores. With a deviation of 11.51 for the pre-test, as against 11.04 for the post-test. The standard deviation of 11.04 at the post-test shows a reduction in standard deviation, which implies that variation in performance the students were reduced. This indicates an improved performance, which may be attributed to interventional effects.

4.3.5 T-TEST CALCULATION FOR THE PRE-INTERVENTION AND POST-INTERVENTION TEST SCORES

Appendix D shows the calculated t-value and the critical t-value from the table. The value of calculated 't' is 6.176. Comparing this with the critical t-value for 25 – 1 = 24 degrees of freedom we notice that the calculated of 6.176 is greater than the table t-value of 2.064 at 0.05 alpha level. The calculated 't' of 6.176 is also greater than 2.797 at alpha 0.01. The result is statistically significant at 0.01 alpha level and may not be attributed to chance. This difference is between the pre-test and post-test scores. This shows that an improvement came about as a result of the intervention. This achievement is attributed to the performance re-orientation and short-term project for the female technology student.

It is evident that performance re-orientation and short term project for female technology students will improve both the perceptions and performance in science and technology courses.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0 SUMMARY OF FINDINGS

This research was set out to use performance re-orientation and short-term projects, which involves the manufacturing of an opener, as an intervention in improving the perception and performance of first and second year female technology students of ATTC. The performance re-orientation was necessary since earlier observations showed majority of the female students pursued the course as a last resort in vocational choice and they also had least information of some of the successful female technologists and how high they could rise in their field of study. The short-term project was necessary since most of the females go through their programme of study with the perception that perceived difficult activities are for males. As a result, it affects their performance in practical subjects, as they mostly lean on their male counterparts for assistance. During practical work majority of the females had a perception that they were the weaker sex, hence they prefer doing the cheaper side of the job, such as holding of tools, running errands, putting "finishing touches" to their work, etc. In activities like cross filing and cutting of thick metals as well as using of machines, one always sees very few females undertaking the task. The few adventurous females who usually take up the challenges and compete with the males are given names like: macho-women, witches, "man-woman", etc..

To overcome such sex stereotyping, an intervention, which involves performance re-orientation and short-term project, was instituted, thus an action research was conducted to correct the distortions. It involves collecting data for both pre-intervention and post-intervention. Purpose sampling technique was used for selecting all the first and second

year female students in the full time programme. Pre-intervention and post-intervention data were collected following test-retest procedure for both perception and performance.

The data were analysed by comparing the variation in the responses and class test performance of pre-test and post-test. Frequency and percentages were used to describe the data of perceptions and mean scores, standard deviation and t-test were used to analyse the pre-test and post-test (i.e. for performance).

The main findings of this study were that performance re-orientation and short-term project have greater influence in improving the perception and performance of the female students in science and technology.

On the issues of "scientific concepts are mostly abstract and difficult", 80% of the respondents at the pre-intervention stage agreed to the statement, whilst 20% of the respondents disagreed. However at the post intervention stage, the percentage of respondents who previously agreed was decreased to 64% whilst the percentage of respondents who disagreed was increased to 36%. This implies that the intervention helped the female student to realise that scientific principles are realistic and practically not difficult.

On the issue that, science education is irrelevant to technical education, 8% of the respondents agreed to the statement at both pre-intervention and post-intervention, while 92% disagreed this implies that almost all the female students agreed that science education is relevant to technical education.

On the issue that, technical drawing is not applicable to our everyday activities, for the pre-intervention responses, 48% of the respondents agreed to the statement whilst 52% of the respondents disagreed. For the post-intervention responses, the percentage of respondents who agreed was decreased to 28% whilst those who previously disagreed to the statement were increased to 72%. This affirms that fact the intervention enabled the female student to realise that technical drawing is applicable in our daily lives activities.

Seventy-two percent (72%) of the respondents agreed to the statement that the use of cutting-tools like the hacksaw, chisel and others are difficult, at the pre-intervention stage, whilst 28% of the respondent disagreed. After the intervention, the percentage of respondent who agreed was decreased to 60% whilst the percentage of respondent who disagreed to the statement was increased to 40%, which implies that the perception that technical courses demanded strength requirement courses in illusive.

During the pre-intervention stage, 68% of the respondents agreed to the statement that the uses of machines are very dangerous and fearful whilst 32% disagreed to statement was increased to 80%, whilst the respondents disagreed to the statement was decreased to 20%. The intervention therefore assisted the student to handle machine confidently and fearlessly.

At the pre-intervention stage, 64% of the respondents agreed to the statement that, some courses like metal work, woodwork, blockwork, etc., are meant for males only, whilst 36% of the respondents disagreed to the statement. However after the intervention, the percentage of respondents who previously agreed reduced to 20% whilst the percentage of respondents who disagreed was increased to 80%. The higher percentage of the

respondents who agreed to the statement during the post-intervention period confirms that the intervention had a positive change in their perception of the statement.

During the pre-intervention stage, 80% of the respondents agreed to the statement that, technical courses are not safe for females with 20% disagreeing. At the post intervention the percentage of respondents who agreed to the statement was decreased to 52%, whilst the percentage of respondents who agreed was increased to 48%. The interventions therefore eroded some level the perception that, technical courses are not for females.

On the issues that women cannot rise high in the industries, since such industries are preserved from men. During the pre-intervention stage, 52% of the respondents of the respondents agreed to this statement, whilst 48% of them disagreed. For the post intervention, the percentage of respondents who agreed to the statement was decreased to 40% whilst those who disagreed increased to 60%. The interventions therefore help the student to realise that female student can rise high in the technology industry.

During the pre-intervention period, 80% of the respondents agreed to the statement that, female technicians cannot compete with their male counterparts in the technology market, whilst 20% disagreed. After the intervention, the percentage of respondents that agreed to the statement was decreased to 48% whilst the percentage of respondents that disagreed was increased to 52%. The interventions therefore help the female student to realise that, female technicians can compete with their male counterparts in the technology market.

During the pre-intervention period, 56% of the respondents agreed to the statement, "given another chance, you will change the science and technology course in future" whilst 44% of the respondents which was less than half of the sample disagreed to the statement. After the intervention the percentage of respondents who agreed previously to the statement was decreased to 28% whilst more than two-third of the respondents (72%) disagreed to the statement. This therefore confirmed that fact that then intervention had positive influence on their perception of themselves as well as the courses they are pursuing.

5.2 CONCLUSION

The achievement was due to the six weeks (daily meeting) of the students and the intervention conducted during the second term of the school year.

The computed mean difference between the post-test (64.2) and the pre-intervention (44.5) was 19.7. This indicates that the intervention strategies registered about 44% increase in mean score. The remarkable result of the female students' performance was demonstrated in the short-term project, which involves the manufacturing of the opener, where each of them tries to maximise her potentials to do the task, independently. Since the male students were not around to give them a helping hand.

Most of the female students showed a higher enthusiasm compare to the situation when they working with their male counterparts in the workshop and contributed their widows' might to achieve the best. The female students who initially lacked confidence, and

mostly used to do holding of tools, finishing touches and errands in most of the workshops, had the zeal to do the whole task by themselves.

As they were able to derive some motivation from interaction with their follow female counterparts working with or on bigger and complex machines with no assistance from the male counterparts. This therefore, have positive effect on their perceptions and performance and they were able to perform better in the post intervention.

It is this vane that Lipman-Blumen (1994), observed that lack of female role models in professorial and administrative positions in science and technology departments in institutions as well as technology industries does not create a leading example for female students to emulate and hence perceive these roles and occupation as not feasible for them. He recommended that to enhance perception and performance of the female students in science and technology, the social barrier must be broken, through regular interaction with successful female role models in society. As a result, the improvement in the performance of the female students after the intervention is likely to be result of the intervention instituted. In addition, ILO (1990) indicated that the participation and performance of girls in technical and science subjects at second cycle schools were limited by their poor background in science at the basic level.

Decrows (1972) observed that boys are always portrayed as showing initiative and being creative while with girls are portrayed as fearful and dependent. In addition ILO (1990) also noted that women's attitude about their own roles and capabilities influenced their performance in the technical fields and that from an early age many females lack confidence in themselves and have negative attitude towards technical subjects which

consequently inhibit their performance in the technical subjects. Thus, the females who were not able to make up the pass mark, lacked confidence and were not very sure of how they were to use line type to present their ideas on paper.

Odugbesan (1990) observed that girls seemed to perform not quite well in technical subjects because they have preconceived ideas that mathematics and science are difficult and therefore make little effort to study them. This avoidance of science and mathematics make it difficult for girls to perform very well in technical courses, which require some background knowledge in science and mathematics. This problem of fearfulness and reliance on assistance were observed during the initial part of the study, however this problem was minimised after the intervention as a result, during the latter part of the study, the female students had the desire and confidence to use machines and tools to perform job confidently with less supervision.

5.3 RECOMMENDATIONS

Based on the findings and the conclusions drawn the following recommendations are made:

- There is the need to educate the people through the electronic and print media of some of the success in terms of establishment like; women artisans of Redeemer machinery and tools work at Tema, where they carry out duties such as casting, milling, grinding, lathe work etc of metal into required shape; Hallelujah Praise auto body shop; Dora Motors; Joyce Peprah (JOPEP) Motors; Aboagyewaa Carpentry shop as well as

some female technologies at Odawna Industrial area, Accra where they do auto body, auto mechanic, welding, motor rewinding and carpentry and joinery works, their average income and fame of some female technologists in the society so that they can be role models to the up and coming females.

- Regardless of the course and the level of class being taught by technical instructor, similar study can be conducted, by periodically organising field trips and regular interaction with role models, which may lead to self-improvement in skills acquisition by the female students. Also, technical instructors can use such interventions whenever they are teaching a class that the female students seem not to be performing well and assess its effects on students' academic performance.

- Lastly, during the orientation period of newly admitted female students, some of the interventions could be adopted as part of the orientation programme. This would help to motivate them to undertake their programme of study in the field of technology education seriously.

5.4 DIRECTIONS FOR FURTHER RESEARCH

A replication of this study may be done in other programmmes and courses in the institutions like construction, welding, woodwork, plumbing and electrical technology. The study may be extended to one academic year to see the effect on the female students' performance.

REFERENCES

Acquaye, E. A. (1994). *Geometrical and Technical drawing*. Accra: the Advent Press.

Adu-Sarkodie, K. G. (1994). *Re-orienting VOCTEC education towards self-employment.* Paper prepared for the formulation of National Employment Policy and Programmes for Ghana. Accra: UNDP/ILO.

Aggrey, S. (2003). *Promotion of self-employment in vocational and technical institution in Ghana: Trends issues and options*. Accra: ILO.

Agyedu, G. O., Donkor, F. & Obeng, S. (2005). *Teach yourself research methods.* Unpublished work, UCEW – Kumasi

Aku, J. (2011). GNECC Marks Global action week. *Graphic Communication Groups.*(P. 3)

Annor, K. (2005). Education (3rd ed). Kumasi: Cita Printing Press Ltd.

Amoani, F. K. (2005). *Research methodology, an overview*. Accra: Pentecost Press Ltd.

Awortwi, S. & Korang-Okrah, R. (2007). Successes and challenges of the girl-child. Gender Matters 1 – 3

Best, J. W. Kahn, J. V. (1989). *Research in education*. New Jersey: Prentice

hall Inc.

Bilodean (1966). *Acquisition of skills.* New York: Academic Press.

Block, J. H. (1994). *Sex role identify and ego development*. London: Gin and Ford Company.

Brog, W. A. & Gak, M. D. (1993). *Educational research: An introduction*. (4th ed). New York: Longman

Bruce, J. B. (2004). *Workshop processes and practices and materials*. London: Sporttis Woode Ballan Tyre Printers Ltd.

Brush, S. G. (1995). *Women's role in economic development*. New York: St. Martin Press.

Byrne, K. M. (1990). *Investing in women: Technical and Scientific training for economic development.* ILO Training discussion paper. No. 62. Geneva: ILO.

Camey, C. & Wells, C. F. (1978). *Career planning skills to build your future*.

(2nd ed) California: Brookscole Ltd.

Clickman, C. D., Gordon, S. P. & Ross Gordon, J. M. (1995). *Supervision of Instruction. A developmental approach*. Boston: Allyn and Bacon.

1 Damptey, S. T., Obeng, J. F. &Seidu E. (2008) Basic design and technology for JHS. Adwinsa Publication Ltd.

Driscoll, T. (2003). *Technical drawing for today*. London: Macmillan Education.

Duncan, T. (1990). *Physics for today and tomorrow* (2nd ed) London: John Murray Publich Ltd.

Faanuye, A. D., Katoule, C. N. & Kpimbimi J. (ED) (1999). *Gender Matters*. 3.4

Finch, C. R. & Crunkilton, J. R (1993). *Curriculum development in vocational and technical education, planning, content and implementation (4th ed)*. Boston: Allyn and Bacon Ltd.

George, L. (1982). *The theory and practice of metalwork (3rd ed).* London, English University Press.

Gockah, C. (1987). A technician's worth is seen in his work. *Ghanaian Times* p 1.

Godwin, D. (1990). Technical education in sub-sahara African countries: A review of developments and strategies. *The vocational aspects of education*. 13 (113)

Gonzalez, J. & Wagenaar, R. (2006). Turning educational structure in Europe. Great Britain : Spottis Wood.

Greer, A. & Howel, A. H. (2002). Mechanical engineering craft studies. Part 1

Ibadan: Oluseyi Press Ltd.

Grewal, J. S. (1999). *Vocational environment and occupational choices.* India:

Haddad, W. D., Carnoy, M., Rineldi, R. & Regal, O. (2001). *Education and development: evidence of new priorities.* World Bank Discussion Paper 95, Washington D. C: World Bank.

Hallack, J. (1990). *Investing in the future sitting educational priorities in developing world.* Paris: IIEP – UNESCO.

Harbison, F. H. (1983). *Human resources as the wealth of nations.* London: Oxford University Press.

Herz, B. K., & Khanker, S. R. (1991). *Women's work education and family life in Peru*: World Bank. Discussion Paper 116. Washington, D. C: World Bank

Hoyt, B., Evans, R. N., Mackin, F. F. & manguru, G. L. (1974). *Career education: What it is and how to do it (2nd ed).* Saltlake City: Olympus Publishing Co.

Hudson, A. (1983). *Sex stereotyping: Child psychology*. Vol. 4 New York: Wiley

Hughes, E & Hughes, C. (1995). *Engineering science.* London: Longman. International Labour Organisation (1990). *Women in Technical Trades.* Geneva Author.

Kane, E. (1990). Caught between two stools. *Women in vocational education and training in Ghana.* ILO Discussion paper No. 29. Geneva: ILO.

King, K. (1985). *The panning of technical and vocational education and training.* IIEP paper No. 72. Paris: IIEP – UNESCO.

Lipman – Blumen, J. (1994). *Gender roles and power*. New Jersey: Prentice hall.

Manu, P. (2000). Wives of Africa. *Gender matters* 4, 7

Miller, M. D. (1985). *Principles and a philosophy of vocational education.* Ohio: National Centre for Research in Education.

MOE (1987) *Things you need to know about the J.S.S programme*. Accra: MOE

Murphy, R. (1981). *Sex differences in objectives test performance*. London: Holder and Stoughton.

Odugbesan, F. H. (1990) Women in technical education training and jobs. Africa, Western Region Report. ILO Training Discussion Papers, No. 58, Geneva: ILO.

Opare, K. Y. (1999) *Non-governmental organizations and vocational education in Ghana*. Unpublished Project Work, UCEW – Kumasi

Oppong, C. (Ed) (1987). *Sex roles, population and development in West Africa*, London: Heinemann.

Pritchard, R.J. (1992). *Technician workshop processes and materials*. Suffolk: The Chancer Press Ltd.

Quasie (1999). Gender bias in the curriculum. *Gender Matters* 4

Sadker, M. E. (1990). *Sex stereotyping and reading: Research and strategies*. Newark – Delawar: International Reading Association.

Statistical Service – Ghana (2011). *Population and Housing: A Preliminary Report*. Accra, Author

Taylor, J. (1979). Sexist bias in physics textbooks. Physics Education. 14

277 – 280.

Towen, A. (1990) *Socio-Economic Development of Women in Zambia*. Leiden Netherlands: Africa Studies Centre.

UNESCO (1986). *The integration of general technical education*. Paris: Author

Wallace, A. G. (1985). *Introducing technical and vocational education*. London: Macmillan Education Ltd.

Weitzmen, L. & Rizzo, D. (1984). *Biased textbooks images of female and males in elementary school textbooks*. Washington D. C.: National Foundation for the Improvement of Education.

Whiteley, P. (2005, March). Gender issues in the Carribean. *Science Education International*, (1), 7 – 12.

Yarwood, A. (1995) *Technical drawing with designs*. London: Macmillan Education Ltd.

Zaccharia, J. S. (1970) *Theories of Occupational Choice and Vocational Development.* New York: Houghton – Mifflin.

APPENDIX A

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

INSTITUTE OF DISTANCE LEARNING

PERCEPTION AND PERFORMANCE INSTRUMENT

This study is designed to evaluate the perception of females in Science and Technology courses at ATTC with the aim of improving performance. It does not require names of students. You are therefore to answer the entire item as candid as you can.

SECTION A

Please, for each of the item in this section tick the appropriate column you identify with. (*SA- Strongly Agreed; AG-Agreed; DA- Disagreed; SD- Strongly Disagreed*)

QUESTIONS	S.A	AG	DA	S.D
	1	2	3	4
1. Basic concepts / definition in science are mostly abstract and difficult to grasp				
2. Science education is irrelevant to technical education.				
3. Technical Drawing is not applicable to our everyday activities				
4. Using Hacksaw to cut pieces of metal is difficult.				
5. Using machines like drilling and milling is very dangerous and fearful				
6. Some courses like metal work, woodwork, block work etc are meant for males only				
7. Technical courses demand strenuous activities and so it not safe for females.				

8. Women cannot rise high in technology industries since they are preserve of men.

9. Women technicians (artisans) do not make enough money and cannot compete with their male counterparts in the technology market

10. If I get the chance I will change the science and technology course in future.

SECTION B (20 MINS)

TECHNICAL DRAWING

Answer the following questions.

1. Differences between faint and firm lines are……..

……

……

……

2. State the differences in application of hidden lines and centre lines…….…

……..….

……..

……..

……

3. Use the appropriate line to sketch two (2) initial ideas if an opener

4. Use the appropriate line to construct the final idea of an opener

SECTION C (20 mins)

SCIENCE

Use your own words to define the following key words as applied in science.

1. Texture of metal;……...

……..

……

……..

2. Corrosion;…….

……..…….

……..

……..

……..…….

3. Conductivity;…..……..

……..…..……

……..

……

4. How would you test for malleability of metal?.....

……

……

……

……

5. How would you test for brittlity of metal?

……

……..

……...

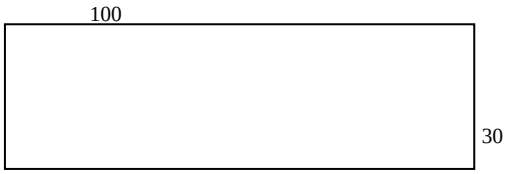
……

……

……..

SECTION D (20mins)

BENCHING FITTING



95

Figure 1

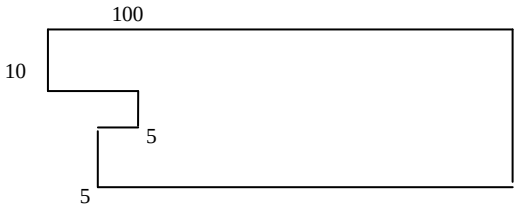


figure 2

All dimensions are in millimeters

In the table below state five (5) steps how you can produce Figure 2 from figure 1 at every stage state the tools required.

STEPS	**OPERATIONS**	**TOOLS REQUIRED**
1		
2		
3		
4		
5		

APPENDIX B

Mean Score Calculation for Pre-test and Post-test

Pre-test **Post-test**

N_1	X_1	d_1	d_1^2	X_2	d_2	d_2^2
1	68	23.5	552.25	91	26.8	718.24
2	51	6.5	42.25	59	-5.2	27.04
3	35	9.5	90.25	68	3.8	14.44
4	48	3.5	12.25	54	-10.2	104.04
5	59	14.5	210.25	81	16.8	282.24
6	56	11.5	132.25	54	-10.2	104.04
7	33	-11.5	132.25	72	7.8	60.84
8	35	-9.5	90.25	53	-11.2	125.44
9	22	-22.5	506.25	65	0.8	0.64
10	43	-1.5	2.25	72	7.8	60.84
11	49	4.5	20.25	55	9.2	84.64
12	66	21.5	462.25	83	18.8	353.44
13	46	1.5	2.25	79	14.8	219.14
14	33	-11.5	132.25	68	3.8	14.44
15	44	0.5	0.25	67	2.8	7.84
16	39	-5.5	30.25	62	-2.2	4.84
17	56	11.5	132.25	57	-7.2	51.84
18	38	-6.5	42.25	41	-23.2	538.24
19	48	3.5	12.25	56	-8.2	67.24
20	31	-13.5	182.25	59	-5.2	27.04
21	31	-13.5	182.25	54	-10.2	104.04
22	50	5.5	30.25	81	16.8	282.24
23	58	13.5	182.25	68	3.8	14.44
24	38	-6.5	42.25	39	-25.2	635.04
25	35	-9.5	90.25	67	2.8	7.84
	X_1=44.5		d_2=3314.25	X_2=64.2		d_2=3046.24

Source: field Data 2011

APPENDIX C

Means and standard deviation score

PRE-TEST **POST-TEST**

No	X_1	X_2	d	d^2
1	68	91	23	529
2	51	59	8	64
3	35	68	33	1089
4	48	54	6	36
5	59	81	22	484
6	56	54	-2	4
7	33	72	39	1521
8	35	53	18	324
9	22	65	43	1849
10	43	72	29	841
11	49	55	6	36
12	66	83	17	289
13	46	79	33	1089
14	33	68	35	1225
15	44	67	23	529
16	39	62	23	529
17	56	57	1	1
18	38	41	3	9
19	48	56	8	64
20	31	59	28	789
21	31	54	23	529
22	50	81	31	961
23	58	68	10	100
24	38	39	1	1
25	35	67	32	1024
	$\sum x_1=1112$	$\sum x_2=1605$	$\sum d=493$	$\sum d_2^2=13916$
	$X_1=44.5$	$X_2=64.2$	D=19.7	
	$S_1=11.51$	$S_2=11.04$	$D=X_2-X_1$	

Source: Field data 2011

APPENDIX D

CALCULATING THE T-TEST

Keys for calculating the T-test

X_1 = Mean of pre-test score

X_2 = Mean of post-test score

N_1 = Number of students in pre-test

N_2 = Number of students in post-test

S^2_1 = Variance of pre-test

S^2_3 = Variance of post-test

S^2 = Variance

S = Standard deviation

S_1 = Standard deviation (pre-test)

S2 = Standard deviation (post-test)

D = Differences between post test and pre test score

Variance

$$S^2 = N\sum d^2 - \frac{(\sum d)^2}{N^2}$$

$$= \frac{25(13916) - 493^2}{25^2}$$

$$= \frac{347900 - 243049}{}$$

625

$= \frac{104851}{625}$

$= \underline{167.76}$

Standard Deviation

$$S = \sqrt{\frac{N\sum(d^2) - (\sum d)^2}{N}}$$

$= \sqrt{167.76}$

$= \underline{12.95}$

Computation of *t*

$$T = X_1 - X_2$$

$$\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N^2}}$$

Variance (Pretest) S_1^2

$$S12 = \frac{N\sum d^2 - (\sum d)^2}{N^2}$$

$$= \frac{25\ (3314.25) - 0}{625}$$

$= \underline{132.57}$

Variance (post-test) S^2_2

$$S^2_2 = \frac{25\ (3046.24) - 0}{625}$$

$= \underline{121.84}$

Standard deviation (Pretest)

$S_1 = \sum S12$

$= \sum 132.57$

$S_1 = 11.51$

$S_2 = \sum S^2{}_2$

$= \sum 121.84$

$= \underline{11.04}$

$T = \dfrac{44.5 - 64.2}{\sqrt{\dfrac{132.57}{25} + \dfrac{121.84}{25}}}$

$= -19.7$

$\sqrt{5.3 + 4.87}$

$= 19.7$

$= 3.19$

$t = \underline{6.176}$

APPENDIX E

DEFINITION OF TERMS

Sex stereotyping – This is the practice of arbitrary assigning males and females to roles determined and limited by their sex.

Technology – It is the application of scientific knowledge to the solution of day-to-day problems especially through the use of machinery and equipment.

Technology Education – This is the instruction and teaching of people in the techniques of doing things practically through especially the use of machinery and equipment.

Performance re-orientation – This refers to the attempt to change the negative perceptions and the consequent poor performance of females through intervention like the use of role models and field trips.

Pictorial Drawing – Drawing which shows the clear picture of an artifact.

Working drawing – Drawing that involves detail specification of an artifact.

Realisation in technology refers to the production of real object or artifact from working drawings.

APPENDIX F

WIVES OF AFRICA: A POEM

"Oh! Wives of Africa!
Mothers of Africa
How wonderful our Maker has made us
He has endowed in us
unsurpassable skills,
But no! society takes us for granted.

No one seems to acknowledge
The important roles we play in we play
in nation building
What can we compare the
Africa wife to?

She's the manageress of a team
of individual s with different
needs and personalities of
all ages. See how flexibly
she performs a number of
contrasting tasks….

She is a perfect companion
for the man;
An advisor and financial
Manageress;
She is a food provider, a
teacher, a nurse.

She is a nutritionist, a good
Child supervisor.

But, which university did
the Africa wife attend to
attain all these qualifications?
Unlimited drive and a very
Strong sense of responsibility.
Independent; self-motivated
Able to work under stress
Competent in handling emergencies
Able to withstand hunger and
Material deprivation when necessary
Can endure physical and emotional pain.

But, how much is her salary?..... NONE!!!
She works all hours of the day,
for her benefits, she has:
no guaranteed holidays
no guaranteed sick leave
no long service award
no retirement benefits.

Oh! Poor Africa Wife!
Oh! Poor Mother of Africa
Your period of employment is for life,
Or, until the team leader, the man,
Decides otherwise…

Arise, seek ye first your educational

Kingdom and empowerment will be
Yours!
Don't just be content with your
reproductive roles
educate your girl-children
so they take up productive
roles in society and no one
can take them for granted.
(Gender Matters, Dec. 2000)